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Protecting People and the Environment

NUREG-1437
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Volume 2

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 46

Regarding Seabrook Station

Final Report

Appendices

Office of Nuclear Reactor Regulation

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ABSTRACT

This final supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by NextEra Energy Seabrook, LLC (NextEra) to renew the operating license for Seabrook Station (Seabrook) for an additional 20 years.

This final SEIS includes the analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include replacement power from new natural-gas-fired combined-cycle generation; new nuclear generation; a combination alternative that includes some natural-gas-fired capacity, and a wind-power component; and the no-action alternative of not renewing the license.

The NRC's preliminary recommendation is that the adverse environmental impacts of license renewal for Seabrook are not great enough to deny the option of license renewal for energy-planning decision makers. This recommendation is based on the following:

- analysis and findings in the generic environmental impact statement (GEIS);
- the Environmental Report (ER) submitted by NextEra;
- consultation with Federal, state, and local agencies;
- the NRC staff's own independent review, as documented in the 2011 draft SEIS and the 2013 supplement to the draft SEIS;
- the NRC staff's consideration of public comments received during the scoping process; and
- consideration of public comments received on the draft supplemental environmental impact statement and the 2013 supplement to the draft SEIS.

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BACKGROUND

By letter dated May 25, 2010, NextEra Energy Seabrook, LLC (NextEra) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue a renewed operating license for Seabrook Station (Seabrook) for an additional 20-year period.

Pursuant to Title 10, Part 51.20(b)(2) of the *Code of Federal Regulations* (10 CFR 51.20(b)(2)), the renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) states that the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG-1437, *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*.

The GEIS was originally published in 1996 and amended in 1999. Subsequently, on June 20, 2013, the NRC published a final rule (78 FR 37282) revising 10 CFR Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." The final rule updates the potential environmental impacts associated with the renewal of an operating license for a nuclear power reactor for an additional 20 years. The 2013 revised GEIS, which updates the 1996 GEIS, provides the technical basis for the final rule. The revised GEIS specifically supports the revised list of National Environmental Policy Act (NEPA) issues and associated environmental impact findings for license renewal contained in Table B–1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The 2013 rule revised the previous rule to consolidate similar Category 1 and 2 issues; changed some Category 2 issues into Category 1 issues; and added new Category 1 and 2 issues.

The 2013 rule became effective July 22, 2013, after publication in the *Federal Register*. Compliance by license renewal applicants is not required until June 20, 2014 (i.e., license renewal applications submitted later than 1 year after publication must be compliant with the new rule). Nevertheless, under NEPA, the NRC must now consider and analyze—in its license renewal Supplemental Environmental Impact Statement (SEIS)—the potential significant impacts described by the revised rule's new Category 2 issues and, to the extent there is any new and significant information, the potential significant impacts described by the revised rule's new Category 1 issues.

Hereafter in this SEIS, general references to the GEIS, without stipulation, are inclusive of the 1996 and 1999 GEIS. Information and findings specific to the June 2013, final rule and GEIS, are clearly identified.

In addition, on September 19, 2014, the NRC published a revised rule at 10 CFR 51.23 (Continued Storage Rule) and associated Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel. The NRC staff has also separately addressed in this SEIS, under the uranium fuel cycle, the impacts from the Continued Storage Rule.

Upon acceptance of NextEra's application, the NRC staff began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare a supplemental EIS (SEIS) and conduct scoping. In preparation of this SEIS for Seabrook, the NRC staff performed the following:

- conducted public scoping meetings on August 19, 2010, in Hampton, NH;
- conducted a site audit at the plant in October 2010;
- reviewed NextEra's environmental report (ER) and compared it to the GEIS;

- consulted with other agencies;
- conducted a review of the issues following the guidance set forth in NUREG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal"; and
- considered public comments received during the scoping process and on the draft SEIS and the supplement to the draft SEIS.

PROPOSED FEDERAL ACTION

NextEra initiated the proposed Federal action—issuing a renewed power reactor operating license—by submitting an application for license renewal of Seabrook, for which the existing license (NPF-86) will continue in effect until March 15, 2030, or until the issuance of renewed license. The NRC's Federal action is the decision whether to issue a renewed license authorizing operation for an additional 20 years beyond that authorized by the existing licenses.

PURPOSE AND NEED FOR THE PROPOSED FEDERAL ACTION

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decision makers, such as state, utility, and, where authorized, Federal agencies (other than NRC). This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the National Environmental Policy Act (NEPA) environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions as to whether a particular nuclear power plant should continue to operate.

If the renewed license is issued, the appropriate energy-planning decision makers, along with NextEra, will ultimately decide if the plant will continue to operate based on factors such as the need for power. If the operating license is not renewed, then the facility must be shut down on or before the expiration date of the current operating license.

ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

The SEIS evaluates the potential environmental impacts of the proposed action. The environmental impacts from the proposed action are designated as SMALL, MODERATE, or LARGE. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

- The environmental impacts associated with the issue are determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts, except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.
- Mitigation of adverse impacts associated with the issue is considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For Category 1 issues, no additional site-specific analysis is required in this SEIS unless new and significant information is identified. Chapter 4 of this report presents the process for identifying new and significant information. Site-specific issues (Category 2) are those that do not meet one or more of the criterion for Category 1 issues; therefore, an additional site-specific review for these non-generic issues is required, and the results are documented in the SEIS.

The environmental review of the Seabrook license renewal application was performed using the criteria from the 1996 and 1999 GEIS. Neither NextEra nor NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. This conclusion is supported by the NRC's review of the applicant's ER and other documentation relevant to the applicant's activities, the public scoping process and substantive comments raised, and the findings from the environmental site audit conducted by the NRC staff.

The NRC staff also reviewed information relating to the new issues identified in the 2013 GEIS, specifically, geology and soils; radionuclides released to the groundwater; effects on terrestrial resources (non-cooling system intake); exposure of terrestrial organisms to radionuclides; exposure of aquatic organisms to radionuclides; human health impacts from chemicals; physical occupational hazards; environmental justice; and cumulative impacts. These issues are documented in Chapter 4 of this SEIS.

The NRC staff has reviewed NextEra's established process for identifying and evaluating the significance of any new and significant information (including the consideration and analysis of new issues associated with the recently approved revision to 10 CFR Part 51) on the environmental impacts of license renewal of Seabrook. Neither NextEra nor NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. This conclusion is supported by NRC's review of the applicant's ER, other documentation relevant to the applicant's activities, the public scoping process and substantive comments raised, consultations with Federal and state agencies, and the findings from the environmental site audit conducted by NRC staff. Further, the NRC staff did not identify any new issues applicable to Seabrook that have a significant environmental impact. The NRC staff, therefore, relies upon the conclusions of the GEIS for all Category 1 issues applicable to Seabrook.

Table ES–1 summarizes the Category 2 issues relevant to Seabrook, as well as the NRC staff's findings related to those issues. If the NRC staff determined that there were no Category 2 issues applicable for a particular resource area, the findings of the GEIS, as documented in Appendix B to Subpart A of 10 CFR Part 51, are incorporated for that resource area.

Table ES–1. Summary of NRC Conclusions Relating to Site-Specific Impact of License Renewal

Resource Area	Relevant Category 2 Issues	Impacts
Land Use	None	SMALL
Air Quality	None	SMALL
Surface Water Resources	None	SMALL
Groundwater Resources	Radionuclides released to groundwater [a]	SMALL
Aquatic Resources	Impingement Entrainment Heat shock	SMALL to LARGE
Terrestrial Resources	Effects on terrestrial resources (non-cooling system impacts)[a]	SMALL
Protected Species and Habitats	Threatened or endangered species	SMALL to LARGE
Human Health	Electromagnetic fields—acute effects (electric shock)	SMALL
Socioeconomics	Housing impacts Public services (public utilities) Offsite land use Public services (transportation) Historic and archaeological resources	SMALL
Cumulative Impacts	Aquatic resources All other resource areas	MODERATE to LARGE SMALL

[a] These issues are new Category 2 issues identified in the 2013 GEIS and Rule (78 FR 37282). U.S. Nuclear Regulatory Commission. "Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." June 2013.

With respect to environmental justice, the NRC staff has determined that there would be no disproportionately high and adverse impacts to these populations from the continued operation of Seabrook during the license renewal period. Additionally, the NRC staff has determined that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of water, local food, fish, and wildlife.

NextEra reported in its ER that it is aware of one potentially new issue related to its license renewal application—elevated concentrations of tritium were documented on the Seabrook site due to a previous leak from the cask loading area/transfer canal adjacent to the spent fuel pool. Overall groundwater monitoring suggests that offsite migration of tritium is not occurring, because NextEra detected no tritium in marsh sentinel wells. As discussed in Section 4.10 of this SEIS, the NRC staff agrees with NextEra's position that there are no significant impacts associated with tritium in the groundwater at Seabrook.

SEVERE ACCIDENT MITIGATION ALTERNATIVES

Since NextEra had not previously considered alternatives to reduce the likelihood or potential consequences of a variety of highly uncommon, but potentially serious, accidents at Seabrook, NRC regulation 10 CFR 51.53(c)(3)(ii)(L) requires that NextEra evaluate Severe Accident Mitigation Alternatives (SAMAs) in the course of the license renewal review. SAMAs are potential ways to reduce the risk or potential impacts of uncommon, but potentially severe, accidents, and may include changes to plant components, systems, procedures, and training.

The NRC staff reviewed the ER's evaluation of potential SAMAs. As stated by the applicant, the four potentially cost-beneficial SAMAs are not aging-related. The staff reviewed the identified potentially cost-beneficial SAMAs and agrees that the mitigative alternatives do not involve aging management of passive, long-lived systems, structures, or components during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

ALTERNATIVES

The NRC staff considered the environmental impacts associated with alternatives to license renewal. These alternatives include other methods of power generation and not renewing the Seabrook operating license (the no-action alternative). Replacement power options considered were new natural-gas-fired combined-cycle generation; new nuclear generation; and a combination alternative that includes a some natural-gas-fired capacity and a wind-power component. The NRC staff initially considered a number of additional alternatives for analysis as alternatives to license renewal of Seabrook; these were later dismissed due to technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing Seabrook license expires. The no-action alternative by the NRC staff, and the effects it would have, were also considered.

Where possible, the NRC staff evaluated potential environmental impacts for these alternatives located both at the Seabrook site and at some other unspecified alternate location. Energy conservation and energy efficiency; solar power; wood waste; hydroelectric power; ocean wave and current energy; geothermal power; municipal solid waste; biomass; oil-fired power; fuel cells; new coal-fired generation; purchased power; and wind power were also considered. The NRC staff evaluated each alternative using the same impact areas that were used in evaluating impacts from license renewal.

RECOMMENDATION

The NRC's recommendation is that the adverse environmental impacts of license renewal for Seabrook are not great enough to deny the option of license renewal for energy-planning decision makers. This recommendation is based on the following:

- the analyses and findings in the GEIS, as published in 1996 and as revised in 1999 and 2013;
- the ER submitted by NextEra;
- the staff's consultation with Federal, state, and local agencies;
- NRC staff's independent environmental review;
- the staff's consideration of public comments received during the scoping process; and

- the staff's consideration of public comments received on the draft SEIS and the supplement to the draft SEIS.

ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
$\mu g/m^3$	microgram(s) per cubic meter
AADT	average annual daily traffic
ac	acre(s)
AC	alternating current
ACAA	American Coal Ash Association
ACC	averted cleanup and contamination costs
ACHP	Advisory Council on Historic Preservation
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Authority
AEC	Atomic Energy Commission
ALARA	as low as is reasonably achievable
ANL	Argonne National Laboratory
ANOSIM	analysis of similarities
ANOVA	analysis of variance
AOC	averted offsite property damage cost
AOE	averted offsite occupational exposure
AOSC	averted onsite costs
AOV	air-operated valve
APE	averted public exposure
AQCR	Air Quality Control Region
ARD	Air Resources Division
ASLB	Atomic Safety and Licensing Board Panel
ASME	American Society of Mechanical Engineers
ATWS	anticipated transient without scram
AWEA	The American Wind Energy Association
BACI	before-after control-impact
BAU	business as usual
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management

BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BTA	best technology available
Btu	British thermal unit(s)
CAA	Clean Air Act, as amended through 1990
CAES	compressed air energy storage
CAIR	Clean Air Interstate Rule
CAR	Code of Administrative Rules
CCP	coal combustion product
CCR	coal combustion residue
CCS	carbon capture and storage
CCW	component cooling water
CDF	core damage frequency
CDM	clean development mechanism
CEI	compliance evaluation inspection
C_{eq}	carbon equivalent(s)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CET	containment event tree
CEUS	central and eastern United States
CEVA	containment enclosure ventilation area
CFR	*Code of Federal Regulations*
cfs	cubic foot/feet per second
CH_4	methane
CIV	containment isolation valve
CL	confidence limit
CLB	current licensing basis
cm	centimeter(s)
CMR	Code of Massachusetts Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent(s)
COE	cost of enhancement
COL	combined license

CPUE	catch per unit effort
CR	control rod
CRI	control rod insertion
CS	cooling system
CSC	Coastal Services Center
CSP	concentrating solar power
CV	coefficient of variation
CWA	Clean Water Act
CWS	circulating water system
dBA	decibels adjusted
DBA	design-basis accident
DBT	design-basis threat
DC	direct current
DFW	Division of Fisheries and Wildlife
DG	diesel generator
DGP	Dewatering General Permit
DNI	direct normal isolation
DOE	U.S. Department of Energy
DR	demand response
DSEIS	draft supplemental environmental impact statement
DSIRE	Database of State Incentives for Renewables and Efficiency
DSM	demand-side management
DWEC	Deepwater Wind Energy Center
EAC	Electricity Advisory Committee
ECCS	emergency core cooling system
ECGA	East Coast Greenway Alliance
EDG	emergency diesel generator
EERE	Office of Energy Efficiency and Renewable Energy
EFH	essential fish habitat
EFW	emergency feedwater
EI	exposure index
EIA	Energy Information Administration
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EMF	electromagnetic field

EMP	electromagnetic pulse
EMS	emergency management system
ENHA	Essex National Heritage Area
EO	Executive Order
EOF	Emergency Operations Facility
EOP	emergency operating procedure
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act of 1986
EPR	U.S. Evolutionary Power Reactor
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ER	Environmental Report
ERC	Energy Recovery Council
ESA	Endangered Species Act
ETE	evacuation time estimate
F&O	facts and observations
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FIVE	fire-induced vulnerability evaluation
FLM	Federal Land Manager
FOTC/NEC	Friends of the Coast/New England Coalition
FPL	Florida Power and Light
FPL-NED	Florida Power and Light-New England Division
FPLE	Florida Power and Light Energy Seabrook, LLC
fps	foot/feet per second
FR	*Federal Register*
FSEIS	Final Supplemental Environmental Impact Statement
ft	foot/feet
ft^2	square foot/feet
ft^3	cubic foot/feet
FWS	U.S. Fish and Wildlife Service
g	gram(s)
g/m^2	gram(s) per square meter
gal	gallon(s)
GEA	Geothermal Energy Association

GEIS	generic environmental impact statement
GHG	greenhouse gas
GL	Generic Letter
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWh	gigawatt hour(s)
GWP	global warming potential
ha	hectare(s)
HAP	hazardous air pollutant
HCLPF	high confidence low probability of failure
HELB	high-energy line break
HEP	human error probability
HFO	high winds, tornadoes, external floods, and other
HPI	high-pressure injection
hr	hour
HRA	human reliability analysis
HUD	Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
IES	Institute of Educational Services
IGCC	integrated gasification combined cycle
ILRT	integrated leak rate test
in.	inch(es)
INEEL	Idaho National Engineering and Environmental Laboratory
IPCC	Intergovernmental Panel on Climate Change
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISEPA	Iowa Stored Energy Plant Agency
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing system loss-of-coolant accident
ISO	independent system operator
ISO-NE	New England's Independent System Operator
kg	kilogram(s)
KLD	KLD Associates
km	kilometer(s)

km^2	square kilometer(s)
kV	kilovolt(s)
kWh	kilowatt-hour(s)
L	liter(s)
lb	pound(s)
Ldn	day-night sound intensity level
LERF	large early release frequency
LHSI	low-head safety injection
LLNL	Lawrence Livermore National Laboratory
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LOS	level(s) of service
LOSP	loss of system pressure
LRA	license renewal application
m	meter(s)
m/s	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
mA	milliampere(s)
MAAP	Modular Accident Analysis Program
MACCS2	MELCOR Accident Consequence Code System 2
MACR	maximum averted cost risk
MD	motor-driven
MDFG	Massachusetts Department of Fish and Game
MDFW	Massachusetts Division of Fisheries and Wildlife
MDS	multi-dimensional scaling
MELCOR	Methods for Estimation of Leakages and Consequences of Releases
MFGD	Massachusetts Fish and Game Department
MFW	main feedwater
mgd	million gallons per day
mg/m^3	milligram(s) per cubic meter
mGy	million gallons per year
MHC	Massachusetts Historical Commission
mi	mile(s)

mi^2	square mile(s)
mm	millimeter(s)
MMI	modified Mercalli intensity
MMPA	Marine Mammal Protection Act
MMS	minerals management services
MMT	million metric tons
MOV	motor-operated valve
MPCS	main plant computer system
mph	mile(s) per hour
mrad	milliradian(s)
mrem	millirem
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
MSSV	main steam safety valve
mSv	millisievert
MSW	municipal solid waste
MT	metric ton(s)
MTBE	methyl tert-butyl ether
MTHM	metric tonne(s) of heavy metal
MW	megawatt(s)
MWd/MTU	megawatt-day(s) per metric ton uranium
MWe	megawatt(s)-electric
MWh	megawatt-hour(s)
MWt	megawatt(s)-thermal
N_2O	nitrous oxide
NAAQS	national ambient air quality standards
NAESC	North Atlantic Energy Service Corporation
NAI	Normandeau Associates, Inc.
NARAC	National Atmospheric Release Advisory Center
NAS	National Academy of Sciences
NCDC	National Climatic Data Center
NCES	National Center for Education Statistics
NECIA	Northeast Climate Impacts Assessment
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act

NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NESN	New England Seismic Network
NETL	National Energy Technology Laboratory
NextEra	NextEra Energy Seabrook, LLC
NF_3	nitrogen trifluoride
NGCC	natural gas-fired combined cycle
NHDES	New Hampshire Department of Environmental Services
NHDHR	New Hampshire Division of Historical Resources
NHDOJ	New Hampshire Department of Justice
NHDOT	New Hampshire Department of Transportation
NHDRED	New Hampshire Department of Resources and Economic Development
NHELMIB	New Hampshire Economic and Labor Market Information Bureau
NHFGD	New Hampshire Fish and Game Department
NHNHB	New Hampshire Natural Heritage Bureau
NHOEP	New Hampshire Office of Energy and Planning
NHPA	National Historic Preservation Act of 1966, as amended
NHSCO	New Hampshire State Climate Office
NHY	New Hampshire Yankee
NIEHS	National Institute of Environmental Health Sciences
NIMS	National Incident Management System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide(s)
NO_2	nitrogen dioxide
NPCC	Northwest Power and Conservation Council
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NREL	National Renewal Energy Laboratory
NRF	National Recovery Framework
NRHP	National Register of Historic Places
NRR	Office of Nuclear Reactor Regulation

NSR	new source review
NTTF	Near Term Task Force
NU	Northeast Utilities Service Company
NUREG	NRC technical report designation (Nuclear Regulatory Commission)
NWCC	National Wind Coordinating Committee
NWF	National Wildlife Federation
NYDEC	New York Department of Environmental Conservation
O_3	ozone
OCS	outer continental shelf
ODCM	offsite dose calculation manual
OPSB	Ohio Power Siting Board
PAB	primary auxiliary building
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCC	primary component cooling
PCCW	primary component cooling water
pCi/L	picocurie(s) per liter
PDS	plant damage state
PGA	peak ground acceleration
PM	particulate matter
PM_{10}	particulates with diameters less than 10 microns
$PM_{2.5}$	particulates with diameters less than 2.5 microns
PNNL	Pacific Northwest National Laboratory
PORV	power-operated relief valve
POST	Parliamentary Office of Science and Technology
ppb	part(s) per billion
PPD	Presidential Policy Directive
ppm	part(s) per million
ppt	part(s) per thousand
PRA	probabilistic risk assessment
PSD	prevention of significant deterioration
psia	per square inch absolute
PSNH	Public Service Company of New Hampshire

PV	photovoltaic
PWR	pressurized water reactor
RAI	request for additional information
RC	release category
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RCS	reactor coolant system
REMP	Radiological Environmental Monitoring Program
RGGI	Regional Greenhouse Gas Initiative
RHR	residual heat removal
ROI	region of influence
ROP	Reactor Oversight Process
ROW	right of way
RPC	replacement power costs
RPS	renewable portfolio standards
RRW	risk reduction worth
RSA	revised statutes annotated
RSCS	Radiation Safety and Control Services, Inc.
RSP	remote shutdown panel
RWST	reactor water storage tank
SAAQS	State Ambient Air Quality Standards
SAMA	severe accident mitigation alternative
SAMG	severe accident mitigation guideline
SAPL	Seacoast Anti-Pollution League
SAR	Safety Analysis Report
SBO	station blackout
SBOMS	Station Blackout Mitigation Strategies
SCR	selective catalytic reduction
SDWIS	Safe Drinking Water Information System
Seabrook	Seabrook Station
SEIS	supplemental environmental impact statement
SEPS	supplemental electrical power system
SER	safety evaluation report
SF_6	sulfur hexafluoride
SFP	spent fuel pool

SG	steam generator
SGTR	steam generator tube rupture
SHPO	State Historic Preservation Officer
SI	safety injection
SLOCA	small break LOCA
SNL	Sandia National Laboratory
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SQG	small quantity generator
SR	State Route
SRP	standard review plan
STG	steam turbine generator
SUFP	start up feed pump
Sv	sievert
SW	service water
SWGR	switchgear
SWPPP	Stormwater Pollution Prevention Plan
SWS	service water system
TAC	Technical Assignment Control
TDAFW	turbine-driven auxiliary feedwater
TDEFW	turbine-driven emergency feedwater
TE	temperature element
TIBL	thermal internal boundary layer
TMDL	Total Maximum Daily Load
TRO	total residual oxidant
U.S.C.	United States Code
UCS	Union of Concerned Scientists
UFSAR	updated final safety analysis report
US	U.S. Route
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDE	U.S. Department of Education
USDOD	U.S. Department of Defense

USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VOC	volatile organic compound
W/m^2	watts per square meter
WCR	Waste Confidence rule
WEC	wave energy conversion
WOE	weight-of-evidence
WOG	Westinghouse Owner's Group
WPCP	water pollution control plant
WTS	water treatment system
YOY	young-of-the-year
yr	year

APPENDIX A
COMMENTS RECEIVED ON THE SEABROOK STATION ENVIRONMENTAL REVIEW

COMMENTS RECEIVED ON THE SEABROOK STATION ENVIRONMENTAL REVIEW

A.1 Comments Received During Scoping

The scoping process began on July 20, 2010, with the publication of the U.S. Nuclear Regulatory Commission's (NRC's) Notice of Intent to conduct scoping in the *Federal Register* (75 FR 42168). The scoping process included two public meetings held at the Galley Hatch Conference Center in Hampton, New Hampshire on August 19, 2010. Approximately 82 members of the public attended the meetings. After the NRC's prepared statements pertaining to the license renewal process, the meetings were open for public comments. Attendees provided oral statements that were recorded and transcribed by a certified court reporter. Any written statements submitted at the public meeting were appended to the transcript. Transcripts of the entire meeting were provided as an attachment to the Scoping Meeting Summary dated September 20, 2010 (NRC 2010a). In addition to the comments received during the public meetings, comments were also received through mail and email.

Each commenter was given a unique identifier, so every comment could be traced back to its author. Table A-1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set of comments. The individuals are listed in alphabetical order, by last name. To maintain consistency with the Scoping Summary Report, dated March 1, 2011 (NRC 2011), the unique identifier used in that report for each set of comments is retained in this appendix.

Table A–1. Individuals Providing Comments During the Scoping Comment Period

Commenter	Affiliation (if stated)	Comment source	Commenter ID	ADAMS accession number
Backus, Robert		Afternoon Scoping Meeting	I	ML102520183
Bamberger, Paul		Evening Scoping Meeting	P	ML102520207
Blanch, Paul		Afternoon Scoping Meeting Evening Scoping Meeting	K	ML102520183 ML102520207
Bogen, Doug	Seacoast Anti-Pollution League	Afternoon Scoping Meeting www.regulations.gov	E	ML102520183 ML102670048
Brown, Gilbert		Evening Scoping Meeting	V	ML102520207
Casey, Joe	NH Building & Construction Trades Council	Afternoon Scoping Meeting	G	ML102520183
Fahey, Joseph	Town of Amesbury, Office of Community & Economic Development	Letter	X	ML102650486
Fleming, Kevin		Afternoon Scoping Meeting	M	ML102520183
Grinnell, Debbie	C-10 Research & Education Foundation	Evening Scoping Meeting	R	ML102520207
Guen, Janet	United Way of the Greater Seacoast	Afternoon Scoping Meeting	F	ML102520183
Gunter, Paul	Beyond Nuclear	Afternoon Scoping Meeting Evening Scoping Meeting	D	ML102520183 ML102520207
Harris, William		Evening Scoping Meeting E-mails	T	ML102520207 ML102500271 ML102420043
Hassan, Maggie	NH State Senator, District 23	Evening Scoping Meeting Letter	N	ML102520207 ML102420037
Kemp, Joyce		www.regulations.gov	Z	ML102640371
Lampert, Mary	Speaking for C-10 Research & Education Foundation	Afternoon Scoping Meeting Evening Scoping Meeting	A	ML102520183 ML102520207
McDowell, Robert		Afternoon Scoping Meeting	C	ML102520183
Medford, Scott		Evening Scoping Meeting	U	ML102520207
Noonis, Tim	Hampton Area Chamber of Commerce	Afternoon Scoping Meeting Evening Scoping Meeting	H	ML102520183 ML102520207
Nord, Chris		Evening Scoping Meeting	O	ML102520207

Commenter	Affiliation (if stated)	Comment source	Commenter ID	ADAMS accession number
Port, Andrew	City of Newburyport, Office of Planning & Development	Letter	W	ML102660331
Read, Robin	NH House of Representatives, District 16	Afternoon Scoping Meeting	B	ML102520183
Schidlovsky, Michael	Exeter Area Chamber of Commerce	Afternoon Scoping Meeting	J	ML102520183
Somssich, Peter		Evening Scoping Meeting & Submittal	Q	ML102520207
Vining, Geordie		www.regulations.gov	Y	ML102450525
Wagner, Dennis		Afternoon Scoping Meeting	L	ML102520183
Wolff, Cathy		Evening Scoping Meeting	S	ML102520207

The NRC staff categorized and consolidated specific comments by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by participants. Comments fall into one of the following general groups:

- Specific comments that address environmental issues within the scope of the NRC environmental regulations related to license renewal. These comments address Category 1 (generic) or Category 2 (site-specific) issues or issues not addressed in the generic environmental impact statement (GEIS). They also address alternatives to license renewal and related Federal actions.
- Comments that are general in nature, including comments in support of, or opposed to, nuclear power or license renewal or regarding the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the Seabrook license renewal application.
- Comments that address issues that do not to fall within or are specifically excluded from the scope of the NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

During the Seabrook scoping process, comments that address environmental issues within the scope of the environmental review are presented in Section A.1.1 below, along with the NRC response. While they are presented as direct quotes, the formatting of the comment in the source document may not necessarily be preserved. The comments that are general in nature, or outside the scope of the environmental review for Seabrook, are not included here but can be found in the Scoping Summary Report (NRC 2011).

The in-scope comments are grouped in the following categories:

- Alternatives to License Renewal,
- Socioeconomic Impacts of Seabrook,

- Aquatic Ecology,
- Effects of Climate Change,
- Radioactive Releases to the Environment,
- Hydrology and Groundwater, and
- Severe Accident Mitigation Alternatives (SAMA) Analysis.

A.1.1 Alternatives to License Renewal

Comment B-01-ALT: I was at a conference of legislators from all over the Northeast in Maine on Monday, where Gordon Van Welie, who's the [independent system operator] ISO -- the president of ISO New England, which runs the grid in New England, said that there are 3,000 megawatts of wind power currently in the pipeline in New England. 12,000 megawatts is available.

Maine in 2008 passed the Maine Wind Energy Act, which calls on Maine to produce 3,000 megawatts of wind by 2020. New Hampshire, we now have renewable portfolio standard, which calls on the state to have 25 percent of its energy produced from renewable sources by 2025.

I seriously question the need for Seabrook, and I still don't understand how we can be doing this process, looking at what the environmental and renewable energy situation and energy efficiency improvements 20 years and 40 years down the road.

I think it's way premature to be doing this process now. I agree with the petitioners, who say that ten years would be a much better time period to look at. There have been huge advances in renewable energy and energy efficiency. There have been huge advantages in storing alternative energy through battery technology.

There was a recent article in the *New York Times* about storing wind power. I think that this is just way premature, and I think that the NRC should look seriously at the petitioners' proposal, and look at the alternatives seriously.

Comment E-04-ALT: I mean I think that we really need to be looking more broadly and look at, you know, really the current and future power systems and power policy in the Northeast, and right now New Hampshire has, I think, 3,500 megawatts of capacity. That's like three times our stage usage of power. We are essentially an energy colony for the rest of the Northeast.

Now that's okay. Obviously some areas are going to be better at producing power, you know, and we fully expect other states will jump in and be major power producers. It was mentioned, I think earlier, the offshore potential for wind power.

The state of Maine in particular has looked into this. They did a report. It came out last December, which said that there was the potential of large scale offshore wind power to produce 149 gigawatts of power. That's about 120 Seabrooks just off the coast of Maine.

I'm sure some of you have seen this map, but this is the Department of Energy map that Mr. Gunter referred to later. In this map, the color code is bright red there. That's not "warning, get out of here"; that is the highest potential, excellent potential, outstanding is the word they use, the Department of Energy, and that's off the coast of Maine, off the coast of New Hampshire and on down the coast.

We need to be looking very carefully at these alternative power sources, and also the economic impact of that. I mean just think of all the many thousands of jobs that would be created if we were to convert some of our coastal facilities to the production of wind power.

I think of the Portsmouth Naval Shipyard, the Bath [Iron Works]. All up and down the coast we have facilities that could be producing very useful technology for the future of our energy system in this region, and we need to be looking at the potential huge public benefit of developing those resources, instead of relying on old, obsolete, potentially unsafe resources like the Seabrook reactor.

Comment E-08-ALT: On the subject of "reasonable alternatives energy sources" relative to re-licensing of this plant, which you claim to want input on, we strongly urge you to make a good-faith effort to examine current projections of renewable energy potential in the New England coastal region. This is a huge topic, but we offer one such study produced at the University of Maine last year and summarized in an AP report from December 15th. Researchers estimated that "within 50 miles of its coast, Maine has the potential wind energy of 149 gigawatts, roughly the equivalent power of 149 nuclear plants." Further, the state has already set a goal to have 5 gigawatts of wind power (4 times that of the Seabrook plant) developed by 2030, the very same year at which Seabrook is currently slated to be retired. Please also see the attached map from the U.S. Dept. of Energy's National Renewable Energy Laboratory depicting the "outstanding" wind power potential offshore of New England.

There are of course many other renewable energy technologies in the offing over the next few decades to be potentially developed in the New England coastal region, from wave power and tidal power to photovoltaic systems on existing residential and commercial rooftops. These technologies are inherently cleaner, safer, more secure and resilient, as well as increasingly more cost-effective and job-producing than continued reliance on nuclear power. If you do not make some effort in your "alternatives" analysis to explore these technologies' potential, your [environmental impact statement] EIS will be highly deficient and will not pass the "laugh test" with the region's residents or public officials. Again, future generations will have to live with the decisions, good or bad, that you make in this current process, and you owe them the respect of making an honest and justifiable effort to examine the reasonable alternatives as well as the environmental impacts of maintaining the status quo in the face or a rapidly changing energy production as well as geophysical climate.

Comment T-04-ALT: So, one other aspect I think that you should consider in a relicensing application is alternative nuclear energy systems where there are scale economies to be on the same site because you already have a site with all the infrastructure and the security systems that are now likely to be much less vulnerable. Some of the Babcock and Wilcox -- I may not have the name right -- plants that are underwater at all times, so that even if an aircraft were to come at just the right angle -- and I've supervised modeling of aircraft attacking nuclear power plants and LNG plants and these plants were not designed for direct attack by aircraft that are purposely trying to take out the plant.

But these plants do have some redundant features -- under many conditions they would survive an aircraft attacking a nuclear plant -- but a safer option is to have plants that are always protected, so even if an aircraft came at just the right angle with just the right amount of energy that you would have a safer outcome. So, I believe that when you're considering relicensing for this long period of time, one ought to consider alternative nuclear plants at the same site as an option to consider in lieu of just automatically extending a license for a plant that simply was not designed for an era of terrorism.

Comment T-07-ALT: Finally, the environmental review should consider the consequences of continued availability of Seabrook Station No. 1, its degradation as a base-load generator, or its total loss if its license is not to be renewed. The life cycle costs per kilowatt hour [kWH] of electric power for rate payers of southern New Hampshire and rate payers of northern Massachusetts should be projected. As of the present writing, it appears that the cost per kWH of electric production at Seabrook Station No. 1 is substantially lower than the recently projected costs of Cape Wind electric power (including downtime for disrupted production) derived from projected offshore wind turbine systems.

For Massachusetts electric rate payers, wind energy is either a projected financial burden for electric ratepayers, or perhaps an acceptable experimental beginning (at higher per unit costs, for now) that is ameliorated by the concurrent delivery of lower cost electric power from the Seabrook Station No. 1 facility. Without concurrent availability of the Seabrook Station No. 1 for baseline load generation, some of the renewable energy alternatives might be assessed as too expensive to add to the grid costs passed on to ratepayers. And disruption costs, when wind and solar systems produce little or no net electric power, could cause system-wide outages if the baseload power of Seabrook is to become unavailable. Seabrook's role in reducing average electric costs and reducing incidents of ISO New England system outages should be included within any environmental assessment.

Response: *These comments refer to the alternatives to license renewal, including the alternative of not renewing the operating license for Seabrook, also known as the "no-action" alternative. In Chapter 8 of this supplemental environmental impact statement (SEIS), the NRC staff evaluated the following alternatives to Seabrook license renewal: natural gas-fired combined-cycle (NGCC); new nuclear; and a combination alternative consisting of an NGCC component and a wind component. Additionally, the NRC staff evaluated the alternative of not renewing the Seabrook operating license in Section 8.5.*

Although many wind projects are planned, wind power alone is not a technically feasible and commercially viable alternative because of the intermittent nature of the energy source. The feasibility of wind as a baseload power relies on the availability, accessibility, and constancy of the wind resource. Research is ongoing (much of it Federally funded) to couple wind farms with advanced energy storage technologies, such as batteries and compressed air storage. The targets of those initiatives, however, involve the storage of relatively minor amounts of power.

Comments B-01-ALT and T-07-ALT raise the issue of need for power; the need for power is considered to be outside the scope of license renewal (10 CFR 51.95(c)(2)). The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for baseload power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decisionmakers, such as State, utility, and, where authorized, Federal agencies (other than NRC). These portions of the comments are outside the scope of the license renewal review and were not considered in the development of this SEIS.

Comment T-04-ALT touches on security issues at nuclear facilities. While malevolent acts are beyond the scope of a National Environmental Policy Act (NEPA) review, the NRC routinely assesses threats and other information provided by other Federal agencies and sources, while also ensuring that licensees meet appropriate security-level requirements. The NRC continues to focus on the deterrence, detection, and prevention of terrorist acts or sabotage or both at NRC-licensed facilities and routinely assesses threat information and other information from a variety of Federal agencies and sources. The issue of security and risk from terrorist acts or sabotage or both at nuclear power reactor facilities is not unique to those facilities that have requested a renewal of their licenses. This portion of the comment is not within the scope of this environmental review and was not evaluated further in development of this SEIS.

Comment B-01-ALT raises the timing of the submittal of the Seabrook license renewal application (LRA); that portion of the comment is considered outside the scope of license renewal. On August 18, 2010, Earth Day Commitment/Friends of the Coast, Beyond Nuclear, *Seacoast Anti-Pollution League, C-10 Research and Education Foundation, Pilgrim Watch, and New England Coalition jointly filed a petition for rulemaking requesting a change to 10 CFR 54.17 to permit an application for license renewal no sooner than 10 years before the expiration of the current license. This petition is currently under review; however, under the current regulations, an applicant is allowed to submit an application 20 years prior to the expiration of its current license. More information on the status of the petition for rulemaking can be found under Docket ID NRC-2010-0291 on the website* www.regulations.gov*. This portion of the comment was not evaluated further in development of this SEIS.*

A.1.2 Socioeconomic Impacts of Seabrook

Comment F-01-SOC: I'd simply ask that in a definition of environment, it be looked at in the broadest possible context, to review not just the traditional definitions of environment, but also environment as it relates to the quality of life that we all experience in our communities, and in particular the health and human service needs of the people who live in our local area.

I would ask that the scope include looking at the role that Nextera plays in helping to provide for the health and human service needs in our area, the large number of jobs it provides that pay a living wage, the taxes it pays to its local communities, and the role that it plays a good citizen in working with local health and human service and other non-profit agencies, the leadership its employees provide on boards and other committees, the financial support that it provides, not just to United Way but other organizations, and the volunteer time and energy that it puts back into the community. Thank you.

Comment U-02-SOC: Will you conduct or will you ensure the applicant conducts an equitable review of taxes paid and contributions made to various states, towns, residences impacted by the siting and continued operation of the plant? Perhaps on a per megawatt basis, per area impacted basis or other comparable metric within the industry or within the region?

Response: *These comments deal with the socioeconomic impacts of Seabrook on local and regional communities, including related issues such as taxes, employment, and public services. The socioeconomic impacts of renewing the Seabrook operating license are discussed in Sections 2.2.9 and 4.9 of this SEIS. This includes a discussion of annual property tax payments to seven local jurisdictions and the State of New Hampshire's Education Trust Fund; however, the State and local jurisdictions ultimately decide how to tax utility companies, assess power plant value, and distribute tax money*.

A.1.3 Aquatic Ecology

Comment I-03-ECO: On environmental impacts, you know, one of the big issues when this plant was going through its original licensing was the operation of the once-through cooling system, which is a total mortality system with a total loss of all entrained organisms in the plant. Will we be able to have baseline data to know whether that plant is having an adverse effect on the environment? How will that be looked at? I assume that that will be covered.

Response: *This comment deals with the operation of Seabrook's once-through cooling system and its effects on the surrounding ecosystem. The design, operation, and ecological effects of Seabrook's once-through cooling system on the surrounding environment are discussed in Sections 2.1.6, 2.2.6, and 4.5 of this SEIS. The NRC found that the impacts from operation of Seabrook's once-through cooling system on phytoplankton, zooplankton, invertebrates, and most fish species to be SMALL; however, the impact on winter flounder, rainbow smelt, and some kelp species would be LARGE.*

A.1.4 Effects of Climate Change

Comment E-02-CLI: Now I recognize that the purpose of this meeting is to identify environmental impacts of this plant. But we're more concerned actually right now I'd like to talk about the plant impacts from the environment. We know now that our environment is changing. I think most everybody and certainly the science is in on this, and to others it should be obvious from recent calamities occurring across the globe as well as in the region, that the climate is changing, that we know now the environmental parameters we have today are not going to be in effect 20, 40, 50, 100 years from now.

Just look at a few of these, sea level in particular. Sea level is going up. It has been going up for decades. But it's going to accelerate. We know this. The question is how quickly will it accelerate? How many meters higher will it be in 50 or 100 years? The current best estimate, without dramatic reductions in carbon emissions, which we certainly aren't seeing in our country, according to recent events, that estimate is that by the end of this century, sea level will rise upwards of a meter. That will affect the, obviously the coastline, the ground water levels, the salinity of the ground water. It will have dramatic effects on our sea coast environment.

Now another organization that I've worked with in the past, Clean Air Cool Planet out of Portsmouth, has put together a map of what the Hampton-Seabrook Harbor will look like with a one meter sea level rise. I'm sorry, I don't have a blow-up of this. I just pulled it out of my files this morning. But if you can see the area in blue, it's essentially all the salt marsh and much of the low-lying coastal area will be under water with a one meter sea level rise. The Seabrook plant is on this little peninsula right in the middle here. It will be almost surrounded by water. Most of the routes out of the plant, out of Seabrook and Hampton will be under water. Route 1, Route 1A, Route 101, they will not be accessible if this sea level rise continues, as is predicted now. We have to take this into account. We'll have a much better picture 10 or 20 years from now. But we certainly can't say right now that everything's going to be fine and that the current water regime is going to be the same.

Now looking at groundwater, this is a very important concern. I've mentioned the issues with tritium, but we're also concerned about all the underground infrastructure specifically at this plant, and what effects this groundwater change will have on that, on those systems. The salinity increases certainly will affect the corrosion levels, the amount of damage going on to these critical infrastructure, and it will affect the coastal area in many other ways. There are studies that have already been done.

The United States Geological Survey did a report on sea coast water resources. They have determined that there will be much greater reliance on groundwater, more extraction of groundwater in our seacoast area in coming decades, and that will also affect the salinity levels of groundwater. We know this on the sea coast. When you pump water out of the ground, you draw in more of the ocean water, the saline water and certainly with sea level rising, that makes it all the much worse.

One other key issue we've heard a little bit about, especially down in the Gulf Coast, is violent storms. We haven't had a significant hurricane up on this region, a really big one since, I think, 1938. But it is predicted that there will be much more and more frequent violent storms in this area. Again, looking at this map here, one of the things that it shows with the one meter sea level rise is that Hampton Beach will be largely under water. Seabrook Beach will be under water.

Those are the barrier beaches that we rely on to protect our salt marsh area and our inland coastal areas. And with those barrier beaches gone, it's much more likely that you're going to see damage. I don't know exactly how high Seabrook plant is above sea level or the spent fuel pools or the dry cast storage area. But I know it's not that high. I know with the 20 foot sea level rise, the whole place will be under water.

So I do hope that you will be, if you don't have on staff, you'll be hiring a climatologist to look at the latest research on this, and a hydrogeologist to look at the impacts on groundwater and the impacts of a changing water regime, because we need to know this information. This could be vitally important to the integrity of the plant in coming decades.

Comment E-07-CLI: As we project into the future, which is what this re-licensing process seems to be all about, we recognize your current scoping is meant to identify future environmental impacts of plant operations, but we're more concerned about environmental impacts to the plant itself, namely, from a changing climate. If you expect to take a "business as usual" [BAU] approach to re-licensing this plant, then it behooves you to adopt a BAU perspective on future climate impacts. The science is in and it should be obvious to most that our climate is changing—what we know is that environmental parameters now will clearly not be the case 50 -100 years from now.

What this means in the current context is that you ought to be planning for significant changes to sea level, groundwater and surface water hydrology, and violent storm/storm surge potential as it will likely affect the plant infrastructure and operations. The "best science" now tells us that without significant and rapid carbon emission reductions, sea level could rise approximately 1 meter by the end of this century. This may seem like a long way off, but considering the ongoing debacle of efforts to implement a long-term storage solution to spent fuel and that your recent actions allow for "temporary" waste storage on-site for up to 60 years after plant closure, it appears that Seabrook's waste storage site as well as the plant itself will likely be underwater before the waste problem is finally resolved.

Please take a look at the attached map of Hampton-Seabrook Harbor with a 1 meter sea level rise, produced recently by Clean Air-Cool Planet, a regional climate action organization with offices in Portsmouth, NH. With magnification, you can see that the plant site is mostly covered by blue, representing sea water under the best estimate scenario at the end of the century. Currently surrounding land, including adjacent saltmarsh and equally important barrier beach are also underwater in this scenario. This eventuality is probably more significant than the overall sea level change projected, in that the plant site will be much more subject to violent storm and coastal flooding damage, even if not underwater itself. Other likely impacts to the region's transportation system, groundwater and surface water regimes, and emergency planning are hard to predict, but clearly can not be assumed to be minimal. Current projections of significant population increases in the Seacoast region will further complicate this picture, and make it all the more important that assurance of plant infrastructure integrity be maintained under this radically different hydro-geological regime.

Therefore, we urge you to address likely future climate and coastal impact issues as you develop your EIS. Without reference to currently projected climate changes, your analysis will be inherently simplistic and deficient, and it will represent a gross dis-service to future generations who will have to live with the decisions you make in this process.

Response: *These comments relate to climate change and its impact on the environmental characteristics of the Seabrook site, such as change in weather patterns and sea level. Climate change and its related impacts are discussed in Sections 2.2.2 and 4.11.2 of this SEIS. Implications of global climate change—including implications for severe weather and storm intensity—are important to coastal communities and to critical infrastructure such as Seabrook. While there is great uncertainty, scientists have predicted that sea levels are expected to rise between 3 4 feet (ft) (0.9 to 1.2 meters (m)) by the end of this century. Changes in sea level, at any one coastal location, depend not only on the increase in the global average sea level but on* *various regional geomorphic, meteorological, and hydrological factors (USGCRP 2009). At Seabrook, all critical structures are located at a finished grade elevation of 20 ft (6.1 m) above mean sea level (MSL) (FPLE 2008), which is well beyond the expected sea level rise.*

Where the comments address the management of underground infrastructure, such as buried piping and inaccessible components, those portions of the comment are considered out of scope for the environmental review and were not evaluated in the development of this SEIS; however, aging management of plant systems is evaluated as part of the Seabrook LRA safety review. The results of the NRC staff's safety review of the LRA will be documented in the NRC staff's safety evaluation report (SER).

A.1.5 Radioactive Releases to the Environment

Comment E-01-RAD: We are very concerned about the ongoing air and water emissions from these plants. You've heard some from others and probably will hear more on that.

One in particular that hasn't been mentioned is the radioactive water, otherwise known as tritium, which we have seen leakage from the plant already, and is a problem throughout the industry. We've most recently heard about the problems at Vermont Yankee.

We're just amazed that in all these years and all the time we've known about the security and leakage problem, that the NRC does not require the power plant owners to have a maintenance plan to report that information. It's a voluntary program.

I just find this appalling that for all this time we've known about this problem, and for all the problems it's caused in particular with the relicensing of Vermont Yankee, that this is still an issue, and that we do not have public access to this information. It just isn't available.

Comment E-06-RAD: Among other issues, [Seacoast Anti-Pollution League] SAPL is generally concerned about ongoing air/water radioactive emissions from the Seabrook plant. Our initial perusal of available NRC documents concerning these emissions found that some years' reports did not appear to be available, and that in any case these annual summaries do not necessarily provide a complete picture of routine emissions. Regarding tritium emissions in particular, it's our understanding that there no requirements for the plant owner to report these leaks except to the extent that they are detected in the surrounding environment. Likewise, the plant owner is not required to have a maintenance plan, though there appears to be a voluntary effort on the part of the industry to address this ongoing problem, which is likely to grow in future years as the plant ages. What we have been able to glean from available sources seems to present conflicting figures about the quantity of tritium released earlier in the decade at Seabrook, as well as the extent of the contamination and efforts to address it at the time. Any EIS ought to provide a better picture of the situation with tritium and other common radioactive emissions, as well as the likelihood of future problems of this sort as the plant ages.

Comment O-03-RAD: Tritium -- tritium and pipe degradation. Almost 20-years ago, again, in a different part of New England -- the Deerfield River Valley of western Massachusetts -- exposure to tritium was linked to Down syndrome -- statistical significance -- for Down syndrome and assorted other health maladies. The study was signed-off on by the State of Massachusetts. The study is available. If you needed the study and don't have it, I can give you the study because I've got it at home. So, tritium is a known evil quantity and the linkage was made 20-years ago to the Yankee Atomic reactor in Rowe, Massachusetts. Yankee Atomic was closed in the early 90s due to concerns around pipe embrittlement. Is it possible that pipe embrittlement caused the release of all of that tritium?

You know, I am not a technician. We've got gentlemen like Paul Blanch here who hopefully will get a chance to speak tonight, but if we've got pipes that are inaccessible and can't be monitored, then that certainly falls within the scope of the upcoming license extension hearings. That stuff has to be looked at because we cannot have tritium flowing into the groundwater and coming right across the marsh into Hampton. I mean, Winnacunnet Road is right on the marsh. I have friends that live on Winnacunnet Road. So, is it true that Florida Power and Light is digging test wells because they're trying to track tritium? I mean, these are hugely important concerns and should be included within the scope of these hearings.

Response: *These comments deal with radioactive releases, including tritium, during the operation of Seabrook and their consequences to human health. The evaluation of radiological impacts of Seabrook operation, as well as the goals of the Radiological Environmental Monitoring Program (REMP), are discussed in Section 4.8 of this SEIS. As discussed in Section 4.8, the objectives of the REMP are as follows:*

- *to provide an indication of the appearance or accumulation of any radioactive material in the environment caused by the operation of the nuclear power station,*
- *to provide assurance to regulatory agencies and the public that the station's environmental impact is known and within anticipated limits,*
- *to verify the adequacy and proper functioning of station effluent controls and monitoring systems, and*
- *to provide standby monitoring capability for rapid assessment of risk to the general public in the event of unanticipated or accidental releases of radioactive material.*

The NRC staff reviewed Seabrook's annual radiological environmental operating reports for 2005 through 2009 to look for any significant impacts to the environment or any unusual trends in the data. A 5-year period provides a representative data set that covers a broad range of activities that occur at a nuclear power plant such as refueling outages, non-refueling outage years, routine operation, and years where there may be significant maintenance activities. Based on the review of the radiological environmental monitoring data, the NRC staff found that there were no unusual and adverse trends, and there was no measurable impact to the offsite environment from operations at Seabrook.

With respect to tritium releases, the NRC staff finds that there are no significant impacts associated with tritium in the groundwater at Seabrook. While onsite tritium remains above EPA's 20,000 picocuries per liter (pCi/L) standard at one location by Unit 1 and is above background at several other onsite locations, the applicant is actively controlling the groundwater with relatively high tritium concentrations. Dewatering operations pump out the groundwater to create a cone of depression that provides hydraulic containment of tritium-impacted groundwater. The tritium-impacted groundwater is sent to the facility's main outfall to the ocean, where it is released in compliance with NPDES and NRC's radiological limits. Groundwater samples from several monitoring wells are well below 20,000 pCi/L and are not expected to impact human or biota receptors (NextEra 2010). The nearest groundwater users are over 3,000 ft (910 m) from the plant site and are upgradient, as the groundwater flow path beneath the plant site is generally to the east and southeast toward the tidal marsh.

Comment O-03-RAD also raises the management of buried piping. That portion of the comment is considered out of scope for the environmental review and was not evaluated in the development of this SEIS; however, aging management of plant systems is evaluated as part of the Seabrook LRA safety review. The results of the NRC staff's safety review of the LRA will be documented in its SER.

A.1.6 Hydrology and Groundwater

Comment A-02-HYD: Currently, there seems to be a legal debate on whether consideration will be given to the leaking of radioactive liquids or other toxics unmonitored off site. The issue seems to be that currently only what will be accepted will be the dysfunction, if you will, of those components as it affects safety systems. However logically, I'd like to bring to your attention the potential of bringing it under the environmental umbrella, because it seems clear if the aging management program has not been found to be sufficient to monitor potential leaks going unmonitored off site, then in fact it would be a violation of regulation and a negative impact on the environment. That also should go for components that are buried, if we figure out how that's defined, that contain fuel from the diesel fuel tanks. I think that would be another way of getting at it, if you will. But the exam question is what you should be doing in your review of the SEIS.

So I would suggest that you fill in the blanks, provide a map, a list first of all the components within scope that are submerged, buried, what have you. Second, provide a map of where they are on the site. Provide to us in the SEIS information regarding the age of those components, the history of repairs, the results of sampling, the material that they're made of, specifics such as their contours, their elbows, etcetera, that would affect corrosion.

Also very important, provide to us, and you should be looking at this yourselves actually, what hydro geo studies have been done to determine where the monitoring wells are currently being placed, and provide those hydro geo studies that have done subsurface investigation to the public in your report, and the date at which those were done. So were the monitoring wells, in other words, put in helter skelter, or have there been very recent hydro geo studies performed?

Response: *This comment deals with the aging management of Seabrook components and the use of monitoring wells to track groundwater quality issues related to the operation of Seabrook. Insomuch as this comment deals with aging management of buried piping at the plant, those portions of the comment are considered out of scope for the environmental review and were not evaluated in the development of this SEIS; however, aging management of plant systems is evaluated as part of the Seabrook LRA safety review. The results of the NRC staff's safety review of the LRA will be documented in its SER.*

Groundwater resources at Seabrook and the effects of plant operations on groundwater hydrology and quality are presented in Sections 2.2.5 and 4.4 of the SEIS. Specifically, Section 2.2.5 summarizes the results of the NRC staff's review of Seabrook's Groundwater Protection Program, including the placement of site groundwater monitoring wells. As part of this evaluation, the NRC staff specifically reviewed the conceptual groundwater model prepared for Seabrook in 2008 and 2009. All studies reviewed by the NRC staff are cited in Section 2.2.5 and listed in Section 2.4 of the SEIS.

A.1.7 Severe Accident Mitigation Alternatives Analysis

Comment A-01-SAMA: I'd like to direct my questions and comments solely to severe accidents. There is a requirement of the applicant to do a severe accident mitigation analysis. It can be found in their application. In reading it, it's akin to reading a fairy tale. There is absolutely nothing in it that has a commonality of what one would expect of a severe accident from a nuclear reactor. It is NRC's job in the SEIS to not just describe what the applicant did, and summarize it in a chapter, as has been done at other licensees. It is rather to do, and we expect a detailed analysis of this issue. A SAMA, that's the shorthand, they're required to analyze. It's a cost-benefit analysis, the consequences of off-site of an accident, and then weigh that against costs for mitigative measures that would help reduce risk.

So this is very, very important. The applicant used a computer code called the MAC [sic] code, [MELCOR Accident Consequence Code Systems 2 (MACCS2)]. My question is I think it's necessary to justify the use of that code. First, it is not -- it was not held to the same quality assurance requirements of the American Society of Mechanical Engineering QA Program, requirements for nuclear facilities. So therefore there is a very important question. It was designed solely for research. There is a paper on this by the author of the code. It was not designed for licensing. So therefore the question is why is it being used? Also in the code, if you read it, go through it, there's no explanation of exactly how it works, which is a problem and your responsibility to explain to the public. The problem, there are many problems with this code, and it's not appropriate for use. As it was used by Seabrook in this application to determine off-site consequences. Why? It's important, when you're looking at consequences, to understand atmospheric dispersion and deposition. The code has embedded in it a module called ATMOS, and relevant for you, that uses the straight-line Gaussian plume model, which assumes that wind blows like a beam of a flashlight. NRC, DOE, the public, the world, meteorologists know that is not how the wind blows in a coastal location. Therefore, it is very important when you are doing your review, that you do site-specific analysis, analyses of plume distribution, meteorology in this area. There have been numerous studies ignored by the applicant, but they cannot be ignored by NRC, of how the meteorology is on the coast of Massachusetts, New Hampshire and Maine, specifically discussing the sea breeze effect, which occurs here, increases deposition, number one, and also when it looks like the wind's blowing offshore, it's brought in sometimes 20 to 40 miles. Very significant, ignored by the applicants in their application.

Also ignored is the fact of how plumes travel over water, where they because of lack of turbulence, they remain concentrated, and as a result you can find, when there are northeast winds, deposition blowing down to the dense urban areas, such as a Boston, where you'd expect to find hot spots, or conversely up the New Hampshire coast, to densely populated areas such as Portsmouth and Portland. This is ignored by the licensee. It cannot be ignored. Nor can it be ignored that they got their meteorological data from one source, the on-site meteorological tower, which simply will tell how wind is blowing on site, but not what happens to it off site. So the data they used is essentially worthless. We expect and demand NRC to do more. The economic costs were also grossly underestimated, particularly the cleanup costs. The MAC-S2 models bases its assumptions on clean up, on WASH 1400. Therefore, the DF factor, decommissioning factor, decontamination rather factor, is 15.

We want you to look at that. What is the DF factor that Seabrook has assumed? More importantly, what level of cleanup? They never talk about the level of cleanup. Would it be required to go [U.S. Environmental Protection Agency] EPA, 15 millirem a year? Are we going to 25? Are we going to 50? Are we going to 500? Because what is allowable greatly affects the cost of cleanup. A GOE report has reported that in fact there's no agreement between EPA and NRC. The public here wants to know. The public wants to know some other factors that were ignored. Where's the waste going to go? How much waste? What is the volume that is expected in a severe accident?

While you're looking for a place, how is it going to be safeguarded? That's a cost that's not accounted for. Are they going to put lead blankets over it? How is resuspension going to be covered? What about workers? Whereas WASH 1400 and the MAC-S2 code that they use for their cost calculations assume and was based on a weapons event, cleaning up; it was during the Cold War, of a weapons event. That is the fundamental underpinning of the code, cleanup cost factors. However, there is a vast difference between cleaning up on a weapons event than cleaning up from a reactor event. A weapons event has larger particles, larger mass loading. They assumed, as the MAC-S2 code assumes, the buildings will be hosed down and fueled to be plowed under. This will not be allowed by the public, by [Comprehensive Environmental Response, Compensation, and Liability Act of 1980] CERCLA, by EPA. So let's get some real cost here, real cost. You don't have real cost.

Also underestimated are the health costs. Look at, and we want to know. This has to be site-specific. We cannot have the health costs that are assumed in the code, that go back to understandings of the 1960's, at best early 70's. We've had [Biological Effects of Ionizing Radiation] BEIR-7. BEIR-7 is not conservative enough, because it does not include the Techna River studies. It does not include the studies by Cardis, which show far greater damage from lower doses than BEIR-7. So therefore the health costs. Health itself is taken off the table as a Category 1 issue. But the costs of health belong in the SAMA.

Next, and I'm almost finished, what is missing is consideration of a spent fuel pool accident. I think obviously this is important, because there's far more radioactivity in a spent fuel pool, and you can have migration from a reactor accident to a spent fuel pool accident, so you get a double whammy, or it can move the other way. The argument for not considering this holds no water. They go to the GEIS and look at Section 6, which takes spent fuel and low level waste for that matter off the table for adjudication, but the first paragraph says “Normal operations.” Section 5 of the GEIS, which this process is under, describes and gives a definition of severe accidents, and it defines it in terms of consequence, not in terms of the origin of the accident. Therefore, consideration of the spent fuel pool accident in a severe accident mitigation analysis, must be considered.

Last in the application, they talk about evacuation time estimates, which are required, because how long it takes and how many people will get out of dodge will affect -- in time will affect health costs. However, when you read the application, the only reference is to Seabrook's radiological emergency plan. There is no reference, no information of evacuation time estimates, no provision if they used [KLD Associates] KLD, whether these time estimates were performed during peak commuter hours, during bad weather in peak commuter hours, during holidays, during high beach season. There's no information whatsoever. Just a mere "other" reference to NUREG-1150, which has absolutely nothing to do with this, that was an analysis of consequence at five reactors, not Seabrook included in 1991. So it is really irrelevant. So that has to be updated. Last, they do a sensitivity analysis to show that we put in more numbers to make a severe accident look a little worse, and see it didn't make enough of a difference.

But what they did was use the same code, the same assumptions, the same processes, so repeating the same mistake one, two, three, four times, that never will give you the right answer. And so these are the questions. We will send these questions to the NRC, because we will not accept, and nor will you -- we're sure you would like to do a good job -- simply to read what they did and then briefly describe it in Reader's Digest form. We expect analyses, and we're very willing to help you with this process.

Comment A-03-SAMA: I spent most of my time on the Severe Accident Mitigation Analysis, which is within scope. And focused mainly on the fact that the computational tool -- the computer code -- that they are using, the MACCS2, is an antiquated code. It is not properly Q/A’d for licensing. It was done for research and it very much underestimates impact by having embedded in it the straight-line Gaussian plume model, which is inappropriate for this coastal site for largely underestimating clean-up because it was based upon WASH 1400, which in turn was based upon cleanup after a weapons event. But there is not a comparability -- as WASH pointed out and also some of the NRC staff reviewer’s of 1150 pointed out -- between a weapons event with large particles and large mass loadings to a reactor accident. So, I won't go into it.

There was also underestimating by a very large measure health costs and also underestimating Evacuation Time Estimates [ETEs] because it's apparent from at least reading the application they did not quote any ETEs for us to even question what the assumptions -- if they used KLD -- whether they considered peak traffic times, holidays, beach traffic, etc., etc. and also ignoring spent-fuel pool accidents, which seem to be in scope because of Section 5 of the GEIS.

But I would say, for something different, that my comments on the MACCS2 particularly in regard to clean-up and the gross underestimation of cost that result from it -- even the author of the code, David Shannon, has written to the fact that if you are interested in economic costs, don't use this code. And who should know better than the person who wrote it. That seems obvious. But, you should bring it in to your discussion of alternatives because in comparing alternative energies, you should be having a chart on economics. The only fair way to do it is not as suggested by a previous speaker that all you look at is the running costs because if that were the case, then a lot of people's houses would be real cheap if somebody else paid their mortgages, if someone else paid their insurance, et cetera, et cetera. That seems to be the case with the nuclear industry.

So, when you compare costs -- when you have to do your alternatives comparison -- I ask you to take the economics -- what the difference in subsidies for each are and then to tie in the MACCS2 code when you're talking about liability and insurance because the MACCS2 -- it was MACCS, actually -- which is the same in every respect to the MACCS2 -- is the underpinning, also the Price Anderson Act. So, the amount of insurance that is provided through the Price Anderson Act that the industry is responsible for rests upon this inadequate code estimation of costs. So, that too should be factored in.

Now, I'm not trying to screw the industry. What I'm trying to do is get an honest assessment of what the costs are, so in fact then we can have an honest appraisal and also then come up with a fair accounting of mitigations as they are offset by the cost. So, thank you for that thought -- or listening to that thought.

Response: *These comments address several aspects of the applicant's SAMA analysis. MACCS2 is the primary radiological dose code in the U.S. and is funded by the NRC and the Department of Energy (DOE). Traditionally, the NRC radiological consequence analyses have been conducted to evaluate potential effects of severe nuclear power plant accidents. The MACCS2 code was developed to support offsite consequence estimates for Level 3 probabilistic risk assessments of severe accidents at light water reactors. Such assessments have long served as the foundation for NRC regulatory decisions, which includes analyses of health and safety, land contamination, and economic consequences (NRC 2009). A description of MACCS2 Version 1.13.1 that was used to perform the calculations of the offsite consequences of a severe accident for Seabrook can be found in NUREG/CR-6613,* Code Manual for MACCS2: Volumes 1 and 2 *(NRC 1998). It is beyond the scope of the environmental report (ER) and the SEIS to describe in detail the code's analytical process. However, a description of the application of the MACCS2 code for the Seabrook analysis has been provided in the relevant portions in Appendix F of this SEIS.*

While arguments can be made that there are individual models more recent than those employed in MACCS2 to estimate cleanup costs, none of these have been integrated into a comprehensive package such as MACCS2. It is important that, when analyzing multiple aspects such as the various capabilities listed above for MACCS2, the various individual models be structured to account for assumptions, simplifications, interfaces, etc. This is the main reason why one cannot simply replace individual modules in an overall code, such as MACCS2, with other individual modules. Essentially, a new code would have to be developed. Until either

MACCS2 undergoes a comprehensive update or a new integrated code is developed, it is not practical to "cherry-pick" from the various modules within MACCS2. The Sandia Site Restoration Study has previously been cited as an alternative to the MACCS2 decontamination costs because these costs are not based on fallout from the explosion of nuclear weapons that produce large particle sizes and high mass loadings. However, the Site Restoration Study only indicates that decontamination data may not be applicable to a plutonium dispersal accident (the subject of the Site Restoration Study) and makes no such assertion with respect to a reactor accident. In fact, it specifically indicates that there is applicable data pertaining to reactor accidents.

The use of a straight-line Gaussian model in the ATMOS module of MACCS2 is entirely consistent with the use of similar straight-line models (e.g., XOQDOQ, which implements guidance in Regulatory Guide 1.111) used to evaluate the consequences of routine releases at all new nuclear power plants and to determine compliance with regulations at existing power plants. The MACCS2 code implicitly models the sea breeze effect because it uses all the meteorological conditions to determine the transport and dispersion of radionuclides, including conditions during sea breeze events. The MACCS2 code will treat any recorded wind that blows inland as continuing inland. That some plumes may initially head out to sea and then be drawn back would simply mean that there would be more time for dispersion before the plume moves inland. Moreover, for every change in direction associated with a sea breeze (winds blowing on shore during the day when the land becomes warmer than the water), there will also be an opposite change in direction associated with a land breeze (winds blowing offshore during the night). The deposition patterns determined by the ATMOS module of MACCS2 are cigar shaped, extending outward 50 miles from the release source in the initial model transport direction. This treatment of the sea breeze is realistic for the use to which the code output is being applied and the atmospheric model in MACCS2. As the ER indicates, the Seabrook meteorological data included 8,760 hourly recordings of wind direction, wind speed, atmospheric stability, and accumulated precipitation over a year. NextEra examined 5 years of meteorological data (2004 through 2008), including a sensitivity analysis of the MACCS2 inputs that varied the annual meteorological data set (NextEra 2010). As a result, NextEra chose to use, in its baseline analysis, the meteorological data set that resulted in the maximum dose and cost risk, namely the data from 2005, thus adding to the conservatism of the analysis. Sea breezes are adequately accounted for in the meteorological data used in the Seabrook analysis.[1]

Furthermore, the modeling of "hot spots" (small, localized volume elements where the radiation level is higher than average) is not essential to the evaluation of SAMAs and is unlikely to affect the identification of potentially cost-beneficial SAMAs. A hot spot is a relatively small area compared to the modeled domain, and the magnitude of hot spots would be small. Consequently the effect of the hot spot on the two spatially and temporally integrated parameters (population dose and economic cost) used in the SAMA analysis is small when a hot spot exists. Further, considering the frequency of conditions that might lead to a hot spot, the effect of hot spots on the climatological mean parameter values is even smaller.

With respect to spent fuel pool (SFP) accidents, onsite storage of spent fuel is considered a Category 1 issue, which was evaluated in the GEIS; therefore, accidents would be encompassed by the analysis of the Category 1 issue of onsite spent fuel storage. As such, the need for mitigation alternatives within the context of renewal has been considered, and the

[1] Sensitivity to sea breeze effect was estimated by NextEra to be, at most, an increase in offsite economic cost risk by 7 percent. There is no currently non-cost-beneficial SAMA where the maximum benefit, including uncertainty, lies within 7 percent of the minimum estimated implementation cost.

Commission concludes that its regulatory requirements already in place provide adequate mitigation incentives for onsite storage of spent fuel. No discussion of mitigation alternatives is needed in an LRA because the Commission has generically concluded that additional site-specific mitigation alternatives are unlikely to be beneficial (NRC 1996). In addition, the NRC staff did not find any new and significant information that would call the analysis of the Category 1 issue into question.

NRC does not reproduce the applicant's SAMA assessment in detail. Calculations are verified for accuracy at a high-level (e.g., using the reported output from the MACCS2 runs), but detailed analysis—such as rerunning the MACCS2 code, or reviewing all inputs—is beyond the scope of the review. If the applicant reports results atypical from what would be anticipated from a SAMA assessment that could also affect the cost-beneficialty determination, the NRC process is to request additional information and justification, including any inputs used, for these analyses. While the NRC reserves the right to require justification of any calculation, this is usually reserved for cases where reanalysis has the potential to affect the cost-beneficiality determination of particular SAMAs. Much of the concern regarding absolute accuracy is addressed via the requirement for various types of sensitivity analyses, designed to bound potential underestimates or analytical simplifications that could affect the cost-beneficiality determinations.

In response to a request for additional information (RAI), NextEra provided site-specific information regarding assumptions for evacuation of the local population, including evacuation time estimates (NextEra 2011). The NRC staff has reviewed the information supplied by the applicant and has determined that no sensitivity analyses are required. Emergency planning decisions would be based on the site Emergency Plan. Pursuant to 10 CFR Part 50.47, the Emergency Plan is required to provide adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition. The Seabrook Emergency Plan, including meteorological and dose projection capabilities, has been reviewed by the NRC staff and found to meet all regulatory requirements.

With respect to health costs and the BEIR VII Report, the National Research Council of the National Academies published "Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2" in spring 2006. The major conclusion of the report is that current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose response relationship between exposure to ionizing radiation and the development of cancer in humans. This conclusion is consistent with the system of radiological protection that the NRC uses to develop its regulations. Moreover, the BEIR VII Report does not say that there is no safe level of exposure to radiation; it does not address "safe versus not safe." It does continue to support the conclusion that there is some amount of cancer risk associated with any amount of radiation exposure and that the risk increases with exposure and exposure rate. It does conclude that the risk of cancer induction at the dose levels in the NRC's and EPA's radiation standards is very small. Similar conclusions have been made in all of the associated BEIR reports since 1972 (BEIR I, III, and V).

The results of the NRC staff's review of the SAMA analysis are presented in Chapter 5 and Appendix F of this SEIS.

A.2 Comments Received on the Draft SEIS

On August 1, 2011, the NRC issued the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station*, Draft Report for Comment (NUREG-1437, Supplement 46, referred to as the draft SEIS) to Federal, tribal, state and local government agencies and interested members of the public. The EPA issued its Notice of

Availability on August 12, 2011 (76 FR 50213). The public comment period ended on September 26, 2011. As part of the process to solicit public comments on the draft SEIS, the NRC did the following:

- placed a copy of the draft SEIS at the Seabrook Library in Seabrook, New Hampshire, and at the Amesbury Public Library in Amesbury, Massachusetts;
- made a copy of the draft SEIS available in the NRC's Public Document Room in Rockville, Maryland;
- placed a copy of the draft SEIS on the NRC website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement46/;
- provided a copy of the draft SEIS to any member of the public that requested one;
- sent copies of the draft SEIS to certain Federal, tribal, state, and local government agencies;
- published a notice of availability of the draft SEIS in the *Federal Register* on August 5, 2011 (76 FR 47612);
- filed the draft SEIS with the EPA; and
- announced and held two public meetings at One Liberty Lane in Hampton, New Hampshire, on September 15, 2011, to describe the preliminary results of the environmental review, answer any related questions, and take public comments.

Approximately 80 people attended the meetings, and 25 attendees provided oral and written comments. A certified court reporter recorded the oral comments and prepared written transcripts of the meeting. A meeting summary is available in the NRC's Agencywide Documents Access and Management System (ADAMS) (Accession No. ML11277A046). In addition to the comments received at the public meetings, the NRC received 34 letters and e-mails with comments. To identify each individual comment, the NRC staff reviewed the transcript of the public meetings, and each letter and e-mail received related to the draft SEIS, all of which are accessible in ADAMS. The NRC staff identified statements related to the proposed action and recorded the statements as comments.

Table A–2 lists each individual that provided a comment during the comment period and their associated correspondence identification number. Each comment identified by the NRC staff was assigned a specific comment identification number consisting of the correspondence identification number and a number associated with the sequential order of the comment within the specific document. Table A–3 lists the comments, grouped by category, and where the comment and response can be found within this appendix.

Three of the comments (005, 032, and 033) do not address the Seabrook Station; rather, they raise the generic issue of electromagnetic pulses (EMPs). As such, they are not included in this Appendix directly. Several Seabrook-specific comments are related to EMPs and are addressed in this Appendix; specifically, comments 018 and 027-10.

Table A–2. Individuals Providing Comments During the Comment Period on Draft SEIS

Commenter	Affiliation (if stated)	Comment source (ADAMS Accession #)	Correspondence ID	Starting page
Josephine Donovan		Comment letter ML11259A162	001	A-67
Sandra Koski		Comment letter ML11265A220	002	A-118
Max Abramson		Comment letter ML11266A153	003	A-27
Donald Tilbury		Comment letter ML11279A117	004	A-238
Graham and Pry	Commission to Assess the Threat to the United States from EMP Attack	Comment letter ML11279A118	005	N/A
William Harris		Comment letter ML11279A119	006	A-102
Mary Broderick		Comment letter ML11287A038	007	A-60
Randall Kezar		Comment letter ML11300A009	008	A-108
Randall Kezar		Comment letter ML11300A010	009	A-109
Douglas Grout	NH Fish and Game Department, Marine Fisheries	Comment letter ML11301A073	010	A-203
Timothy Drew	NH Department of Environmental Services	Comment letter ML11301A074	011	A-196
Ilse Andrews	Seacoast Anti-Pollution League	Comment letter ML11301A075	012	A-28
Mary Lampert Raymond Shadis David Agnew	 Friends of the Coast/New England Coalition Cape Downwinders	Comment letter ML11304A243	013	A-121
Timothy Timmerman	U.S. EPA	Comment letter ML11304A059	014	A-69
Kelvin Allen Brooks	NH Department of Justice	Comment letter ML11304A058	015	A-200
Peter Colosi	National Marine Fisheries Service	Comment letter ML11304A057	016	A-208
Doug Bogen	Seacoast Anti-Pollution League	Comment letter ML11304A054	017	A-40
William Harris Thomas Popik	Foundation for Resilient Societies	Comment letter ML11304A055	018	A-87
Steven Athearn		Comment letter ML11304A054	019	A-32

Commenter	Affiliation (if stated)	Comment source (ADAMS Accession #)	Correspondence ID	Starting page
Robin Willits		Comment letter ML11304A053	020	A-25
Richard Knight		Comment letter ML11304A052	021	A-116
Donald Tilbury		Comment letter ML11305A011	022	A-239
Phyllis Killam-Abel		Comment letter ML11307A392	023	A-113
Filson and Shirley Glanz		Comment letter ML11308A031	024	A-77
Donald Tilbury		Comment letter ML12059A074	025	A-245
Mary Broderick		Comment letter ML12059A073	026	A-61
Afternoon	Not applicable	Meeting Transcript ML11273A139	027	multiple
Evening	Not applicable	Meeting Transcript ML11273A140	028	multiple
NextEra	NextEra Energy Seabrook, LLC	Comment letter ML11307A235	029	A-186
Donald Tilbury		Comment letter ML12083A056	030	A-248
Susan Kepner		Comment letter ML12094A095	031	A-107
William Harris	Foundation for Resilient Societies	Comment letter ML12125A263	032	N/A
William Harris	Foundation for Resilient Societies	Comment letter ML12132A133	033	N/A
Andrew Raddant	U.S. Department of the Interior	Comment letter ML11201A099	034	A-66
Brona Simon	MA Historical Commission	Comment letter ML11257A088	035	A-184
Edna Feighner	NH Division of Historical Resources	Comment letter ML11242A111	036	A-199

Table A–3. Comments by Category

Comment category	Page	Commenter (comment ID)
Air quality (Rad)	A-233	Stern, Brian (027-25)
Alternatives	A-28	Andrews, Ilse (012-1)
	A-40 A-48 A-54 A-58	Bogen, Doug (017-2, 027-34, 028-27, 028-31)
	A-75	EPA (014-7)
	A-85	Gunter, Paul (028-6)
	A-110	Kezar, Randall (009-1)
	A-225	Saporito, Thomas (028-12)
	A-228	Shadis, Raymond (027-30)
	A-235	Stern, Brian (027-44)
	A-238 A-239	Tilbury, Donald (004-1, 022-3)
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	A-189 A-189 A-189 A-189 A-189 A-191 A-191 A-191 A-193 A-194	NextEra Energy (029-9, 029-10, 029-11, 029-12, 029-13, 029-14, 029-15, 029-16 - 029-19, 029-20 - 029-21, 029-22 - 029-24)
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A.2.1 Public Comments on the Draft SEIS and NRC Staff Responses

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

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SEABROOK STATION
Draft Supplemental Environmental Impact Statement
Division of License Renewal
NRC-2010-0206

Written Comment Form
Must be received on or before October 26, 2011. Please print clearly.

Name: Max Abramson
Title:
Organization: Seabrook Budget Committee, speaking on my own behalf
Address: PO Box 746
City: Seabrook State: New Hampshire Zip Code: 03874

Comment:
1. What types of natural disasters are likely at Seabrook Station, and what is being done in this regulatory environment? 003-1

2. Nearly all countries that use nuclear fission, if I recall correctly, recycle spent nuclear fuel. Seabrook Station is burying spent fuel on site. Are there regulations being offered that would allow American reactors to recycle waste? 003-2

Use other side if more space is needed.

Comment Forms may be mailed to:
Chief, Rules, Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUNSI Review Complete
Template = ADM-013
E-RIDS = ADM-03
Add = M. Wentzel (mjwr)

003-1 Seabrook was originally sited using criteria set forth in 10 CFR Part 100, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. These regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tsunami, and other natural phenomena, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR). When new natural hazard information becomes available, the NRC evaluates the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

003-2 The United States, as a policy, currently prohibits the commercial reprocessing of spent fuel from nuclear power reactors. The NRC is working to identify and establish the regulations necessary to license and regulate a reprocessing facility, if there is a change in national policy to allow commercial reprocessing of spent nuclear fuel. For more information, please visit: http://www.nrc.gov/materials/reprocessing.html.

Chapter 6 of the SEIS discusses the storage of spent nuclear fuel onsite at Seabrook. It is important to note that no nuclear fuel is being buried on the Seabrook site. Spent fuel generated during the operation of Seabrook is stored onsite in accordance with NRC's regulations in either the SFP, or in dry casks.

This comment provides no new information, and no changes have been made to this SEIS as a result.

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8/5/2011
76 FR 47612

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Comment On: NRC-2010-0206-0013
NextEra Energy Seabrook, LLC; Notice of Availability of Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1

Document: NRC-2010-0206-DRAFT-0026
Comment on FR Doc # 2011-19875

Submitter Information

Name: Ilse Andrews
Organization: SAPL

General Comment

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ILSE ANDREWS TRANSLATIONS

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October 25, 2011

Comment Regarding the Seabrook, New Hampshire, DEIS

Having attended three recent presentations in New Hampshire under the auspices of the NRC, I would like to comment as follows:

The DEIS fails to give fair consideration to planned or expected alternative power generation in the region, even though it will clearly exceed Seabrook's output.
The sustainable power sources of the immediate future will be diverse and decentralized, thus assuring the population in this region of reliable power regimes without the dangers inherent in nuclear power. 012-1
No explanation is provided in the DEIS on foreseeable control of current tritium leakage at Seabrook; nor is there a consideration of the likely increase of tritium leakage as the plant ages. I think the NRC should insist on scheduled full-scale investigation and reporting of contaminated plants and animals in the marine environment of Seabrook. 012-2
Climate-change, with its expected rise in sea level and resulting impact on coastal erosion, severe storms and 012-3

SUNSI Review Complete
Template = ADM-013
E-RIDS = ADM-03
Add = M. Wentzel (mjw2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f5bec... 10/26/2011

012-1 The commenter feels that the alternatives to relicensing Seabrook were not fairly considered, however, there were no specific examples given to indicate that the analysis performed was inadequate. As described in Chapter 8 of this SEIS, the NRC initially considered 16 different power generation alternatives to renewing the Seabrook license, before narrowing the list to 3 alternatives that were considered in-depth. As a result of its analysis, the NRC staff concluded that there is no clear, environmentally-preferred alternative.

This comment provides no new information, and no changes have been made to this SEIS as a result.

012-2 The NRC staff reviewed Seabrook's radioactive gaseous and liquid effluents, including tritium leakage, and the radiation doses to members of the public from current operations in Section 4.9.1 of the SEIS. Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within dose standards specified in NRC's and EPA's regulations.

As described in Section 4.8.1.2, the NRC staff also evaluated Seabrook's radiological environmental monitoring program (REMP). The REMP provides an independent mechanism for determining the levels of radioactivity in the environment to ensure that any accumulation of radionuclides released into the environment will not become significant as a result of station operations. The in-plant radiation monitoring programs are used to control radioactive effluent releases to ensure the dose to members of the public are within the dose limits in 10 CFR Part 20 and the As Low As Is Reasonably Achievable (ALARA) design criteria in Appendix I to 10 CFR Part 50. The REMP provides direct verification of any environmental impact from the released radioactive effluents. Based on the review of several years of REMP data, the NRC staff concluded that there were no measurable impacts to the environment as a result of radioactive releases, including tritium, from Seabrook operations.

In addition, Section 2.1.7.2 and 2.2.5 contain information on the tritium leak and a discussion of Seabrook's groundwater quality and groundwater monitoring program.

groundwater hydrology are inadequately considered in the DEIS and are palpably out of date. 012-3

Respectfully submitted,
Ilse Andrews

012-2 cont'd The NRC provides continuous oversight of nuclear power plants through its Reactor Oversight Process to verify that they are being operated in accordance with NRC regulations. The NRC has full authority to take whatever action is necessary to protect public health and safety, and the environment and may demand immediate licensee actions, up to and including a plant shutdown. NextEra is required to maintain the Seabrook REMP in compliance with NRC regulations. The NRC will continue to inspect NextEra's compliance with radioactive effluent releases during the term of license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

012-3 This comment in part expresses concern that the analyses of climate change impacts in the SEIS are inadequate and out of date. The EIS has been updated to include the recent information on climate change and its related impacts, including the U.S. Global Research Program's (USGCRP) latest 2014 report, "Climate Change Impacts in the United States," the National Oceanic and Atmospheric Administration 2013 technical report, "Regional Climate Trends and Scenarios for the U.S. National Climate Assessment," and the Intergovernmental Panel on Climate Change 2013 report, "Climate Change 2013: The Physical Science Basis." These reports reflect the current state of knowledge regarding climate change and impacts. The USGCRP integrates and presents the prevailing consensus of federal research on climate and global change, as sponsored by thirteen federal agencies. Climate change and its related impacts on the environment are discussed in Sections 2.2.2, 4.12.1.2, 4.12.2, 4.12.3, 4.12.4, 4.12.6, and 4.12.7 of this SEIS.

Implications of global climate change—including implications for severe weather and storm intensity—are important to coastal communities and to critical infrastructure such as Seabrook. While there is great uncertainty, global mean sea levels are expected to rise an additional 0.5 to 1 ft. (0.15 to 0.3 m) by 2050 and between 1 to 4 ft. (0.3 to 1.2 m) by the end of this century; sea level rise along the Northeast coast is expected to exceed the global rate due to local land subsidence and is projected to rise 0.7 to 1.7 ft. (0.2 to 0.5 m) by 2050 (USGCRP 2014). Changes in sea level, at any one coastal location depend not only on the increase in the global average sea level but on various regional geomorphic, meteorological, and hydrological factors (USGCRP 2009). At Seabrook, all critical structures are located at a finished grade elevation of 20 ft (6.1 m) above mean sea level (MSL) (FPLE, 2008), which is well beyond the expected sea level rise.

012-3 cont'd Furthermore, site-specific design bases for flood protection are prescribed by a nuclear power plant's Updated Safety Analysis Report/Updated Final Safety Analysis Report and by applicable technical specifications. Acceptable protection for floods includes levees, seawalls, floodwalls, or breakwaters. If new information or operating experience relating to flooding becomes available, the NRC evaluates the new information to determine if any changes are needed at existing plants. Flood protection issues are considered during site-specific safety reviews and, more specifically, are addressed on an ongoing basis through the reactor oversight process and other NRC safety programs, which are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, Robin. Ilse --

ILSE ANDREWS: Thank you. Good evening. I've lived a long life. Very early in my life I spent years in air-raid shelters in Europe. Life does not become much more dangerous. When I drive past Seabrook, I consider it nothing more than an ominous presence. I see nothing friendly or beneficial about it. And I cannot understand why there is an effort to prolong it, when we have viable and -- if there's such a word as -- provable alternatives.

I'm standing here only because of my concern for future generations. It makes my hair stand on end when I read the phrase -- unavoidable adverse impacts with regard to Seabrook emissions. And on the slides this evening, there was a remark that said -- the NRC's response to Fukushima, among other things -- is that here there is no imminent risk to public health and safety. Imminent means right now, not 20-years or 21-years hence.

All of what I'm saying leads to a sort of rhetorical question -- if current NRC regulations permit such unavoidable adverse impacts and on the other hand you are admittedly responsible for protecting our health and safety, then I would like to ask you -- what are you doing to change these regulations? Thank you.

028-21

028-21 The commenter expresses concern that Seabrook could be relicensed when relicensing would result in unavoidable adverse impacts. As described in Section 9.3.1, there will be both radiological and non-radiological impacts associated with renewing the Seabrook license. It is important to note that there would be unavoidable adverse environmental impacts for any power generation alternative to Seabrook. Impacts would vary by alternative, and would likely occur during the construction and operation of the power source.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Nuclear Regulatory Commission:

I would like to draw your attention to a matter that is likely to have major impact on the assumptions used to evaluate the license renewal option at Seabrook and other nuclear power plants: declining fossil fuel availability and the prospect of a permanent end to economic growth during the period of Seabrook's current license.

019-1

As your studies of the life-cycle carbon impacts of various power generation options makes clear, at least implicitly, you understand that neither nuclear power nor any of the various "alternative" energies are stand-alone entities, with assured viability independently of the infrastructural context provided by easily available fossil fuels. However, the full import of this dependency is lost by failure to take any note of the actual prospects for declining fossil fuel availability or predictable consequences of such decline. How is fossil fuel decline and associated effects such as decreased ability to manufacture steel, concrete, and heavy machinery, or to transport goods and people on a global scale, likely to affect the ability to manage the complex systems such as nuclear power plants, the ability to obtain nuclear-grade parts, the ability to manage high- and low-level wastes, the ability to decommission plants at the end of their operating lives, or the ability to mitigate severe accidents such as the one ongoing in Fukushima? The

019-1 The commenter expresses concern about a decline of fossil fuel availability, and its impacts on the world economy. The impacts of the availability of fossil fuels and its effect on the economy are beyond the scope of the Seabrook environmental review, and, moreover, outside the regulatory authority of the NRC.

While any significant change (either positive, or negative) in the economy could have the potential to affect the funding available to decommission Seabrook, it would be too speculative to assume, as the commenter does, that a decline in fossil fuel availability would necessarily lead to a collapse of the world economy. Additionally, like all licensees, NextEra must report to the NRC every two years the status of its decommissioning funding. The NRC's regular analysis of Seabrook's decommissioning funding plans includes a conservative growth estimate to account for inflation and market instability. This analysis disregards unsupported hopes for better market performance or expectations for reactor license renewals. The NRC is also prepared to require additional contributions to decommissioning funds or other acceptable financial mechanisms should the analysis indicate possible shortfalls. Decommissioning funds are separate from other plant assets and are protected by law for cleanup activities only—a plant operator cannot "walk away" from its responsibilities to return a site to an acceptable state.

This comment provides no new information, and no changes have been made to this SEIS as a result.

uncertainties involved do not obviate the need for such an analysis.

Domestic oil production peaked in the U.S. in 1970. The country compensated by importing ever greater quantities of oil. Since then a majority of oil producing countries have seen their own peaks in production, and they have responded in basically the same way. When world oil production peaks, the world will not be able to rely on this strategy of increasing imports from "elsewhere."

019-1

World oil production has plateaued over the past five years, during a period when prices have been near record highs, and during which major investments in increase production *have* been made. Total liquid hydrocarbon production (which includes natural gas liquids and ethanol) has increased by about 2.5% over the most recent 5 years for which data are available (2005-2009), while the total energy content has declined by about 2.8% over the same period – and that decline no doubt obscures an additional decline in net energy available for supporting the rest of the economy, as increasing energy has to be used to obtain this slightly growing supply with slightly declining energy content. (Similarly, in recent years, small increases in US coal production have been accompanied by small absolute declines in energy derived from coal.)

Furthermore, when world oil production peaks, oil available for purchase on international markets is likely to decline at a faster rate than overall global rate of oil decline, for the simple reason that exporting countries tend to satisfy internal demands first. Indeed this trend seems to be beginning already on a global scale. Global oil exports declined 7% over 2005-2009. (Above statistics from Roger Blanchard, "The President, the Media and Oil Supply," Energy Bulletin, June 27, 2011, based on EIA data)

We can expect substantially faster decline rates going forward. For example, Alaskan production is declining at about 10% per year despite many new projects coming on line. Exploration success in the millions of acres of National Petroleum Reserve-Alaska (NPR-A) and ANWAR which have been opened to exploration in recent years that the USGS has had to reduce its estimate of resources available in NPR-A by a factor of ten. Similarly, the deep water Gulf of Mexico, recently the one bright spot in U.S. production trends, may have peaked in 2010, with little prospect of new finds comparable in quantity or size to the ones already brought on line. Declines of 10% per year are typical of offshore production (e.g. the North Sea), with some Mexican fields, such as Cantarell - a decade ago responsible for half of Mexico's total production - experiencing declines of around 20% per year. Mexico has remained a source of imports for the U.S. (currently the third largest) only because of the rapid development of Ku-Maloop-Zaap, a field about half Cantarell's size, using the same nitrogen injection technique which led to Cantarell's rapid rise and fall. But this stop gap is not expected to last at current output levels more than two or three years more.

019-1

I have argued in detail elsewhere that Persian Gulf oil has effectively peaked as well. (See "Largely About Access," attached.) I urge you to look at those details, instead of relying on official forecasts. Indeed U.S. officials such as former Commerce Secretary Don Evans (2006), President George W. Bush (2008) have basically acknowledged the same thing.

Arguably, an average annual decline in oil availability of 3-5 percent per year is likely over the period of Seabrook's current license, assuming outright financial and industrial collapse can somehow be averted (no planning has yet been given for how to manage and finance an economy without growth, in which, on average, there is no prospect that debts will be repaid). This would mean a 50% reduction in oil availability, compared to current levels, in the 2025-2035 timeframe. 019-1

There are many issues that could be raised regarding the reports assumptions in the face of this unacknowledged but game changing condition, but I here draw your attention only to one: the assumption that "Decomissioning would occur whether Seabrook shuts down at the end of its current operating license or at the end of the period of extended operation." The difference between 2030 and 2050 could be the difference between being able to conduct planned decommissioning only with great difficulty and being able to do so not at all. We must face the question of whether, for lack of foresight, the result in the end will be permanent cessation of operations *without* decommissioning, and the environmental impacts that would entail. 019-1

BRIAN ANDERSON: Brian, thank you for those comments. Just as a reminder to everybody -- this meeting is not the only avenue to provide comments. NRC staff will certainly take spoken comments at this meeting and a session again tonight, but today is not your only chance and this meeting is not your only chance. As the staff discussed earlier, there are ways to provide written comments electronically or by conventional mail.

So, if there's more to say than you're able to get in during the comment period of these meetings, NRC staff will continue to take comments outside of this meeting and for other times.

The next speaker is Marcia Bowen --

MARCIA BOWEN: I'm Marcia Bowen and I [indiscernible] --

BRIAN ANDERSON: Okay. Thank you, Marcia. The next speaker is Steven Athearn -- am I saying that right?

STEVEN ATHEARN: You're saying it correctly.

BRIAN ANDERSON: And Mary Ross will be after Steven.

STEVEN ATHEARN: Hi. I'm, as I mentioned earlier, walking to Boston to the Japanese consulate with my wife who's from Fukushima. She spoke earlier at the end. She would like to share with you what her immediate family and her nephews and nieces, who are young people, are going through. They're living with concern that they're breathing everyday and eating and drinking radioactive isotopes to be incorporated into their bodies. I know that you understand the issue between internal/external exposure, but I think that the internal exposure has not been -- as I understand it -- focused on in the general models of radiation exposure and public health.

Doing this walk -- I'm just so busy organizing it, I haven't had a lot of time to read -- but there's one aspect that I think I am fairly knowledgeable about and that is the energy situation in general, which I studied for about three or four hours a day for about four-years up until about two-years ago. Somebody said that this is outside the scope and I'm not sure if that's because it's considered a Safety issue, but the general finite nature of the energy resources that we depend upon cannot be outside the scope of the safety of nuclear power plants. This may not be an issue of the impact of a plant on the environment, but of the impact of the environment on the plant. Which is in the same category as the natural disasters that can happen. 027-26

But, if you look at the Middle East, for example, which is supposed to contain 60% of the world's oil -- I think it's more like 45% if you drop that by at least 300-million barrels as the highest Saudi expert on their production says that we should reduce that -- he's talking about the OPEC-5 because he doesn't want to -- he tends to avoid talking about Saudi Arabia specifically. But, there were some WikiLeak documents that recently surfaced describing what he had told U.S. intelligence and it was said that no U.S. official had commented on this. That isn't true. George Bush -- when he visited Saudi Arabia in January 2008 -- said that basically we really can't ask them to raise their production because they're already producing as much as they can. Don Evans said the same thing in 2006. That was not the thing that remained, after

027-26 The commenter expresses concern about a decline in the availability of energy resources, particularly fossil fuels, and its impacts on the world economy. The impacts of the availability of energy resources and its effect on the economy are beyond the scope of the Seabrook environmental review, and, moreover, outside the regulatory authority of the NRC.

This comment provides no new information, and no changes have been made to this SEIS as a result.

he went to Saudi Arabia, in the media -- it doesn't matter what part of the spectrum you were on, you didn't hear that part unless you were concerned specifically about energy.

But these resources are finite. The oil resource is going into decline now. We're evidently at a bumpy plateau, but we could expect -- the only thing we can expect rationally, if the Middle East can no longer raise its production, is that the world is at peak oil. And world production will be declining just as the production of many countries already has, such as the United States, which began in 1970. The rate at which the world production declines is not the rate at which our ability to import oil will decline. That will decrease faster because countries that are able to export tend to meet their own needs first and those are growing, especially when oil is expensive and the wealth of those countries is going up. But if you look at the other resources -- the situation is not so great either.

Natural gas recently was viewed as going into decline. In fact, conventional natural gas production has peaked in 1973. We surprisingly discovered shale gas and we've had the shale gas revolution and all of a sudden there's no problem in sight. It's just that our shortsightedness in energy, which you're probably familiar with.

027-26

But in the case of coal, which supplies most of our electric generation -- it takes (3) mile-and-a-half long train cars every day to supply Plant Scherer in Georgia and that's sub-bituminous coal. We're already in decline of the good coal -- the coal that has high energy density. The gentleman over here talked about the loss of external power -- we've got to consider the situation when we think about that issue and we've got to consider the impact on the economy. Almost all of us are -- we've lived in a situation where all of these things are growing.

I looked at one of these oil production curves -- of course, the future is a little bit uncertain, but in general terms it's pretty clear. But, I realized that I was born in 1966 and if I live another 10 or 15-years -- more than half of the total oil resource that will ever be consumed -- ever -- will have been consumed in my lifetime. That's the lifetime of one individual, which shows how short -- we think of 20 or 30-years as a long time just because we're people, but the situation is -- it's very -- it's incredibly short. If you look at it over a scale of 1000-years, it would just be a spike that went straight up and straight down and that's it.

And our financial system is geared towards growth -- we need to have growth in order to prevent collapse. But if our society collapses, we cannot guarantee the safety of nuclear reactors. We tend to think only in terms of our needs -- what we need. We project that we need this much energy or this much electricity, but if we want to be the least bit realistic, we've got to think about what we can actually expect to happen.

So, I would urge you to -- it absolutely cannot be outside the scope. Maybe it's outside of the scope of a narrowly defined environmental effect, but in terms of the safety of operating nuclear power plants after 2030 -- if oil declines at 5% a year, it's going to be half in 14-years, which is before 2030. We could be in a very different society by that time. We might even be in a collapsed society. To not discuss this risk -- this is not something that's going to happen once in a thousand years. This is going to happen.

Oh, by the way, uranium is also finite and nuclear plants are using -- the uranium mines are supplying only 78% of the need of nuclear plants worldwide. That's up from about 50% since Kazakhstan came online. But uranium supply is also finite. 027-26

BRIAN ANDERSON: Steven, I'll ask that you finish up your comment.

STEVEN ATHEARN: I'll wrap it up. Okay.

BRIAN ANDERSON: Thank you.

STEVEN ATHEARN: So, we need to look at the contingencies for what can happen to our society when energy declines. That is a real risk and it does impact -- it has obvious implications for our ability to run nuclear power plants for sure -- the most complex thing around. 027-26

I think wind has its clear limitations. I think offshore wind in the Gulf of Maine does have some hopeful possibilities. But if that program fails, you don't get the same consequences as you do if a nuclear power plant explodes. So, thank you very much.

Seacoast Anti-Pollution League
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October 26, 2011

Cindy Bladey, chief
Rules, Announcements, and Directives Branch (RADB)
Division of Administrative Services
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC

Dear Ms. Bladey,

On behalf of Seacoast Anti-Pollution League, I would like to submit the following comments on the Draft Supplemental Environmental Impact Statement (DSEIS) for Seabrook Station's proposed re-licensing. These comments are submitted as expansion/clarification of my oral comments given at the DSEIS public meeting in Hampton, New Hampshire on September 15th.

In general, we are concerned about the assumptions and the timeframe the SEIS uses in its presumed purpose. There is of course an inherent difficulty in projecting twenty years into the future, as required by your legally allowed but nevertheless premature consideration of NextEra's proposal at this time. You seem to be operating on the assumption that the plant structures and the environment surrounding them, particularly the hydrogeologic regime, will largely remain the same two decades into the future. While the draft SEIS does make some general references to potential climate change impacts and existing degradation of plant infrastructure, there seems to be the presumption throughout this report that things will remain the same, that what's happening now will continue at the same rate two to four decades into the future. 017-1

Similarly, with respect to future power needs and sources you repeatedly appear to rely on the assumption that what's needed or available now will necessarily persist for future decades. As someone who has closely watched regional electric power policy development over the past decade, as well as nuclear industry planning over several decades, I am highly troubled by some of the assumptions and statements you make to justify the purpose of this SEIS. 017-2

For example, in the executive summary (pg. xvi), the draft SEIS summarizes your dismissal of alternative power options "due to technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing Seabrook license expires." Considering that you're talking about two decades hence,

017-1 The commenter expresses general concern about the assumptions and timeframe used for the Seabrook assessment, specifically as it pertains to the potential change in the environment around Seabrook. Climate change and its potential impact on the environment around Seabrook is discussed in Chapters 2 and 4 of this SEIS. As part of the assessment of environmental impacts, the NRC analyzed the past and current impacts of Seabrook on its surrounding environment. The NRC then determined if those impacts were likely to continue into the period of extended operation, or if there were other factors that would influence that impact.

This comment provides no new information, and no changes have been made to this SEIS as a result.

017-2 The commenter takes issue with the alternatives analysis in this SEIS, specifically, with the future need for the power currently generated by Seabrook, as well as the assumptions used when selecting which alternatives to consider. With regard to the future need for the power generated by Seabrook, need for power is outside the scope of the license renewal environmental review and is not evaluated in this SEIS. The need for Seabrook's generating capacity is determined by other energy-planning decision makers, rather than the NRC. Those may include State, utility, and other (non-NRC) Federal agencies.

As far as the basis for selecting the alternatives that were considered, the purpose and need for the proposed Federal action (license renewal) is to provide an option that allows for baseload power generation capability beyond the term of Seabrook's current operating license. Therefore, any alternative to relicensing Seabrook that is considered must be capable of meeting the needs being served by Seabrook. As discussed earlier, the determination of that need for power is not considered in this SEIS. When selecting alternatives to review, the NRC attempted to identify all reasonable alternatives to renewing the Seabrook license. For consideration, a reasonable alternative must be commercially viable on a utility scale and operational prior to the expiration of Seabrook's operating license, or expected to become commercially viable on a utility scale and operational prior to the expiration of the Seabrook operating license.

that's quite a predictive ability, one that many other energy planners and developers would be envious of if was based on any real-world experience. The basic facts are that the nuclear industry and government energy planners have been consistently wrong about future energy needs and subsequent power development for decades now, and there are dozens of unfinished/killed reactor construction sites (eg., Seabrook #2) and electric power overcapacities (eg., New Hampshire/New England) to show for that. Due to technical change, resource un-availability and commercial opportunities, our power system is changing now, and that change away from "discrete" centralized power sources like Seabrook will no doubt accelerate in coming decades. So we have little reason to trust the NRC staff's "beliefs" about future power needs and options.

Again, in the draft SEIS's discussion of environmental impacts of alternatives (section 8), the draft SEIS repeatedly refers to "current" use of various alternatives (pgs. 8-32/line 34, 8-34/line 29 and probably elsewhere) and "current" needs for Seabrook's power (pgs. 8-42/line 12, 8-45/line 30), as if we lived in a static energy environment and the present conditions were an adequate predictor of future needs and options. For accuracy's sake at the very least, shouldn't you correct the text on 8-42/line 12 and 8-45/line 30 to say "presumed to exist in 2030"? Isn't that the real issue here?

Relatedly, the draft SEIS repeatedly refers to a need for "discrete" sources of power (pgs. 8-33/line 33, 8-34/line 31 and probably elsewhere), ignoring and negating the distinct advantages of having a decentralized and diversified power system, and more relevant to the current situation, assuming once again that the present serves as an appropriate guide and predictor for the future. Where is it written that we will always need 1250 MW from one "discrete" source on New Hampshire's seacoast, when it isn't even contracted to be used here? 017-2

Regarding the draft SEIS's comparison of alternative power sources, the general approach appears to be "divide and conquer," as if there was one "discrete" solution, or we would even desire to find solely one alternative power source to replace Seabrook. As you knock down each alternative power source in turn, you make one feeble though inappropriate attempt to combine two potential sources – new NGCC and wind farms - that once again appears based on past experience rather than future potential. Besides ignoring the fact that New Hampshire already has an overcapacity of underutilized ICCG plants not far from Seabrook to employ before building new capacity, you proceed under the dubious assumption that most new wind farms will be land-based. This assumption ignores recent analysis (eg., DOE-NREL, June 2010) on the potential feasibility and greater efficiency of offshore wind development. If I read it correctly, the DOE report finds there's enough socio-economically feasible wind power potential just of the New Hampshire coast alone to replace Seabrook, let alone vastly greater potential off adjacent coasts in Maine and Massachusetts. This poorly researched "straw man" approach to viable alternatives does a disservice to the NEPA process you are obligated to address, let alone commonsense public understanding of future power options in our region.

Regarding radioactive effluent releases generally, the draft SEIS does admit (on pg. 4-45) that all nuclear plants are expected to "release radioactive material to both the air and water during normal operations," yet it neglects to provide any specifics as to the quantities of these emissions. Given that it's been definitively established now that there are NO completely safe levels of radiological exposures (NAS BEIR VII, 2005), one would think that some specific estimates of the amounts and kinds of radioactive substances being emitted into our local environment (beyond those given for tritium) would be appropriate here. When I turned to the 017-3

017-2 cont'd In making the determination as to alternatives to relicensing Seabrook, the NRC reviewed multiple technical publications, including the June 2010 National Renewable Energy Laboratory (NREL) report referenced by the commenter. While the commenter is correct the report indicates that the potential for wind power off the coast of New Hampshire exceeds the output of Seabrook, it is important to note that the report assumes that the entire offshore area is available as a wind resource and that no areas were excluded "due to environmental and other ocean-use factors" (NREL 2010). As NREL stated in a September 2010, technical report "[f]urther studies [of offshore wind potential] are needed to evaluate the impact of specific exclusions, such as unacceptable human encroachments, shipping lanes, and fisheries, among others" (NREL 2010a).

This comment provides no new information, and no changes have been made to this SEIS as a result.

017-3 The NRC's regulatory limits for radiological protection for nuclear power reactors specified in 10 CFR Part 20 are given in units of dose (i.e., millirem) vice radioactive concentrations. It is correct that the dose is based on the amount of radioactive material that is released from the plant. However, due to the complexities associated with the types and amounts of radionuclides being released and the different amounts released over the course of a year, the NRC requires each nuclear power reactor to calculate the resultant dose associated with the releases. Each nuclear power plant is required to report the dose to members of the public from their radioactive releases in an annual report. The reported dose value is used by the NRC to determine the licensee's compliance with dose limits.

Radiation doses to members of the public from the current operations of Seabrook were evaluated in Section 4.9.1.1 of the SEIS. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological doses to members of the public were within NRC's dose limits.

As described in Section 4.9.1.3, the NRC staff also evaluated NextEra's radiological environmental monitoring program (REMP). Based on the review of several years of data, the NRC staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

017-3 cont'd The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation to humans. The limits are based on the recommendations of scientific standards-setting organizations, and reflect extensive scientific study by national and international organizations. The models recognized by the NRC for use by licensees to calculate dose incorporate conservative assumptions to ensure that workers and members of the public are adequately protected from radiation.

Although radiation may cause cancers at high doses, currently there are no reputable scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 10 rem (0.1 Sv). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This is consistent with the information contained in the National Academy of Sciences' (NAS's) Biological Effects of Ionizing Radiation report cited in the comment. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit in 10 CFR Part 20 is 100 mrem (1 mSv) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor has enforceable license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

appropriate page in the draft SEIS (pg. 4-46), I found simply a reference to a previous report by NextEra. Perhaps a brief chart summarizing these quantities in milliCuries could be added here.

I was even more dismayed to find that all the stated figures for calculated doses to the public missing negative sign (-) on the exponents, resulting in a description of potential lethal doses! Please correct these typos! Also on that page (line 34-35), you state broadly that the radiological impacts from Seabrook "are not expected to change significantly" based solely on past performance, yet you don't take into account the detection limits of existing environmental monitoring or that emissions could conceivably increase to the cumulative dose limits without raising regulatory alarms. Given the propensity of aging equipment and foundations to leak more (as evidenced by ongoing tritium leaks), the future impacts from these potential emissions increases may not be "insignificant." 017-3

Specific to tritium, the draft SEIS provides a great amount of monitoring data and other details of ongoing leaks that have not been previously available to the public, though there seems to be little discussion of the amelioration of these leaks beyond increased pumping of groundwater. There is also scant mention of the relatively high detection limits of employed environmental monitoring, particularly in seawater, which results in the technically correct but nevertheless misleading statements, such as on page 4-59, line 2 that "no offsite migration of tritium in groundwater has been observed," pg. 4-44, line 7 that "[surface water] samples showed not indication of tritium," and again on pg. 4-44, line 28-30 that "no tritium or gamma emitters were detected in any of the groundwater samples collected during the year," and that "results do not indicate any measurable impact from Seabrook plant operation." This last line is repeated throughout the discussion of other environmental parameters and in the summary without reference to detection limits, which could mislead the reader to conclude that there was "no impact" when the cumulative environmental impact could be quite larger. 017-4

Also, I found it odd and unclear why you refer to tritium leakage to groundwater as "new and potentially-significant information" (pg. 4-58), when the overall problem has been known and monitored for fully 12 years now – more that half the operating age of the plant. And NextEra's applied solution by dilution into to the ocean, while regulator-approved, just does not seem to make sense in the long run (40 more years!), when again, no amount of increased radioactive exposure is completely safe. Also, section 2.2.5 (pg. 2-29) doesn't seem to mention unit 2 dewatering (at 32,000 gpd), even though that appears to be the lion's share of dewatering activities on the plant site. 017-5

On climate impacts, since my scooping meeting comments a year ago largely focused on this, I'm glad to see some reference to related research, though the description of impacts from increased storms, storm surge, coastal flooding, more powerful/more frequent hurricanes, etc. is vague or non-existent. Perhaps more importantly, your IGCC-based description of potential sea level rise estimates is now considered by most climate scientist to be too conservative and out-of-date. The current business-as-usual sea level rise projections have been effectively DOUBLED, as detailed a in major report released last May and elsewhere. Given all this, the draft SEIS's defense, based on NextEra's previous pronouncements, that the plant's "critical structures" are 20ft. above mean tide is simply not adequate to the issue at hand. How about rest of plant site, the waste storage, site access/egress, powerlines/transformers? What about the effects on groundwater infiltration and tritium migration? Given the gravity the issue, a bit more explanation beyond "it's above the projected high-tide" seems in order here. 017-6

017-3 cont'd On April 7, 2010, the NRC announced that it asked the NAS to perform a state-of-the-art study on cancer risk for populations surrounding nuclear power facilities (ADAMS Accession No. ML100970142). The NAS study will update the 1990 U.S. National Institutes of Health National Cancer Institute (NCI) report, "Cancer in Populations Living Near Nuclear Facilities" (NCI 1990), which concluded there was no evidence that nuclear facilities may be linked causally with excess death from leukemia or from other cancers in populations living nearby. The study's objectives are to: 1) evaluate whether cancer risk is different for populations living near nuclear power facilities, 2) include cancer occurrence, 3) develop an approach to assess cancer risk in geographic areas that are smaller than the county level, and 4) evaluate the study results in the context of offsite doses from normal reactor operations. The study began in the summer of 2010 and is ongoing.

The NRC staff appreciates the feedback noting that reported doses were missing the negative sign for the exponents. The correct values are reported in the final SEIS.

017-4 As described in Section 4.8.1.2, the NRC requires Seabrook REMP to sample and analyze atmospheric, terrestrial, and aquatic media and biota in the environment around its facility for radiation and radioactivity that is released during the operation of the plant. The REMP conducted at Seabrook is based on NRC guidance regarding the types and numbers of environmental media to be collected and also specifies the detection levels that must be used in the analysis. The detection levels are designed to be sensitive enough to distinguish ambient background radiation (i.e., natural radioactivity and fallout from atomic weapons testing) from radioactivity released from Seabrook. The NRC requires a detection level of 2000 picocuries/liter (pCi/l) for tritium in drinking water pathways and 3000 pCi/l for non-drinking water pathways. In section 2.2.5 of the SEIS, the NRC staff reported that Seabrook had a detection level of 600 pCi/l, which is well below the NRC's required value.

The NRC staff review of Seabrook's evaluation of tritium in the groundwater and deemed it to be adequate. Further, the NRC staff discussed its assessment of the impacts from Seabrook operation on groundwater resources in Sections 4.5 and 4.12.1 of the SEIS and concluded that there would be no significant impacts related to groundwater issues. The NRC staff considers its evaluation of the issue of radioactive liquid releases to be complete for the purposes of this NEPA evaluation. No further evaluation of this issue is needed for the final SEIS.

017-5 This comment questions the characterization of the inadvertent release of tritium-containing liquids to groundwater as new and significant information, the safety of discharging radionuclides to the ocean, and dewatering activities at Seabrook Unit 2. In accordance with NRC's regulations at 10 CFR 51.53(c)(3)(iv), an applicant for license renewal must include in its environmental report any new and significant information of which it is aware. In summary, new and significant information includes in part (1) information that identifies a significant environmental impact that was not previously considered or addressed in NRC's GEIS and regulations, and (2) information not considered in the assessment of impacts evaluated in the GEIS leading to an environmental impact finding different from that codified in NRC's regulations. Sections 1.4 and 1.5 of this final SEIS describe NRC's process for evaluating environmental impacts associated with license renewal as well as the evaluation of new and significant information. In its 2010 Environmental Report, NextEra identified tritium in groundwater adjacent to Unit 1 to be new but not significant information, and Section 4.10 of the SEIS presents the NRC staff's evaluation of the information provided by NextEra.

As described in Section 2.2.4 of this SEIS, NextEra holds a U.S. Environmental Protection Agency-issued National Pollutant Discharge Elimination System (NPDES) permit that allows for the discharge of certain effluents containing radioactive constituents through its primary ocean outfall. However, as further described in the section, such discharges are subject to compliance with NRC's radiation protection standards in 10 CFR Part 20 including monitoring and reporting in accordance with NRC's Radioactive Effluent Release and Radiological Environmental Monitoring Program (REMP), as further described in the NRC staff's response to comment 014-6.

Section 2.2.5 of this SEIS discusses dewatering activities related to Unit 2 in several locations including the statement that "…shallow [aquifer] system has a localized cone of depression due to dewatering at the Unit 2 containment building." Nevertheless, the nature of dewatering from beneath the Unit 1 and unfinished Unit 2 buildings is first discussed in Section 2.1.7.2, which has been revised to clarify the total volume of groundwater withdrawn via dewatering points at Seabrook.

017-6 This comment expresses concern that the analyses of climate change impacts including severe storms and erosion and the analysis of groundwater hydrology presented in the SEIS are inadequate and out of date. Climate change and its related impacts are discussed in Sections 2.2.2, 4.11.2, and 4.11.3 of this SEIS. As further discussed in response to comment 011-6, Section 2.2.5 of this final SEIS describes the groundwater hydrology of the Seabrook site and vicinity. Section 4.11.2 of the SEIS discusses the potential implications of severe weather stemming from climate change.

Implications of global climate change—including implications for severe weather and storm intensity—are important to coastal communities and to critical infrastructure such as Seabrook. While there is great uncertainty, global mean sea levels are expected to rise an additional 0.5 to 1 ft. (0.15 to 0.3 m) by 2050 and between 1 to 4 ft. (0.3 to 1.2 m) by the end of this century; sea level rise along the Northeast coast is expected to exceed the global rate due to local land subsidence and is projected to rise 0.7 to 1.7 ft. (0.2 to 0.5 m) by 2050 (USGCRP 2014). Changes in sea level, at any one coastal location, depend not only on the increase in the global average sea level but on various regional geomorphic, meteorological, and hydrological factors (USGCRP, 2009). At Seabrook, all critical structures are located at a finished grade elevation of 20 ft (6.1 m) above mean sea level (MSL) (FPLE, 2008), which is well beyond the expected sea level rise. This discussion from Section 2.2.2 of the SEIS is based on the U.S. Global Research Program's (USGCRP) latest report, "Global Climate Change Impacts in the United States." As cited above and listed at the end of Chapters 2 and 4 of this SEIS, the report reflects the current state of knowledge regarding climate change impacts in the U.S. The USGCRP integrates and presents the prevailing consensus of federal research on climate and global change, as sponsored by thirteen federal agencies.

017-6 cont'd The potential for storm damage, erosion, and flooding to affect a nuclear power plant is not specifically analyzed in the license renewal environmental review, as it is outside the scope. The environmental impact statement analyses the impacts of continued operation on the environment. However, Seabrook was originally sited in consideration of the hydrologic siting criteria set forth in 10 CFR 100, as applicable, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. The regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as flooding from severe storms, without loss of capability to perform safety functions. Site-specific design bases for flood protection are prescribed by a nuclear power plant's Updated Safety Analysis Report/Updated Final Safety Analysis Report and by applicable technical specifications.

Acceptable protection for floods includes levees, seawalls, floodwalls, or breakwaters. If new information or operating experience relating to flooding becomes available, the NRC evaluates the new information to determine if any changes are needed at existing plants. Flood protection issues are considered during site-specific safety reviews and, more specifically, are addressed on an ongoing basis through the reactor oversight process and other NRC safety programs, which are separate from the license renewal process. For instance, as part of the Japan lessons-learned activities resulting from the March 2011 earthquake and tsunami, the NRC has used its regulatory authority under 10 CFR 50.54 to request flood re-evaluations of existing nuclear power plants (see ADAMS No. ML12053A340). Licensees of operating nuclear power plants have been asked to reevaluate the flooding hazards that could affect their sites using present-day information. These newly reevaluated hazards, if worse than what the plant had originally calculated upon initial licensing, will be analyzed to determine whether plant structures, systems, and components need to be updated to protect against the new hazards.

This comment provides no new information, and no changes have been made to this SEIS as a result.

While we welcome any reference to on-site CO_2 emissions and relative life-cycle emission analysis, almost every study you cited is from the IAEA, hardly an unbiased source. How about including some independent, peer-reviewed studies? One in particular you should include is "Valuing the greenhouse emissions from nuclear power: A critical survey," by Benjamin K. Sovacool, in Energy Policy 36 (2008), pgs. 2940-2953, which is a broad survey of existing studies and comes to much more unequivocal conclusions about nuclear versus renewable power life-cycle emissions. 017-7

Overall, we have to object to your conclusions that the adverse environmental impacts of continued operation of the Seabrook plant are not great enough to deny the option of license renewal, particularly considering the report's poor comparison of replacement power alternatives as well as its own conclusions about LARGE impacts to several economically-important marine species. You owe it to the residents around the Seabrook plant, human or otherwise, to provide a fairer comparison of the alternatives at hand and a more transparent description of the radiological impacts, and considered at the general time of the license renewal, rather than now or in the past. If you are unable to do that given current experience with respect to these alternatives, then the only fair approach would be to delay the final analysis until a more reasonable comparison can be made. 017-8

Thank you for the opportunity to provide these comments.

Sincerely,

Doug Bogen
Executive Director
Seacoast Anti-Pollution League
Exeter, NH

017-7 This comment expresses concern over the potential bias of some studies of greenhouse gas emissions cited and used by NRC to compare replacement power alternatives in the SEIS. A large number of technical studies, including calculations and estimates of the amount of GHGs emitted by nuclear and other power generation options, are available in literature. These studies, however, are inconsistent in their application of full lifecycle analyses, including plant construction, decommissioning, and resource extraction (uranium ore, fossil fuel). Almost every existing study has been critiqued, and its assumptions challenged by later authors. Therefore, no single study has been selected to represent definitive results in this SEIS. Instead, the results from a variety of the studies are presented in SEIS Tables 6.2-1, 6.2-2, and 6.2-3 to provide a weight of evidence argument comparing the relative GHG emissions resulting from the proposed Seabrook relicensing compared to the potential alternative use of coal fired plants, natural gas fired plants, and renewable energy sources. As referenced by the commenter, the cited tables in Chapter 6 have been revised to include comparative information from Sovacool (2008). The NRC staff provides a more detailed discussion on GHGs in Chapter 6, where comparisons of GHG emissions are presented from a variety of energy generation technologies. The NRC staff's analysis of alternatives in Chapter 8 also addresses relative levels of GHG emissions for alternatives.

017-8 The commenter expresses opposition to the conclusions of the Seabrook SEIS that the adverse environmental impacts of continued operation of the Seabrook plant are not great enough to deny the option of license renewal. The commenter is specifically concerned with the comparison of replacement power alternatives.

The specific language used for the conclusion of the SEIS is taken from 10 CFR 51.95 (c)(4):

"… the NRC staff…and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable."

License renewal provides the energy planning decisionmakers an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, Connie. I'm sorry that I said your name wrong three times in a row. That's my reading problem. Doug Bogen and then Lee Roberts.

DOUG BOGEN: For the record, my name is Doug Bogen. I'm executive director of the Seacoast Anti-Pollution League based near here in Exeter, New Hampshire. We are one of the interveners on the relicensing renewal. I was at the scoping session about a year ago and I do have quite a few different points to make. I may make more general comments later, perhaps in the evening session.

But I do want to mention a few specific things that didn't look right in reading -- my initial reading of -- the SEIS. Just one general comment as I think others have alluded to before -- the world has really changed in the last year and it's changing rapidly. I think probably too quickly for many of us. I'm not just speaking of Fukushima. Obviously that was a huge event on the world scene -- but regarding renewable energy, the development of new sources, a new approach to our energy development in this country, but even more so in other countries -- in Europe, China, you name it, perhaps more so than in the U.S.

But we are facing very different circumstances both in the risks that we face through natural and unnatural disasters and also in the opportunities for changing our energy system -- our infrastructure -- and providing more safe, clean, affordable power in the future. I may have more to say on that later.

027-34

But I did want to speak to a number of key points. In my comments in the scoping session, I did say a lot about the effect of the environment on the plant and in particular climate change impacts. I am glad to see that you certainly have done some research. There is quite a few words -- a number of pages -- referring to climate impacts and the general scene of climate change. But I did feel that it was really kind of vague about the specific impacts on the Seabrook plant.

You refer to the critical structures at the plant being 20-feet above the mean tide and that doesn't really square with the overall site -- at least as far as U.S.G.S. is concerned -- it's much lower than that. I'm glad to know perhaps that you have your emergency generators and other things above the water level, which of course, wasn't the case at Fukushima.

027-35

But certainly it would be useful to know regarding the rest of the site -- how high are the sea walls, the waste storage height, the dry cask storage? How high is that above sea level? The power lines -- the transformers -- as we saw the plants in the upper Midwest -- on the Missouri River -- they were running into great difficulties because their power lines transformers were becoming inundated from water. It would be better to have more than one sentence about this because this is increasingly a greater concern regarding future climate impacts.

Another point there is -- you do refer to the U.N. IPCC estimates, which are now four to five-years old. The research on them was even older. It should be noted that the IPCC is a consensus document. It's very conservative. The most recent and I think a growing consensus among climate scientists is that the figures they are looking at -- projected with the business as usual approach and our energy system -- leads to a doubling in sea level rise over

027-34 This comment speaks to the changing nature of renewable energy sources. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

027-35 This comment in part expresses concern that the analyses of climate change impacts in the SEIS are inadequate and out of date and that the EIS does not address the impacts of climate on Seabrook. The EIS has been updated to include the recent information on climate change and its related impacts, including the U.S. Global Research Program's (USGCRP) latest 2014 report, "Climate Change Impacts in the United States," the National Oceanic and Atmospheric Administration 2013 technical report, "Regional Climate Trends and Scenarios for the U.S. National Climate Assessment," and the Intergovernmental Panel on Climate Change 2013 report, "Climate Change 2013: The Physical Science Basis." These reports reflect the current state of knowledge regarding climate change and impacts. The USGCRP integrates and presents the prevailing consensus of federal research on climate and global change, as sponsored by thirteen federal agencies. Climate change and its related impacts on the environment are discussed in Sections 2.2.2, 4.12.1.2, 4.12.2, 4.12.3, 4.12.4, 4.12.6 and 4.12.7 of this SEIS.

Implications of global climate change—including implications for severe weather and storm intensity—are important to coastal communities and to critical infrastructure such as Seabrook. While there is great uncertainty, global mean sea levels are expected to rise an additional 0.5 to 1 ft. (0.15 to 0.3 m) by 2050 and between 1 to 4 ft. (0.3 to 1.2 m) by the end of this century; sea level rise along the Northeast coast is expected to exceed the global rate due to local land subsidence and is projected to rise 0.7 to 1.7 ft. (0.2 to 0.5 m) by 2050 (USGCRP 2014). Changes in sea level, at any one coastal location, depend not only on the increase in the global average sea level but on various regional geomorphic, meteorological, and hydrological factors (USGCRP, 2009). At Seabrook, all critical structures are located at a finished grade elevation of 20 ft (6.1 m) above mean sea level (MSL) (FPLE, 2008), which is well beyond the expected sea level rise.

their initial estimates of 1 to 3 feet. It's now they're talking 4 to 5 to even 6 feet of elevation change by the end of this century. That's a huge difference and I know there was a major report in May released in Copenhagen -- I'm sure you can look up the references. It got a lot of attention and it seems that it behooves you to include that in your report. That's certainly the most recent science and it's been discussed for several years now. So, again, if you go 4 or 5-years back, you're way in the past. 027-35

Just moving on to other air issues, I guess. The atmosphere -- I noticed on the chart in the copy I had that I had gotten online -- on page 4-46 you list a number of emission estimates and it appears that there's a typo actually repeated throughout the page of not using negative exponents. I found this rather amazing. I don't do a lot of scientific notation, but as far as I know, the figure you give of 1.1 x 105 millisieverts, I believe that works out to 10 sieverts, which as far as I understand that's a lethal dose. I think you meant to the negative fifth. So, I hope you go back and correct those. That would get a lot of people very concerned, I think. So, just one specific item. 027-36

Moving on to waste management. I was very distressed that there didn't seem to be any discussion about the increase -- I believe it would be about a 50% increase -- in total spent fuel that you would be dealing with if you renew the license. Is there enough room onsite? How much longer is that waste going to be there? It's my understanding that, you're looking at 2060/2070 -- obviously the country does not have a plan for the long-term final disposal of storage of that waste. I understand you referred to the Generic EIS on this, but it would be good to have more than one line explaining what the story is there. It's really pretty unclear when you say that -- excepting for off-site radioactive collection impacts. Well, that's a pretty big deal. 027-37

A lot of us in this country would like to know what those might be. It is our concern -- we are all downwind and there should be some discussion of how that waste gets off-site. My understanding is the rail connection there is pretty much dead. It's being, perhaps, converted into a rails to trails -- are you going to be taking it out on the highways? I realize these are all issues that need to be addressed anyway and they probably are generically, but it seems like it's worth mentioning in the EIS itself.

Just moving on to tritium. There was some mention earlier about this, but I would like to say there's much more information in the SEIS than was previously reported in news reports and anything else I'd seen. I understand the industry is not required to report this. It's a voluntary program. But, it does appear to be worse than what was originally presented. This is a problem that has been going on for over a decade now. I believe it was 1999 when the initial -- when it was determined that there was a leak. We don't know whether it happened sooner than that because they weren't reporting it. Perhaps the plant owners can tell us that, but it does appear that there is more widespread contamination. In one point on page 4-59, you say that -- the off-site contamination wasn't observed. Well, I know most of the off-site is the salt marsh -- if you're looking down gradient -- so are you saying we didn't see it in the seawater, we couldn't measure it in the seawater? 027-38

In general, it appears that your solution --certainly the way you dispose of this or the plant is disposing of this contaminated water -- is to send it out the out-fall pipe and I 027-39

027-35 cont'd The impacts of climate change on operations and safety at Seabrook are considered out of scope for the environmental review, which documents the potential impacts on the environment from continued operation. Therefore, the potential for storm damage, erosion, and flooding to affect a nuclear power plant is not specifically analyzed in the license renewal environmental review. Currently operating nuclear power plants were originally sited in consideration of the hydrologic siting criteria set forth in 10 CFR 100, as applicable, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. The regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as flooding from severe storms, without loss of capability to perform safety functions. Site-specific design bases for flood protection are prescribed by a nuclear power plant's Updated Safety Analysis Report/Updated Final Safety Analysis Report and by applicable technical specifications. Acceptable protection for floods includes levees, seawalls, floodwalls, or breakwaters. If new information or operating experience relating to flooding becomes available, the NRC evaluates the new information to determine if any changes are needed at existing plants. For instance, as part of the Japan lessons-learned activities resulting from the March 2011 earthquake and tsunami, the NRC has used its regulatory authority under 10 CFR 50.54 to request flood re-evaluations of existing nuclear power plants (see ADAMS No. ML12053A340). Licensees of operating nuclear power plants have been asked to reevaluate the flooding hazards that could affect their sites using present-day information. These newly reevaluated hazards, if worse than what the plant had originally calculated upon initial licensing, will be analyzed to determine whether plant structures, systems, and components need to be updated to protect against the new hazards. The flooding hazard reanalysis was originally due to be completed and submitted to the NRC by March 12, 2015. On March 6, 2015, NextEra requested an extension to the March 12, 2015, deadline until September 30, 2015 (ML15070A545).

027-36 The NRC staff appreciates the feedback noting that reported emission estimates were missing the negative sign for the exponents. The correct values are reported in the final SEIS.

027-37 Regarding the expected increase in the amount of spent fuel generated as a result of an additional 20 years of plant operation, the draft SEIS did not contain a full discussion because, as noted by the commenter, it is discussed in the GEIS. To read the information on the assessment of the impacts associated with the increase in spent fuel, the GEIS can be accessed on the NRC website as NUREG-1437, *Generic Environmental Impact for License Renewal of Nuclear Plants*.

The environmental impacts associated with the transportation of spent fuel from nuclear power plants to an interim storage location or disposal site were evaluated by the U.S. Department of Energy (DOE) in its document DOE/EIS-0250F-S1, "Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." This document can be accessed on the U.S. DOE's website or on the NRC's website and by using the NRC's web-based Agencywide Documents Access and Management System (ADAMS) and searching for accession number ML081750191.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-38 The NRC staff reviewed the impacts associated with the onsite tritium contamination in section 4.11 of the SEIS and concluded that no significant impacts to offsite drinking water sources are expected from the tritium in the groundwater. This is because "The nearest groundwater users are over 3,000 ft (910 m) from the plant site and are upgradient, as the groundwater flow path beneath the plant site is generally to the east and southeast toward the tidal marsh." As reported by the NRC staff in section 4.9.1.2 of the SEIS, NextEra's REMP monitors seawater and groundwater. Based on monitoring performed by NextEra, no tritium was detected in the seawater samples. In the offsite environment, the groundwater samples were collected from three offsite locations; the drinking water line supplied by the Town of Seabrook to the Seabrook Station, an inactive well located approximately 0.6 mi (1 km) north of the plant, and a private well 0.8 mi (1.3 km) north by northwest. No tritium was detected in the water samples.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-39 The NRC's regulatory limits for radiological protection for nuclear power reactors specified 10 CFR Part 20. The dose to members of the public from a nuclear plant is based on the amount of radioactive material that is released from the plant. The NRC requires each nuclear power plant to calculate the dose associated with the radioactive releases. Each nuclear power plant is also required to report the dose to members of the public from their radioactive releases in an annual report submitted to the NRC and publically available on the NRC's website. The NRC inspects the reported dose values to determine the licensee's compliance with its dose limits.

Radiation doses to members of the public from the current operations of Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological doses to members of the public were within NRC's dose limits.

As discussed in Section 4.8.1.2 of this SEIS, the NRC staff also evaluated NextEra's REMP. Based on the review of several years of data, the staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation to humans. The limits are based on the recommendations of scientific standards-setting organizations, and reflect extensive scientific study by national and international organizations. The models recognized by the NRC for use by licensees to calculate dose incorporate conservative assumptions to ensure that workers and members of the public are adequately protected from radiation. Although radiation may cause cancers at high doses, currently there are no reputable scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 10 rem (0.1 Sv). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures.

understand that's the regulatory approach that we use, but we need to accept that the solution you're applying is dilution -- Well, let's just put it out into a larger body of water and it'll sort of go away. I understand that's the regulatory regime you're under, but there's real questions about whether that makes sense given that there's no safe level of radiation. We really need to be keeping in mind -- I'm sure you all are very aware of the BEIR VII report that there's no safe levels of radiation. However small you may say the air emissions, the water emissions are, the fact is they do stay in the environment -- the half-life of tritium is over 12-years. These other elements that are coming out, which are not very specified in the report -- we'd like to know more about the disposition of them. Not just that -- Oh, you couldn't measure them in the fish or the water or the soil. We need a much more thorough explanation of that. 027-39

I suspect my time is almost up. But I do hope you will be able to make some of these changes and I probably will have written comments later. But we do think that there are a number of ways that this report can be improved. That the information should be more tight and that we have a better sense of what you're really talking about here because it's our future. We have to live with it and when we're looking 20, 30, 40-years down the road -- we want good projections not just reliance on past performance. We need to be able to know what the impact will be. So, I think I'll leave it at that. Thank you.

027-39 cont'd Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This is consistent with the information contained in the National Academy of Sciences' Biological Effects of Ionizing Radiation (BEIR) report cited in the comment. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit in 10 CFR Part 20 is 100 mrem (1 mSv) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor has enforceable license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

BRIAN ANDERSON: Okay. Thank you, Marcia. And the last speaker that I have here is Doug Bogen.

DOUG BOGEN: If you don't mind, I want to wait until they find a new battery for the camera there.

My name's Doug Bogen. I'm Executive Director of the Seacoast Anti-Pollution League based in Exeter, New Hampshire. I would like to make some kind of general comments and have a few specific ones, as well, about the Draft report. I will try to make different comments than what I made in the earlier session this afternoon, but I think they're no less pertinent and important.

As others have suggested tonight, the world has changed since Fukushima. Just as it changed after Three-Mile Island. Just as after Chernobyl. Yet, everything I read in this Environmental Statement seems to indicate that it's business as usual at the NRC. I don't see any change of perspective. I don't see any greater consideration of the public interest. As we've heard from others, this just seems to be business as usual. It's the same old story. Same dismissal of alternatives -- they don't seem to have learned anything. 028-24

I should mention, for the record, we are one of the interveners along with Beyond Nuclear, New Hampshire Sierra Club and other groups. Our intervention is based on the National Environmental Policy Act, but we don't get the sense that the writers of this report have picked up anything from what we've submitted. Even though these are many peer reviewed studies, on-the-ground actual projects -- but they don't seem to find their way into the report.

The facts are that you have zero actual experience with commercial reactors older than 42-years old. I looked it up. I don't think there's one in this country that's older. In fact, in the whole world, I don't believe there are any reactors that made it to 50-years. So, you have no experience with real-world impacts on the environment past that age. What we do know is that younger reactors have leaked huge quantities of tritium into the groundwater -- Seabrook among them. Seabrook was only nine-years old when it started leaking tritium back in '99. For 12-years now, they've been pumping the groundwater. Pumping out the leaking water just to put it out into the ocean to dilute it. That doesn't sound like a solution. That sounds like pump and dilute and just pushing the issue further offshore. 028-25

Younger reactors -- including Seabrook -- have had chronic problems with the emergency diesel generators. This has certainly been seen as a greater concern after Fukushima and what happened with theirs and the need to be able to respond to difficult situations -- natural disasters, unnatural disasters. Younger reactors have had critical safety structures corroded almost to the point of failure.

This was recently covered in an AP series and it ran in the local papers here, as well as around the country. Younger reactors have ended their useful lives prior to reaching 40-years old and there have been, I think, at least two-dozen reactors around the country that didn't make it to 40, but everyone of them are still storing their spent fuel on-site in vulnerable areas. Just in our neighborhood, we've got Maine Yankee, Yankee Rowe, Connecticut Yankee, Haddam Neck -- that are all just waiting for some day that fuel is going to be put somewhere 028-26

028-24 The commenter expresses dissatisfaction with the NRC's environmental review process and the Seabrook SEIS. The comment is general in nature and provides no new information, and no changes have been made to the SEIS as a result.

028-25 The commenter expresses concern over the ability to manage the aging of plant systems, structures and components at Seabrook, which is outside the scope of the license renewal environmental review. The aging management of passive, long-lived systems, structures and components is addressed in the Seabrook license renewal safety review. Plant maintenance activities not associated with license renewal are outside the scope of the environmental review for license renewal. For all plant components, the NRC provides continuous oversight through its Reactor Oversight Process to verify that they are being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action required to protect public health and safety.

Regarding the tritium leakage at Seabrook, the NRC found in Section 4.10 that there are no significant impacts associated with tritium in the groundwater at Seabrook.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-26 This comment relates to the storage of spent fuel after the termination of operations at a nuclear power plant.

NextEra is required to safely handle and store its radioactive waste in accordance with NRC regulations. Spent nuclear fuel is stored onsite in a combination of two types of NRC approved methods; storage in a pool and in dry casks. Both of these methods maintain the used fuel in a safe configuration. Additionally, to ensure the long-term safety of spent fuel, NextEra is required by the NRC regulations at 10 CFR 50.54(bb) to maintain adequate funding for the safe long-term storage of spent fuel on its site.

else. This is the record. This is the legacy that we leave to future generations. This is what you have as real-life experience. 028-26

Another point -- just looking at the power needs. There keeps being this reference to the need for power -- I want to know where it's written that we will always need 1,250 megawatts on the New Hampshire seacoast, when it isn't even used on the New Hampshire seacoast or even in New Hampshire at all. We have more than enough energy -- more than enough electrical power in New Hampshire, even without Seabrook. I don't think that corporation was given an unlimited life -- perpetual power generation -- permission. We need to stop thinking that once they build it, it'll always be there. 028-27

In your comments tonight and in the report itself -- page 8-42, you say that -- assuming that a need currently exists for the power -- but we're not talking about current need, we're talking about need decades into the future -- 20, 30, 40-years. So, what does current power use have to do with it? It just seems like we're just sort of saying -- Well, this is the way it is today and this is the way it's going to be 30-years from now. That just doesn't make any sense. It doesn't pass the laugh test. I would suggest that you at least amend that to say -- assuming that a need will exist in 2030. That would be at least a little bit more accurate, a little more appropriate to the report. That should be the issue here.

I'll say a little bit about tritium. I did talk about it earlier tonight, but first off I want to say it's in a few different sections in the report. It's kind of hard to find out where all the tritium information is. I understand that you're referring to it as a kind of a new issue. Although, again, it's been ongoing for at least a dozen years. One of the sections that talks about the other de-watering doesn't mention this new de-watering -- the 32,000 gallons per day -- in the Unit 2 foundation. 028-28

What is the total amount and why is this considered acceptable? Do you expect it's going to continue? Is it going to increase? Where are we at with the water there? Why can't they stop the leaks? That sounds like an awful lot of water to be putting out into the ocean. I understand that the EPA regulation allows 20,000 picocuries per liter of tritium in drinking water -- or that's the limit -- but that doesn't mean that something under that is perfectly safe. In fact, many other countries have much stricter standards.

My understanding is the state of California and the state of Colorado -- that would be completely unacceptable. They've set standards more I think around 500 or 400 picocuries per liter. You state in one part of the document that the levels of tritium in seawater were under 3,000 picocuries per liter. I understand in salt water you can't test as low as you can in freshwater, but if they're at 2,999 that again does not make it safe. That's still somewhere in 100 times greater than background levels for tritium. Natural occurring tritium is in the single digits -- maybe up to double digits. 028-29

So, even the EPA standard -- we're talking 1000 times more than the ambient levels in our environment. That just doesn't make sense. It doesn't sound safe to me. We all know now that there are no safe levels of radiation and I don't know how you can continue this idea that that's an acceptable level, when many other countries much of the science shows that's not enough.

028-26 cont'd Regarding the long-term storage of spent fuel after the term of license renewal when the plant shuts down, on August 26, 2014, the Commission approved the Continued Storage Rule and associated "*Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*" (NUREG-2157). Subsequently, on September 19, 2014, the NRC published the final rule (79 FR 56238) in the *Federal Register* along with NUREG-2157 (79 FR 53238, 56263). The Continued Storage Rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license (i.e., those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor or away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available). The information in NUREG-2157 provides the appropriate NEPA analyses of the potential environmental impacts associated with the continued storage of spent fuel beyond the licensed life for reactor operations at Seabrook.

Chapter 6 of the Seabrook SEIS was revised to include a discussion, based on NUREG-2157, of the potential environmental impacts associated with the continued storage of spent nuclear fuel.

028-27 The commenter takes issue with the need for Seabrook's generating capacity. The determination of the need for the power generated by Seabrook is outside the scope of the license renewal environmental review and is not evaluated in this SEIS. The need for Seabrook's generating capacity is determined by other energy-planning decision makers, rather than the NRC. Those may include State, utility, and other (non-NRC) Federal agencies.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-28 This comment expresses concern over the release of tritium-containing liquids to groundwater, the effect of plume control on local groundwater resources, the potential for future tritium leaks, and the need for groundwater pumping during decommissioning. As detailed in response to comment 011-6, Section 2.2.5 of this final SEIS describes the current state of knowledge on groundwater hydrology and groundwater quality of the Seabrook site and vicinity, and Section 4.10 of this SEIS presents the NRC staff's evaluation of the impacts of inadvertent releases of tritium with respect to groundwater quality and human health. Based on the environmental review performed, the NRC staff has concluded that while inadvertent releases of liquids containing tritium (a radioactive isotope of hydrogen) have occurred to the subsurface at Seabrook, levels of tritium in groundwater have remained well below the drinking water standard of 20,000 picocuries per liter, and no upward trend in tritium levels has been observed.

Further, offsite water supply wells are located hydrologically upgradient from Seabrook and groundwater dewatering activities at the site otherwise provide hydraulic containment of tritium plumes beneath the site.

With respect to the impact of groundwater pumping (dewatering) on local groundwater, Section 4.4.1 of this SEIS presents the staff's analysis of Seabrook's groundwater withdrawals. As noted in Section 4.4.1, the issue of groundwater use conflicts from nuclear power plants withdrawing less than 100 gallons per minute (gpm) (380 liters per minute [L/min]) is considered a Category 1 issue, which was generically evaluated in the GEIS (NRC 1996) with an impact finding of SMALL. The GEIS further found that total onsite groundwater withdrawals of less than 100 gpm are not expected to cause any ground-water use conflicts with local water supplies. Total onsite groundwater withdrawal associated with dewatering and plume control at Seabrook is about 24 gpm (91 L/min).

The staff did not identify any new and significant information regarding groundwater use conflicts from nuclear power plants withdrawing less than 100 gpm (380 L/min) during the review of NextEra's ER, the public scoping process, or as a result of the environmental site audit that would change the conclusions presented in the GEIS. Therefore, it is expected that there would be no impacts related to continued groundwater withdrawals at the site during the period of extended operation.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-29 The response to comment 028-28 above addresses the NRC staff's review of the groundwater and tritium leak issues in the SEIS. Regarding the radiological health aspects of the tritium leak, the NRC's regulatory limits for radiological protection for nuclear power reactors specified at 10 CFR Part 20 are given in units of dose (i.e., millirem) vice concentrations. The dose is based on the amount of radioactive material, including tritium, that is released from the plant. The NRC requires that the dose to members of the public be calculated based on the types and amounts of radionuclides released. Each nuclear power plant is also required to report the dose to members of the public from their radioactive releases in an annual report submitted to the NRC and publicly available on the NRC's website. The reported dose value is used by the NRC to determine the licensee's compliance with dose limits.

Radiation doses to members of the public from the current operations of Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, including tritium, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological doses to members of the public were within NRC's dose limits.

The NRC requires NextEra to conduct a radiological environmental monitoring program (REMP) to sample and analyze atmospheric, terrestrial, and aquatic media and biota in the environment around its facility for radiation and radioactivity that is released during the operation of the plant. The REMP conducted at Seabrook based on NRC guidance regarding the types and numbers of environmental media to be collected and also specifies the detection levels that must be used in the analysis.

The detection levels are designed to be sensitive enough to distinguish ambient background radiation (i.e., natural radioactivity and fallout from atomic weapons testing) from radioactivity released from Seabrook. The NRC requires a detection level of 2000 picocuries/liter (pCi/l) for tritium in drinking water pathways and 3000 pCi/l for non-drinking water pathways.

028-29 cont'd In section 2.2.5 of the SEIS, the NRC staff reported that Seabrook had a detection level of 600 pCi/l, which is well below the NRC's required value. Based on its review, the NRC staff concluded that Seabrook's evaluation of tritium in the groundwater to be adequate. Further, the NRC staff discussed its assessment of the impacts from Seabrook operation on groundwater resources in sections 4.4 and 4.11.1 of the SEIS and concluded that there would be no significant impacts related to groundwater issues.

The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation to humans. The limits are based on the recommendations of scientific standards-setting organizations, and reflect extensive scientific study by national and international organizations. The models recognized by the NRC for use by licensees to calculate dose incorporate conservative assumptions to ensure that workers and members of the public are adequately protected from radiation.

Although radiation may cause cancers at high doses, currently there are no reputable scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 10 rem (0.1 Sv). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit in 10 CFR Part 20 is 100 mrem (1 mSv) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor has enforceable license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

This comment provides no new information, and no changes have been made to this SEIS as a result.

So, I want to move on to some of the carbon emissions. I talked a bit about this earlier, but I did want to point out, as well, that again as Mr. Gunter emphasized -- it doesn't seem like you picked up much from the materials that we submitted in our intervention petition. The cited studies that you list comparing carbon emissions from nuclear versus carbon from other renewable energy sources -- just about everyone of those studies appears to be from the International Atomic Energy Association, which we all know has the double-purpose of both promoting and regulating nuclear power. So, I would suggest it might be a little bit biased.

Why aren't there more independent studies? One in particular that we referred to in our petition from a researcher named Sovacool in 2008 -- that was a broad survey of previous existing studies. He concluded that nuclear power emits seven times more carbon dioxide than wind for a new plant. I believe it's five times more for an existing plant. Indeed, in your own information regarding Seabrook, you mentioned an average over five-years -- 24,000 tons of carbon dioxide equivalent released just on-site. That's not including the fuel, the transportation, construction and so forth. That's just on-site each year.

Just to put that in perspective, which would be helpful in your report -- that's about 10% of the carbon emissions of one of the Schiller boilers -- the 15-megawatt boiler -- the Schiller Plant being in Portsmouth, New Hampshire -- just up the road. It's the equivalent -- the plant owners love to say how many homes they can provide power to with their plant -- well, the carbon emissions from Seabrook alone on-site are the equivalent of the carbon emissions from over 3,000 homes -- just from their power use -- or 4,000 homes for their overall carbon footprints. I think that's pretty significant. I think people would be surprised to know that -- that Seabrook, in particular, is not carbon-free, as is the whole industry. So, we'd like to see a little bit better treatment of the relative impacts and of course that influences your whole decision about which types of power sources would be most environmentally sound. 028-30

We really have concern with the comparison you make with the one you do look at -- the combined cycle gas and wind power combined versus nuclear. I'm just mystified why you chose to look at -- you mentioned the idea of having five wind farms. Four of which would be on land and one of which offshore. Well, everything you've heard from other speakers tonight and again in our petition shows that offshore is the future. We don't need to be building as many farms onshore. I understand that's where Florida Power and Light -- the parent company of NextEra -- that's where they get their wind, where they're used to using it.

But that doesn't mean that's going to be the future. It just seems like an unfair comparison and not really representative of future development. So, I wonder whether you're just setting it up to fail? That seems to be the way you present this. You say that's the only potentially viable project, but then you don't look at what would be the most attractive -- the most environmentally sound approach to that development. So, I would, if you can, I would like you to reconsider that choice -- take another look at those comparisons. 028-31

I just have a few more points -- just again talking about groundwater -- not so much the tritium issue, but just the increases, particularly under climate. I talked earlier about the sea level impacts on the site. Clearly with the existing infiltration of the foundations leading to the ASR problem -- there ought to be some projection. I know you make reference to some hydrological studies, but it seems like again it deserves more than a sentence or two about 028-32

028-30 This comment expresses concern over the potential bias of some studies of greenhouse gas emissions cited and used by NRC to compare replacement power alternatives in the SEIS. A large number of technical studies, including calculations and estimates of the amount of GHGs emitted by nuclear and other power generation options, are available in literature. These studies, however, are inconsistent in their application of full lifecycle analyses, including plant construction, decommissioning, and resource extraction (uranium ore, fossil fuel). Almost every existing study has been critiqued, and its assumptions challenged by later authors. Therefore, no single study has been selected to represent definitive results in this SEIS. Instead, the results from a variety of the studies are presented in SEIS Tables 6.2-1, 6.2-2, and 6.2-3 to provide a weight of evidence argument comparing the relative GHG emissions resulting from the proposed Seabrook relicensing compared to the potential alternative use of coal fired plants, natural gas fired plants, and renewable energy sources. As referenced by the commenter, the cited tables in Chapter 6 have been revised to include comparative information from Sovacool (2008). The NRC staff provides a more detailed discussion on GHGs in Chapter 6, where comparisons of GHG emissions are presented from a variety of energy generation technologies. The NRC staff's analysis of alternatives in Chapter 8 also addresses relative levels of GHG emissions for alternatives.

028-31 As part of the combination alternative, the NRC staff evaluated a reasonable amount of wind energy generation that could be produced by March 2030 based on the current status of the onshore and offshore wind energy sector as well as reasonable projected growth of the onshore and offshore wind energy sector. For example, the NRC staff reviewed data and studies on the historical development of onshore and offshore wind energy and projections of future onshore and offshore wind energy growth in the northeast to anticipate wind generation's future contributions to electricity in the ISO-NE territory. The Combination Alternative of wind and NGCC discussed in Section 8.3 is based on the relatively strong wind potential in New Hampshire, primarily on mountain ridgelines, as well as offshore. The selection of a complement of five wind farms, four of which would be land-based, reflects the development of the wind industry to date in the United States and reasonable growth by the time Seabrook's license expires in March 2030. All of the current utility-scale wind farms put into operation have been land-based and only recently has the first utility-scale off-shore wind farm, Cape Wind, secured the necessary approvals and begun construction.

future infiltration. I think that's something we all want to know about. That's an environmental impact on the plant. Even though I know it's supposed to be addressed in other reports. 028-32

So, again, I think all of these things are worth consideration and I do hope that you will make some changes in the final version of your report. Thank you very much for your time.

028-31 cont'd Nevertheless, the NRC staff believes that the advancements of offshore wind technologies that have resulted from the European experience and evolving policies and programs of the Department of Interior's Bureau of Ocean Energy Management (BOEM) have done much to facilitate future offshore wind energy development in the United States. Because of these recent developments, an updated discussion of offshore wind generation was added to the final SEIS. After considering the updated discussion, the NRC determined that despite the presence of a high-value wind resource, wind turbine technology advancements, an improved ability to forecast wind, and the introduction of interconnected wind farm strategies, wind energy alone was not a reasonable alternative to Seabrook due to the limited installed capacity, immature status of technology to store energy, high costs of constructing offshore wind farms, and limited projected growth of wind power projects within the ISO-NE service territory.

028-32 The commenter expresses interest relating to the groundwater infiltration at Seabrook, and the alkali-silica reaction (ASR) occurring in certain concrete structures at the site. The issue of current and future groundwater infiltration at Seabrook is outside the scope of the license renewal environmental review, which focuses on the effects to the environment from the proposed action of license renewal. Should the NRC determine that additional groundwater modeling, including any modeling of projected future infiltration, be required as a condition of license renewal, that determination will be made as part of the license renewal safety review, and documented in the NRC staff's safety evaluation report.

This comment provides no new information, and no changes have been made to this SEIS as a result.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

8/5/2011
76FR47612

(9)

SEABROOK STATION
Draft Supplemental Environmental Impact Statement
Division of License Renewal
NRC-2010-0206

Written Comment Form
Must be received on or before October 26, 2011. Please print clearly.

Name: Mary Broderick
Title: Hampton resident who sees Seabrook Station from my bedroom window
Organization: self
Address: 609 Ocean Blvd.
City: Hampton State: NH Zip Code: 03842

Comment:

At my age I don't expect to be impacted by the license renewal for Seabrook Station but I feel railroaded by the premature license extension. Who knows if winter flounder, rainbow smelt, and a specific kelp are just the canaries in the mine?? Japan has made us all more conscious of safety issues. I don't understand why there is a rush.

007-1

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Use other side if more space is needed.

Comment Forms may be mailed to:
Chief, Rules, Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (mswz)

007-1 The commenter expresses concern about the timing of the license renewal process for Seabrook. As allowed by 10 CFR 54.17, NextEra submitted the Seabrook license renewal application 20 years before the expiration of their current license. The NRC has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Should the NRC grant NextEra's request for a renewed license, the NRC will continue to provide continuous oversight through its Reactor Oversight Process to verify that they are being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action is required to protect public health and safety.

This comment provides no new information, and no changes have been made to this SEIS as a result.

NRC FORM 659
(4-2010)

U.S. NUCLEAR REGULATORY COMMISSION

NRC PUBLIC MEETING FEEDBACK

Category: 3

Meeting Date: 09/15/2011

Meeting Title: Public Meeting to Discuss the Seabrook Station License Renewal Application Draft SEIS

In order to better serve the public, we need to hear from the meeting participants. Please take a few minutes to fill out this feedback form and return it to NRC.

1. How did you hear about this meeting?

- [ ] NRC Web Page
- [ ] NRC Mailing List
- [x] Newspaper
- [ ] Radio/TV
- [ ] Other

	Yes	No	Somewhat (Please explain below)
2. Were you able to find supporting information prior to the meeting?	☐	☐	☐
3. Did the meeting achieve its stated purpose?	☐	☐	☐
4. Has this meeting helped you with your understanding of the topic?	☐	☒	☐
5. Were the meeting starting time, duration, and location reasonably convenient?	☒	☐	☐
6. Were you given sufficient opportunity to ask questions or express your views?	☒	☐	☐
7. Are you satisfied overall with the NRC staff who participated in the meeting?	☐	☒	☐

COMMENTS OR SUGGESTIONS:

Thank you for answering these questions.

How come an environmental impact study doesn't consider the human animal?? 026-1

Continue Comments on the reverse.

OPTIONAL

Name: M. Broderick

Organization: self

Telephone No.:

E-Mail: mtbroderick609@comcast.net

☐ Check here if you would like a member of NRC staff to contact you.

OMB NO. 3150-0197

Expires: 08/31/2012

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Please fold on the dotted lines with Business Reply side out, tape the bottom, and mail back to the NRC.

026-1 The commenter questions why the effect of relicensing on humans was not considered; however, no specific detail was given as to what was missing in the Seabrook draft SEIS. The effects of relicensing on humans are considered throughout the SEIS, and specifically in Section 4.9, Human Health, and 4.10, Socioeconomics.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, sir, for those comments. Thank you for joining us by phone and thank you for your comments. The next speaker is Ben Clichester -- did I say that even close to right? After Ben -- Randall Kezar.

BEN CHICHESTER: Chichester.

BRIAN ANDERSON: Chichester -- Ben Chichester.

BEN CHICHESTER: Good evening staff of the NRC. We know that this meaning is a farce coming in here because we've been through this with you guys plenty of times before. We know it's a feel-good thing and a technicality for you to have to go through this public hearing.

UNIDENTIFIED AUDIENCE MEMBER: Please speak into the mic.

BEN CHICHESTER: This is a public hearing, but it is a farce and we know that coming in here. It's a farce I say because if it wasn't a farce then we wouldn't be having to address so many ridiculous considerations that you are pretending are something that is manageable and real. I can mention a few, but one of the things that comes to mind is the Evacuation Calendar that is sent out to us on a regular basis. It tells us where to go if there's a nuclear problem. But, everybody knows that you don't go where the wind is blowing and there's no accounting for that in the Evacuation Calendar. 028-15

Initially, we were told we were going to not have a power plant if you couldn't have an evacuation plan that was workable. But then we were told that it was enough just to have an evacuation plan -- it didn't have to work. That's one example of the kind of farcical nature of this meeting.

There are too many things that you are not considering. We live in a world where the health of our economy and the very functioning of an economy is at risk from day to day from total breakdown. Where is the money going to come to pay for and who is going to be in charge of paying for the costly work of maintaining and protecting the citizens from spent fuel pools? Who's going to pay when the seawater rises from global warming and we have popping sounds with explosive plumes coming from Seabrook? Who's going to pay? Where's that money coming from?

We've already heard testimony here that several plants were perilously close to flooding out West and there is no assurance that this is not going to happen here. But you can come into our town and tell us that there is no safety impact 20 to 40-years down the road from this plant. All this period of time that you are proposing to extend this license -- the waste will be building up in and on the site. That's a new uncharted territory because I don't believe you know how to take care of that much waste in one spot. You've never done it. 028-16

I think that there's an inherent collusion between the industry and the NRC. I've heard that the NRC gets most of its funding from the industry. This may or may not be true.

PAUL GUNTER: 90%.

BEN CHICHESTER: How can you say that we're going to be safe from terrorist attacks on the plant either from foreign or domestic sources? The Price Anderson Act says that the industry doesn't have to pay very much in the event of a catastrophic accident, but our

028-15 This comment addresses issues dealing with emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal, therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-16 The commenter expresses concern with severe accidents at Seabrook and their financial implications. As discussed in Chapter 5, the NRC staff found no new and significant information that would challenge the conclusions of the GEIS that the probability-weighted consequences of severe accidents, including those caused by acts of sabotage, were of small significance.

With regard to the costs associated with nuclear accidents, the Price-Anderson Act is a Federal law that governs liability-related issues for all nonmilitary nuclear facilities in the United States. The main purpose of the Act is to provide prompt and orderly compensation to the public who may incur damages from a nuclear incident. Power reactor licensees are required to have the maximum level of primary insurance available from private sources (currently $375 million) and are also required to participate in a Secondary Financial Protection. Under this program, should an accident at any participating power reactor result in injury or damage in excess of the $375 million maximum level of primary insurance, all power reactor operators will be charged a retrospective premium, up to a maximum of $111,900,000 per reactor per incident. These insurance levels are subject to adjustments due to inflation at five-year intervals. The operating power reactors that participate in the Secondary Financial Protection program create a combined level of protection of approximately $12 billion.

government really can't afford to pay for it either. So, it seems like we're going to be stuck there. 028-16

You're only thinking about 20-years at a time, but we should be thinking like the Native Americans think -- which would be more like seven-generations ahead. 20-years is sort of a selfish way of looking at what we're doing with these nuclear plants. We should be looking down the road so that we can ensure life on this planet will go on for a long time.

We have companies like Westinghouse and General Electric -- we're told that they bring good things to life. You boys are here and you're the functioning arm of these corporations -- the rubberstampers -- that allow this pollution to be created. We are tired of the corporations -- the mafia -- the corporate nuclear mafia -- controlling our lives here on the seacoast with your nuclear plants forced on us above and beyond our local votes. 028-17

I know we're supposed to be here debating whether or not it's going to be more prudent to have a nuclear plant as opposed to some other form of energy, but I can just tell you that the nuclear plants are highly energy intensive to make them and to run them. So, there's a lot of carbon involved in that process -- global warming will increase. But the alternatives and the renewables -- which we've already heard testimony -- are coming really fast and you can't tell me today that they can't take the place of this nuclear power plant 20-years down the line. And here you are 20-years ahead of time looking for extended license for your corporations that are making the money. 028-18

Have you ever heard of an internal emitter? That's a little piece of plutonium or strontium that comes from these plants that can make its way into the food chain and all it takes is a little speck of it to be ingested to get cancer. So, you're making tons of this product that nobody has an answer for it. And it's happening all over the planet really -- we've got to stop. We've got to stop making nuclear waste because the waste has turned into nuclear bombs and it's a dirty process from the mining of the uranium, all the way through. It's the same corporations that give us nuclear power that gives us nuclear weapons. And it was all given to us secretly. And then we were told it was great by little documentaries they teach to school children. So, we know what we're doing here tonight. And we know who we are up against. I would just hope that we can get real and see what we're doing -- see what we're doing to this planet. And try to do things better. And try to be truthful about what's going on. Thank you. 028-19

028-16 cont'd In the event of a nuclear incident involving damages in excess of the limits established in the Act, Price-Anderson does include a specific provision that obligates Congress to take appropriate action to assure full compensation for all unresolved public liability claims.

With regard to NRC funding, the Omnibus Budget Reconciliation Act of 1990 requires the NRC to recover through fees approximately 90 percent of its current fiscal year budget authority. It is important to note that fees paid by applicants and licensees, do not directly fund the NRC. The NRC receives its funding through the same appropriations process as other Federal agencies.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-17 The commenter expresses dissatisfaction with the time periods considered, the nuclear industry, and the NRC. The comment is general in nature and provides no new information, and no changes have been made to the SEIS as a result.

028-18 The commenter makes a general comment on the nuclear fuel cycle and alternatives energy sources. The nuclear fuel cycle, including an analysis of greenhouse gases associated with the fuel cycle, is contained in Chapter 6 of this SEIS. The evaluation of alternatives to renewing the Seabrook license is contained in Chapter 8 of this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-19 The commenter expresses opposition to nuclear power and the use of nuclear materials. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Sir, for the comment period -- NRC staff doesn't have all of the technical experts here that would be able to answer all of the questions. So, for the comments, we're going to take all the comments -- all comments that are received here today and after this meeting are going to receive a written response.

Jim Cotter is the next speaker.

JIM COTTER: My name is Jim Cotter. I'm from Wakefield, Massachusetts. I have a consulting company -- energy consulting company. We're looking at oversights with respect to spent fuel rod pools. One of the documents we're using is (51) rulemaking petitions with respect to spent fuel rod pools that I think was put together by the Foundation for Resilient Scientists. I'm a managing partner in the consultancy.

My background -- I studied nuclear physics at Northeastern University; nuclear chemistry and geology at Boston College; I was a nuclear weapons crew chief during the Vietnam War; I'm the seismic technician, 1968-69; I worked on Seabrook, Vernon, Wiscasset, Pilgrim, Millstone, Nine-Mile, North Anna -- where they just had the 5.8 earthquake; I did the bore-hole studies for the reactor siting at Seabrook; I went on to go for a doctorate in geo-physics at Umass/Amherst, changed my mind and did a BA/MBA Finance.

My concerns -- we're facing a potential 6.0 earthquake within our lifetimes. In the last 1000-years -- in 1050 we had a 7.2 estimated in the St. Lawrence River Valley; 1638, estimated 6.8 between Manchester and Concord; 1725, 1727, 5.6 plus for Portsmouth; 1755, 6.4 estimated off Cape Ann. There was a periodicity of approximately 250-years -- so that's why they say the 6.0 is coming. 027-6

One of the concerns with respect to spent fuel rods -- inadequate offsite power generation. In the event of an extended loss of power for the electrical grid, collapse in excess of seven-days -- which is one of the scenarios of the power generation from diesel. Will the pool withstand a 6.0 earthquake? 027-7

Issues of corrosive piping at various nuclear power plants -- including leaking tritium in the Vernon, Vermont plant. How many other power plants are leaking tritium? It's probably estimated at 20 or more. 027-8

Petition for rulemaking -- I mentioned. We are working on five-petitions for rulemaking to address what we see as serious oversights -- or lack. One may have been addressed is weather. Weather moves west to east. Has anyone considered a nor'easter storm with the spent fuel rod pool? 027-9

Fukushima -- I'll address that. It's what is called a black swan event. It could not be predicted -- approximately every 10,000 years. We have a potential black swan here that's been overlooked. One is a 6.0 in coincidence with a volcano in the Canary Islands splitting up the middle. In the last 50,000 years, it's put three escarpments into the ocean creating a 100 to 150 foot tsunami wave. There's documentation of sediments in Scotland about 250-years ago of at least a 25-meter wave.

That's just my comments.

027-6 The commenter expresses concern about a possible seismic event in the area of Seabrook. Seabrook was originally sited using criteria set forth in 10 CFR Part 100, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. These regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tsunami, and other natural phenomena, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR). When new natural hazard information becomes available, the NRC evaluates the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-7 The commenter raises issues related to the complete loss of power, known as station blackout, and SFP design. The requirements and adequacy of the station blackout rule (10 CFR 50.63) are outside the scope of license renewal. On March 20, 2012, the NRC issued a proposed rulemaking to examine the need to make revisions to the agency's current regulations regarding station blackout. Public comments and supporting materials related to this proposed rulemaking can be found at http://www.regulations.gov by searching on Docket ID NRC–2011–0299.

With respect to SFP design, as stated in the previous response, Seabrook was originally required to be sited, designed and constructed such that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's UFSAR. Again, when new natural hazard information becomes available, the NRC evaluates the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

No changes have been made to this SEIS as a result of this comment.

027-8 The commenter makes a general comment about piping degradation and tritium leakage at nuclear power plants. The NRC staff's description and evaluation of tritium leakage at Seabrook is in Section 4.10 of this SEIS. The aging management of plant components at Seabrook, such as piping, are addressed during the safety review of Seabrook license renewal application, and is therefore outside the scope of the environmental review.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-9 The commenter makes reference to various potential severe weather events and natural disasters. As discussed in response to comment 027-6, the site-specific analyses of natural disasters considered for the siting and design of Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR).

With respect to the portion of the comment dealing with the effect of a nor'easter on an SFP, it is unclear what the commenter is asking to be addressed. As discussed in response to comment 027-7, SFPs are designed to protect against natural phenomena likely to occur in the area in which a nuclear power plant is sited. Site-specific analyses of meteorological events and natural disasters considered for Seabrook can be found in Seabrook's UFSAR.

This comment provides no new information, and no changes have been made to this SEIS as a result.

United States Department of the Interior
OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue – Room 142
Boston, Massachusetts 02110-3334

TAKE PRIDE IN AMERICA

October 25, 2011

9043.1
ER 11/695

Cindy Bladey, Chief
Rules, Announcements, and Directives Branch
Division of Administrative Services
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: COMMENTS
Draft Supplemental Environmental Impact Statement
NUREG-1437, Supplement 46, Draft, License Renewal
Seabrook Station, Unit 1, Rockingham County, New Hampshire

Dear Ms. Bladey:

The U.S. Department of the Interior (Department) has reviewed the Draft Supplement 46 to the Generic Environmental Impact Statement (SEIS) for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1, Rockingham County, New Hampshire (NUREG-1437). The Department has no comment on the draft SEIS. 034-1

Thank you for the opportunity to review and comment on this supplement. Please contact me at (617) 223-8565 if I can be of assistance.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

034-1 This comment acknowledges the opportunity to comment on the draft SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Page 1 of 1

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As of: September 15, 2011
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Docket: NRC-2010-0206
Notice of Receipt and Availability of Application for Renewal of Facility Operating License

Comment On: NRC-2010-0206-0013
NextEra Energy Seabrook, LLC; Notice of Availability of Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1

Document: NRC-2010-0206-DRAFT-0011
Comment on FR Doc # 2011-19875

Submitter Information

8/5/2011
75 FR 47612
3

Name: Josephine Donovan
Address:
294 Dennett St.
Portsmouth, NH, 03801

General Comment

To Nuclear Regulatory Commissioners:

As a resident of Portsmouth, approximately ten miles from Seabrook, I am concerned that you haven't addressed in your draft environmental impact statement the question of thyroid cancer incidence in the vicinity of Seabrook. According to the National Cancer Institute (http://statecancerprofiles.cancern.gov), the incidence rates for Strafford and Rockingham Counties (adjacent to Seabrook) are higher than the national average (which is 11.0 cases per 100,000 for the period 2004-2008) and the highest (along with one other county) in New Hampshire. Strafford County is 15.5 and Rockingham 14.6. Essex County is Massachusetts, just south of Seabrook, is 16.3.

001-1

In 1999, the year of the tritium leak, thyroid cancer cases in Hillsborough County (adjacent to Rockingham, approximately 20 miles from Seabrook) spiked to 27 cases and in Rockingham County to 13 cases—over ½ (58%) of the thyroid cancer cases in the entire state for that year (NH Bureau of Health Statistics and Data Management, 2006).

There has been a dramatic rise in the incidence of thyroid cancer in NH (6.2% increase, 2004-08) and in Mass. (10.1%, 2004-08), as well as elsewhere.

While the evidence is not wholly conclusive, it is highly suggestive that there is a causal link between nuclear power plant emissions and thyroid cancer. Therefore I wonder why you haven't addressed this issue or why you haven't conducted a serious study of it?

I fear that when you conclude that the public health risk of continued operation is "small" (4.11.1; also 9.3.1 and 9.3.2), you are relegating thyroid cancer sufferers to the status of "collateral damage."

Thank you for your consideration,
Dr. Josephine Donovan
Professor Emerita
University of Maine

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (MSW2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f17f6... 09/15/2011

001-1 The NRC does not perform a study of cancer incidence as part of the environmental impacts assessment of a nuclear power plant seeking license renewal. This is because the radiation doses to plant workers and members of the public are well within the NRC's dose limits specified in 10 CFR Part 20, *Standards for Protection against Radiation*, which are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation to humans. The limits are based on the recommendations of scientific standards-setting organizations, and reflect extensive scientific study by national and international organizations.

Although radiation may cause cancers at high doses, currently there are no reputable scientifically-conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 10 rem (0.1 Sv). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit in 10 CFR Part 20 is 100 mrem (1 mSv) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor has enforceable license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

001-1 cont'd On April 7, 2010, the NRC announced that it asked the National Academy of Sciences (NAS) to perform a state-of-the-art study on cancer risk for populations surrounding nuclear power facilities (ADAMS Accession No. ML100970142). The NAS study will update the 1990 U.S. National Institutes of Health National Cancer Institute (NCI) report, "Cancer in Populations Living Near Nuclear Facilities" (NCI 1990), which concluded there was no evidence that nuclear facilities may be linked causally with excess death from leukemia or from other cancers in populations living nearby. The study's objectives are to: 1) evaluate whether cancer risk is different for populations living near nuclear power facilities, 2) include cancer occurrence, 3) develop an approach to assess cancer risk in geographic areas that are smaller than the county level, and 4) evaluate the study results in the context of offsite doses from normal reactor operations. The study began in the summer of 2010 and is ongoing. Phase 1 of the NAS study report was published on March 29, 2012, and is available on the NAS website (http://www.nap.edu). Once the entire study is complete, the NRC will review the report for potential changes to NRC regulations, as appropriate.

Radiation doses to members of the public from the current operations of Seabrook were evaluated in the draft SEIS in Section 4.8.1.1. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within dose standards specified by the NRC and EPA.

As discussed in Section 4.8.1.2 of this SEIS, the NRC staff also evaluated Seabrook's radiological environmental monitoring program (REMP). Based on the review of several years of data, the staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

This comment provides no new information, and no changes have been made to this SEIS as a result.

plant's condenser cooling needs. It uses this water to absorb the power plant's waste heat and then convey it to the ocean for disposal. In the process of withdrawing ocean water, Seabrook kills or injures large numbers of marine organisms. In addition, the facility's disposal of large quantities of waste heat in the ocean has the potential to degrade the quality of the marine habitat receiving this thermal pollution. Furthermore, discharges by the facility of other pollutants, such as chlorine, to the ocean must also be considered. The DSEIS should characterize these and any other relevant impacts and should discuss alternative means of avoiding, reducing or otherwise mitigating these possible environmental effects. The DSEIS presents and explains the NRC staff's preliminary recommendation that the adverse environmental effects of license renewal for Seabrook Station "are not great enough to deny the option of license renewal for energy-planning decision makers."

In addition to the comments in this letter, we have provided more detailed comments on the DSEIS in the attachment to this letter. These more detailed comments highlight areas where we believe additional information is needed to more fully describe the impacts of Seabrook. Our comments recommend a more complete consideration of alternative plant cooling system scenarios for the relicensing period and also address other operational impacts, including the entrainment and impingement of fish and other aquatic organisms, and releases of tritium to groundwater. The NRC should address these issues in the Final Supplemental Environmental Impact Statement (FSEIS).

We also recognize that pollutant discharges and withdrawals of ocean water for cooling at Seabrook are regulated under the National Pollutant Discharge Elimination System (NPDES) permit issued by EPA to the facility. NextEra has submitted an application to EPA for renewal of the NPDES permit. The comments in this letter are based solely on a review of the information in the DSEIS from the standpoint of what is required by NEPA and are not intended to address the requirements of the Clean Water Act NPDES permit. EPA will address those requirements when it takes action on Seabrook's NPDES permit renewal application.

EPA has some concern about timing of this DSEIS and licensing action being conducted so far in advance of the expiration date of the existing license. The existing license expires in 2030. Therefore, this DSEIS in support of relicensing is being prepared more than 18 years before the existing license expires. While it makes sense to start this process well in advance of the expiration date to allow for the time needed to conduct an appropriate analysis and allow for public involvement in the process, 18 years may be excessive. Such a large span of lead time poses potential problems, such as the increased chance that conditions could change in material ways that would necessitate further supplemental environmental review and revisiting of the licensing decision. There is always a risk of changed circumstances, but that risk is much greater when a review is being done so far before the action in question will take effect. 014-1

In addition, commencing the EIS process this far in advance of when the new license would go into effect calls for the public and numerous state and federal agencies to mobilize themselves and apply their limited resources to address an action that will not go into effect for more than 18 years and that, as stated above, is necessarily at greater risk of having to be revisited due to changed circumstances. Waiting to start the EIS process until the need for relicensing is closer in time may be a preferable approach. Alternatively, the NRC could explain in the Final

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014-1 The commenter expresses concern over the timing of SEIS development and a licensing action relative to the expiration of the current operating license for Seabrook. On May 25, 2010, as allowed by regulations at 10 CFR 54.17, NextEra submitted an application to renew the Seabrook operating license for an additional 20 years, thereby initiating the Federal action. If and when the NRC makes the determination to renew the Seabrook operating license, as stated in NRC's regulations at 10 CFR 54.31(c), the renewed license would become effective immediately and would incorporate the remainder of the current operating license, plus any additional approved time, up to a maximum of 20 additional years from the current license expiration. Since the renewed license would go into effect immediately rather than upon expiration of the existing license, the Federal action, license renewal, is occurring upon license issuance rather than in 2030. Therefore, consistent with the requirements of NEPA and NRC regulation the SEIS for license renewal is being prepared currently rather than in 2030.

A renewed operating license is just one of a number of authorizations that a licensee must obtain in order to continue to operate its nuclear plant beyond the expiration of its current license. Many of these additional authorizations, such as EPA's NPDES permitting process, directly relate to meeting requirements designed to minimize the impact of Seabrook's operation on the surrounding environment, and must be renewed at a great enough frequency to adequately respond to changing conditions. As a result, the environmental impacts of the operation of Seabrook will continue to be analyzed and evaluated throughout the term of a renewed license.

Additionally, should the NRC approve NextEra's request for a renewed license, the NRC will continue to monitor the operation of Seabrook to ensure that it is operated in a manner that is consistent with the NRC's regulations designed to protect people and the environment. Should new information become available relevant to the operation of Seabrook, or its impacts on the environment, the NRC will evaluate the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Supplemental Environmental Impact Statement (FSEIS) why it has commenced the EIS process so far in advance of actual relicensing and its strategy for monitoring for changed circumstances that might trigger the need for further environmental review prior to the actual relicensing. 014-1

For the reasons discussed above (and in the attachment that follows), EPA has rated this DSEIS "EC-2 Environmental Concerns-Insufficient Information" in accordance with EPA's national rating system, a description of which is attached to this letter. We look forward to reviewing responses to the issues highlighted in this letter and technical attachment in the FSEIS. EPA is available to provide additional input, as necessary, to help the NRC respond to the issues discussed in this letter. Please feel free to contact Timothy Timmermann of the Office of Environmental Review at 617/918-1025 if you wish to discuss these comments further.

Sincerely,

H. Curtis Spalding
Regional Administrator

Attachment

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Detailed Comments
Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 46 Regarding Seabrook Station
Draft Report for Comment

Consideration of Alternative Cooling System Designs over the Relicensing Period

The DSEIS documents meaningful entrainment impacts from the normal operation of Seabrook's cooling water system. For example, data presented in the DSEIS suggests destabilization of populations near the facility's cooling water intake structure (see, for example, the discussion at pages 4-20 and 4-34). In particular, the DSEIS explains that cumulative impacts on aquatic species would be "MODERATE for most species and LARGE for winter flounder, rainbow smelt, and other species that would be adversely affected from climate change, such as lobster and Atlantic cod." In addition, the NRC recognizes (page 8-4) "…the mounting concerns for potential adverse impacts to aquatic ecosystems from once-through cooling systems…" and suggests (page 8-14) that a new plant constructed today would likely use closed cycle cooling due to the potential for aquatic impacts. EPA shares these concerns and finds NRC's suggestion with regard to how a new plant would likely be designed to be reasonable.

While EPA understands that the NRC concludes that "…the adverse environmental impacts of license renewal for Seabrook are not great enough to deny the option of license renewal for energy planning decision makers." Nevertheless, EPA regards these concerns to be significant enough to warrant careful assessment of a range of alternatives for structural and operational modifications to the Seabrook cooling system that could reduce these adverse impacts should the plant be relicensed. In addition, we recommend that the FSEIS fully discuss and evaluate the comparative environmental impacts of these alternatives. Project modifications should be framed as operational alternatives (for impact comparison purposes) and the FSEIS should characterize the relative impacts of the alternatives, such as the differing numbers of organisms to be impinged and/or entrained by the intake structure under the different alternatives. The information from the analysis should be utilized to support NRC decision-making under the criteria applicable to its licensing decision. The FSEIS should not, however, purport to provide or suggest the answers to the ultimate permitting questions that EPA must address under the Clean Water Act. 014-2

Concerns with Estimated Impacts

Due to the large cooling water demand at Seabrook Station, total entrainment and impingement loss estimates are correspondingly high. The mean entrainment losses for fish eggs are almost 1 billion per year, with maximum losses per year being more than twice that. Mean entrainment loss estimates for fish larvae are about 260 million a year, with the peak estimate being approximately 1 billion larvae per year. In addition, on average, 18×10^{12} larval bivalve are lost each year, with peak years being 3.5 times more than that. 014-3

Impingement losses varied from a low of 7,200 fish and lobsters per year to nearly 72,000 per year. The mean impingement rate of fish and lobsters is approximately 21,000 per year.

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014-2 Section 4.5.4 of this SEIS has been revised to include an expanded discussion of potential mitigation options, including structural and operational modifications to the Seabrook cooling system. In addition, Chapter 8 of the SEIS has been revised to include an evaluation of a closed-cycle cooling alternative. In this analysis, the NRC staff compares the environmental impacts of the current once-through cooling system with a closed-cycle cooling system, such as the estimated impingement and entrainment rates.

014-3 In its comments on the DSEIS, the U.S. Environmental Protection Agency (EPA) stated that it agrees with NRC's characterization of the impact to winter flounder as LARGE and EPA stated that the impact to rainbow smelt should be characterized as LARGE. In Section 4.5.5, NRC characterized the impact to winter flounder and rainbow smelt as LARGE.

In its comments on the DSEIS, EPA stated that that the impacts to silver hake should be characterized as MODERATE based on trawl survey results presented in the DSEIS. In Section 4.5, NRC defined the impingement and entrainment impact as MODERATE if Seabrook monitoring data indicated that the abundance of a certain species or biological group increased at sites further from the Seabrook cooling system and remained steady near the cooling system. In addition, the NRC staff looked for a strong connection between the Seabrook cooling system and the biological group or species, such as high entrainment or impingement.

Seabrook trawl data indicated that the mean abundance of benthic silver hake near the sea floor decreased at the nearfield site and increased at the farfield sites. However, the decrease in abundance was relatively small and whereby the range of variability overlapped between the preoperational and operational monitoring periods at the nearfield, as shown in Table 4.5-9. Specifically, the 95 percent confidence interval overlapped between the preoperational and operational data. NAI (2010) did not test whether the trends for silver hake were statistically significant. Gill net monitoring data indicated that the abundance of pelagic silver hake within the water column increased at the nearfield sites and increased or remained similar at the farfield sites. Similarly, ichthyoplankton monitoring data indicated that the abundance of silver hake eggs and larvae increased at both nearfield and farfield sampling sites.

Rainbow smelt is a Species of Concern for NOAA and has suffered annual impingement losses of over 1,000 fish per year, on average.

These large entrainment and impingement losses are worthy of concern on their own, but they become especially troubling when viewed in conjunction with the trawl survey results. Trawl surveys showed a statistically significant reduction in the nearfield abundance of rainbow smelt and winter flounder. The data also suggested a nearfield reduction in silver hake, but this was not statistically tested. EPA agrees with the characterization of the impact to winter flounder as large. We also think that the impact to rainbow smelt should be characterized as large, in part due to the size of the impact and the current status of the stock. Moreover, EPA concludes that that the impacts to silver hake should also be rated as moderate in light of the trawl survey results presented in the DSEIS. 014-3

Need for Expanded Monitoring Program

The monitoring program that has been in place through the NPDES program has provided a useful long-term record of conditions offshore. The trawl program has now detected an impact for several fish species in the nearfield stations. Due to the limited number of trawl stations, however, the geographic scope of this impact cannot be characterized with a high level of confidence. In light of the recent results, EPA believes that an expansion of the geographic coverage of the trawl program is in order to better characterize the full scope of the impacts. We look forward to discussing expansion of this effort at the federal-state interagency review meetings to discuss biological monitoring data anticipated to occur in December 2011. 014-4

Comparison with Other Facilities' Entrainment and Impingement (pages 4-16 to 4-19)

The DSEIS compares entrainment and impingement losses between Seabrook and the Pilgrim Nuclear Power Station in Plymouth, MA (Pilgrim), in an effort to characterize the scale of the impacts. EPA believes that it is inappropriate to draw conclusions on the scale of impact at one facility by simply comparing its entrainment and impingement numbers with those of another facility. The specific circumstances of each receiving water and species involved must be taken into account. In other words, each facility must be evaluated individually in light of its ecological context. For example, entrainment and impingement losses caused by the Brayton Point Station power plant in Somerset, MA, were very large, but were lower on an absolute basis than the losses at either Pilgrim or Seabrook. The losses at Brayton Point Station were regarded to be very serious because of their contribution to a baywide decline in fish populations. Losses at Seabrook need to be evaluated in light of their environmental context. (EPA also notes that it does not necessarily concur with the characterization of the losses at Pilgrim presented in the DSEIS.) 014-5

Groundwater Contamination

Background

Radionuclide contamination of groundwater at the Seabrook site is a concern. Since a leak was detected in the spent fuel pool water in 1999, Seabrook has undertaken efforts eliminate the leak and to monitor and actively contain tritium-contaminated groundwater. Although there are no

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014-3 cont'd Because of the high variability from the trawl surveys and the consistent change in abundance at the nearfield and farfield sites found during the ichthyoplankton studies and the gill net monitoring, NRC staff determined that the monitoring results for silver hake did not fit the definition of a MODERATE impact as defined in Section 4.5 of this SEIS. No change was made based on this comment.

014-4 The NRC acknowledges the EPA's intention to discuss the potential need for expanded monitoring around Seabrook with NextEra. No change was made based on this comment.

014-5 In its comment on the DSEIS, EPA stated that it is "inappropriate to draw conclusions on the scale of impact at one facility by simply comparing its entrainment and impingement numbers with those of another facility. The specific circumstances of each receiving water and species involved must be taken into account." For the aquatic resources impact assessment, a comparison of the impingement rates, entrainment rates, and overall conclusions between Pilgrim and Seabrook was a small part of five lines of evidence that the NRC staff considered to assess the impacts from Seabrook. The NRC staff presented this information in the SEIS because both plants are in the same region of the United States, many of the same fish species are impinged and entrained at both plants, and because in 2002, EPA conducted a case study analysis for a proposed Section 316(b) Phase II existing facilities rule that evaluated the economic losses associated with impingement and entrainment at both Seabrook and Pilgrim. In addition to this comparison, the NRC staff's assessment took into account the specific circumstances near Seabrook, as suggested by the commenter. For example, the assessment considered the relative impingement and entrainment rates among the species found near Seabrook, the commonality of the impinged and entrained species, as well as the abundance trends near the intake and discharge structures and areas approximately 3–4 nautical mi (5–8 km) from the intake and discharge structures. Thus, the assessment not only considers the absolute losses from entrainment and impingement, but also the relative impact to the population near Seabrook. No change was made based on this comment.

known drinking water supplies downgradient of the site and no drinking water supplies appear to be threatened by tritium-contaminated groundwater, the continued detection of elevated tritium in groundwater requires vigilance. Based on our review of the DSEIS, it is unclear whether groundwater monitoring and containment activities performed at the site are performed on a voluntary basis or are subject to regulatory or public oversight.

Comments/Recommendations
Due to the history of radionuclide contamination of groundwater at this site (and others around the country), we offer the following comments and recommendations:

- Seabrook's efforts related to groundwater contamination should be reported publicly and subject to review by appropriate regulators. Information related to groundwater tritium contamination should be made easily accessible by the public. The Vermont Department of Health's website on tritium contamination at Vermont Yankee provides a useful example of how data can be made accessible to the public (http://healthvermont.gov/enviro/rad/yankee/tritium.aspx).
- We recommend license renewal permit conditions that require groundwater monitoring and reporting to ensure that groundwater contamination is appropriately characterized and controlled. Groundwater monitoring and management should be part of a well-defined, long-term, comprehensive strategy. Periodic reviews of the overall strategy and the data and reports generated should be conducted in coordination with Seabrook and NRC officials. 014-6
- Groundwater sampling for other contaminants of concern (e.g. metals) should also be conducted to ensure that the full extent of contamination has been characterized. Groundwater analytes should not be limited to tritium, but should also include additional contaminants that are present in spent fuel pool water, the source of the leak. For example, Cesium 137 and Strontium 90 are potential additional contaminants to be monitored. In order to obtain a representative sample, unfiltered, "low flow" sampling should be employed.
- Management and monitoring of groundwater should be conducted in accordance with the recommendations contained in NRC's Groundwater Task Force Final Report, June 2010 (http://www.regulations.gov/#!documentDetail;D=NRC-2010-0302-0002).

Questions regarding these recommendations should be directed to Marcel Belaval at 617-918-1239 (belaval.marcel@epa.gov).

Comment Related to the Combination Alternative of Natural-Gas-Fired Combined-Cycle and Wind Alternative

Section 8.3 of the DSEIS analyzes the Combination Alternative of Natural-Gas-Fired Combined-Cycle and Wind as a means to replace the baseload power of Seabrook Station. This framework can work conceptually when just "truing up" the annual output of a small gas plant and a series of wind farms, but we believe it would be challenging to achieve full replacement as described in the DSEIS, particularly when the gas plant is sized for only half of the output of Seabrook. The discussion does not fully address how baseload power plants work – which is to provide a 014-7

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014-6 This comment expresses concern about the availability of information on groundwater contamination relative to Seabrook and its adequacy, the need for license conditions related to groundwater monitoring and reporting, and implementation of NRC's Groundwater Task Force Final Report. As described in the NRC staff's response to comment 011-6, Section 2.2.5 of this SEIS summarizes the state of knowledge related to historical radionuclide releases to groundwater beneath the site, and Section 4.10 of this SEIS presents the NRC staff's evaluation of the impacts of inadvertent releases of tritium with respect to groundwater quality and human health. Sections 2.2.5 and 4.10 of this SEIS have been updated to reflect the latest groundwater monitoring results for Seabrook, which are documented in annual radioactive effluent release reports submitted to the NRC. These reports are publicly available, along with additional information on radiological monitoring conducted at Seabrook, at http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/seab1.html. These radioactive effluent release reports are required to be submitted to NRC by 10 CFR 50.36a. The regulation requires nuclear power plants to annually submit a report that lists the types and quantities of radioactive effluents released into the environment as a requirement of each nuclear power plant's operating license. Further, as described in Section 4.8 of this SEIS, NextEra conducts a Radiological Environmental Monitoring Program (REMP) to assess the radiological impact, if any, to its employees, the public, and the environment from the operations at Seabrook. The REMP measures the aquatic, terrestrial, and atmospheric environment for radioactivity, as well as the ambient radiation. In addition, the REMP measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). The REMP supplements the radioactive effluent monitoring program by verifying that any measurable concentrations of radioactive materials and levels of radiation in the environment are not higher than those calculated using the radioactive effluent release measurements and transport models. Section 4.8 of this SEIS contains the staff's review of the latest radioactive effluent and REMP reports for Seabrook. The NRC's ongoing Inspection Program periodically inspects NextEra's radioactive effluent monitoring and REMP programs for compliance with NRC's radiation protection standards in 10 CFR Part 20. The NRC's Reactor Oversight Program (ROP) evaluates the data for compliance with radiation protection standards (Inspection Procedure (IP) 711124.08). If the data were to show a noncompliance with requirements, the NRC would take appropriate enforcement action.

014-6 cont'd As also noted in Section 2.2.5 of the SEIS, NextEra has separately implemented a groundwater monitoring program as part of its participation in the Nuclear Energy Institute's Groundwater Protection Initiative (NEI 2007) to ensure timely detection and effective response to situations involving inadvertent radiological releases to groundwater, from whatever the source, and to enhance licensee communications with their stakeholders about these situations. The early detection of contamination, typically through on-site monitoring wells, allows licensees to take actions as necessary to prevent the off-site migration of licensed radioactive material. The NRC does review licensees' implementation of the industry-wide Ground Water Protection Initiative as part of its radiation protection program oversight. However, the program itself is not an NRC-required program and the guidance in the document is not subject to regulatory enforcement.

As also cited by the commenter, NRC has taken proactive steps to implement many of the recommendations outlined in the June 2010 Groundwater Task Force Final Report (NRC 2010b). Immediately upon publication, NRC's Executive Director for Operations appointed a senior management review group to evaluate the Final Report and to assess the 16 conclusions and 4 recommendations identified in the report by the Groundwater Task Force (ADAMS Accession Number ML101680435). In February 2011, NRC's Executive Director of Operations presented an information paper to the Commission detailing the review group's findings and initiatives to address two of the four themes presented in the Groundwater Task Force Final Report (ADAMS Accession Number ML110050252). This paper outlines the near term actions taken and longer term actions that are proposed or ongoing. They include initiatives to strengthen public trust and ensure greater reliability and consistency of the NRC's response to leakage of radioactive effluents or potential contamination of groundwater through better communication with the States, the public, and other stakeholders. A separate Commission information paper (SECY-11-0019, ADAMS Accession Number ML110050525) was also submitted that describes the staff regulatory approach for addressing groundwater protection and the themes of reassessing the regulatory framework and maintaining barriers as designed to confine licensed material. Subsequently, in August 2011, the Commission issued a staff requirements memorandum (SRM-SECY-11-0019, ADAMS Accession Number ML112270292) approving of the senior management review group's approach, including the recommendation not to incorporate the voluntary industry initiative on groundwater protection into the NRC's regulatory framework.

This comment provides no new information, and no changes have been made to this SEIS as a result.

steady, daily, consistent source of power. While the DSEIS presents a range of sizes and locations of wind farms to help address the variability of wind speed and duration, there are still likely to be times when the output from the wind farms is less than their share of the amount of power produced daily by a baseload power plant. Therefore, we believe periodic gaps in output from the wind farm arrays would be more realistically addressed through a combination alternative gas plant sized for more than just half of the total output. 014-7

014-7 The intermittency of wind energy is discussed in Section 8.3 of this SEIS. This discussion includes the basis for why it is reasonable to assume that wind farms, paired with an NGCC plant, could provide replacement, baseload power for Seabrook. For example, the analysis assumes that there would be five onshore and offshore wind farms separated geographically. The five wind farms would be interconnected and operate in concert with one another as a "virtual power plant," reducing the probability that all of the wind farms would experience the same unproductive wind conditions simultaneously. Introducing an off-shore wind farm further reduces the potential for intermittent wind power generation because wind profiles in offshore locations are expected to be relatively constant throughout a diurnal cycle. The NRC acknowledges that, should an alternative such as the one described in Section 8.3 be implemented, the capacity of the NGCC plant may need to be adjusted based on actual conditions at the time of implementation. However, the NRC staff believe that the impacts resulting from such a change would not be large enough to change the conclusions reached in the SEIS.

No changes have been made to this SEIS as a result of this comment.

Summary of Rating Definitions and Follow-up Action

Environmental Impact of the Action

LO--Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

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10-20-2011

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8/25/2011
76FR 49612

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Letter to the Nuclear Regulatory Commission (NRC)
Dear NRC Commissioners:

We are writing to express our concern with the re-licensing of the Seabrook (NH) nuclear plant. Our environmental concerns are given below:

The owners of that plant have applied for a 20 year extension of their license even though their current license does not expire for almost 20 years. This is significant since there have been quite a few problems with reactors which are much younger than Seabrook will be if given the extension. Such problems are corrosion of critical pipes in systems, decay/cracking of foundations that support reactors, tritium leakage problems, among others. These can lead to environmental problems. 024-1

There has been no public discussion about the fact that Seabrook is close to sea level and within the new license period sea level is predicted to rise several feet at least. It is not clear that the NRC has evaluated the effects on the plant of higher water level during storms, erosion, ground water level increase leading to decay of the foundations, 024-2

Seabrook, as well as most other nuclear plants in the USA, has spent fuel rods in "swimming pools" which are subject to terrorism, large storms, and accidents thus exposing a large area to very high levels of radioactivity. Again these are environmental problems. 024-3

It is premature to re-license a plant significantly earlier than the end of the current license; In the time left on the current license, critical failures could happen leading to dangerous environmental problems. 024-4

Sincerely,
Filson Glanz Shirley Glanz
Filson and Shirley Glanz
25 Orchard Drive, Durham, NH 03824
603 868-5398; filglanz@comcast.net

SUNSI Review Complete
Template - ADM-013

E-RIDS= ADM-03
Add= M. Wentzel (mswz)

024-1 The commenter raises issues related to the aging management of systems structures and components at Seabrook. Aging management issues that are within the scope of license renewal are evaluated as part of the safety review of the Seabrook license renewal application. The NRC staff's evaluation of NextEra aging management programs is contained in its safety evaluation report.

This comment provides no new information, and no changes have been made to this SEIS as a result.

024-2 This comment in part expresses concern that the EIS does not address the impacts of climate changes on Seabrook. Climate change and its related impacts on the environment are discussed in Sections 2.2.2, 4.12.1.2, 4.12.2, 4.12.3, 4.12.4, 4.12.6, and 4.12.7 of this SEIS. However, the impacts of climate change on operations and safety at Seabrook are considered out of scope for the environmental review, which documents the potential impacts on the environment from continued operation. Therefore, the potential for storm damage, erosion, and flooding to affect a nuclear power plant is not specifically analyzed in the license renewal environmental review. Currently operating nuclear power plants were originally sited in consideration of the hydrologic siting criteria set forth in 10 CFR 100, as applicable, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. The regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as flooding from severe storms, without loss of capability to perform safety functions. Site-specific design bases for flood protection are prescribed by a nuclear power plant's Updated Safety Analysis Report/Updated Final Safety Analysis Report and by applicable technical specifications. Acceptable protection for floods includes levees, seawalls, floodwalls, or breakwaters. If new information or operating experience relating to flooding becomes available, the NRC evaluates the new information to determine if any changes are needed at existing plants. For instance, as part of the Japan lessons-learned activities resulting from the March 2011 earthquake and tsunami, the NRC has used its regulatory authority under 10 CFR 50.54 to request flood re-evaluations of existing nuclear power plants (see ADAMS No. ML12053A340). Licensees of operating nuclear power plants have been asked to reevaluate the flooding hazards that could affect their sites using present-day information. These newly reevaluated hazards, if worse than what the plant had originally calculated upon initial licensing, will be analyzed to determine whether plant structures, systems, and components need to be updated to protect against the new hazards.

024-3 The environmental and health impacts of design basis accidents (DBAs) which include accidents involving the storage of spent nuclear fuel in pools was evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of an operating license. The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents and the potential doses from an accident meet NRC requirements in 10 CFR Part 100. As part of the license renewal process, the NRC staff has not identified any new and significant information during its independent review of the Seabrook environmental report, the site visit, the scoping process, or evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to DBAs beyond those discussed in the GEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

024-4 The commenter expresses concern about the timing of license renewal process for Seabrook. As allowed by 10 CFR 54.17, NextEra submitted the Seabrook license renewal application 20 years before the expiration of their current license. The NRC has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Should the NRC grant NextEra’s request for a renewed license, the NRC will continue to provide continuous oversight through its Reactor Oversight Process to verify that they are being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action is required to protect public health and safety.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Yes, ma'am. If you could please give us your name.

DEBBIE GRINNELL: Debbie Grinnell -- I'm with the C-10 Foundation. After Fukushima, we have now added three more core melts that need to be factored into -- I think it's now up to five -- in evaluating or recalculating your mass and that pertains to the relicensing process. So, is anyone doing those calculations and they need to be done before you relicense any other plants post-Fukushima. 027-1

BRIAN ANDERSON: NRC staff -- any specific information as it relates to core melt frequency given the Fukushima events this year?

MICHAEL WENTZEL: I'm afraid I didn't really understand what the question was.

DEBBIE GRINNELL: You use incidents in --

BRIAN ANDERSON: Debbie -- here's the microphone.

DEBBIE GRINNELL: You use incidents in evaluating and doing the mass in terms of predicting the risk, so I don't know who's doing that at the NRC, but I'm assuming that because now we have factual information -- we have three additional core melts -- that that has to be factored into your evaluations and predictability of the risk. 027-1

BRIAN ANDERSON: Debbie -- we may need to get back to you with a better answer. Diane -- do you have anything that you can add or help out with here?

MICHAEL WENTZEL: I would say it almost sounds like a comment that's related to [indiscernible] --

BRIAN ANDERSON: Mike -- is your mic on?

MICHAEL WENTZEL: Okay -- there we go. I'd say that really sounds like a comment. I don't have a specific answer to that question, but it sounds like that may be a comment that would be worth submitting this evening or whenever you want.

DAVE WRONA: We can take it as a comment.

MICHAEL WENTZEL: Right -- absolutely. And actually, we can take -- and Dave's absolutely right -- you've already provided the comment. We can handle this as a comment and address it as part of the Final.

BRIAN ANDERSON: So, Debbie, the NRC staff is going to take your question as a comment, but also look into it and get back to you with information, if that's okay with you.

DEBBIE GRINNELL: When you re-draft the calculations, I'd like to see those.

027-1 The commenter has a concern about how the three core melts associated with Fukushima were considered in the evaluation and predictability of the risk.

PRAs are plant- and site-specific analyses. So, three core melts due to a seismic-induced tsunami in one area of the world does not de facto increase the "risk" everywhere in the world. For example, a plant that is sited such that it is not susceptible to either a seismic event or a tsunami event (including one induced by the other) essentially has a zero risk from these events.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thomas -- thank you for those comments. The next speaker is Debbie Grinnell followed by Brian Stern and then Marcia Bowen.

DEBBIE GRINNELL: I'm Debbie Grinnell. I live in West Newbury, Massachusetts within the 10-mile EPC of Seabrook. I work for the C-10 Foundation. We do the real-time radiation monitoring for the state of Massachusetts. And I'm a founding Board member.

The C-10 Foundation requests the NRC suspend any decision on Seabrook Station's relicensing until:

The NRC required Supplement 4 to GL-88-20/Individual Plant Examination of External Events for Severe Accident Vulnerabilities is completed and submitted by NextEra and approved by the NRC. 027-11

Secondly -- the NRC's license renewal process completes a formal review of Seabrook's design and licensing basis against current NRC requirements and guidance. This has not been done yet. 027-12

Thirdly -- all NRC required seismic upgrades for Seabrook Station are completed and those reports made public. 027-13

Four -- in-depth engineering analysis to determine the extent and structural weakness imposed by Seabrook Station's ASR concrete degradation is completed and all reports are made public. Seabrook's ASR concrete degradation has been characterized as Moderate and Severe in NRC inspection reports. The extent of the structural damage and its impact to the structural integrity of four safety related building foundations is currently unknown. Seabrook's seismic vulnerability cannot be determined until the structural weakness imposed by the ASR concrete degradation of these safety related foundations and other plant areas susceptible to ASR degradation is determined and integrated into Seabrook's updated Seismic Risk Analysis. 027-14

Due to the unknown degree of structural weakness imposed by the concrete, NextEra cannot provide reasonable assurance that they are operating within their current license. Therefore, the NRC must suspend NextEra's application for a license extension until: both in-depth assessments are completed; upgrades are done; and the structural integrity of all buildings is determined and assured for 40-years.

The NRC must aggressively undertake staff requests for additional information concerning the Severe Accident Mitigation Alternatives review of Seabrook Station. 027-15

So, I would like to know when all of that is completed and there's resolution to the seismic risk -- Seabrook's vulnerability -- and the concrete -- the extent of the concrete issue. That I know we have a suspension at the moment, but somehow the Safety suspension does not seem to stop the process of this Environmental Impact. It seems to be considered a separate issue. They're integrated. 027-16

After the tragic events at Fukushima in Japan and the recent earthquake in Virginia -- on September 1, 2011, the NRC has requested operators of all (104) commercial reactors to conduct new assessments of their facility's vulnerability to earthquake damage. 027-17

027-11 The commenter stated the NRC should delay its decision on renewing the Seabrook license until NextEra completes the actions required of it by Generic Letter (GL) 88-20, Supplement 4. GL 88-20 requested licensees to perform an analysis to identify plant-specific severe accident vulnerabilities initiated by external events and to submit the results to the NRC. The GL process is one of the mechanisms by which the NRC can address technical issues that may have generic applicability to all or a subset of nuclear power plants. The issues addressed by GL 88-20 are current operating issues and are, therefore, outside the scope of license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-12 The commenter states the NRC should delay its decision on renewing the Seabrook license until the NRC completes a review of the design and licensing basis for Seabrook, which are part of Seabrook's current licensing basis. The focus of a license renewal review under 10 CFR Part 54 is to assess the applicant's ability to effectively manage the effects of aging on certain passive, long-lived systems, structures, and components and to complete an environmental review. Except as it relates to managing the effects of aging, the NRC does not perform a review of a nuclear power plant's current licensing basis as part of a license renewal review. However, the NRC does continually monitor a facility's compliance with its current licensing basis through the ongoing reactor oversight process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-13 The commenter states the NRC should delay its decision on renewing the Seabrook license until NextEra completes any required seismic upgrades for Seabrook. Seismic upgrades that may be required at Seabrook, either now or in the future, would be identified and addressed through one of the agency's other existing regulatory processes. These processes are separate from the license renewal process. As a result, any required seismic upgrades, should they exist, are considered outside the scope of license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thomas -- thank you for those comments. The next speaker is Debbie Grinnell followed by Brian Stern and then Marcia Bowen.

DEBBIE GRINNELL: I'm Debbie Grinnell. I live in West Newbury, Massachusetts within the 10-mile EPC of Seabrook. I work for the C-10 Foundation. We do the real-time radiation monitoring for the state of Massachusetts. And I'm a founding Board member.

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The NRC required Supplement 4 to GL-88-20/Individual Plant Examination of External Events for Severe Accident Vulnerabilities is completed and submitted by NextEra and approved by the NRC. 027-11

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Thirdly -- all NRC required seismic upgrades for Seabrook Station are completed and those reports made public. 027-13

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Due to the unknown degree of structural weakness imposed by the concrete, NextEra cannot provide reasonable assurance that they are operating within their current license. Therefore, the NRC must suspend NextEra's application for a license extension until: both in-depth assessments are completed; upgrades are done; and the structural integrity of all buildings is determined and assured for 40-years.

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027-14 The commenter stated that the NRC should delay its decision on renewing the Seabrook license until the NRC has a full understanding of both the impact of the alkali-silica reaction (ASR) that is occurring at Seabrook, and NextEra's plan to manage the effects of aging throughout the period of extended operation. While the impact of ASR on the structures at Seabrook is outside the scope of the environmental review for the Seabrook LRA, ASR and its impacts on the ability of NextEra to effectively manage the effects of aging on structures at Seabrook are evaluated as part of the license renewal safety review. The NRC will not make a decision on license renewal before it fully understands both the issue with ASR-affected structures and NextEra's plan to address the issue.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-15 The commenter states the NRC should request additional information from NextEra pertaining to their SAMA analysis; however, no information was provided indicating what information should be requested, nor were any particular deficiencies in the Seabrook SAMA analysis identified. It should be noted that the NRC staff issued multiple rounds of requests for additional information for NextEra's original SAMA supplement, to which this comment refers.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-16 The commenter refers to the fact that a delay in the safety review does not translate into a delay in the environmental review. The safety and environmental reviews are separate but related processes. As such, the reviews are conducted on separate schedules. Should an issue come up in one of the reviews that is deemed to have an impact on the other, the NRC staff will take steps to address that issue, as appropriate, regardless of where the reviews are in their schedule. For the Seabrook LRA, even though the environmental review process is continuing, if new information were to be identified during the conduct of the safety review that was deemed to have an impact on the environmental review, the staff would still address it, as appropriate, in the SEIS. This comment provides no new information, and no changes have been made to this SEIS as a result.

Plants have been given up to two-years to complete these assessments. Until these assessments are done, individual plant risk will be unknown and the NRC will not know what upgrades to require. According to the U.S. geological survey maps, Seabrook's seismic risk level is described as Moderate.

027-17

Unfortunately, the NRC's application to renew the license of an existing reactor does not entail a formal review of the reactor's design and licensing basis against current NRC requirements and guidance. Therefore, shortcomings are not identified that would have required upgrades. However, now -- post-Fukushima and the earthquake in Virginia -- the NRC Task Force has recommended upgrading seismic and flooding design basis for every nuclear plant in this country. But here's the sad history of the NRC concerning this issue -- as early as 1996, the NRC established new seismic regulations for new site application, but these regulations were not applied to existing sites.

027-18

Since 1996, the NRC has also established interim staff guidance, but only for the new reactor reviews. In 2005, the NRC requested applications for new reactors -- often proposed for the same sites as existing reactors -- include earthquake risk assessments that were worse than previously understood in several cases and suggested some existing plants could be in jeopardy -- that was 2005. In 2007, the NRC staff established interim guidance in three areas related to seismic issues: high frequency ground motion; winter precipitation loads on the roof of structures; and seismic margin analysis based on probabilistic risk assessment. Again, these pertained only to new sites.

For nearly a decade, the NRC has known that the seismic risk to nuclear plants in the eastern two-thirds of the U.S. was greater and existing plants had outdated protection against seismic and flooding hazards, but took no action.

027-19

It is our understanding that the NRC establishes renewal regulations based on its determination that existing regulatory processes are adequate to ensure that the licensing basis of currently operating U.S. nuclear power plants provides and maintains an adequate level of safety. Renewal of Seabrook's license must be suspended as the NRC has known the seismic risks were greater for existing plants for a decade. Valuable time has been lost as the NRC has known for years that existing regulatory processes were inadequate to assure an adequate level of safety and has taken no action.

That ends my comment.

027-17 The commenter raises potential changes that may be required to an operating plant's design basis that may occur as a result of the natural disasters that occurred in 2011, specifically Fukushima, the earthquake near Mineral, VA, and the prolonged flooding experienced in parts of the Midwest. Seabrook was originally sited using criteria set forth in 10 CFR Part 100, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. These regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tsunami, and other natural phenomena, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR). When new natural hazard information becomes available, the NRC evaluates the new information through the NRC safety programs, such as the Generic Safety Issues Program or the Fukushima Lessons Learned Taskforce, to determine if any changes are needed to regulations, guidance, or at one or more existing plants. These processes are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Plants have been given up to two-years to complete these assessments. Until these assessments are done, individual plant risk will be unknown and the NRC will not know what upgrades to require. According to the U.S. geological survey maps, Seabrook's seismic risk level is described as Moderate.

Unfortunately, the NRC's application to renew the license of an existing reactor does not entail a formal review of the reactor's design and licensing basis against current NRC requirements and guidance. Therefore, shortcomings are not identified that would have required upgrades. However, now -- post-Fukushima and the earthquake in Virginia -- the NRC Task Force has recommended upgrading seismic and flooding design basis for every nuclear plant in this country. But here's the sad history of the NRC concerning this issue -- as early as 1996, the NRC established new seismic regulations for new site application, but these regulations were not applied to existing sites. 027-17

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For nearly a decade, the NRC has known that the seismic risk to nuclear plants in the eastern two-thirds of the U.S. was greater and existing plants had outdated protection against seismic and flooding hazards, but took no action.

It is our understanding that the NRC establishes renewal regulations based on its determination that existing regulatory processes are adequate to ensure that the licensing basis of currently operating U.S. nuclear power plants provides and maintains an adequate level of safety. Renewal of Seabrook's license must be suspended as the NRC has known the seismic risks were greater for existing plants for a decade. Valuable time has been lost as the NRC has known for years that existing regulatory processes were inadequate to assure an adequate level of safety and has taken no action. 027-19

That ends my comment.

027-18 The commenter raises issues dealing with the design basis for existing plants, and the difference in standards for new nuclear power plants. With the exception of how it relates to aging management, issues of a nuclear power plant's design basis are outside the scope of license renewal and this SEIS. The design basis as it relates to aging management is considered in the NRC staff's development of the Safety Evaluation Report (SER).

With regard to the differences between standards for operating and new reactors, the NRC believes that its safeguards and security requirements for operating licenses are comprehensive and robust to assure continued safe operation. The safe operation of nuclear power plants is not limited to license renewal but is dealt with on an ongoing basis as a part of a current operating license. When new information becomes available that may impact an operating plant's design basis, it is evaluated as part of the NRC's ongoing safety programs, such as the Generic Safety Issues Program or the Fukushima Lessons Learned Taskforce, to determine if any changes are needed to regulations, guidance, or at one or more existing plants, which is separate from license renewal. For example, the updated seismic hazard information referenced by the commenter is being evaluated generically through a request for information (ML12056A046), NRC follow up letters (ML14030A046 and ML14111A147) and site specific responses (ML14092A413).

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-19 The commenter states that the NRC should suspend relicensing Seabrook due to perceived inadequacies in the NRC's oversight process relating to seismic risk. The commenter is correct that the license renewal regulations were based on a determination that existing regulatory processes were sufficient to assess the adequacy of and compliance with the current licensing basis; however, the NRC disagrees with the commenter that the existing regulatory processes are inadequate to assure continued safe operation. As discussed in the previous response and in the Japan Lessons Learned process, updated seismic hazard information for nuclear power plants in the central and eastern U.S. is being evaluated generically through a request for information (ADAMS No. ML12056A046), NRC follow up letters (ADAMS No. ML14030A046 and ML14111A147) and site specific responses (ADAMS No. ML14092A413).

As part of the Japan Near Term Task Force, the NRC reviewed the current regulatory approach and the plant capabilities as a result of the current regulatory approach. This review gave the NRC the confidence to conclude that an accident with consequences similar to the Fukushima accident is unlikely to occur in the United States (U.S.). The NRC concluded that continued plant operation and the continuation of licensing activities did not pose an imminent risk to public health and safety. While making this conclusion, the Near Term Task Force also concluded that a more balanced application of the Commission's defense-in-depth philosophy using risk insights would provide an enhanced regulatory framework. The result of the Task Force review is a set of recommendations that take a balanced approach to defense-in-depth as applied to low-likelihood, high-consequence events. These recommendations, taken together, are intended to clarify and strengthen the regulatory framework for protection against natural disasters, mitigation, and emergency preparedness, and to improve the effectiveness of the NRC's programs. One of these recommendations address seismic hazards.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Chris -- thank you for those comments. I'll check one more time. I believe that Mary Lampert is not here in the room -- so the next speaker would be Paul Gunter and after Paul -- Representative Peter Schmidt.

PAUL GUNTER: Thank you. My name is Paul Gunter and I'm director of reactor oversight at Beyond Nuclear out of Tacoma Park, Maryland. We are one of the interveners in the Seabrook relicensing proceeding. As I mentioned earlier, we've already had a preliminary hearing before an Atomic Safety and Licensing Board. Specifically, our contention has to deal with the environmental alternative and the requirement of the National Environment Policy Act for Seabrook to consider the environmental alternatives and the NRC to incorporate that in its decision for licensing renewal.

When I read the Draft Environmental Impact Statement, I note that within 54-lines the NRC is able to dismiss the alternative of wind power in the region of interest. What this says to me is that the Agency -- particularly the staff in its review -- did not look at the documentation that was presented to -- in a persuasive argument to even your own Atomic Safety and Licensing Board -- enough for you to incorporate a whole host of documentation, which I'm going to briefly go through here, as long as my time permits. But it seems apparent that these concerns are falling upon deaf ears with regard to the Agency's consideration.

Within 54-lines, basically you say that -- the wind energy alternative is intermittent and not feasible in terms of baseload power -- and that -- its availability, its accessibility and its consistency is not of a standard for addressing the environmental impacts that are forced upon us by the continued operation of the Seabrook plant.

In fact, what this does -- the statement of fact -- as your Draft Environmental Impact Statement reads -- basically takes a page out of the Environmental Report of the applicant in that your perspective is a review of the alternative at this time. I think that that's disingenuous when we're talking about not issuing a relicense application tomorrow or even 10-years from now, but 20-years from now -- approximately -- we're talking about this time frame.

028-6

In fact, what it does is serve to obfuscate a whole host of expert documentation, Memorandums Of Understanding and basically -- as we have contended, as your Draft Environmental Impact Statement reinforces -- that the NRC is not following the requirements under the National Environment Impact Statement [sic] that you must honestly acknowledge and be sufficiently complete in your review.

Let me just read a couple of these as time would permit me. When you talk about that it's not a reliable baseload power source -- what you do is that you've ignored Exhibit Number-4 in our intervention, which is entitled -- Supplying Baseload Power and Reducing Transmission Requirements by Interconnected Wind Farms -- from the Journal of Applied Meteorology and Climatology, which was prepared by Stanford University. This scientific manuscript concludes -- contrary to common knowledge -- an average of 33% and a maximum of 47% of yearly averaged wind power from interconnected wind farms can be used as reliable baseload electrical power. Equally significant -- interconnecting multiple wind farms to a common point and then connecting that point to a faraway city can allow for the long-distance portion of transmission capacity to be reduced, for example, by 20% with only 1.6% loss of

028-6 The NRC staff considered the potential for wind energy to provide baseload power in Chapter 8 of this SEIS. As part of this analysis, the NRC staff evaluated a reasonable amount of wind energy generation that could be produced by March 2030 based on the current status of the onshore and offshore wind energy sector, as well as reasonable projected growth of the onshore and offshore wind energy sector. For example, the NRC staff reviewed data and studies on the historical development of wind energy and projections of future growth in the northeast to anticipate wind generation's future contributions to electricity in the ISO-NE territory. The NRC staff determined that despite the presence of a high-value wind resource, wind turbine technology advancements, an improved ability to forecast wind, and the introduction of interconnected wind farm strategies, wind energy alone was not a reasonable alternative to Seabrook due to the limited installed capacity, immature status of technology to store energy, high costs of constructing offshore wind farms, and limited projected growth of wind power projects within the ISO-NE service territory. However, due to the quality and constancy of wind power in the Seabrook service territory, NRC analyzed wind power as part of the combination alternative in Section 8.3.

The commenter suggested that the NRC staff examine interconnected wind farms. As part of the combination alternative in Section 8.3, the NRC staff analyzed five onshore and offshore wind farms operating together in a "virtual power plant."

Based on comments received on the draft SEIS, Section 8.4.1 of the final SEIS has been revised to include an expanded and updated discussion of potential storage technologies to couple with wind power, such as pumped hydrological storage and compressed air energy storage. In addition, an expanded discussion of offshore wind energy has added, which includes a discussion of the current status of proposed offshore wind farms. The updated discussion also describes a Memorandum of Understanding signed in 2010 by the Department of the Interior and several northeast states to "create an Atlantic Offshore wind energy consortium to coordinate issues of regional applicability for the purpose of promoting the efficient, expeditious, orderly and responsible development of the wind resources of the Atlantic Outer Continental Shelf." After updating these discussions and considering the initial analyses, the NRC staff determined that wind energy would not be a reasonable alternative to provide replacement baseload power as a standalone alternative.

energy. Nowhere in your evaluation do you acknowledge the expert opinion that already in this day and age -- the baseload promise, the baseload capacity is in fact clearly feasible.

There are an increasing number of news accounts and current events that reveal that there is in fact this building of momentum for baseload power. For example, you do not mention in your Environmental Impact Statement that Google Corporation has already invested $5 billion of its money to lay the first vertebrae of a backbone of offshore wind transmission from Virginia to Maine. So, your dismissal of this power source as a baseload power for the license period of 2030-2050 -- I think, again, it demonstrates a disingenuous approach to looking at the environmental impact issue.

A few more examples here. The potential here is just tremendous. There are now (9) European North Sea countries -- Germany, France, Belgium, Denmark, Sweden, Norway, Great Britain and the Netherlands -- that have announced an investment of $40 billion in an offshore, undersea, energy super-smart grid, which basically is dedicated to the transmission of renewable energy. This investment and development supports a model for the United States, which your own Draft Environmental Impact Statement ignores. I mean, we can go on.

028-6

The University of Delaware and Stony Brook University study -- they did a study that says that based on a five-year wind data from (11) meteorological stations distributed over a 2,500 km extent along the U.S. Eastern Seaboard -- power output for each hour of the site is calculated and in short that -- there is evidence that the wind blows all the time somewhere and if interconnected along a transmission line you have a demonstrated baseload.

But since I'm about to be cut short here, I just want to also note that what you've ignored are Memorandums Of Understanding, bids that are now going on with the state of Maine. By 2030 -- so by the time you're talking about this license renewal to take effect in this federal action that you're looking at -- the state of Maine is looking at having 5 gigawatts of wind in the offshore waters -- 10 to 50-miles out into the Gulf of Maine. That's the equivalent of (5) Seabrooks. And again, there's no mention of this in your Environmental Impact Statement review.

I don't think that that's an honest evaluation. I think that what it does is it does not build public confidence that this Agency is doing nothing more than just promoting this industry. That's not your job, particularly when we now know that Seabrook -- what it forces upon us are these environmental consequences that require emergency planning zones -- out to 50-miles -- enhanced security because of the environmental threat that putting these reactors in our communities is all about and the alternatives clearly don't represent that level of threat. And you've ignored this.

1 Environmental Mitigation and Financial Benefits of SAMA Alternatives via Supplemental Environmental Assessment

We appreciate the opportunity to comment on significant risks to the quality of the human environment. We concentrate upon what we believe are cost-effective mitigation measures as conditions of re-licensure of Seabrook Station No. 1 for a 20 year term from March 2030 to March 2050.

The National Environmental Policy Act serves as an instrumentality to better inform decision-makers, whether they are officials responsible for power plant licensure, or officials responsible for mitigation of foreseeable risks, or owner-operators who have good prospects of increasing capacity utilization rates at better-mitigated power plants. The NEPA process also serves to inform residents in emergency evacuation regions or elsewhere who rightfully expect the Commission will adequately safeguard all of the nation's nuclear power plants. If the public is to be properly informed, the Commission must make sure that all the major risks affected by re-licensure are properly disclosed, analyzed with all other "Severe Accident Mitigation Alternatives," and demonstrated to be or not to be cost-effective.

Our framework for analysis includes a recognition that a wide array of energy resources and technologies contribute to the public welfare. With rigorous risk assessments and timely mitigation of severe risks, plus ongoing safety monitoring, nuclear-electric power plants provide a vital contribution to the production and conservation of energy. Nuclear power reduces dependence upon imported petroleum and petroleum products. Nuclear power provides relatively low-cost base load power, without which wind or solar energy systems with variable supply would offer reduced value. Nuclear energy, which can convert excess fissionable materials from former weapon stockpiles, also reduces the nation's production of greenhouse gases. 018-1

Seabrook Station No. 1 has operated for more than 21 years, with high capacity utilization rates and without accidents that would impair public health and safety, with minor, generally rectified exceptions.[1]

We are committed to the analysis of critical infrastructure, for the purpose of protecting functionality, prudently managing risks, and identifying financial benefits of risk mitigation initiatives. Further, we have a particular interest in identifying candidate mitigation measures that would enhance

[1] We note that on October 5, 2011, Seabrook Station is reported to have experienced a scram event relating to the loss of water for production of steam needed to operate turbines. If water supplies through pipes within aging concrete structures experience flow unreliability, we would request that related risks be explained, and that mitigation measures be included in the Final SEIS for Seabrook Station. An NRC meeting involving proprietary data of the owner-operator is scheduled for October 27, 2011, one day after the close of the public comment period for NEPA site-specific environmental review.

018-1 This comment is "designed to encourage the Commission to embrace frontally the risks of adverse solar weather…"

As mentioned in Comments 027-28, 006-1, and 027-10, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an extended period of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

safety at reasonable costs, and produce a positive "benefit / cost" valuation using NRC approved level 3 probabilistic risk assessments (PRAs).

Equally important, for high plant-specific risks that may also be regionally present, such as solar geomagnetic induced currents that are accentuated by eastward electrojets and igneous rock formations in the northeasterly region of the United States, we seek to identify risk-mitigation remedies that offer positive financial returns to both owner-operators and electric ratepayers.

We will later explain why we urge the Commission to perform Severe Accident Mitigation Analyses (SAMAs) for the hardware-protection of high voltage step up transformers, in contradistinction to the temporary "down-rating" of power plant generation to reduce transformer overheating and fire risks, and as a means to reduce cumulative stresses to high voltage transformer operability.[2]

If hardware protections, using capacitors and neutral grounding techniques, can allow safe operation through adverse solar weather, while extending transformer life, then higher overall capacity utilization of existing nuclear plants can produce financial benefits to both owner-operators and to electric consumers.

If the Commission can identify additional severe accident mitigation alternatives that align with reduction in risks to public health and safety, while concurrently increasing net electric generation and net revenues, the incentives of the marketplace can be the primary driver for a more reliable and stable U.S. electric grid. Our comments are designed to encourage the Commission to embrace frontally the risks of adverse solar weather, and to assist the nuclear-electric industry to identify and implement revenue-positive mitigation measures.[3]

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2 Excerpts from a database prepared by Thomas Popik for a Geomagnetic Disturbance (GMD) Task Force of the North American Electric Reliability Corporation (NERC) are included as an Appendix to these Comments. Efforts to avoid transformer overheating or permanent damage through "down-rating" of generation below rated capacity is sure to reduce revenues from electric sales, but it is less certain to protect extended transformer life. Some large transformers still may have failed as a result of geomagnetic storms; further investigation should be conducted. See Appendix C for a one-page list of nuclear plant down-ratings reportedly impacted by solar geomagnetic induced currents. These forecast-dependent mitigation strategies predictably cost owner-operators significant revenues lost during extended down-ratings. See Appendix C to these Comments, Foundation for Resilient Societies, "Nuclear Power Plant Reductions [from Rated Power] Attributed to Solar Activity." October 26, 2011, 1 page.

3 Historically, plant-specific measurements of ground-level "geomagnetic-induced currents" (GICs) have been treated as proprietary. Thus, analyses in some of Metatech's Reports and other industry studies that might be overlaid with databases of GIC magnitudes, transformer failures, plant capacity utilization, and changes in plant and company electric production income are now unattainable. Both the NRC and FERC need to consider Rulemaking requirements to collect and make available to interested publics the "black box" data on ground level GICs, high voltage transformer health, and transformer loading. We believe that more efficient "best practices" and higher per plant revenues would be attainable if plant-specific GIC data were required to be made publicly accessible to protect public health and safety and to improve bulk power grid reliability.

The Seabrook Station Final SEIS should identify now-missing severe solar weather-related accident risks, together with cost-effective mitigation alternatives that are absent from the Draft SEIS filed on July 31, 2011.

2 NRC Duties under the National Environmental Policy Act Remain Unfulfilled

Since NRC licensing of Seabrook Station No. 1 in 1990, significant new information has indicated (a) that the U.S. power grid is *substantially more vulnerable* that it was in the 1980s, with rapid growth of extra high voltage transmission systems, which because of lower resistance and longer average line lengths are *more susceptible to larger geomagnetic-induced currents*; and (b) *the northeast region of* the U.S. power grid is particularly vulnerable to the Eastward electrojet enhancement of high GICs during major geomagnetic storms ,with its end-of-line and ocean boundary effects, better understood now than before Seabrook's initial licensing; (c) modeling of nuclear plant specific risks of loss of outside power with longer durations, and risk of loss of backup power, available since filing with NRC in March 2011[4], shows, for the Seabrook Station configuration an East-West(Scoobie) 345 kV line orientation, which elevates GIC risks; an end of line effect, which elevates GIC risks; the proximity of ocean waters, which elevates GIC risks; the high latitude of the plant, which elevates GIC risks; the electrical resistance of geological formations in New Hampshire, which elevates GIC magnitudes; and improving knowledge of the accelerating GICs associated with the Eastward electrojet during severe solar weather, based on NASA satellite observations, which increases risks within the Northeast region of the U.S. power grid.[5] 018-1

Recently, Jerry Adler's article, "The End of the Black Box: There's a Better Way to Capture Plane Crash Data," Wired, July 2011, proposed near-real-time transmission of relevant performance parameters with remote ground station readouts. NRC's Miller Task Force expressed interest in satellite relay of performance parameters on each NRC licensed power plant. This option sounds attractive until the costs of EMP hardening for a family of spacecraft, uplinks, downlinks, crosslinks, and ground stations are considered. This option could be yet another *common fault failure* pathway.

[4] Foundation for Resilient Societies Request for Rulemaking, *Proposal for Rulemaking* PRM-50-96, NRC Docket NRC-2011-0069.

[5] NRC Staff has recently noted in its explanations for the exclusion of severe accident risks that the Federal Energy Regulatory Commission (FERC) and not the Nuclear Regulatory Commission is primarily responsible for setting reliability standards for the (bulk power) grid, nationally and regionally. NRC still retains primary responsibility to protect "public health and safety" when it licenses or relicenses nuclear power plants. FERC's limited regulatory authority under the year 2005 amendments to the Federal Power Act mean that the NRC cannot depend upon the bulk power system as presently configured or operated. FERC cannot guarantee cost recovery for reliability system improvements, unless the Congress once again amends the Federal Power Act. Hence, the risk of prolonged station blackout, and the risks of unexpected delays in restoration of grid power are ever present. If a coal fired plant or a gas fired plant must shut down, there is no significant risk to the plant's fuel. To the contrary, for nuclear fuel assemblies of recent vintage, the loss of grid-provided electricity and the loss of backup on-station power to operate water pumps and temperature controls is a potential disaster in the making. The

Also since year 1990 licensing of Seabrook Station, it has been possible to identify that low cost, cost-effective backup emergency generator types are available; and hardware options to protect generation step-up transformers have become available recently.[6] The latter may prove to produce positive payback of investment through reduced dependence upon "down-rating" of electric generation; and through higher capacity utilization rates for nuclear power plants that opt to install hardware protections for high voltage transformers.

When new information about significant risks to the quality of the human environment, such as severe nuclear accidents, including operational experience from Fukushima, Japan, becomes available, a federal agency – the Nuclear Regulatory Commission included – has a duty to include significant new information in an otherwise required supplemental EIS. That Supplemental EIS should not provide minutia about extremely low probability risks with modest adverse consequences, while excluding altogether a roughly 1 in 12 risk of nuclear fuel assembly (zirconium cladding) fires that could spread radioactive material for considerable distances. If there are common mode failures that include, for example, significant risk of high voltage transformer fire or outage at the nuclear power plant, those risks need to be assessed. It should be mandatory that these higher probability, high consequence, foreseeable events be included in the SAMA analyses within the Final Supplemental EIS for Seabrook Station.

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primary malfunctions at Fukushima were centered in the reactor buildings and their containment systems that failed in the absence of backup power. In the U.S., spent fuel pools are not protected by the same containment shell as protects the main power reactor. The Nuclear Regulatory Commission and not FERC, is primarily responsible to assure the safety of high voltage step-up transformers that are peculiarly vulnerable to solar geomagnetic induced currents. The NRC, and not FERC, is primarily responsible for backup power needed to prevent dangerous buildup of hydrogen gas, and to assure make-up water supplies for spent fuel pools.

The Commission in its September 20, 2011 response to EMP Commission Chairman William R. Graham stresses that NRC expects it could shut down the reactor core of each nuclear power plant safely. Even if this is true under many scenarios, if there is a large regional cascading grid failure, and if grid power is not thereafter restored, we have concerns about the adequacy of on station power once the power plant has been safely scrammed. The remedies proposed in the Petition for Rulemaking, NRC 2011-50-96 provide sufficient power for water pumps to maintain safe temperatures in spent fuel pools. The 4 kW capacity might well suffice to assure, additionally, that hydrogen gases are safely managed inside containment vessels housing the main reactor, or that backup power to expel excess hydrogen through containment vents suffices for the task. But these backup power systems are insufficient to restart and safely operate nuclear power plants if the regional grid is not operational. So after a shutdown, where is the on-site power to restart the plant if outside grid power is unavailable? This Commission must develop mitigation options that work even when NERC reliability standards are unattainable.

6 In November 2011, EMPrimus and ABB propose to display for the Geomagnetic Disturbance Task Force of NERC a high voltage transformer safeguarding system that includes capacitors and neutral ground shunts. While the cost of this system has not been formally established, cost estimates for similar devices are in the range of $200,000. Installation of transformer protection hardware of this type, or comparable step up transformer hardware protections should be included in a SAMA mitigation option analysis for Seabrook Station No. 1 within the Final SEIS.

Literally and unfortunately, "the perfect storm" for a regional electric blackout of extended duration is projected for the Northeasterly quadrant of the U.S. power grid. The Foundation for Resilient Societies modeling estimates a roughly a 1 in 12 (eight percent or more) cumulative risk – for years 2011 through 2050 -- of zirconium fires with potential to disperse radioactive materials from Seabrook station.[7] If the severe accident events were included in the Final SEIS, the NRC would have the opportunity and duty to address low-cost options to provide for on-station improved backup power.

Backup power using Organic Rankine Combustion Cycle generators would provide reliably 4 kW of on-site backup power for moderate cost. This capability would be relatively invulnerable to solar weather or the loss of outside power. Solar panels with DC current could, for a comparable investment, keep water pumps working so older (less radioactive) fuel assemblies would not become uncovered and so the fuel assemblies stored underwater would not produce zirconium fires. The benefit, measured in protection of human lives valued by NRC at $4 million per life, exceeds the cost of each system by a factor of 110. Even if a solar storm probability were just one tenth the likelihood estimated by Oak Ridge National Laboratory, in conjunction with advice via the R-319 Metatech Report of January 2010, on site backup power for spent fuel cooling would be highly cost-effective.

Because the risks at Seabrook are above the average risks, because of site specific factors, the high latitude causing higher frequency of severe solar weather, adjacency to the Atlantic Ocean, end of the Scoobie 345 kV transmission line, East-West orientation of that line, and ground resistance conditions, the benefit-cost ratio specific to Seabrook Station of GIC-immune backup power systems would be substantially higher than would apply to the average U.S. commercial nuclear power plant. 018-1

In year 2004 when the EMP Commission completed its first major report, the NRC decided not to consider as a generic issue high altitude EMP risks to the electric grid of the nation. As of August 31, 2011, the Commission has reiterated its exclusion from consideration of man-made EMP risks that produce such prompt injuries from high altitude nuclear weapons that use of solar storm warning systems is totally ineffective for transformer protection.[8]

In more than three and one half years since the Congressionally-mandated EMP Commission released a supplemental report (April 2008) on the specific electric sector vulnerabilities to EMP and impacts of electric grid collapse on a range of other U.S. critical infrastructures, the NRC has not

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[7] William R. Harris, Comments on Proposed Rulemaking (PRM-50-96), July 20, 2011, at pp. 7-8, filed as ADAMS ML 112098682.

[8] It is important to note that solar storm warnings will not protect high voltage transformers from high altitude nuclear EMP effects. The so-called E1 wave from a nuclear weapon detonated in the atmosphere would arrive in a matter of nanoseconds, at higher energy levels than E3 induced currents. Nonetheless, proposed hardware protections against E3 geomagnetic induced currents could have additional surge arrestors included to protect against E1 pulses. Were the U.S. electric utility industry to accelerate installation of protective hardware for high voltage transformers, the incentive to launch a high altitude EMP attack against the United States could be rapidly eroded for some nations that have acquired or might in the future acquire nuclear weapons. See the Reports of the EMP Commission (2004, 2008) for further details.

required nuclear power plant operators to install "black box" recorders covering transformer performance parameters, peak and cumulative GIC currents, nuclear reactor health, or spent fuel pool conditions. Nor has NRC required that safety related "black box" data be reported to NRC on peak and cumulative ground-level geomagnetic induced currents impacting large on-station transformers. Data from these "black boxes" could provide the analytic foundation to demonstrate when to replace or repair a transformer, and whether there are positive financial returns to owner-operators who invest or have invested in hardware protections for generation step up transformers (GSUs).[9]

Should the Congress or the Courts accept at face value any future Nuclear Regulatory Commission claim of an inability to perform statistical modeling of risks to nuclear power plants from adverse solar weather? Unless the Commission requires the installation of black boxes for each high voltage transformer at NRC-licensed facilities, with the continuous measurement of GIC peaks and cumulative GIC loadings, the Commission will be failing to fulfill its public safety mandate. [10]

The Draft Supplemental EIS of July 31, 2011 provides Severe Accident Mitigation Analyses (SAMA's) for risks of flooding, risks of earthquakes, risks of tsunamis, risks of short term loss of outside power (LOOP).[11] But one set of events is altogether excluded despite careful Probabilistic Risk Assessment and PRA Level 3 estimation of expected loss of life (somewhat more than 2,000 persons) in the March 14, 2011 Petition for Rulemaking on Backup Power to Protect Spent Fuel storage Facilities. This set of risks includes projections (calculated shortly *before* the Fukushima accidents in March 2011), of the probability of loss of outside power, [not expressly] loss of large step up transformers, loss of power to operate on-site water pumps for cooling spent fuel pools that are *at least two orders of magnitude more likely than the cumulative risk for all of the other severe accidents analyzed in the Seabrook Draft SEIS.*

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It is neither appropriate nor lawful to exclude high consequence risks from an Environmental Impact Statement if the risks are reasonably foreseeable. The Council on Environmental Quality

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[9] The Federal Aviation Administration required installation of "black box" recorders in U.S. jurisdictional commercial aircraft in the 1950s. Under an international Maritime Convention, registered ships must carry black boxes to understand and reduce risks of accidents at sea. Starting in year 2001, some automobile manufacturers have installed "black box" recorders in automobiles to diagnose and reduce risks of highway accidents.

[10] Some large electric utilities in England, Scotland and Wales have embarked on systematic GIC measurement programs. These monitoring systems may have the capacity to demonstrate the financial returns to investments in hardware protections for high voltage generator step-up transformers (GSUs). Data in seconds, or at least minutes as dB/dt is generally preferred to the USGS Dst indices. If comparable data in the U.S. were mandatorily reportable to NRC for nuclear-licensed plants, and to FERC for all bulk power facilities, and if independent contractors could analyze these safety-related data, it should be possible to accelerate improvements in system reliability because of the prospects for increased rates of capacity utilization and higher aggregate owner-operator revenues.

[11] See Table F.3.1.1.1-1 in Volume II, "Dominant Initiating Event Contribution to Core Damage." Pages F-14 and F-15.

requires consideration of these low-probability, high-consequence accidents significantly impacting the quality of the human environment.[12] The courts have upheld this duty of a federal agency to consider low probability, high consequence accidents that are reasonably foreseeable.[13]

Further, the refusal of the Commission and its Staff to consider the highest probability of low probability, high consequence events results in an apparent regulatory failure. Specifically, if the Commission will not consider severe accidents for which cost effective mitigation measures now exist, the Commission has no practical means – through education, through public participation, through conditions of re-licensure, or through Commission Orders if necessary – to accelerate mitigation measures that are needed now.

NEPA was not designed as an exercise within which responsible agencies would contract out risk assessments and guide contractors to exclude the most relevant severe accidents[14], hence to avert public consideration of the most consequential unmitigated risks.

A central goal of the environmental review must be to reduce risks and improve prospects for future environments that provide opportunities, within the limits of human feasibility, for safe and healthy living. By excluding all scenarios involving severe solar geomagnetic weather, the Nuclear Regulatory Commission has deprived the public and the Commission staff from considering cost-effective mitigation measures. This must be corrected in the Final SEIS for Seabrook Station, and for all other pending license renewals at licensed power plants with above average risks from geomagnetic induced currents.[15]

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12 See CEQ Regulations at 40 C.F.R. § 1508.27(b)(5) and § 15022.22(b).

13 See *Sierra Club v. Watkins*, 808 S. Supp. 852 (1991); *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission*, 449 F.3d 1016 (C.A. 9, 2006). For commentaries see P. L. McChesny, "CEQ's 'Worst Case Analysis' Rule for EISs." 13 Environmental L. Rev. 1669 (1983) and Cass R. Sunstein, "Irreversible and Catastrophic," 91 Cornell L. Rev. 841 at 876-77 (2006). A parallel Massachusetts environmental laws known as MEPA also requires consideration of low probability, high consequence accidents. A failure to consider the escape of anthrax pathogens from a proposed Biomedical Laboratory, although of low probability, caused a court to vacate the Final EIR. See *Allen v. Boston Redevelopment Authority*, 877 N.E.2d 904 (2007).

14 For the Draft SEIS for Seabrook Station No. 1, the NRC Staff provided guidance to Pacific Northwest National Laboratory, operated by Battelle under a renewable contract. The result has been for Pacific Northwest National Laboratory to consider lower probability risks of conventional weather, but to exclude altogether any consideration of the risks of adverse solar weather with a higher probability of significant harm and far higher expected loss of human life if risks are not both analyzed and mitigated.

15 35 of NRC licensed commercial power plants of the 104 now-operating have even higher site-specific risks than Seabrook. See the Foundation for Resilient Societies Petition for Rulemaking in NRC Docket 2011-50-96. Assessment of solar weather risks and appropriate mitigation measures, plant by plant, should occur even if the Commission adopts a generic rulemaking process for backup power to protect on-site spent fuel pools. The Commission's Staff has recently informed the Commission that in its recent history the shortest period between commencement of a Rulemaking process and a resulting Commission Order has been 23 months.

With appropriate consideration in the Final SEIS for Seabrook Station, cost-effective mitigation measures could and should be put in place in advance of the projected peaking of solar geomagnetic activity in years 2012-2013. These measures would also protect against risks of additional geomagnetic disturbances within the first several years on the downside of a 10.5 year (short) solar geomagnetic cycle peak.

Among the lessons from the March 2011 disaster at Fukushima highlighted in the NRC's Miller Task Force Report[16] are proposals to emphasize the need for a rigorous reassessment of NRC risk management to cope with *common fault failures*. The augmentation of backup power systems is considered and recommended, but without considering solar geomagnetic risks,[17] nor requiring that on-site backup power be designed for resilience against solar or man-made electromagnetic pulse risks. [18] More importantly, the Task Force urged the Commission to analyze and protect against *common mode failures*. If a common mode risk is triggered by adverse solar weather and a parallel failure to protect generation step-up transformers throughout a regional electric grid, common mode failures are reasonably foreseeable and predictable. The common assumption that grid power will be promptly restored, as in the SAMAs considered in the Draft SEIS for Seabrook, will be simply invalid. If the Commission is to fulfill the renewed purposes and the "defense in depth" philosophy of the Miller Task Force Report, the arbitrary exclusion of foreseeable, mitigatable high-consequence risks should be halted as an NRC procedural practice

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Moreover, significant new circumstances or information relevant to the increased risks of environmental concern must be addressed within a Supplemental Environmental Impact Statement.

If the Commission cannot accelerate its implementation of essential public safety protections through Rulemaking and resulting Commission Orders, the substantial majority of 104 NRC-licensed commercial nuclear power plants in the U.S. may proceed into an eleven year (short) peak solar weather hazard in 2012-2013 without availability of mandatory mitigation measures. Hence we explain our recent interest in encouraging analysis of relationships between peak and cumulative GIC insults to generation step up transformers and both capacity utilization and revenue changes for plant owner-operators. Financial self-interest could result in protection of high voltage transformers without assistance of NRC or FERC. Mandatory reporting and public accessibility of reports on GIC peaks and cumulative exposures could allow third party analyses of financial returns for procurement of protective hardware. In short, neutral party analysis of returns on investments in safety and system reliability might well accelerate grid stabilization even without mandatory government standards.

16 Recommendations for Enhancing Reactor Safety in the 21st Century, Washington, D.C.: NRC, July 12, 211.

17 Letter, NRC Rulemaking Staff to William R. Harris, July 12, 2011.

18 Charles A. Miller, et al., Recommendations for Enhancing Reactor Safety, *op.cit.*, Section 4.2, Mitigation, considers "prolonged loss of alternating current power," at pp. 32-33. The Task Force recommends protecting emergency diesel generators (EDGs) so they will function throughout accidents involving loss of outside power. But the Task Force neither recommended design of backup power systems to withstand adverse solar weather, nor recommended extending on-site capabilities for backup power beyond a seven day period.

Regulations promulgated by the Council on Environmental Quality are not optional; they are mandatory for NRC and other federal agencies.[19]

Without consideration of adverse solar weather, the northeast states would suffer projected loss of a substantial number of high voltage transformers. Some transformers are subject to the extra high voltage lines (345, 500, and 765 kV) that with reduced resistance will create higher flows of GIC and are more vulnerable to GICs of high magnitude. Even with transmission lines at the lower level of 345kV, New Hampshire is especially vulnerable to loss of generation step up transformers due to East-West alignment, length of transmission line, interconnections with surrounding EHV grid of New England that allows flow of larger GIC, proximity to Ocean, resistance of igneous rock formations, and frequency of high energy eastward electrojet channeling in this region.

Disturbingly, Metatech, *Inc.*, under contract to the Oak Ridge National Laboratory, has projected that all of the extra high voltage transformers in the State of New Hampshire are expected to be subjected to 90 Amp per phase insults from geomagnetic induced currents, GIC levels which put them at-risk of failure. New Hampshire is the only state in the Union with this projected 100 percent failure outcome at 90 amps per phase. At 30 amps per transformer phase, both East and West Coast high voltage transformers are at risk. On the West Coast, a severe geomagnetic storm at 30 amps per phase is projected to eliminate operability of 100 percent of HV transformers in California, Oregon, and Washington State. On the East Coast only Vermont and New Hampshire are projected to suffer 100 percent transformer losses with these postulated electrical currents.[20] 018-1

The Commission's scenarios assume a rapid reconstitution of backup grid power, in all of the severe accidents posited for Seabrook Station. By the Commission's own admission,[21] in responding to the EMP Commission Chairman and staff director, as of September 2011 the Commission has not analyzed the Oak Ridge National Laboratory Report of 2010, estimating an at-risk solar geomagnetic storm with a frequency estimated as 1 in 100 years. [22] Presumably, the same reasoning that led the

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[19] See 40 C.F.R. § 1502.9(c).

[20] John Kappenman, Geomagnetic Storms and Their Impacts on the U.S. Power Grid, Goleta, CA: Metatech Corp. January 2010, Meta-R-319, prepared for Oak Ridge National Laboratory, at Table 4-14. "Of particular concern would be the permanent loss of large GSU (generator step-up) transformers at power plants in the northeast region of the U.S. (i.e. NE Quad). The loss of these transformers causes a compounding of difficulties in that the EHV transmission network is impaired along with the loss of output of vital and usually base load nuclear, coal, and hydro-electric generation sources for the power grid...." Kappenman, at p. 4-16).

[21] Letter signed for Operations Executive Director Borchardt of the NRC to William R. Graham, Chairman, and Peter V. Pry, Staff Director of the Congressionally-mandated EMP Commission, September 20, 2011, reproduced as Appendix B, and found on the ADAMS website as document ML112301365.

[22] The U.S. Geological Survey has been improving, even retrospectively, estimates of the frequency and magnitude of terrestrial geomagnetic storms derived from solar activities. Retrospectives on the magnitude of solar and solar-terrestrial geomagnetic phenomena have been back-fitted to the May 1921 geomagnetic storm,

Commission to exclude consideration of the Oak Ridge year 2010 study also kept the Commission from considering the specific and more severe impacts upon New England and, in particular, transformers in the State of New Hampshire, analyzed in Metatech Report R-319 of January 2010.

3 Duty of the Commission to Assess Low-Probability, High-Consequence Events that Are Reasonably Foreseeable and Subject to Cost-Benefit Analysis

Just because there is more than one cycle involving the frequency of solar storms, a short cycle of about 10.5 years, and a longer cycle, or more than one longer cycle, does not mean that a distribution of frequencies and magnitudes cannot be analyzed for the purpose of designing power plants and for the purpose of back-fitting mitigation measures as needed.

The NRC's apparent reasoning, however convenient, falls afoul of the National Environmental Policy Act of 1969 and the CEQ's mandatory guidelines, which require the Commission to analyze low probability high consequence risks that are reasonably foreseeable. Further, under the Atomic Energy Act, if the Commission determines reasonable cause to improve the safety of previously licensed power plants, to protect "public health and safety," the Commission has authority to require back-fitting of on-station backup power designed to operate through solar geomagnetic storms. And the Commission has the authority to require hardware protection for generation step-up transformers (GSUs) that, if enough of them fail, can cause a cascading failure of the national or regional bulk power systems. The

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with one USGS estimate of -900 nanoTeslas/minute Dst, and a Kappenman retrospective estimate in R-319, cited above, of about -5000 nanoTeslas/minute using a dB/dt index often preferred to the Dst index. A retrospective re-estimate of the GIC of the Carrington event of September 1-2, 1859 is -1760 nanoTeslas/minute Dst. The highest level of magnetic current in recent years involved the March 13/14, 1989 event, which collapsed part of the North American grid at just over -400 nanoTeslas/minute before surging to about -589 nanoTeslas/minute using the Dst index. Back-fitting to prior centuries, before Russian observatories commenced measuring geomagnetic currents in the 1840s, is feasible to some extent by the analysis of ice core samples containing nitrates and other byproducts of solar geomagnetic events covering a time scale of at least 450 years. Hence, it is unreasonable to claim that it is retrospectively *possible* to analyze earthquake magnitudes before modern seismology (used by the NRC in the Seabrook Draft SEIS), yet *impossible* to backfit geomagnetic induced currents over the past four or five centuries. Relevant literature on the frequency and magnitude of solar coronal mass ejections and terrestrial impacts includes: J. J. Love and J. L. Gannon, "Revised Dst and the epicycle of geomagnetic disturbance: 1958-2007," at www.ann-geophys.net/27/1/2009; J. L. Gannon and J. J. Love, "USGS 1-min Dst index," J. Atmospheric and Solar-Terrestrial Physics 73 (2011), 324-334; N. G. Ptitsyna, M. I. Tyasto, and B. A. Khrapov, "Very Intense Magnetic Storms in 1841-1870 Registered by the Russian Geomagnetic Network," Geocosmos (2010); E. W. Cliver and L. Svalgaard, "The 1859 Solar-Terrestrial Disturbance and Current Limits of Extreme Space Weather Activity," Solar Physics, 224 (2004); 407-422.

Commission only has jurisdiction over the NRC-licensed nuclear facilities, but these operate nearly 50 percent of the higher voltage GSU transformers in the nation, and a higher percentage of those in New England.

Resources that can assist NRC in fulfilling its severe accident risk assessment duties include:

- The Geomagnetic Disturbance Task Force of the North American Electric Reliability Corporation (NERC;
- The members and staff of the EMP Commission;
- The technical staff of the Defense Threat Reduction Agency of DoD;
- The Defense Science Board;
- The JASONS, who are nearing the completion of an assessment of electromagnetic pulse phenomena coordinated through the MITRE Corporation; and
- The National Laboratories of the U.S. Department of Energy.

It is reasonably foreseeable that solar-terrestrial geomagnetic induced currents will affect NRC-jurisdictional nuclear power plants. It is reasonably foreseeable that some sites will have above average risks at that site or in that region. These sites will have greater benefit to cost ratios of mitigation measures. These more at risk *sites* require unique analysis in a Supplemental EIS for that site and that specific reactor.

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Given the reasonably foreseeable geomagnetic induced currents during solar storms, given the patterns of solar storms over the past 450 years, given the recording of solar coronal activity via space observatories globally since the 1840s, and an increasingly broad array of land and space based monitoring of solar activity and terrestrial impacts, the Nuclear Regulatory Commission is long overdue for mandatory consideration of geomagnetic storm-related severe accidents, and the search for cost-effective mitigation options.

As an illustration of the reasonable foreseeability of impacts of solar weather upon terrestrial geomagnetic induced currents, see the 50 year time-spiral produced by the Staff of the U.S. Geological Survey. Fifty years of (short) solar geomagnetic cycles are spaced in a spiral with cyclic duration of 10.5 years. Magnetic flux with Dst magnitude above 30 nanoTeslas/minute are shown in red. Magnetic flux between 20 and 30 nanoTeslas/minute are shown in **black**. Magnetic flux under 20 nanoTeslas/minute are shown in green. The short term solar cycle indicates a peak period within one quadrant of the epicycle, but also a related risk of high magnitude GICs on the downside of the cyclic peak.

See on the following page the time-spiral described above, reported in J. J. Love and J. L. Gannon, "Revised Dst and the Epicycle of geomagnetic disturbance: 1958–2007":

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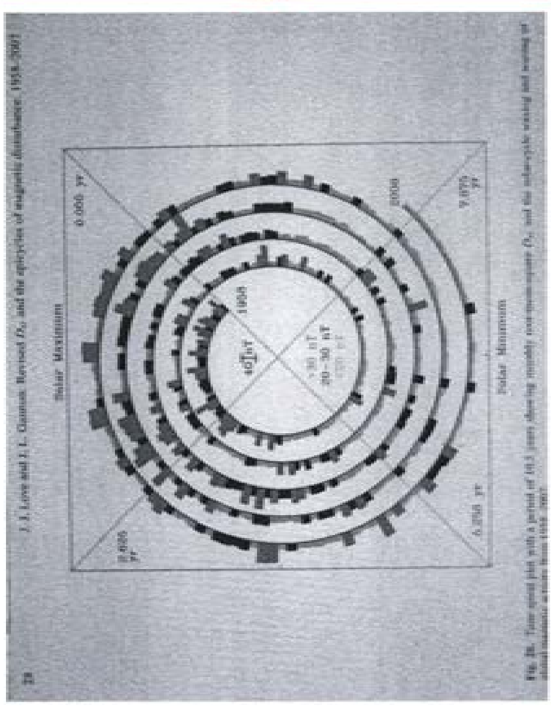

BRIAN ANDERSON: Mary -- thank you for those questions and comments. William --

WILLIAM HARRIS: Good afternoon. My name is William R. Harris. I'm speaking today as an individual. I live within the 10-mile evacuation zone in Newburyport, Massachusetts. But I expect to do joint comments together with Thomas Popik for the Foundation for Resilient Societies before your October 26th deadline.

What Tom Popik covered in his remarks were the general problems from geomagnetic storms, which are natural occurring events involving the weather of the sun. So, it's not exempted from your duty to consider under your enemy-of-the-state doctrine, which is probably obsolete -- that's a 1967 doctrine that the NRC applies. It turns out the same mitigation measures for the natural occurring solar weather will protect against nuclear explosions -- man-made nuclear explosions, which the press suggests could be in the offing if we have additional proliferation to Iran, etc.

So, I'm just going to summarize briefly a table I prepared -- a two-page table. But, before I go issue by issue, I'd like to point out that although there's a generic rulemaking that Mr. Popik presented on March 14th -- I commented -- its docket 50-96 -- because of his very careful PRA Level 3 analysis, we actually have a site-specific analysis of the risks from geomagnetic storms -- plant by plant -- for all (104) nuclear plants. (35) of those plants have higher risks than Seabrook, but I believe it is a fundamental flaw of the Draft Supplemental Environmental Impact Statement to not do the site-specific analysis of this risk for Seabrook because we have modeling that shows effects that are special and site-specific for Seabrook that increase the risks and therefore changed the cost-benefit analysis for SAMA analysis -- whether you have a cost effective remedy.

In particular, Seabrook is pretty far north -- latitude matters. If you're near the North Pole -- you have higher risks of geomagnetic storms with high surges -- what are called E-3 surges. If you're near the South Pole you have that. We've had major outages in South Africa in 2003. In addition to latitude, we have three other specific effects because of Seabrook being where it is and the transmission grid being the way it is. In particular, we have an east/west transmission grid -- one of the 345kV lines is east/west. It turns out that magnifies the effects of solar storms.

We have a second effect -- that Seabrook is at the end of the line. When the line ends, you get a bigger surge.

Third effect -- we have the ocean right next to Seabrook. The modeling that was done at Oak Ridge National Laboratory and that Tom Popik has done shows that's another important effect.

Then we also have the effect of the rock that transmits current below the surface of the ground. We have the granite of New Hampshire also compounds and exasperates these effects. So we have site-specific impacts. They have not been analyzed in this draft SEIS. They are significant.

I believe -- and Mr. Popik's analysis shows in a PRA Model 3 analysis where there could be roughly an expected loss of 2000 people -- that we have the highest risk for the

027-28

027-28 As mentioned in Comments 018-1, 006-1, and 027-10, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

Seabrook plant, which is an above-average risk compared to the average of the (104) plants, from the effects of geomagnetic storms. The risk is two orders of magnitude greater than any other risk analyzed in this Draft Supplemental EIS. So to leave out the overwhelmingly largest risk would be irresponsible.

In addition, it appears that almost all these risks can be mitigated at very low-cost by cost effective mitigation measures. If you don't analyze those measures you will not mitigate those measures. Then we will have the needless kind of common fault failure that the Miller Task Force has told us all the NRC's trying to avoid in the future.

So, it's not a tsunami that causes a loss of backup power. It would be a solar storm that takes out much of the grid -- the large transformers especially vulnerable -- and then you have the loss of diesel power on-site because you're not sheltering the diesel engines -- the pumps. If you go to off-site gas stations -- those pumps may be out. But at relatively low cost these can be sheltered.

So, let me run through briefly the (9) issues that I propose and will comment on detail. So the first is to provide on-site backup power that's designed to cope with electromagnetic events. Mr. Popik suggests an organic Rankine cycle engine. It could use the waste heat from the power plants. You can get 4kW for $80,000. This is cheap in terms of -- the benefit cost analysis shows it's a benefit of (110) -- if you take the NRC's value for loss of life -- that's extraordinary. 027-28

So, if you don't take the Oak Ridge National Lab estimate, which is new and significant information you should consider from 2010, which is a 1% chance per year -- the expected large magnitude event every 100-years, let's say it's every 200-years -- and don't take Tom Popik's modeling, which is a 50% likelihood of restoration of power after loss of outside power. If it's 90%, you still have a positive return of (11). These are mitigation measures that really need to be done.

I'd like also to say that Mr. Popik -- the Oak Ridge analysis was criticized in a July 20 filing by the Nuclear Energy Institute -- a trade institute -- they said that Mr. Popik didn't really understand what they did. But they utilized two national experts on electromagnetic pulse -- a Mr. Kappenman of Minnesota and a William Rudasky of California, who are national experts on these issues. He had them review his modeling as well. So, it's inexcusable not to consider this significant risk that is magnified at the Seabrook site. Second, there's a possibility --

BRIAN ANDERSON: Excuse me, William -- I'm sorry to interrupt. If you could wrap up in the next minute. I'll allow you the same --

WILLIAM HARRIS: Okay.

BRIAN ANDERSON: -- if there's time at the end of the meeting.

WILLIAM HARRIS: There are other backup measures -- basically backup batteries. If you have battery chargers it's important to shelter them. The switches are vulnerable. These are very low-cost measures. So, I've identified the measures and some references to what can be done. 027-28

To summarize the site-specific risk for Seabrook with Mr. Popik's analysis -- the risk for the next 19-years of licensure of long-term loss of outside power -- 2011 to 2030 -- is 17.4%; the probability of water boil-off -- 8.7% for the spent fuel pool; probability of zirconium fire -- 4.3%. When you extend the license 20-years, you end up with roughly a 1 in 12 chance of a zirconium fire at Seabrook. And this is avoidable at very low cost by just the appropriate backup power -- some of which is recommended in the Miller report.

So, it's very important that you include this significant risk because it's site-specific and it's new information and there're low-cost measures to remediate it. Thank you.

027-28

2

ENVIRONMENTAL RISK MANAGEMENT AND MITIGATION ISSUES

RISK MANAGEMENT / MITIGATION ISSUES	ENVIRONMENTAL SIGNIFICANCE	REFERENCE DOCUMENTS
1. On-site backup power for spent fuel pool cooling in event of LOOP during & after solar geomagnetic disturbances including electromagnetic pulse. Mitigation measures are highly cost-effective. PRA Type III analysis indicates Benefit-to-cost ratio of about 110.	Solar geomagnetic disturbances constitute highest risk of common mode failures; extended LOOP; on site transformer fire; dysfunction of backup diesel generators to electro- magnetic pulse (EMP). Site specific risks to Seabrook Station No. 1 are 2 orders of magnitude greater than all other SAMA risks analyzed in Draft SEIS. Long term LOOP probability 2011-2030: 17.4% Probab. Water boil off 8.7% Probab. Zirconium fire 4.3%. With 20 year license renewal, Probability of zirconium fire(s) at Seabrook Station No. 1 about 1 in 12 (period 2011 – 2050). East-West 345kV transmission lines + end of line at plant + ocean proximity + geology of New Hampshire result in above average EMP vulnerabilities requiring site specific	Thomas Popik, Foundation for Resilient Societies, NRC Proposed Rulemaking March 14, 2011, William R. Harris Comments on Proposed Rulemaking, July 20 2011. NUREG-1437 Supplement 46, Seabrook Station Draft SEIS See Harris Comments on Popik Proposed Rulemaking, July 20, 2011.
2. Retrofit for on-site backup AC power for Seabrook reactor control & emergency functions during long term LOOP – including options to retrofit heat exchangers to convert reactor-related thermal energy into backup AC power for station power.	Reduce dependence on outside power, especially during events triggering common mode failures, such as solar coronal mass ejections causing risks to the U.S. transmission grid and station power from onsite backup sources.	Calvert Cliffs MD reactor is a prototype for generation of station power onsite. Also review European nuclear power plants designed to generate power from on-site thermal energy in event of loss of outside power (LOOP).
3. On-site backup diesel generator operability extension from 7 days to longer (parametric) periods.	Reduce risks of zirconium fires if backup onsite generators fail and spent fuel pools are not continuously cooled	NRC Miller Task Force Report July 11, 2011 Harris Comments of July 20, 2011.

William R. Harris Summary of Severe Accident Mitigation Alternatives Requiring NRC Analysis within Final SEIS to NUREG-1437 Supplement 46 of Seabrook Station No. 1 Relicensing, September 15, 2011

006-1

006-1 As discussed in Comment 018-1, 027-28, and 027-1, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Regarding emergency planning (EP), EP outside the scope of license renewal and is addressed under the Reactor Oversight Process (ROP).

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

4. Reduce reactor trip and fire risk due to solar geomagnetic disturbance damage to Generator Step Up transformer. Reduction can be accomplished with neutral current blocking device.	Reduce risks of fires dispersing sulfur hexafluoride (SF6), 2300 times CO2 impacts on global warming Reduce risk of loss of onsite power	Thomas Popik, Presentation to North American Electric Reliability Corp. Atlanta, GA August 30-31, 2011. Credible Reports of Geomagnetic Disturbance Impacts
5. Installation of remote readout & SCADA system command capabilities, including protection of satellite relays from system generated electromagnetic pulse during adverse solar weather	Allow remote command & triage to restore backup power in event of station blackout. Marginal cost per nuclear power plant reduced if nationwide access to EMP-protected Comsat and commo links	NRC Miller Task Force Report of July 12, 2011. Harris Rulemaking Comments July 20, 2011
6. Extend coverage & duration for C-10 Foundation regional (n = 22) radiation monitors & remote readouts by (a) adding ~30 sites in Southeast New Hampshire; and (b) extending battery life for monitoring sites to ≥ 14 days. 7. Utilize U.S. Dept. of Transportation modeling systems to plan staged *contraflow* evacuations with & w/o upgrades to MA Route 110 2 lane on-ramps & off-ramps at I-95 and I-495, and other evacuation route connectors.	Existing 22 regional sensor sites (northeast Massachusetts only) utilize back-up batteries with short duration. Extended reporting capacity would enable better-staged evacuation of radiation hot spots, reduce loss of life. Avert evacuation congestion, e.g., region of Three Mile Island (1979), when randomized evacuation impaired evacuation flow rates.	C-10 Foundation
8. Deploy "intelligent" remote SCADA controlled signal systems for unmanned evacuation signal management for relevant traffic corridors.	Reduce energy consumption & air pollution in day to day use; protect emergency personnel from radiation exposure in event of spent fuel zirconium fires	U.S. Department of Transportation Emergency Evacuation DOT websites.
9. Shelter on-site AC Battery Chargers & Diesel Generator to recharge on station batteries. Variant of SAMA 157	Reduce risks of loss of on-site capability to cool spent fuel pools. Avert zirconium fires.	Appendix F at page F-41 to NUREG 1437 Supp. 46, July 2011. See EMP Commission Report on Critical Infrastructure, April 2008, for vulnerabilities of battery chargers and switches.

006-1

William R. Harris Summary of Severe Accident Mitigation Alternatives Requiring NRC Analysis within Final SEIS to NUREG-1437 Supplement 46 of Seabrook Station No. 1 Relicensing, September 15, 2011

006-1

Probability of Zirconium Fire at Spent Fuel Pools

Estimates Over Remaining Reactor Operation

Probability of No Outside Assistance	50%
Probability of Spontaneous Zirconium Ignition	50%

Within Area of Probable Power System Collapse	State	Plant	Years Remaining in Reactor Operation	Long-Term LOOP Probability	Probability of Water Boil-Off	Zirconium Fire Probability
yes	Illinois	Clinton	15	14.0%	7.0%	3.5%
yes	Illinois	Dresden 2	18	16.5%	8.3%	4.1%
yes	Illinois	Dresden 3	20	18.2%	9.1%	4.6%
yes	Illinois	La Salle 1	11	10.5%	5.2%	2.6%
yes	Illinois	La Salle 2	12	11.4%	5.7%	2.8%
no	Illinois	Quad Cities 1	21	0.0%	0.0%	0.0%
no	Illinois	Quad Cities 2	21	0.0%	0.0%	0.0%
no	Iowa	Duane Arnold	3	0.0%	0.0%	0.0%
no	Kansas	Wolf Creek	34	0.0%	0.0%	0.0%
no	Louisiana	River Bend	14	0.0%	0.0%	0.0%
no	Louisiana	Waterford	13	0.0%	0.0%	0.0%
yes	Maryland	Calvert Cliffs 1	23	20.6%	10.3%	5.2%
yes	Maryland	Calvert Cliffs 2	25	22.2%	11.1%	5.6%
yes	Massachusetts	Pilgrim	1	1.0%	0.5%	0.3%
yes	Michigan	Cook 1	23	20.6%	10.3%	5.2%
yes	Michigan	Cook 2	26	23.0%	11.5%	5.7%
yes	Michigan	Enrico Fermi 2	14	13.1%	6.6%	3.3%
yes	Michigan	Palisades	20	18.2%	9.1%	4.6%
no	Minnesota	Monticello	19	0.0%	0.0%	0.0%
no	Minnesota	Prairie Island 1	2	0.0%	0.0%	0.0%
no	Minnesota	Prairie Island 2	3	0.0%	0.0%	0.0%
no	Mississippi	Grand Gulf	13	0.0%	0.0%	0.0%
no	Missouri	Callaway	13	0.0%	0.0%	0.0%
no	Nebraska	Cooper	3	0.0%	0.0%	0.0%
no	Nebraska	Fort Calhoun	22	0.0%	0.0%	0.0%
yes	New Hampshire	Seabrook	19	17.4%	8.7%	4.3%
yes	New Jersey	Hope Creek	15	14.0%	7.0%	3.5%
yes	New Jersey	Oyster Creek	18	16.5%	8.3%	4.1%
yes	New Jersey	Salem 1	5	4.9%	2.5%	1.2%
yes	New Jersey	Salem 2	9	8.6%	4.3%	2.2%

006-1

Probability of Zirconium Fire at Spent Fuel Pools

Estimates Over Remaining Reactor Operation

Probability of No Outside Assistance	50%
Probability of Spontaneous Zirconium Ignition	50%

Within Area of Probable Power System Collapse	State	Plant	Years Remaining in Reactor Operation	Long-Term LOOP Probability	Probability of Water Boil-Off	Zirconium Fire Probability
yes	New York	FitzPatrick	23	20.6%	10.3%	5.2%
yes	New York	Ginna	18	16.5%	8.3%	4.1%
yes	New York	Indian Point 2	2	2.0%	1.0%	0.5%
yes	New York	Indian Point 3	4	3.9%	2.0%	1.0%
yes	New York	Nine Mile Point 1	18	16.5%	8.3%	4.1%
yes	New York	Nine Mile Point 2	35	29.7%	14.8%	7.4%
yes	North Carolina	Brunswick 1	25	22.2%	11.1%	5.6%
yes	North Carolina	Brunswick 2	23	20.6%	10.3%	5.2%
yes	North Carolina	Harris	35	29.7%	14.8%	7.4%
yes	North Carolina	McGuire 1	30	26.0%	13.0%	6.5%
yes	North Carolina	McGuire 2	32	27.5%	13.8%	6.9%
yes	Ohio	Davis-Bessie	6	5.9%	2.9%	1.5%
yes	Ohio	Perry	15	14.0%	7.0%	3.5%
yes	Pennsylvania	Beaver Valley 1	5	4.9%	2.5%	1.2%
yes	Pennsylvania	Beaver Valley 2	16	14.9%	7.4%	3.7%
yes	Pennsylvania	Limerick 1	13	12.2%	6.1%	3.1%
yes	Pennsylvania	Limerick 2	18	16.5%	8.3%	4.1%
yes	Pennsylvania	Peach Bottom 2	22	19.8%	9.9%	5.0%
yes	Pennsylvania	Peach Bottom 3	23	20.6%	10.3%	5.2%
yes	Pennsylvania	Susquehanna 1	11	10.5%	5.2%	2.6%
yes	Pennsylvania	Susquehanna 2	13	12.2%	6.1%	3.1%
yes	Pennsylvania	Three Mile Island	23	20.6%	10.3%	5.2%
yes	South Carolina	Catawba 1	32	27.5%	13.8%	6.9%
yes	South Carolina	Catawba 2	32	27.5%	13.8%	6.9%
yes	South Carolina	Oconee 1	22	19.8%	9.9%	5.0%
yes	South Carolina	Oconee 2	22	19.8%	9.9%	5.0%
yes	South Carolina	Oconee 3	23	20.6%	10.3%	5.2%
yes	South Carolina	Robinson	19	17.4%	8.7%	4.3%
yes	South Carolina	Summer	31	26.8%	13.4%	6.7%

008-1

Probability of Zirconium Fire at Spent Fuel Pools

Estimates Over Remaining Reactor Operation

Probability of No Outside Assistance	50%
Probability of Spontaneous Zirconium Ignition	50%

Within Area of Probable Power System Collapse	State	Plant	Years Remaining in Reactor Operation	Long-Term LOOP Probability	Probability of Water Boil-Off	Zirconium Fire Probability
yes	Tennessee	Sequoyah 1	9	8.6%	4.3%	2.2%
yes	Tennessee	Sequoyah 2	10	9.6%	4.8%	2.4%
yes	Tennessee	Watts Bar	24	21.4%	10.7%	5.4%
no	Texas	Comanche Peak 1	19	0.0%	0.0%	0.0%
no	Texas	Comanche Peak 2	22	0.0%	0.0%	0.0%
no	Texas	South Texas 1	16	0.0%	0.0%	0.0%
no	Texas	South Texas 2	17	0.0%	0.0%	0.0%
yes	Vermont	Vermont Yankee	1	1.0%	0.5%	0.3%
yes	Virginia	North Anna 1	27	23.8%	11.9%	5.9%
yes	Virginia	North Anna 2	29	25.3%	12.6%	6.3%
yes	Virginia	Surry 1	21	19.0%	9.5%	4.8%
yes	Virginia	Surry 2	22	19.8%	9.9%	5.0%
yes	Washington	Columbia	12	11.4%	5.7%	2.8%
yes	Wisconsin	Kewaunee	2	2.0%	1.0%	0.5%
yes	Wisconsin	Point Beach 1	19	17.4%	8.7%	4.3%
yes	Wisconsin	Point Beach 2	22	19.8%	9.9%	5.0%

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Nuclear Regulatory Commission
Chief Rules and Directive Branch
Division of Administrative Services
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Washington, DC 20555-0001

March 21,2012

8/25/2011

76FR 47612

29

Members of the Commission;

I write to you asking for your denial of the request of NextEra Energy Resources LLC for licensing from 2030-2050 of the Seabrook Power Plant in Seabrook, NH.

I have lived most of my life on this coast of New Hampshire. The short 18 mile coast is a treasure that has been marred by the presence of the Seabrook Nuclear Power Plant. Since it is already here, we have to put up with it. However to extend its permit even longer is unacceptable!

There is NO way that the thousands of tourists a day during June-September could be evacuated from nearby Hampton Beach in a safe way should there be a problem at the plant. I have been at the beach on a typical beach day, streets clogged with cars and people, "no vacancy" signs at all the over night accommodations, a narrow bridge to the South, and no access to public transportation from any direction; a disaster waiting to happen!!

All this is bad enough, now NextEra is asking to extend the license of an "older" structure with older technology. Yes, I am sure that there has been "new" technology in the Nuclear Energy field; will you MAKE NextEra spend the $$$$ to put that in place "if" they are granted an extension?

With all the new solar and wind energy advancements, which are much safer to operate, why continue to permit that which has safety hazards, and no safe plan for the disposal of nuclear waste??

While I don't expect a tsunami or earthquake, there are fault lines nearby. The population of this area has grown since the plant opened, more people to evacuate, no new roads to carry them. Why take chances for a longer period of time?

Again, I respectfully, adamantly, oppose the extending of the license of the Seabrook Nuclear Power Plant to anyone! Just because you CAN extend, does not mean that you MUST. The people of this region deserve unbiased regulation, in their best interests, not the Nuclear Industry's!

Please deny the extension of the license of the Seabrook Nuclear Plant.

031-1

Susan Kepner

Mrs. Susan Kepner
105 Mill Rd Hampton, NH 03842
603-926-3051

SUNSI Review Complete
Template = ADM-013

E-RIDS= ADM-03
Add = M. Wentzel (mxs4)

031-1 The commenter expresses opposition to the relicensing of Seabrook, citing concerns relating to emergency planning and aging management (i.e., requiring installation of new equipment upon granting a renewed license). On the issue of emergency planning, emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are codified at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal.

On the issue of aging management, the NRC will not issue a renewed license unless there is reasonable assurance that the applicant has the ability to adequately manage the effects of aging on certain critical safety equipment throughout the period of a renewed license. As such, the focus of the license renewal safety review—which is separate from the environmental review—is to make a determination as to whether or not an applicant is able to adequately manage the effects of aging throughout the period of a renewed license. The NRC staff's final evaluation of NextEra's ability to manage the effects of aging for Seabrook will be documented in its Final Safety Evaluation Report relating to the Seabrook license renewal application. Regarding spent nuclear fuel, Chapter 6 of this SEIS contains information on the storage of spent nuclear fuel at Seabrook.

The commenter makes reference to alternative power generation capabilities. For the NRC's evaluation of alternatives to license renewal for Seabrook, see Chapter 8 of this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

8/05/2011
76FR47612

Page 1 of 2

PUBLIC SUBMISSION

(10)

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Submission Type: Web

Docket: NRC-2010-0206
Notice of Receipt and Availability of Application for Renewal of Facility Operating License

Comment On: NRC-2010-0206-0013
NextEra Energy Seabrook, LLC; Notice of Availability of Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1

Document: NRC-2010-0206-DRAFT-0020
Comment on FR Doc # 2011-19875

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Submitter Information

Name: Randall Kezar
Address:
134 Main St.
Kingston, NH, 03848

General Comment

With respect to the degrading condition of Seabrook during the next four decades:

1. What *additional* safety procedures, management procedures, and monitoring equipment will be required of the Seabrook station? 008-1

2. What are the estimates by the NRC of the increased accidental risks for an aging reactor such as Seabrook for the next four decades. How are they calculated? Since there is little to no experience with reactors running so far beyond their design lifetime, what is the assurance that these calculations are realistic? 008-2

3. What are the estimates for the greater future operating costs of the aging station. If the station is estimated not to be economical will the license renewal be denied?

4. Given the increased risks of running Seabrook beyond it's lifetime design date, shouldn't the NRC have a representative with full ownership privileges at all levels of Seabrook management? In particular, shouldn't the NRC monitor and require more than adequate finances for maintenance and safety procedures? 008-3

SUNSI Review Complete
Template = ADM-013
E-RIDS = ADM-03
Add = M. Wentzel (mSw2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f59dd... 10/24/2011

008-1 The commenter raises issues relating to managing the effects of aging at Seabrook during the period of extended operation, which is outside the scope of the environmental review. NextEra's ability to manage the effects of aging on passive, long-lived systems, structures and components at Seabrook is evaluated as part of the license renewal safety review. The final results of the NRC's evaluation will be documented in the final safety evaluation report. As part of the safety review, if additional aging management activities are needed, the applicant may be required to establish new monitoring programs or increase inspections.

This comment provides no new information, and no changes have been made to this SEIS as a result.

008-2 The commenter raises issues related to aging effects on severe accidents. The potential impacts of severe accidents during a license renewal period were evaluated in the GEIS. As discussed in the GEIS, unmanaged aging-related effects could result in increased failure rates, which could then result in increased accident frequencies or consequences. However, as noted in the GEIS the focus of the NRC's license renewal safety review is to identify those structures and components necessary to ensure continued safe operation, and that are susceptible to age-related degradation. The NRC determined that, "[t]he combined impact of [the license renewal process] should be to provide high confidence that significant incremental increases in public risk will not result from aging effects related to the plant." (NRC, 1996). As a result, the NRC assumed as part of its assessment of severe accidents that the probability of radioactive releases from accidents will not increase over any license renewal period. As far as assurances that the calculations are realistic, the NRC utilized the best available information and generally-accepted standards to perform its severe accidents assessment. However, should new information become available that would call into question the continued safe operation of any or all nuclear power plants, the NRC will evaluate that information though the appropriate process and make a determination as to what, if any, action should be taken.

This comment provides no new information, and no changes have been made to this SEIS as a result.

008-3 The commenter raises issues related to licensee economics. The issue of licensee economics is outside the scope of license renewal and was not evaluated in this SEIS.

Page 2 of 2

Can the NRC require such expenses, even in the case of reduced profitability or financial loss? 008-3

5. Should not the NRC require the Seabrook management to be of the very highest level. How should the NRC monitor and evaluate proactively the quality of the Seabrook management? What would be the penalties for inadequate or incompetent management? 008-4

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f59dd... 10/24/2011

008-3 cont'd In order to continue to operate, licensees must continue to meet the requirements set forth in the NRC's regulations. Should any licensee fail to meet those requirements, the NRC is empowered to take appropriate actions to resolve the issue.

This comment provides no new information, and no changes have been made to this SEIS as a result.

008-4 The commenter raises issues dealing with the management quality at Seabrook. Like issues of economics, the issues of management quality are outside the scope of license renewal and were not evaluated in this SEIS. Furthermore, the NRC does not formally evaluate the management performance of licensees. Much like issues of economics, in order to continue to operate, licensees must continue to meet the requirements set forth in the NRC's regulations. Should any licensee fail to meet those requirements, the NRC is empowered to take appropriate actions to resolve the issue. Appropriate action, however, does not include mandating specific personnel changes at licensed facilities, as the NRC does not have the authority to do so.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Page 1 of 1

8/25/2011
76FR 47612
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PUBLIC SUBMISSION

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Docket: NRC-2010-0206
Notice of Receipt and Availability of Application for Renewal of Facility Operating License

Comment On: NRC-2010-0206-0013
NextEra Energy Seabrook, LLC; Notice of Availability of Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1

Document: NRC-2010-0206-DRAFT-0021
Comment on FR Doc # 2011-19875

Submitter Information

RECEIVED
2011 OCT 24 AM 9:40
RULES AND DIRECTIVES BRANCH

Name: Randall Kezar
Address:
134 Main St.
Kingston, NH, 03848

General Comment

With respect to the degrading condition of Seabrook during the next four decades:

6. If the Gulf of Maine offshore wind power project can be shown to make the Seabrook station non-competitive, will the NRC nevertheless grant a renewal license? Why is this project not mentioned and analyzed in the draft document? 009-1

7. Should not all currently known safety and operational problems be actually diagnosed and fixed before a renewal license be considered? 009-2

8. Should not the evacuation plans be reevaluated? 009-3

9. Where and how will the radioactive waste which will be generated during the proposed additional decades of operation be stored? Will the Seabrook station secure sufficiently funds to store them for a very significant period of time. Since there is no foreseeable permanent storage plan, should not the NRC cease relicensing all reactors? 009-4

10. Since operating the Seabrook station beyond it's lifetime design date will increase safety risks, should not the Seabrook station carry a correspondingly much greater financial liability? 009-5

11. What are the probabilities that the increased reactor metal brittleness will force the Seabrook reactor to cease operation? What is the probability that the Seabrook reactor will be free of such brittleness problems up to 2050? If the Seabrook reactor is not likely to run until 2050 shouldn't the NRC refuse a relicense? 009-6

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Call = M. Wentzel (MSW2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f59dd... 10/24/2011

009-1 The commenter raises issues related to the need for alternatives to relicensing Seabrook. As explained in Chapter 1, the need for power being provided by Seabrook is outside the scope of license renewal and is not evaluated in this SEIS. The purpose of the NRC's license renewal review is to ensure that there is reasonable assurance that NextEra will be able to adequately manage the effects of aging at Seabrook throughout the period of extended operation. The decision to keep operating Seabrook in the future should the power provided no longer be necessary, or uneconomical to operate, lies with other energy-planning decision makers, rather than the NRC. Those decision makers may include State, utility, and other (non-NRC) Federal agencies. However, an expanded discussion of offshore wind projects was added to Section 8.5.1 of this SEIS.

009-2 The commenter raises issues related to safety and operational issues impacting the license renewal process. As stated in the previous response, the purpose of the NRC's license renewal review is to ensure that there is reasonable assurance that NextEra will be able to adequately manage the effects of aging at Seabrook throughout the period of extended operation. Unless issues are identified that may have an impact on the ability of NextEra to adequately age manage systems, structures and components at Seabrook, any known safety or operational issues that may exist at Seabrook will be handled as part of the NRC's ongoing reactor oversight process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

009-3 The commenter raises issues relating to emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are codified at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS. This comment provides no new information, and no changes have been made to this SEIS as a result.

009-4 NextEra is required to safely handle, process, store, and dispose of its radioactive waste in accordance with NRC regulations. Low level radioactive waste is handled onsite and is typically sent to an offsite waste vendor for processing where it is then either sent on to a licensed burial site or returned to the plant for storage until it can be shipped to a licensed burial site for disposal. Spent nuclear fuel is stored onsite in a combination of two types of NRC approved methods; storage in a pool and in dry casks. Both of these methods maintain the used fuel in a safe configuration. Additionally, to ensure the long-term safety of spent fuel, NextEra is required by the NRC regulations at 10 CFR 50.54(bb) to maintain adequate funding for the safe long-term storage of spent fuel on its site.

Regarding the long-term storage of spent fuel after the term of license renewal when the plant shuts down, on August 26, 2014, the Commission approved the Continued Storage Rule and associated "*Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*" (NUREG-2157). Subsequently, on September 19, 2014, the NRC published the final rule (79 FR 56238) in the *Federal Register* along with NUREG-2157 (79 FR 53238, 56263). The Continued Storage Rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license (i.e., those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor or away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available). The information in NUREG-2157 provides the appropriate NEPA analyses of the potential environmental impacts associated with the continued storage of spent fuel beyond the licensed life for reactor operations at Seabrook.

Chapter 6 of the Seabrook SEIS was revised to include a discussion, based on NUREG-2157, of the potential environmental impacts associated with the continued storage of spent nuclear fuel.

009-5 The commenter raises issues relating to licensee economics, which are outside the scope of license renewal. To the extent that "greater financial liability" refers to liability due to accidents, as outlined in the Price-Anderson Act, all nuclear power plant operators are required to maintain the maximum level of primary insurance available from private sources and are also required to participate in a Secondary Financial Protection. These requirements do not change if a license renewal is granted.

This comment provides no new information, and no changes have been made to this SEIS as a result.

009-6 The commenter raises issues related to reactor vessel embrittlement during the term of a renewed license for Seabrook, which is outside the scope of the environmental review. Reactor embrittlement is evaluated as part of the license renewal safety review. The NRC requires that an applicant detect and mitigate the effects of aging, beginning with an examination and verification that the systems, structures, or components function as they were originally intended to and that their functions have not been compromised or degraded. The NRC staff's final determination relating to the potential for embrittlement will be documented in the final safety evaluation report for the Seabrook license renewal application. As to the commenter's question about Seabrook not being able to operate safely for the entire license renewal period, the NRC will make a determination as to whether or not there is reasonable assurance that Seabrook would be able to safely operate during the term of any renewed license. If the NRC staff makes a determination that Seabrook would not be able to safely operate for the entirety of the requested term, the NRC will take appropriate action. Possible actions could include, but are not limited to, imposing additional conditions on a renewed license, granting a renew license for some shorter period of time than was requested, or denying the request for renewed license.

This comment provides no new information, and no changes have been made to this SEIS as a result.

October 24, 2011

TO: Ms. Cindy Bladey, Chief
Rules, Announcement, and Directives Branch (RADB)
Division of Administrative Services
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C.

6/15/2011
76FR 47612
26

RECEIVED

FROM: Phyllis Killam-Abell PKA
10 White Oak Drive #321
Exeter, NH 03833

RE: NRC-2010-0206

I live 10 miles from the Seabrook Nuclear Reactor in southeastern New Hampshire and I am greatly concerned about the environmental and public health effects upon people living within 50 to100 miles of the reactor. There are several issues which I will address that create hazardous conditions for people living in eastern Massachusetts including the major city of Boston, the whole coastline area of New Hampshire, and southern Maine.

The first issue is tritium, a highly toxic, radioactive substance, should not be allowed to continue to leak from the reactor. In the Vermont Yankee plant, local wells were found to be contaminated with tritium as well as the Connecticut River, which is very harmful to people and animals. No studies have been performed at Seabrook to ascertain the presence of tritium in the surrounding area within 10 miles from the plant and to correct this hazard. As the plant ages it is likely that tritium leakage will increase. 023-1

Secondly, there are no realistic, adequate plans for evacuation of people in this area, should there be an earthquake or other kind of destruction of the nuclear plant. The government and the nuclear plant owners have responsibility for the safety of millions of people in the area within at least 50 miles from the plant. 023-2

Next, the degrading concrete due to ground water infiltration has been present for the past 10-15 years. There has been a 21% decrease in concrete strength, and it is significant that standards have been lowered to define 21% to be of no concern. However, in fact this would seem to weaken the whole structure making it more vulnerable to the increasing level of water on the coastline which is occurring with climate changes.. 023-3

Last, there is the issue of spent fuel rods being stored outside and too close to the reactor itself, which if an earthquake occurred would effect the whole surrounding area. This would not only affect the people there in a productive and important part of New England, but also the means of production in small and large businesses would be destroyed, as happened in Japan. This in turn would create the need for massive funds and care for millions of people at a time of continuing downturns in the US and world economy. 023-4

It is for these reasons that I recommend that the relicensing of the Seabrook Nuclear Reactor be denied at this time; the hazards to the environment and people living in this region are too great. Further, it is not in the interests of people in New Hampshire, Massachusetts and Maine to have a nuclear reactor that produces no electricity for New England. We are moving to produce our own power at a local level with renewable energy. There is also research and specific plans based on known technologies at the University of Maine for hydroelectric wind turbines along the coast of Maine, which can supply energy for all of New England, making a hazardous and faulty nuclear power plant unnecessary. 023-5

SUNSI Review Complete
Template = ADM-013
E-RIDS = ADM-03
Add = M. Wentzel (mxw2)

023-1 Radiation doses to members of the public from the current operations of Seabrook were evaluated in Section 4.8.1.1 of the SEIS. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities, and inadvertent leaks of radioactive liquids). Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within dose standards specified in NRC's and EPA's dose standards.

The NRC requires NextEra to conduct a radiological environmental monitoring program (REMP) at Seabrook to sample and analyze atmospheric, terrestrial, and aquatic media and biota in the environment around its facility for radiation and radioactivity that is released during the operation of the plant. The REMP conducted at Seabrook is based on NRC guidance regarding the types and numbers of environmental media to be collected and analyzed. The REMP provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposure to members of the public. Based on the review of several years of Seabrook's REMP data, the NRC staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

The NRC staff discussed NextEra's groundwater protection program in Section 2.2.5 of this SEIS. As part of the NRC staff's review of groundwater monitoring wells used at Seabrook, the NRC staff also reviewed the issue of tritium leaks associated with Seabrook's containment building. The NRC staff discussed its assessment of the impacts from Seabrook operation on groundwater resources in Section 4.5 of the SEIS and concluded that there would be no significant impacts related to groundwater issues. The NRC staff considers its evaluation of the issue of radioactive liquid releases to be complete for the purposes of this NEPA evaluation.

As part of the NRC's continuous reactor oversight process, the NRC routinely inspects NextEra's implementation of its groundwater protection program. The NRC inspector will review records of any identified leakage and spill events, to assess whether the source of the leak or spill was identified and mitigated, and to review any remediation actions taken for effectiveness.

023-1 cont'd Issues related to age-related plant component degradation are addressed in the NRC's safety evaluation of NextEra's license renewal application. The regulations covering the safety review for license renewal are in 10 CFR Part 54.

This comment provides no new information, and no changes have been made to this SEIS as a result.

023-2 The commenter raises issues relating to emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are codified at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

023-3 The commenter raises concerns about the long-term effects of ASR at Seabrook. While the impact of ASR on the structures at Seabrook is outside the scope of the license renewal environmental review, ASR and its impacts on the ability of NextEra to effectively manage the effects of aging on structures at Seabrook is under evaluation as part of the license renewal safety review. As discussed in response 027-14, the NRC will not make a decision on license renewal before it fully understands both the issue with ASR-affected structures and NextEra's plan to address the issue.

This comment provides no new information, and no changes have been made to this SEIS as a result.

023-4 The environmental and health impacts of design basis accidents (DBAs), including accidents involving the storage of spent nuclear fuel in pools, was evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of an operating license. The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants, because the plants were designed to successfully withstand these accidents. As part of the license renewal process, the NRC staff has not identified any new and significant information during its independent review of the Seabrook environmental report, the site visit, the scoping process, or evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to DBAs beyond those discussed in the GEIS.

In response to the earthquake, tsunami, and resulting reactor accidents at the Fukushima Dai-ichi Nuclear Power Plant, the Commission directed the NRC staff to convene an agency task force of senior leaders and experts to conduct a methodical and systematic review of the relevant NRC regulatory requirements, programs, and processes, including their implementation, and to recommend whether the agency should make near-term improvements to its regulatory system. As part of the short-term review, the task force concluded that, while improvements are expected to be made as a result of the lessons learned from the Fukushima events, the continued operation of nuclear power plants and licensing activities for new plants do not pose an imminent risk to public health and safety. The staff is continuing its systematic review of NRC requirements and making recommendations to the Commission. The review and final Commission direction on the need for new requirements is ongoing. Refer to the NRC Japan Lessons Learned website (http://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard.html) to find out the latest information regarding NRC's continuing action to enhance the safety of reactors in the United States based on the lessons learned from this accident.

This comment provides no new information, and no changes have been made to this SEIS as a result.

023-5 The commenter expresses opposition to relicensing Seabrook. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

10/17/2011 15:54 603-335-3097 ELIZABETH KNIGHT PAGE 01

RULES AND DIRECTIVES BRANCH

8/5/2011
76 FR 47612

2011 OCT 27 AM 11:05

24

RECEIVED

October, 26, 2011

Division of Administrative Services
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear NRC:

As an engineering physicist, I believe all nuclear power plants should be phased out of electricity production because of safety concerns, environmental pollution and economic costs. I live within 10 miles of the Seabrook, NH nuclear power plant and see no reason to extend its operating license another 20 years when its current license will allow it to operate until 2030. 021-1

The following environmental concern is raised for the NRC to answer. It is only one concern out of dozens that could be asked.

As with all nuclear power plants, Seabrook, NH has a problem with tritium or radioactive hydrogen. The water that cools the reactor core becomes heavily contaminated with tritium. It has leaked from underground pipes into the ground surrounding the plant and it has routinely been discharged into the ocean nearby. Even though the tritium has a half-life of only 12.4 years, it will remain radioactive for 248 years. Does the NRC know how much ground water is being affected? Does it know what effect the tritium-laced water has on all ocean fish and other creatures which could end up in our food chain? 021-2

I believe a thorough study of these situations is in order before extending the plant license.

Sincerely,

Richard A. Knight

Richard A. Knight
P.O. Box 1605
Rochester, NH 03866

SUNSI Review Complete
Template = ADM - 013

E-RIDS = ADM-03
Add = M. Wentzel (MJW2)

021-1 The commenter expresses opposition to nuclear power. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

021-2 Radiation doses to members of the public from the current operations of Seabrook were evaluated in Section 4.8.1.1 of the SEIS. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities, and inadvertent leaks of radioactive liquids). Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within limits specified in NRC's and EPA's dose standards.

The NRC requires NextEra to conduct a radiological environmental monitoring program (REMP) at Seabrook to sample and analyze atmospheric, terrestrial, and aquatic media and biota in the environment around its facility for radiation and radioactivity that is released during the operation of the plant. The REMP conducted at Seabrook is based on NRC guidance regarding the types and numbers of environmental media to be collected and analyzed. The REMP provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposure to members of the public. Based on the review of several years of Seabrook's REMP data, the staff concluded that there were no measurable impacts to the environment, including aquatic biota, as a result of radioactive releases from Seabrook operations.

The NRC staff discussed NextEra's groundwater protection program in Section 2.2.5 of this SEIS. As part of the NRC staff's review of groundwater monitoring wells used at Seabrook, the NRC staff also reviewed the issue of tritium leaks associated with Seabrook's containment building. The NRC staff discussed its assessment of the impacts from Seabrook operation on groundwater resources in Section 4.5 of the SEIS and concluded that there would be no significant impacts related to groundwater issues. The NRC staff considers its evaluation of the issue of radioactive liquid releases to be complete for the purposes of this NEPA evaluation.

021-2 cont'd As part of the NRC's ongoing reactor oversight process, the NRC routinely inspects NextEra's implementation of its groundwater protection program at Seabrook. The NRC inspector will review records of any identified leakage and spill events, to assess whether the source of the leak or spill was identified and mitigated, and to review any remediation actions taken for effectiveness.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Page 1 of 1

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(4)

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Notice of Receipt and Availability of Application for Renewal of Facility Operating License

Comment On: NRC-2010-0206-0013
NextEra Energy Seabrook, LLC; Notice of Availability of Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1

Document: NRC-2010-0206-DRAFT-0014
Comment on FR Doc # 2011-19875

Submitter Information

RECEIVED
2011 SEP 21 AM 11:03
RULES AND DIRECTIVES

Name: Sandra Koski
Address:
35 New Boston Rd
Newton, NH, 03858

General Comment

I attended the NRC hearings at One Liberty Lane in Hampton, NH on Sept. 15, 2011. I spoke in the afternoon session about Seabrook being a nuclear waste dump and how that was never supposed to happen. I am writing now to voice my complaints about the choice of venue, which was extremely difficult to find and, once found, intimidating to enter with so many police officers milling around. It was supposedly a public hearing but there were signs on every intersection coming up to One Liberty Lane stating it was private property. Also, members of the public were not allowed on the grounds to hold signs expressing their views against the re-licensing, but there were people passing out pro-re-licensing buttons that were worn inside the hearings. Finally, the announcements for the hearing in local publications were pathetic, yet consistent with what appeared to be a sham of a public hearing in the first place. 002-1

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Call = M. Wentzel (MJW2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f24e1... 09/21/2011

002-1 The commenter expresses dissatisfaction with the circumstances of the September 15, 2011, public meeting to discuss the Seabrook draft SEIS, which is outside the scope of the Seabrook license renewal environmental review. It should be noted that the insights provided on the quality aspects of the meeting are noted and evaluated for lessons learned in implementing future public meetings.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, Lee. The next speaker is Sandra Koski. Did I get any of that right, Sandra?

SANDRA KOSKI: Yes. Sandra Koski from Newton, New Hampshire. I've been in the area for most of my life and 35-years ago was involved in some of the civil disobedience -- even under the threat of having our children taken away from us because we were trying to protect their environment. The one thing that I have always focused on and all I really needed to know is there is no place for the radioactive waste. It's now being stored at Seabrook, which they said was never going to happen. It's a nuclear waste dump. That's all I have to say. Thank you.

027-41

027-41 NextEra is required to safely handle, process, store, and dispose of its radioactive waste in accordance with NRC regulations. Low level radioactive waste is handled onsite and is typically sent to an offsite waste vendor for processing where it is then either sent on to a licensed burial site or returned to the plant for storage until it can be shipped to a licensed burial site for disposal. Spent nuclear fuel is stored onsite in a combination of two types of NRC approved methods; storage in a pool and in dry casks. Both of these methods maintain the used fuel in a safe configuration. Additionally, to ensure the long-term safety of spent fuel, NextEra is required by the NRC regulations at 10 CFR 50.54(bb) to maintain adequate funding for the safe long-term storage of spent fuel on its site.

Regarding the long-term storage of spent fuel after the term of license renewal when the plant shuts down, on August 26, 2014, the Commission approved the Continued Storage Rule and associated "*Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*" (NUREG-2157). Subsequently, on September 19, 2014, the NRC published the final rule (79 FR 56238) in the *Federal Register* along with NUREG-2157 (79 FR 53238, 56263). The Continued Storage Rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license (i.e., those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor or away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available). The information in NUREG-2157 provides the appropriate NEPA analyses of the potential environmental impacts associated with the continued storage of spent fuel beyond the licensed life for reactor operations at Seabrook.

Chapter 6 of the Seabrook SEIS was revised to include a discussion, based on NUREG-2157, of the potential environmental impacts associated with the continued storage of spent nuclear fuel.

Comment 013

The attachments to Comment 013 can be found at ADAMS No. ML11304A243

Gallagher, Carol

Subject: FW: Comment Seabrook NUREG-1437, Supplement 46, Section 5.0 - October 26, 2011
Attachments: COMMENT SEABROOK NUREG- 1437, SUPPLEMENT 46, SECTION 5.0 -Oct26,2011.pdf

From: Mary Lampert [mailto:mary.lampert@comcast.net]
Sent: Wednesday, October 26, 2011 2:44 PM
To: Wentzel, Michael
Cc: Ray Shadis; David Agnew
Subject: Comment Seabrook NUREG-1437, Supplement 46, Section 5.0 - October 26, 2011

8/5/2011
76 FR 47612
16

Hello:

Attached please find *Comment Seabrook NUREG-1437, Supplement 46, Section 5.0* submitted by Mary lampert, Raymond Shadis, and David Agnew.

We would appreciate your replying by return email to indicate receipt and that the comments will be docketed.

Thank you and have a pleasant afternoon,

Mary

RECEIVED

2011 OCT 27 AM 8: 39

RULES AND DIRECTIVES BRANCH

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (MJW2)

1

COMMENT SEABROOK NUREG- 1437, SUPPLEMENT 46, SECTION 5.0

Oct 26, 2011

The following comments are focused on Section 5.0 Environmental Impacts of Postulated Accidents. They are submitted by the following parties. Mary Lampert is a stakeholder owning two residential properties in Boston on Beacon Hill that are located within 50-miles of Seabrook Station. Friends of the Coast – Opposing Nuclear Pollution (Friends of the Coast) and New England Coalition, Inc. (NEC) are co-signing the comments. They have standing and are a party to the LRA proceedings. Friends of the Coast/NEC has numerous members that reside in the immediate vicinity Seabrook Station and throughout New England; said members' concrete and particularized interests will be directly affected by this proceeding. Capedownwinders, although approximately 70 miles distant from Seabrook, are nevertheless at risk as evidenced by the spread of direct and indirect actual impacts in Japan.

We contend that NRC Staff incorrectly found the SAMA analysis adequate. NextEra's SAMA analysis improperly minimized offsite consequences and costs when filed in 2010 and those inadequacies were underscored, and others made apparent, by the new and significant issues raised by Fukushima regarding the probability of both a severe accident and containment failure, and subsequent larger off-site consequences and costs. If properly accounted for, mitigations that the public deserves to reduce risk would be found cost justified. The SAMA must be redone. NRC Staff are wrong.

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS-POST FUKUSHIMA

I. INTRODUCTION

In the license renewal process, the Applicant is required under 10 CFR 013-1

013-1 This comment expresses concerns that the SAMA review did not meet the purpose of a SAMA review per 10 CFR §5l.53(c)(ii)(L).

10 CFR 51.53(c)(3)(ii)(L), states: "If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided." The regulation only requires severe accident mitigation alternatives [SAMAs] be submitted to the NRC.

The SAMA analysis constitutes a systematic and comprehensive process for identifying potential plant improvements, evaluating the implementation costs and risk reduction for each SAMA, and determining which SAMAs may be cost beneficial to implement. The analysis is technically rigorous and consistent with the NEPA expectation that federal agencies take a "hard-look" at the environmental impacts of their proposed actions, including consideration of viable alternatives. If a SAMA is determined to be potentially cost beneficial but is not related to adequately managing the effects of aging during the re-licensing period, it is not required to be implemented as part of license renewal pursuant to 10 CFR Part 54. Further refinement beyond determining whether a SAMA is potentially cost beneficial is not necessary for an objective evaluation. Nevertheless, potentially cost-beneficial alternatives are identified and considered as part of the license renewal process, and licensees often indicate that they will further evaluate the most promising potentially cost-beneficial SAMAs among those that have been identified, for possible future implementation in order to further reduce plant risk. However, the further evaluation and implementation of these non-aging related SAMAs is not a condition of granting a renewed license. Accordingly, a license renewal applicant's decision to defer this further evaluation of the potentially cost-beneficial SAMAs it has identified to some point in the future (i.e., outside the license renewal SAMA review) is acceptable.

The NRC staff uses NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal, Revision 1, as guidance on how to review and evaluate applicants license renewal applications, including reviewing the SAMA analysis. NUREG-1555 states: "The purpose of the review is to ensure that plant and procedure changes with the potential for improved severe accident safety performance are identified and evaluated." NUREG-1555 only requires identification and evaluation.

§51(c)(ii)(L) to perform a severe mitigation analysis if they had not previously done so. The purpose of a SAMA review is to ensure that any plant changes that have a potential for significantly improving severe accident safety performance are identified and addressed. 013-1

Post Fukushima Daiichi, it plainly is necessary to redo NextEra's SAMA analysis to take into account new and significant information learned from Fukushima regarding the probability of a severe accident, including containment failure, in the event of an accident and the concomitant probability of a significantly larger volume of off-site radiological releases and costs. 013-2

NRC Staff's pre-Fukushima statement that, "The generic analysis (GEIS) applies to all plants… and that the probability- weighted consequences of atmospheric releases fallout onto open bodies of water, releases to ground water, and societal and economic impacts of severe accidents are of small significance for all plants" (SEIS 5-2, 5-3) requires a fresh look.

Further the Staff says that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3) Prior to Fukushima the analysis was wrong; Post -Fukushima it is ludicrous and NEPA requires NRC to perform a new analysis before license renewal.

II. NATIONAL ENVIRONMENTAL POLICY ACT

National Environmental Policy Act, NEPA, 42 USC § 4332, requires that the Staff look at new and significant information in order to "help public officials make decisions that are based on understanding of environmental consequences, and take decisions that protect, restore and enhance the environment." 40 CFR § 1500.1(c) (Emphasis added)

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013-1 cont'd The applicant uses NEI-05-01, Severe Accident Mitigation Alternatives (SAMA) Analysis - Guidance Document, to develop the application package. NEI-05-01 states the purpose of the SAMA analysis is "to identify SAMA candidates that have the potential to reduce severe accident risk and to determine if implementation of each SAMA candidate is cost-beneficial."

013-2 The commenter raises potential changes that may be required to the Seabrook severe accident mitigation alternative (SAMA) analysis as a result of the natural disasters that occurred in 2011 at the Fukushima Dai-ichi nuclear power plant.

The events that occurred at Fukushima Dai-ichi have resulted in numerous re-evaluations and actions to ensure nuclear safety, both by the regulator and the industry. These actions are being addressed by all licensees in the current term whether or not they are pursuing license renewal. Many of these activities are still on-going, such as seismic and flooding re-evaluations, and any recommended changes resulting from these activities will be addressed within the current regulatory framework. Other actions include addressing appropriate Near Term Task Force (NTTF) recommendations, installation and implementation of Diverse & Flexible Coping Capability (FLEX) and mitigative strategies. These actions will also be implemented under the current regulatory framework and are expected to be completed by 2016. In the context of SAMAs most (if not all) of these additional capabilities that grew out of the Fukushima accident are not credited as part of the Seabrook SAMA evaluations. As such, they would tend to lower the potential benefit of the current SAMAs if these additional capabilities were credited and would make some potentially cost-beneficial SAMAs no longer cost beneficial. In this regard the Seabrook SAMA analysis results are conservative.

NRC "ha[s] a duty to take a hard look at the proferred evidence" *Marsh v Oregon Natural Resources Council, 490 U.S. 360, 385 (1989)* before relicensing Seabrook and before finalizing the SEIS. NEPA requires an agency to consider the environmental effects before decisions are made; the NRC must ensure that "important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast." *Robertson v Methow Valley Citizens Council, 490 U.S. 332,349 (1989)* NRC cannot rely on NextEra's June 1, 2010 SAMA analysis and minor updates.

The fundamental purpose of the National Environmental Policy Act, NEPA, 42 USC § 4332, is to "help public officials make decisions that are based on understanding of environmental consequences, and take decisions that protect, restore and enhance the environment." 40 CFR § 1500.1(c)

In its application for license renewal of Seabrook, NextEra was required under 10 CFR § 51 to provide an analysis of the impacts on the environment that could result if it is allowed to continue beyond its initial license. The environmental impacts that must be considered in NextEra's EIS include those which are "reasonably foreseeable" and have "catastrophic consequences, even if their probability of occurrence is low." 40 CFR §1502.22(b)(1). Therefore the Staff's position that the probability of a severe accident is remote is not simply wrong after Fukushima but immaterial to satisfying NEPA's obligations.

013-3

The NRC must assure Seabrook's SEIS and adjudication process considers issues raised by Fukushima prior to relicensing Seabrook; the Fukushima events plainly show that, even if they are not yet all conclusively understood, the environmental impacts of the NRC relicensing

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013-3 These comments express concerns that the probability of a severe accident is not correct or appropriate and raise potential changes that may be required to the Seabrook severe accident mitigation alternative (SAMA) analysis as a result of the natural disasters that occurred in 2011 at the Fukushima Dai-ichi nuclear power plant. The core damage frequency (CDF) used in the NextEra's severe accident mitigation analysis (SAMA) is based on the examination of site specific identified accident scenarios, statistical evidence and models at the component level. The determination of CDF takes into account the current state of knowledge as informed by science, engineering, and operating experience including lessons learned from past incidents. As evidenced by the distribution of CDF values among the U.S. nuclear fleet, individual plant designs can vary by a significant degree. Basing CDF on global statistical estimates ignores the variations in plant design, variations in operating procedures, variations in regulatory requirements, and variation in siting.

In addition, basing CDF on global statistical estimates ignores the lessons learned from past accidents including both design and procedure changes implemented to reduce the likelihood of similar events at other sites. The NRC staff disagrees that the applicant's SAMA analysis is inadequate because the CDF is not estimated generically from direct experience. The SAMA analysis for license renewal is a Category 2 issue, which means that it should be evaluated on a site-specific basis. The applicant calculates the CDF using a plant specific probabilistic risk assessment (PRA) model, using plant specific fault trees, event trees and reliability information, and which has been subject to independent peer review. This approach is consistent with the current guidance for preparing a SAMA analysis provided in Revision A of Nuclear Energy Institute (NEI) 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis," which has been endorsed by the NRC staff for use in SAMA analysis. This document provides the applicant guidance to use the plant-specific PRA model. Based on this site specific information, the applicant estimates the severe accident risk and evaluates the economic impacts of a severe accident.

Regarding changes to the SAMA analysis, please see comment 013-2.

Seabrook may "affect the quality of the human environment in a significant manner or to a significant extent not already considered." *Marsh* at 374; see also *Marsh* at 372-373

013-2

Unless the NRC Staff take the "hard look" required by NEPA and adjust the cost/benefit analysis based on lessons now learned, NextEra's 20106 SAMA analysis will stand as is, based on pre-Fukushima assumptions that seek to show that mitigation is not justified, that the risks to society are really too low, and that there is no need to spend that money for safety enhancements we now know the public needs and deserves. The degree to which a project may affect public health or safety is a major consideration under NEPA. See 40 C.F.R. 1508.27.

The public is not obligated to perform a complete and new SAMA analysis or conduct a comprehensive review of potential mitigation measures before the NRC that is obligated to take a hard look at the lessons learned from Fukushima: "[it]is the agency, not an environmental plaintiff, that has a 'continuing duty to gather and evaluate new information relevant to the environmental impacts of its actions." *Friends of the Clearwater v. Dombeck*, 222 F.3d 552, 559 (9th Cir. 2000) (*quoting Warm Springs Dam Task Force v. Gribble*, 621 F.2d 1017, 1023 (9th Cir. 1980)); *see also Te-Moak Tribe v. U.S. Dept of the Interior*, 608 F.3d 592, 605-06 (9th Cir. 2010); *Davis v. Coleman*, 521 F.2d 661, 671 (9th Cir. 1975) ("compliance with NEPA is a primary duty of every federal agency; fulfillment of this vital responsibility should not depend on the vigilance and limited resources of environmental plaintiffs."). NRC Staff has an obligation to go back to the drawing board and take the required "hard look" at issues raised herein and any other new, significant and material issues that arise from Fukushima.

As the First Circuit remarked in *Dubois v. U.S. Dept. of Agric.*, 102 F.3d 1273, 1291 (1st Cir. 1996), discussing the public's role under NEPA:

'Specifics' are not required… [T]he purpose of public participation regulations is simply to 'provide notice' to the agency, not to 'present technical or precise scientific or legal challenges to specific provisions' of the document in question…Moreover, NEPA requires the agency to try on its own to develop alternatives that will "mitigate the adverse environmental consequences" of a proposed project. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351 (1989)

III. LESSONS LEARNED FROM FUKUSHIMA - INADEQUACIES SEIS 5.0

Based on new and significant information from Fukushima, the Environmental Report is inadequate post Fukushima Daiichi. NextEra's SAMA analysis ignores new and significant issues raised by Fukushima regarding the probability of both containment failure, and subsequent larger off-site consequences.

A. New and Significant Information Regarding The Probability of a Severe Accident

1. Probability of Reactor Core Damage and Radioactive Release - Cumulative

Direct Experience

The probability of severe core damage and radioactive release can be estimated either from a PRA study or from direct experience. Fukushima has expanded our knowledge and provides a reality check for PRA estimates.

<u>Estimating core-damage probability using PRA</u>

013-3

The accident at Fukushima showed that Seabrook's SAMA analysis underestimates the extent of core damage (CDF) by an order of magnitude. Core damage probability, post Fukushima shows that of the 12 core-damage accidents at NPPs, five have occurred at Generation II plants and involved sunsbtantial core melting. These were at Three Mile Island, Unit 2(PWR), Chernobyl Unit 4 (RBMK plant) and Fukushima Units 1 through 3. (BWRs). These 5 occurred in a worldwide fleet of of commercial NPPS of which 440 are currently in

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operation. The data provides a reality check on PRA estimates of CDF. Confidence is enhanced because the 5 occurred in different countries, at three different types of reactor designs, and over a period of 32 years. The 5 core damage accidents over a world wide experience of 14, 500 RY can be trnslated to a CDF of 3.4E-04 per RY (1 event per 2,900 reactor years). This is significantly different than NextEra's SAMA's baseline 1.5 X 10^{-5} RY (1.5 events per 100,000 RY). Therefore the SAMA analysis done by NextEra pre Fukushima must be redone with a baseline CDF orders of magnitude higher. 013-3

2. **Flooding and Seismic Hazards:** The probability of flooding and seismic hazards is higher than previously estimated post Fukushima. The October 11, 2011 SECY attests to its significance. Seabrook's location places it at a significant risk for flooding, a risk that will increase in subsequent years as a consequence of global warming. 013-4

3. **Station Blackout:** The probability of SBO is higher than previously estimated post Fukushima and increases the probability of a severe accident at Seabrook. The October 11, 2011 SECY attests to its significance. Lack of reliability of electric power is not properly accounted for in the PRA due to: (a) Seabrook's submerged Non- EQ (environmentally qualified) electric cables that carry offsite electricity needed to power safety systems; and (b) backup systems are insufficient and susceptible to damage from manmade and natural events. 013-5

4. **Spent Fuel:** Higher reelases than initally reproted by the Japanese and releases from the spent fuel pool cannot be discounted post-Fulushima. 013-6

Nature Magazine's October 25 report, Fallout forensics hike radiation toll: Global data on Fukushima challenge Japanese estimates[1], Geoff Brumfeil, Nature 478, 435-436 , October 25,

[1] Available on line at http://www.nature.com/news/2011/111025/full/478435a.html

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013-4 These comments address issues related to the potential impacts of natural disasters on the plant. The potential impacts of natural disasters, such as earthquakes and floods, and the plant's ability to continue to operate are addressed on an ongoing basis as part of the NRC's oversight process.

The NRC has directed licensees to perform a seismic re-evaluation using updated information and a flooding evaluation as part of its request for information under 10 CFR 50.54(f).

NextEra Energy Seabrook, LLC Seismic Hazard and Screening Report (CEUS Sites) was submitted to the NRC in a letter dated March 27, 2014, in response to NRC request for information pursuant to 10 CFR 50.54(f) regarding recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, and is available through the Agencywide Documents and Management System (ADAMS), Accession No. ML14092A413.

Operating reactor sites are using present-day information to re-evaluate the seismic and flooding hazards that could impact their site. These newly re-evaluated hazards, if worse than what the plant had originally calculated, will be analyzed to determine if plant structures, systems, and/or components need to be updated to protect against the new hazard. The NRC will review each step in the analysis process and take action to require plant changes as necessary.

On June 16, 2014, the NRC staff issued an assessment of the Seabrook Station flooding walk-down report supporting implementation of near-term task force recommendation 2.3 related to the Fukushima Dai-ichi nuclear power plant accident. This assessment is available through the Agencywide Documents and Management System (ADAMS), Accession No. ML14128A498.

Additional information is provided at:

http://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard/seismic-reevaluations.html

Modifications to requirements for mitigation strategies for beyond design basis external events are evaluated on a plant by plant basis and are currently ongoing.

Information regarding the status of Seabrook is available at:

http://www.nrc.gov/reactors/operating/ops-experience/japan/plants/seab1.html

These comments do not provide new and significant information and will not be evaluated further.

013-5 This comment expresses concerns that the probability of a station blackout (SBO) is higher than previously thought.

The influence of station black out (SBO) on the core damage frequency (CDF) used in the NextEra's severe accident mitigation analysis (SAMA) is based on the examination of site specific identified accident scenarios, statistical evidence and models at the component level. The determination of CDF, which includes the influence of an SBO, takes into account the current state of knowledge as informed by science, engineering, and operating experience including lessons learned from past incidents. As evidenced by the distribution of CDF values among the U.S. nuclear fleet, individual plant designs can vary by a significant degree. Basing CDF on global statistical estimates or singular events such as the SBO resulting from the events at Fukushima Dai-ichi Nuclear Power Plant ignores the variations in plant design, variations in operating procedures and variations in regulatory requirements.

In addition, basing CDF on global statistical estimates or singular events ignores the lessons learned from past accidents including both design and procedure changes. The NRC staff disagrees that the applicant's SAMA analysis is inadequate because the CDF is not estimated generically from direct experience. The SAMA analysis for license renewal is a Category 2 issue, which means that it should be evaluated on a site-specific basis. The applicant calculates the CDF using a plant specific probabilistic risk assessment (PRA) model, using plant specific fault trees, event trees and reliability information, and which has been subject to independent peer review. This approach is consistent with the current guidance for preparing a SAMA analysis provided in Revision A of Nuclear Energy Institute (NEI) 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis," which has been endorsed by the NRC staff for use in SAMA analysis. This document provides the applicant guidance to use the plant-specific PRA model. Based on this site specific information, the applicant estimates the severe accident risk and evaluates the economic impacts of a severe accident.

2011 said:

013-6

The disaster at the Fukushima Daiichi nuclear plant in March released far more radiation than the Japanese government has claimed. So concludes a study_1 that combines radioactivity data from across the globe to estimate the scale and fate of emissions from the shattered plant.

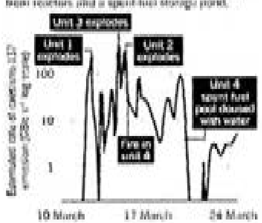
The study also suggests that, contrary to government claims, pools used to store spent nuclear fuel played a significant part in the release of the long-lived environmental contaminant caesium-137, which could have been prevented by prompt action. The analysis has been posted online for open peer review by the journal Atmospheric Chemistry and Physics[3].

Stohl believes that the discrepancy between the team's results and those of the Japanese government can be partly explained by the larger data set used. Japanese estimates rely primarily on data from monitoring posts inside Japan_3, which never recorded the large quantities of radioactivity that blew out over the Pacific Ocean, and eventually reached North America and Europe. "Taking account of the radiation that has drifted out to the Pacific is essential for getting a real picture of the size and character of the accident," says Tomoya Yamauchi, a radiation physicist at Kobe University who has been measuring radioisotope contamination in soil around Fukushima.

The new analysis also claims that the spent fuel being stored in the unit 4 pool emitted copious quantities of caesium-137. Japanese officials have maintained that virtually no radioactivity leaked from the pool. Yet Stohl's model clearly shows that dousing the pool with water caused the plant's caesium-137 emissions to drop markedly.

RADIATION CRISIS

Modelling the first week of the Fukushima disaster reveals that huge bursts of radioisotopes poured from reactors and a spent-fuel storage pond.



5. **Concrete Degradation:** Concrete is degrading presently at Seabrook Station; there is no evidence that it shall not continue. The environmental consequences are not analyzed in the SEIS 013-7

[3] Atmos. Chem. Phys. Discuss, 11, 28319-28394, 2011, www.atmos-chem-discuss.net/11/28319/2011/doi:10.5194/acpd-11-28319-2011

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013-5 cont'd The events that occurred at Fukushima Dai-ichi have resulted in numerous re-evaluations and actions to enhanced nuclear safety, both by the regulator and the industry. These actions are being addressed by all licensees in the current term whether or not they are pursuing license renewal. Many of these activities are still on-going, such as seismic and flooding re-evaluations, and any recommended changes resulting from these activities will be addressed within the current regulatory framework. Other actions include addressing appropriate Near Term Task Force (NTTF) recommendations, installation and implementation of Diverse & Flexible Coping Capability (FLEX) and mitigative strategies to prevent reactor core damage during long term station blackout. These actions will also be implemented under the current regulatory framework as a result of order EA-12-049 and the subsequent rulemaking. In the context of SAMAs most (if not all) of these additional capabilities are not credited as part of the current Seabrook SAMA evaluations. As such, they would tend to lower the potential benefit of the current SAMAs if these additional capabilities were credited, which would make some potentially cost-beneficial SAMAs no longer cost beneficial. In this regard the Seabrook SAMA analysis results are conservative.

013-6 This comment expresses concerns that there were higher releases from the SFPs at Fukushima than initially reported.

The NRC staff is not aware of any significant SFP releases resulting from the events that occurred at the Fukushima Dai-ichi Nuclear Power Plant. Initial concerns regarding the condition of the Unit 4 SFP was in part caused by the inability of operators to accurately monitor local conditions in the SFP. The Near Term Task Force (NTTF) identified this issue and recommended enhancing makeup capability and instrumentation for the SFP. The NRC issued an order modifying licenses with regard to reliable SFP instrumentation which will insure that all operating plants have reliable indications of spent fuel water level. In addition the display of this information shall be such that trained personnel shall be able to monitor the SFP water level from the control room, alternate shutdown panel, or other appropriate and accessible location.

such as the environmental and economic consequences from lime leached from the concrete into the environment. 013-7

B. New and Significant Information Regarding the Magnitude of Release and Increased Offsite Costs

1. **Duration of Release:** The MACCS2 computer code used by NextEra limits the total duration of a radioactive release to no more than four (4) days, if the Applicant chooses to use four plumes occurring sequentially over a four day period.[3] NextEra chose not to take that option and limited its analysis to a single plume having a total duration of the maximum-allowed 24 hours[4]. The Analysis and SEIS fail to say how many hours were actually modeled by NextEra and we request that information. In any case either a 24-hour plume or a four-day plume is insufficient duration in light of lessons learned from Fukushima. The Fukushima crisis now stretches into its seventh month and shows that releases can extend into many days, weeks, and months; a longer release will cause more significant offsite consequences that, in turn, will affect cost-benefit analyses. Any attempt to deny this would be counterintuitive and absurd. 013-8

2. **Computer Codes In Use Are Totally Incapable Of Modeling A Chain Reaction That Continues After A Scram.** MACCS2 is no exception. Like all the computer codes, it is incapable of modeling a "severe accident" release that lasts weeks and months. The MACCS2 code used by NextEra, and all other codes, assumes that the reactor is scrammed when the accident begins, and that the production of all fission products ceases at that time. We know that criticality was continuing at Fukushima Unit 2 through and past April 27, 2011, and to shorter duration at Unit 1, because of their continued post-scram high findings of I-131 reported by 013-9

[3] NUREG/CR-6613 Code Manual for MACCS2: Volume 1, User's Guide, 2-2

[4] The MACCS2 uses a Gaussian plume model with Pasquill-Gifford dispersion parameters (Users code 3=1). Its equation is limited to plumes of 10 hour duration.

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013-6 cont'd The objective of the SAMA evaluation is to identify and evaluate potential plant improvements that provide the greatest level of risk reduction in a cost-beneficial manner. The focus of SAMA evaluations is on reactor accidents because reactor accidents account for the majority of the severe accident risk for a nuclear power plant facility. Previous studies show that the risk associated with SFP accidents and dry cask storage accidents is considerably less than that for reactor accidents (e.g., NUREG-1738 and NUREG-1864). Given that an SFP accident risk is considerably less than that for a reactor accident, a SAMA that addresses spent fuel accidents would not be expected to have a significant impact on total risk for the site. Additional mitigation strategies implemented subsequent to September 11, 2001, further reduce the risk from SFP fires by enhancing spent fuel coolability and the ability to recover SFP water level and cooling prior to a potential SFP fire, and make it even more unlikely that additional SFP safety enhancements could substantially reduce risk or be cost-beneficial.

Further, as the Commission observed during the Pilgrim license renewal proceeding, the GEIS determined that the impacts of onsite spent fuel storage, including SFP accidents, are "small" and constitute a Category 1 issue for which site-specific consideration in a license renewal proceeding is not required (CLI-10-14). The comments provide no new and significant information; therefore no changes were made in the FSEIS in response to this comment.

013-7 The comment expresses concern that the environmental and economic consequences from the concrete leaching is not considered in the SEIS. While the impact of ASR on the structures at Seabrook is outside the scope of the environmental review for the Seabrook LRA, ASR and its impacts on the ability of NextEra to effectively manage the effects of aging on structures at Seabrook are evaluated as part of the license renewal safety review. The NRC will not make a decision on license renewal before it fully understands the issue with ASR-affected structures and NextEra's plan to address the issue. For more information about the NRC oversight of the Seabrook concrete degradation, refer to:

http://www.nrc.gov/info-finder/reactor/seabrook/concrete-degradation.html

This comment provides no new information, and no changes have been made to this SEIS as a result.

013-8 These comments express concerns that the release duration was not calculated appropriately.

Notwithstanding the fact that the duration of the releases is not necessarily the controlling factor in NextEra's SAMA analysis, NextEra provided a conservative SAMA assessment regarding the assumed release duration as described in NextEra's submittal based on the updated probabilistic risk assessment (PRA) (NextEra, 2012a). The discussion of NextEra's conservative treatment of the assumed release duration is shown below.

The Level 3 analysis was revised using the new accident release category definitions from the SB2011 PRA mode L. The probability of occurrence, timing (release times and duration) and rate/quantity of radionuclides released to the environment, and public warning times related to the release timing for each of the categories from the Level 2 analysis were also reflected in the Level 3 analysis. All other data used in the Level 3 calculation (e.g., meteorology, population distribution, agriculture and economy, rates of evacuation) were unchanged from the previous analysis.

The Release Tables provide the radionuclide release parameters for the revised model. The tables provide the MELCOR Accident Consequence Code System (MACCS2, version 1.13.1) parameters which simulate the release during the entire duration as provided by the plant-specific Modular Accident Analysis Program (MAAP) results used to characterize the Level 2 release categories. Note that because of MACCS version 1.13.1 input requirements of a maximum of 4 plumes, each with a maximum duration of 1 day, the impact analysis compacts the entire 7-day MAAP calculated release in a compressed time period.

A total accident release/duration of 7 days is assumed in the base case Level 3 runs. This is a conservative assumption that will overstate the public impact and the cost-benefit of candidate SAMAs because the model gives only modest credit for long-term release mitigation actions that are likely to be strategized and implemented via execution of the Severe Accident Mitigation Guidelines.

TEPCO. The reactors were shut down, scrammed, on March 11.[18] I-131 has an 8-day half-life. I 013-9 criticality had stopped after the reactors scrammed, the I-131 would have largely decayed. It would not, be at the levels TEPCO reported, that exceeded the Cesium readings. Conventional accident analysis of reactor accidents begin at reactor scram, t=0, and assume that the fission chain reaction ceases completely at that time, and that thereafter there is only "spontaneous" nuclear decay, with it being common practice to ignore the very tiny amount of "spontaneous fission" triggered by random neutrons from cosmic radiation hitting a fissile atom and creating infinitesimal amounts of I-131. A large problem created by the ongoing chain reaction is the calculation of food doses. The code has no way of modeling the continual production of I-131 and I-134 which can get to people both by milk and from fresh leafy-vegetable consumption.

The NRC Staff has an obvious duty to re-evaluate the Applicant's SAMA analysis on the basis of this new and significant information and its public health and safety consequences.

3. Probability of Higher Releases - Post Fukushima Analyses Deficiencies in Mitigation Measures-EDMGs/SAMGs

The NRC Task Force and October 3 SECY to the Commissioners, *Prioritization of Recommended Actions to Be Taken in Response to Fukushima Lessons Learned Task Force,* substantiate that NextEra's assumptions regarding probability and consequences pre-Fukushima were incorrect and overly "optimistic" regarding the effectiveness of mitigation measures. One fundamental problem is that both the SAMGs and EDMGs are 013-10 voluntary and not evaluated or enforced by NRC. Therefore the weight given them in assuming a lower probability of an accident is not justified.

The capability of operators to mitigate an accident at Seabrook would affect the

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013-9 This comment expresses concerns that the computer codes in use are incapable of modeling a chain reaction that continues after a scram.

Re-criticality is unlikely and assertions of re-criticality are more simply explained from the known and well-studied methods for iodine and cesium behavior during an accident. Even in the unlikely event that re-criticality occurred at the Fukushima plant, the impact of this re-criticality would be negligible on the SAMA analysis and would not change the results of the SAMA analysis.

Achieving sustained critical reaction in a light-water reactor core of U.S. design requires (1) favorable geometry and (2) sufficient moderator (water). During a severe accident, when the core materials are melted and geometry is lost, it is not easy to achieve good conditions for re-criticality. Control rod materials (poisons) will be part of the fuel melt, too, and sufficient water and the right configuration (geometry) must be present to sustain a chain reaction. Although re-criticality might occur in very small isolated pockets of slumped (melted) fuel where sufficient water is present. Such conditions, if possible, would occur in only small localized regions, for short periods of time. It would be nothing like producing 100% power from the entire core.

The net effect of re-criticality (if it occurred) would be to slightly change the source terms for a small subset of accidents in the SAMA analysis. For these accidents, the change in source term would be a small fraction of the total source term (e.g., small increase in short-lived isotopes such as 131I later in time from the start of the accident). The subset of accidents that might be affected is also limited to a small fraction. Hence, the net effect on source term is expected to be a small fraction of a small fraction, resulting in no appreciable change in the SAMA results.

013-10 This comment expresses concern that the SAMGs and EDMGs are voluntary and not enforced by the NRC.

probability of a radioactive release from the accident, including from a spent fuel pool 013-10
fire. Fukushima showed that events can result in high radiation fields and explosions, and long periods without fresh water and electricity.

Examples- strategies to provide make-up water

Spent Fuel Pools: Review of NEI's newly-disclosed EDMGs (NEI, B.5.b Phase 2 &3 Submittal Guideline, NEI 06-12, Revision 2, December 2006) show that they are inadequate to respond to the type of accident we now can expect post-Fukushima. For example: various strategies are discussed to provide makeup water. However important considerations are ignored such as:

- Events that initiate the accident such as: hurricanes, ice storms, and blizzards could render the water supply unavailable.
- A radioactive release from the reactor or spent fuel pool could produce radiation fields that render the water supply truck unavailable or preclude its use.
- There is no recognition that spraying water on exposed fuel could exacerbate the accident and cause a steam explosion or in the pool feed a zirconium-steam fire.

Containment: There is recognition in the Severe Accident Mitigation Guidelines (SAMGs) of the need for huge amounts of water during a severe accident but in a narrow way. The weight of the water along with how much space it would occupy was considered. The SAMGs have a provision for using water from the lake, river, or ocean to fill the containment until the level is higher than the top of the active fuel in the reactor core. This option seeks to cool the reactor core, assuming all other means failed, by immersion in water. The plant-specific calculations performed to support this SAMG step consider how high the containment must be flooded to achieve this condition. The SAMGs direct the operators to position motor-operated valves and such to their desired positions before submerging them in water and disabling them. The SAMGs

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013-10 cont'd Currently, the Extensive Damage Mitigation Guidelines (EDMGs) are not voluntary, they are required under 10 CFR 50.54(hh)(2):

> "(2) Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas:
>
> (i) Fire fighting;
>
> (ii) Operations to mitigate fuel damage; and
>
> (iii) Actions to minimize radiological release."

In the wake of the earthquake and subsequent tsunami that damaged the Fukushima nuclear power plant, the NRC staff has developed proposed rulemaking for mitigation of beyond-design-basis events that is currently with the Commission for consideration (and vote). This proposed rulemaking includes a more comprehensive symptom-based and function-based framework for the integration of response capabilities that extend beyond the Emergency Operating Procedures (EOPs). The framework would coordinate strategies and guidance that are currently distributed among the fire response procedures, flooding response procedures, FLEX Support Guidelines (FSGs), EDMGs, and Severe Accident Management Guidelines (SAMGs).

also look at how much water much be added to achieve the desired level and the weight (water weighs about 8 pounds per gallon) this level has on the structural integrity of the containment.

However the SAMGs do not consider the need, as seen in Japan, to continuously fill because of evaporation and leakage; nor does it consider the added weight from the water in the containment in its seismic calculations. Probabilities are improperly assumed lower.

Feed & Bleed

Last the SAMGs do not consider the effect on contaminating the waters from the reactor bleeding large volumes of highly contaminated water into the ocean and significantly increasing offsite consequences/costs.

Prior to Fukushima NRC Staff in reviewing Seabrook's SAMA apparently did not consider the probability that a huge volume of water required to be poured into the reactor in a severe accident after the type of events that we see are now credible and the consequent huge amount of highly contaminated water flowing out directly into the ocean.

The Areva method to decontaminate the water failed.[5] The Scientific American reported that " a trial run of the new filtration system was halted on June 18 in less than five hours when it captured as much radioactive cesium 137 in that span as was expected to be filtered in a month." The inability to store large volumes of decontaminated water was not modeled.

An additional problem in Japan was that the currents are such that the contaminants keep coming back to shore and are predicted to bring the contaminants back for 20-30 years. There is

[5] http://www.scientificamerican.com/article.cfm?id=fukushima-meltdown-radioactive-flood&print=true Scientific American, Three months after its meltdown, the stricken nuclear power plant continues to struggle to cool its nuclear fuel--and cope with growing amounts of radioactive cooling water, David Biello | Friday, June 24, 2011

no indication that so-called "feed and bleed" and the effects of currents were modeled in Next Era's SAMA; thereby consequences/costs were minimized.

There are numerous press reports describing the impact on the environment from feed and bleed, ignored by NextEra's SAMA. For example: *Fukushima's radioactive sea contamination lingers*, Andy Coghlan, New Scientist, September 30, 2011

> Peak leaks: Official estimates from the Japanese government and TEPCO, the company that owns Fukushima-Daiichi, suggest that 3500 terabecquerels of caesium-137 from the plant entered the ocean between 11 March and late May. The pollution was exacerbated in April by problems locating a persistent leak of contaminated water and a decision by TEPCO to dump contaminated water at sea. A further 10,000 terabecquerels of caesium-137 is thought to have found its way into the ocean after escaping as steam from the facility. And TEPCO said last week that Fukushima-Daiichi may still be leaking as much as 500 tonnes of contaminated water into the sea every day. (Emphasis added)

Radioactive cesium may be brought back by Ocean in 20-30 years, Tokyo Times, 09.16.11

> Radioactive substances from the Fukushima nuclear facility which spilled into the ocean in the aftermath of the March quake and tsunami may reach the Japanese coasts again in 20-30 years, according to a new research.
>
> The Meteorological Research Institute and the Central Research Institute of Electric Power Industry compiled a study indicating that the leaked radioactive cesium may travel clockwise through the northern Pacific Ocean and return to the Japanese coast in two or three decades.

Radioactive plankton found near Fukushima plan, Mark Willacy, Reuters Kodo, October 15, 2011

> Researchers say high concentrations of radioactive caesium have been detected in plankton in the Pacific Ocean off the shattered Fukushima nuclear plant.
>
> The Fukushima nuclear plant was badly damaged in the March earthquake and tsunami that struck Japan, and has been leaking radiation ever since.
>
> It is feared more radiation could now enter the food chain.
>
> Researchers from Tokyo University collected plankton from the sea south of the Fukushima nuclear plant, discovering nearly 700 becquerels per kilogram of caesium in plankton close to the shore.
>
> Research leader professor Takashi Ishimaru told Japan's NHK network sea currents had carried contaminated water south from the nuclear plant, heavily contaminating the plankton.
>
> A wide range of fish and other marine species feed on the plankton, leading to fears it could have a serious impact on the food chain.

The GEIS, like the SEIS, modeled atmospheric releases fallout on open bodies of water but apparently not leaks of large quantities of water from the necessity to dump tons of water on the top of the reactor followed by tons of water leaking out from the bottom through cracks into adjacent waters.

> The generic analysis (GEIS) applies to all plants… and that the probability- weighted consequences of atmospheric releases fallout onto open bodies of water, releases to ground water, and societal and economic impacts of severe accidents are of small significance for all plants." (SEIS 5-2, 5-3, emphasis added)

4. **Cleanup Challenges and Offsite Costs Not Considered**

New and significant information from Fukushima underscore what was already known and add new and significant information to show that the SAMA analysis for Seabrook significantly minimized offsite cleanup costs so that mitigation measures that properly should have been found cost effective to implement were not.

a. **Size Area Contaminated- Underestimated (Duration Release, Meteorology & Averaging)**

Estimated 13,000 square km eligible for decontamination Asahi.com (Asahi Shimbun), Oct 12, 2011 reported that 8077 miles will be decontaminated:

> The central government will be responsible for decontaminating about 13,000 square kilometers across eight prefecture, or about 3 percent of Japan's total landmass

Lessons learned from Fukushima confirmed that costs of offsite cleanup will reflect the size of the area contaminated. As discussed above (at 5) the MACCS2 code used by NextEra limits the total duration of a radioactive release to a single plume having a total duration of the maximum-allowed 24 hours[6] that is insufficient duration in light of lessons learned from

013-8

6 The MACCS2 uses a Gaussian plume model with Pasquill-Gifford dispersion parameters (Users code 5-1). Its equation is limited to plumes of 10 hour duration.

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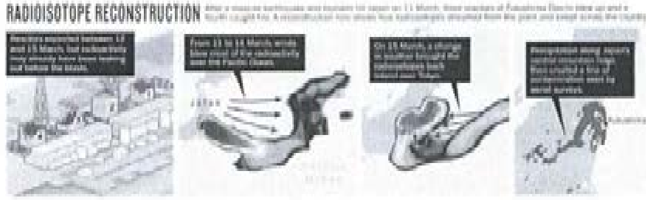
Fukushima. A longer release will cause offsite consequences that will increase contamination, and result in required re-decontamination, and significantly increase cleanup costs and the overall cost-benefit analyses. Assumptions need to be changed post-Fukushima. 013-8

Plume, Straight-line Variable: Fukushima showed that the plume did not travel simply in a straight-line.[7] Fukushima Daiichi, like Seabrook, is on the coast and the area around it topographically varied. The wind in Japan was variable, as it is and would be in a severe accident at Seabrook. 013-11

Further it is obvious that releases extending over a longer duration than a day will travel in varied directions over that extended time period. However, the MACCS2 code's ATMOS module, used by NextEra, assumes a straight-line Gaussian plume. Consequently it fails to predict the area impacted and significantly minimizes it. NEPA requires the SAMA analysis to be redone using a variable plume model.

Fallout forensics hike radiation toll, Global data on Fukushima challenge Japanese estimates, Nature 478, Geoff Brumfel, 435-436, October 25, 2011[8]

RADIOISOTOPE RECONSTRUCTION



Radiation levels in Japan vary greatly by location. The Japanese Ministry of Education, Culture, Sports, Science and Technology has been posting radiation levels by prefecture on its

[7] Gov't radiation info in English http://radioactivity.mext.go.jp/en/

[8] Available on line at http://www.nature.com/news/2011/111025/full/478435a.html

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013-11 These comments express concern that the straight-line plume is the wrong method for modeling meteorology in the area around Seabrook.

The MACCS2 code was developed under NRC sponsorship for use in evaluating the potential impacts of severe accidents at nuclear power plants on the surrounding public. The MACCS2 code considers, among other things, phenomena related to atmospheric transport and deposition under time variant meteorology, short- and long-term mitigative actions, potential exposure pathways, deterministic and stochastic health effects, and economic costs. The NRC is not aware of any code other than the MACCS2 code that fully addresses each of these factors completely. The issue of concern in a SAMA analysis is not the results of a single meteorological data trial but the results of numerous meteorological trials that provide the mean consequences over the entire 50-mile radius. In this regard, the atmospheric transport model used in MACCS2 has been found to generally perform as well as several more modern atmospheric transport models, and within the level of accuracy of other portions of the analysis. As such, the MACCS2 model has proven its acceptability for the purpose of conducting a SAMA analysis. The adequacy of the atmospheric transport model used in the MACCS2 code was raised in a contention filed by Friends of the Earth and the New England Coalition in the Seabrook license renewal adjudicatory proceeding. The contention includes the criticisms mentioned in the comments and was admitted for litigation by the Atomic Safety and Licensing Board (ASLB or the Board).

Questions regarding the adequacy of straight-line, or Gaussian, atmospheric dispersion models have been studied in detail. This included a detailed code comparison completed in 2004 with the objective of determining if the average atmospheric transport and dispersion results from codes such as MACCS2 are sufficiently accurate that more complex models are not required. In that study, documented in NUREG/CR-6853, “Comparison of Average Transport and Dispersion Among a Gaussian, a Two-Dimensional, and a Three-Dimensional Model,” results from the MACCS2 code were directly compared to those from the LODI (Lagrangian Operational Dispersion Integrator) code.

English-language web site, with data going back to two days after the accident. For example the Mainichi Daily, October 7, reported that: *Gov't releases new radiation map for Tohoku, Kanto districts*[9]

Mainichi Daily News reported that:

> The Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) has released a new map showing the spread of radiation from the crippled Fukushima No. 1 Nuclear Power Plant across 10 prefectures, including Tokyo and Kanagawa.
>
> The map released on Oct. 6 shows levels of radioactive cesium (cesium-137 and cesium-134) that have accumulated in soil in the prefectures of Yamagata, Miyagi, Fukushima, Tochigi, Gunma, Ibaraki, Saitama, Chiba, Kanagawa and Tokyo.
>
> The map shows 30,000 to 60,000 becquerels of radioactive cesium per square meter of soil in the areas of Higashikanamachi, Mizumotokoen and Shibamata in Tokyo's Katsushika Ward, as well as some parts of Kitakoiwa in Tokyo's Edogawa Ward.
>
> Radioactive amounts ranging between 30,000 and 100,000 becquerels per square meter were detected in the mountain areas in northwestern Okutama, in western Tokyo.

Further, the press has numerous recent reports on the spread of contamination. For example: *Citizens' Testing Finds 20 Hot Spots Around Tokyo*, Hiroko Tabuchi, New York Times, Oct 14, 2011; *Residents' feelings mixed over discovery of radioactive strontium in Yokohama*, Mainichi Daily News, October 17, 2011 reported that: "YOKOHAMA -- Residents have expressed mixed

[9] Mainichi News, http://mdn.mainichi.jp/mdnnews/news/20111007p2a00m0na009000c.html

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013-11 cont'd LODI is a state-of-the-art, three-dimensional (3D) advection dispersion code that uses a Lagrangian stochastic Monte Carlo method. LODI is coupled to ADAPT (Atmospheric Data Assimilation and Parameterization Technique), which provides time-varying, 3D fields of mean winds, turbulence, pressure, temperature, and precipitation based on observed meteorology. LODI is an element of the National Atmospheric Release Advisory Center (NARAC) emergency response modeling system at Lawrence Livermore National Laboratory (LLNL), which is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving the spread of hazardous material accidentally or intentionally released into the atmosphere.

As discussed in NUREG/CR-6853, this comparison shows that MACCS2 provides results consistent with those from the more complex plume models at distances up to 100 miles (161 kilometers). This is well beyond the 50-mile (80-kilometer) radius considered in the SAMA analysis. The MACCS2 predictions for average, time-integrated, ground-level air concentrations (which directly relate to inhalation and cloud shine doses), and for average deposition (which directly relates to groundshine and ingestion pathway doses) were very comparable (i.e., less than a factor of two) to predictions made by the state-of-the-art NARAC codes, ADAPT/LODI, at all distances. The direct comparison to the state-of-the-art NARAC codes demonstrates that straight-line air dispersion modeling is well within its range of validity when used to perform SAMA analyses.

013-11 cont'd Notwithstanding the considerable evidence cited above that MACCS2 is an appropriate code for modelling the off-site consequences from a reactor accident and in order to respond to concerns regarding the use of the straight line Gaussian meteorological model as well as the use of a single meteorological tower and state of the art modeling, NextEra provided an additional analysis based on the use of a state of the art meteorological model to assess the impacts of the use of more advanced modeling on their SAMA analysis. NextEra provided a sensitivity analysis of the meteorological model using the EPA's CALMET wind field model. NextEra's analysis indicated that the use of the more complex CALMET model could potentially increase the calculated benefit of a SAMA by about 32 percent. However, based on an analysis of the conservatisms used in NextEra's baseline SAMA analysis and the overestimation of the increased benefits associated with NextEra's sensitivity analysis, the NRC staff concluded that NextEra's original SAMA analysis was performed in a conservative manner relative to accepted practices for the evaluation of severe accidents and that NextEra's results represent a reasonable assessment of the identification of potentially cost beneficial SAMAs notwithstanding any variations resulting from the use of the more complex CALMET wind field model. This additional evaluation is discussed in Chapter 5 and Appendix F of the SEIS.

The subject of this comment is similar to Contention 4D, relating to the reasonableness of the atmospheric dispersion model utilized in NextEra's SAMA analysis. Contention 4D was admitted by the Board in the Seabrook license renewal proceeding on February 15, 2015. The parties to Contention 4D reached a settlement agreement and submitted the settlement agreement to the Board on August 8, 2013. On August 12, 2013, the Board approved the settlement agreement.

Under the Settlement Agreement, the NRC Staff included an analysis of the CALMET sensitivity in its final SEIS, and identified the SAMAs (13, 24, 44, 55, 56, 77, 96, 108, 109, 147, 163, 167, 168, 169, and 170) that might be considered potentially cost beneficial if the CALMET sensitivity were added to NextEra's uncertainty factor. The final SEIS also analyzed conservatisms in NextEra's SAMA analysis and the extent to which such conservatisms may off-set the uncertainty factor. Upon issuance of the final SEIS, the NRC Staff will submit a letter to the ASLB identifying the portions of the final SEIS which address the CALMET sensitivity, the treatment of uncertainty, and off-setting conservatisms in NextEra's analysis.

feelings over the discovery of radioactive strontium in Yokohama's Kohoku Ward, some 250 kilometers away from the crisis-hit Fukushima No. 1 Nuclear Power Plant."

Averaging Meteorological Data: Fukushima also makes plain the effect the Applicant's choice of averaging has on estimating consequences. The User can choose the averaging method in the code's OUTPUT file[10]. If the mean is chosen, as was the case in Seabrook's SAMA, then the site's meteorological variability is washed out - made meaningless. For example sea breeze occurs only in warmer months; therefore at the 95th percentile its impact is accounted for but not if the mean is used. Averaging is a choice; no NRC rule requires the Applicant to use the MACCS2 code or a particular statistical method. Whether NRC determines that the Applicant made the correct choice depends if: NRC Staff is on the side of NextEra and wishes to assure that they will not be required to spend monies for mitigation in the post- Fukushima world; or whether NRC is on the side of assuring public safety. 013-12

[10]**Explanation MACCS2 code's averaging**: For each plant damage state, the code is run over a meteorological data set to produce a set of consequence results. For each consequence endpoint, the values corresponding to various statistical parameters of the resulting data set (mean, median (50th percentile), 95th percentile, 99th percentile, and the maximum value over all weather trials considered) are provided in the MACCS2 code's OUTPUT file. Then, it is necessary for the SAMA analysis to determine which statistical parameter should be used as input into the SAMA analysis: e.g., the mean, the median or the 95th percentile. Once this input parameter is chosen, then the population dose-risks and off-site economic dose risks can be calculated, summed and compared to the costs of mitigative measures. The choice of statistical input parameter determines the level of protection which mitigative measures would be expected to provide. A choice of 95th percentile, for example, means that mitigative measures would be considered cost-beneficial if they were no more expensive than the value of the averted risk to the public from a severe accident for 95 percent of the meteorological conditions expected to occur over the course of a year. In contrast, use of the mean consequences would imply that measures would be cost-beneficial if they were no more expensive than the (significantly lower) value of the averted risk to the public for an accident occurring under average meteorological conditions. This is analogous to the situation of a homeowner who is considering whether to spend the money to install windows to protect against a 20-year storm or just an average storm. Thus the outcome of the SAMA analysis is functionally dependent on the choice of statistical input.

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013-11 cont'd In return, Friends of the Coast and the New England Coalition (FOTC/NEC) consented to the dismissal of Contention 4D effective seven (7) days after issuance of the final SEIS, with the CALMET sensitivity, uncertainty factor and off-setting conservatism evaluated to the sole satisfaction of the NRC Staff. FOTC/NEC will not challenge the NRC Staff's disposition of, or make any further claims in this proceeding regarding, any of the SAMAs that might be considered potentially cost beneficial if the CALMET sensitivity were added to NextEra's uncertainty factor.

013-12 These comments express concern that averaging the meteorology data is not appropriate for use in the SAMA review.

NextEra's SAMA analysis was performed in a conservative manner regarding the use of meteorological data because NextEra used the worst year of the five years of meteorological data that were evaluated. Data from other years or a five year average of meteorological data would have resulted in decreases in dose and economic risk when compared to the submitted evaluation.

SAMA analyses, however, are intended to be a realistic evaluation of the impacts of severe accidents and not a representation of worst case scenarios. As a NEPA mitigation analysis, the SAMA analysis is not based on either the best-case or the worst-case accident scenarios. Rather, the SAMA analysis estimates mean accident consequence values which are averaged over the many hypothetical severe accident scenarios and over the examined 50-mile radius region. NEI 05-01, Rev. A, "Severe Accident Mitigation Alternatives (SAMA) Analysis," which has been endorsed as an appropriate guidance document by the NRC, recommends the use of mean values in the SAMA analysis. Notwithstanding the intention of these analyses to represent a realistic assessment of severe accidents, NEI 05-01 also endorses the use of an uncertainty factor derived from the ratio of the 95th percentile to the mean point estimate for internal events core damage frequency which is used to account for overall uncertainties. NextEra's use of an uncertainty factor in their SAMA analysis conservatively accounts for uncertainties in their analysis.

Comparative Studies Missing: We note also that the NRC Staff did not provide reference to, or ask the Applicant for, a single study that compared the results from: using a variable plume model versus a Gaussian plume model; or statistically treating the data with the 95th percentile versus the mean. Consequently, we question the basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3) 013-11

Further, we also understand that the NRC does not have the capability or knowledge to run the MACCS2 code. If this is so, and we deserve to know, on what basis did the staff approve NextEra's analysis?

b. **Cleanup Standard**

Estimated 13,000 square km eligible for decontamination Asahi.com (Asahi Shimbun), Oct 12, 2011 reported that a change in cleanup standard dramatically affected the area required to be cleaned up and costs 7-fold.

> The central government will be responsible for decontaminating about 13,000 square kilometers (8077 miles) across eight prefecture, or about 3 percent of Japan's total landmass, under new standards for cleaning up radiation from the Fukushima No. 1 nuclear power plant, according to Asahi Shimbun estimates.
>
> The Environment Ministry on Oct. 10 endorsed a basic policy to make the government responsible for decontaminating all areas with radiation levels exceeding 1 millisievert per year. (100 mirem)
>
> Based on an earlier annual threshold of 5 millisieverts, the ministry initially said about 1,800 square km of land in Fukushima Prefecture would be subject to decontamination. But under the new standard, the size of the area will grow sevenfold.

The cleanup standards that will determine what clean-up is required (and hence its cost) have not been defined in the U.S. and without defining how "clean is clean" there was no way for NextEra to make any reasonable estimate of offsite costs or for NRC Staff to make its evaluation in the SEIS. 013-13

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013-12 cont'd Questions regarding the adequacy of straight-line, or Gaussian, atmospheric dispersion models have been studied in detail. This included a detailed code comparison completed in 2004 with the objective of determining if the average atmospheric transport and dispersion results from codes such as MACCS2 are sufficiently accurate and that more complex models are not required. In that study, documented in NUREG/CR-6853, "Comparison of Average Transport and Dispersion Among a Gaussian, a Two-Dimensional, and a Three-Dimensional Model," results from the MACCS2 code were directly compared to those from the LODI (Lagrangian Operational Dispersion Integrator) code.

LODI is a state-of-the-art, three-dimensional (3D) advection dispersion code that uses a Lagrangian stochastic Monte Carlo method. LODI is coupled to ADAPT (Atmospheric Data Assimilation and *Atmospheric* Parameterization Technique), which provides time-varying, 3D fields of mean winds, turbulence, pressure, temperature, and precipitation based on observed meteorology. LODI is an element of the National Release Advisory Center (NARAC) emergency response modeling system at Lawrence Livermore National Laboratory (LLNL), which is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving the spread of hazardous material accidentally or intentionally released into the atmosphere.

As discussed in NUREG/CR-6853, this comparison shows that MACCS2 provides results consistent with those from the more complex plume models at distances up to 100 miles (161 kilometers). This is well beyond the 50-mile (80-kilometer) radius considered in the SAMA analysis. The MACCS2 predictions for average, time-integrated, ground-level air concentrations (which directly relate to inhalation and cloud shine doses), and for average deposition (which directly relates to groundshine and ingestion pathway doses) were very comparable (i.e., less than a factor of two) to predictions made by the state-of-the-art NARAC codes, ADAPT/LODI, at all distances. The direct comparison to the state-of-the-art NARAC codes demonstrates that straight-line air dispersion modeling is well within its range of validity when used to perform SAMA analyses.

Further lessons learned at Fukushima have shown that absent a cleanup standard set before the accident, there is added delay in getting started. Time is important in cleanup. The longer it takes to start the process of decontamination will result in an increase in damage to the environment, public health, and economy via resuspension and contamination of agricultural products – again increasing overall offsite costs.

013-13

Additionally, Fukushima has shown that the public will demand a lower standard and more inclusive area to be compensated because of known health effects from radiation and the discovery of hot spots resulting in variation from property to property and resuspension.

In One Japanese City, Hot Spots to Avoid, Wall Street Journal, Phred Dvorak, Sept 3, 2011

> The new hot spots are devilishly small and scattered: one out of five houses in the neighborhood of Kaki-no-uchi; six households of 10 in Aiyoshi. In some cases, next-door neighbors have received differing recommendations.
>
> In radiation-contaminated Date, Japan, Morio Onami was told his house doesn't qualify for evacuation, even though his son's home, just a few steps away, does. Date residents complain the measurements aren't reliable, and that the line between who stays and who goes is fuzzy. Families who qualify for evacuation get breaks on property taxes, insurance premiums and medical fees—assistance potentially worth thousands of dollars—fanning jealousy among neighbors who get nothing. And many residents aren't convinced it is safe to stay behind, particularly when others nearby are moving.

Background: As background to supplement lessons learned from Fukushima, the US Department of Homeland Security has commissioned studies for the economic consequences of a Rad/Nuc attack and although much more deposition would occur in reactor accident, magnifying consequences and costs, there are important lessons to be learned from these studies.

Barbara Reichmuth's study, Economic Consequences of a Rad/Nuc attack: Cleanup Standards Significantly Affect Cost, 2005,[1] Table 1 Summary Unit Costs for D & D (Decontamination and Decommissioning) Building Replacement and Evacuation Costs provides

[1] Economic Consequences of a Rad/Nuc attack: Cleanup Standards Significantly Affect Cost Barbara Reichmuth, Steve Short, Tom Wood, Fred Rutz, Debbie Swartz, Pacific Northwest National laboratory, 2005

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013-12 cont'd Regarding whether Gaussian plume modeling is appropriate for air dispersion modeling for reactors in complex terrain, the Gaussian plume model provides further conservatism under variable terrain conditions. Specifically, when variable terrain features such as river embankments or mountains intervene between a source and an observation point, these features would tend to disperse and dilute the plume as it is forced to move around obstacles. The plume model conservatively estimates that the plume travels in a straight line over or through the obstacles, thereby resulting in larger accumulated radiological doses and higher estimates of economic consequences in areas farther from the plant.

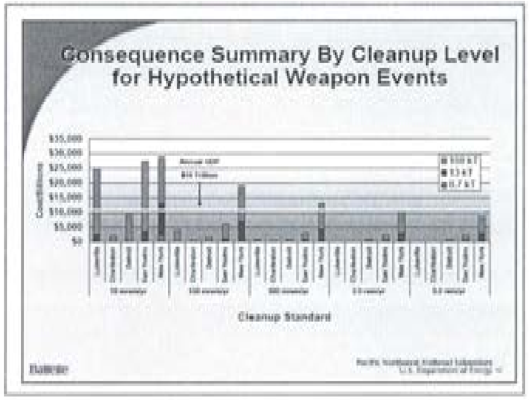
013-13 This comment expresses concern that the definition of cleanup standard is inadequate.

The EPA developed a manual entitled, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992) to assist public officials in planning for emergency response to radiological incidents. This Manual provides radiological protection criteria for application to all incidents that would require consideration of protective actions, with the exception of nuclear war. In March 2013 the EPA issued a draft update of this manual for public comment.

The EPA suggested levels for reentry following a radiological accident are 2,000 mrem (20 mSv) projected for the first year, and 500 mrem (5 mSv) per year projected in subsequent years. In this phase, scientists would run dose calculations using computer models such as RESRAD which is designed to estimate radiation doses and risks from residual radioactive materials. RESRAD and similar models allow users to choose sensitive age groups, or to enter more restrictive limits, if desired. Local decision makers can adapt the EPA guides with incident-specific considerations and implement variations as needed.

It is important to recognize that as an analysis performed to satisfy the requirements under the NEPA a SAMA analysis should not be based on either the best-case or the worst-case accident scenarios, but on mean accident consequence values, averaged over the many hypothetical severe accident scenarios. The SAMA analysis requires many individual inputs and as such it will always be possible to propose more conservative values which could result in greater estimated accident consequences. The question is not whether alternative inputs could be used but rather if the inputs in question were reasonable for use under the NEPA rule of reason.

estimates for different types of areas from farm or range land to high density urban areas. Reichmuth's study also points out that the economic consequences of a Rad/Nuc event are highly dependent on cleanup standards. "Cleanup costs generally increase dramatically for standards more stringent than 500 mrem/yr;" however currently a cleanup standard is not agreed upon by NRC and EPA and appears to range from 15 mrem/yr to 5 rem/yr.



Source: Battelle Study-locations range from a small rural community to densely populated NYC)

The General Accounting Office (GAO) reports that the current EPA and NRC cleanup standards differ and these differences have implications for both the pace and ultimate cost of cleanup.[2] NextEra's SAMA does not account for this issue.

[2] GAO, "radiation Standards Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues," June 2004

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013-13 cont'd Additional discussion of the decontamination cost estimates and their impact on the SAMA analysis has been provided in Chapter 5 and Appendix F of the SEIS.

A similar study was done by Robert Luna, *Survey of Costs Arising from Potential Radionuclide Scattering Events*.[3] Luna concluded that,

> …the expenditures needed to recover from a successful attack using an RDD type device …are likely to be significant from the standpoint of resources available to local or state governments. Even a device that contaminates an area of a few hundred acres (a square kilometer) to a level that requires modest remediation is likely to produce costs ranging from $10M to $300M or more depending on the intensity of commercialization, population density, and details of land use in the area." (Luna, Pg., 6)

Therefore a severe accident at Seabrook from lessons learned at Fukushima is likely to result in huge costs; costs not accounted for by NextEra, because of the type and magnitude of radionuclides released in comparison with a RDD type device.

In place of the outdated decontamination cost figure in the MACCS2 code, the SAMA analysis for Seabrook must be redone to incorporate the lessons learned from ongoing actual experience in Japan. 013-14

Again, there is no basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3)

e. <u>**Waste Disposal - ignored**</u>

It is evident from Japan's efforts today to deal with contaminated waste that NextEra and the MACCS2 code ignored the real costs and issues associated with radioactive waste disposal.

Radioactive soil can fill 23 Tokyo Domes, Five prefectures' nuclear burden a hot potato no one wants to catch, Setsuko Kamiya, Japan Times, September 29, 2011

[3] Survey of Costs Arising From Potential Radionuclide Scattering Events, Robert Luna, Sandia National laboratories, WM2008 Conference, February 24-28, 2008, Phoenix AZ

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013-14 These comments express concern that the decontamination costs are outdated and need to be updated.

It is important to recognize that as an analysis performed to satisfy the requirements under the NEPA a SAMA analysis should not be based on either the best-case or the worst-case accident scenarios, but on mean accident consequence values, averaged over the many hypothetical severe accident scenarios. The SAMA analysis requires many individual inputs and as such it will always be possible to propose more conservative values which could result in greater estimated accident consequences. The question is not whether alternative inputs could be used but rather if the inputs in question were reasonable for use under the NEPA rule of reason.

Additional discussion of the decontamination cost estimates and their impact on the SAMA analysis has been provided in Chapter 5 and Appendix F of the SEIS.

Radioactive soil and vegetation that must be removed in Fukushima and four adjacent prefectures could reach up to 28.79 million cu. meters, equal to filling the Tokyo Dome 23 times, according to a recent Environment Ministry estimate.

But finding a disposal or temporary storage site will be a tall order.

The estimate covers soil and dead leaves mainly from areas with radiation levels of more than 5 millisieverts per year in the prefectures of Fukushima, Miyagi, Yamagata, Tochigi and Ibaraki, whose data were used to mete out the rough figures.

In Fukushima, home of the nuclear plant leaking all the radiation, about 17.5 percent of the prefecture is contaminated to that level.

The estimate was submitted Tuesday to a 12-member expert panel working out decontamination plans. The panel assumed that 5 cm of topsoil should be removed from contaminated areas, including pinpoint decontamination efforts in certain locations with radiation of 1 to 5 millisieverts per year.

The government is hammering out details on plans to remove and store the soil and leaves. But finding a location to temporarily store such a huge amount of radioactive materials will be an extremely sensitive and politically difficult task for the central government.

Breaking down the total, contaminated soil from residential areas was estimated at 1.02 million cu. meters, farm land at 17.43 million cu. meters and forests at 8.76 million cu. meters, the Environment Ministry said.

A single facility capable of housing the entire 28.79 million cu. meters of soil would have to be 1 sq. km in area and 30 meters deep. But if the central government decides on multiple facilities, negotiations would have to be completed with numerous local governments.

The location for a temporary facility is still undecided, but the government is reportedly considering Fukushima Prefecture.

Contaminated soil can amount to 29 million cubic meters, Denki Shimbun, Sep. 30, 2011 estimated that the amount of soil contaminated from Fukushima could be as much as 29 million cubic meters (38 million cubic yards). For context, the waste if placed on a football field, including the end zones, would make a pile 6,000 feet high or over a mile.

Reuters in May estimated that the cleanup would take 10-20 years, cost $100 Billion dollars, require 10,000 nuclear cleanup workers, decontamination of a 100,000 square mile area, and produce 100,000 gallons of waste. They made note of the facts that: "Japan doesn't have robust shipping plans for nuclear waste and will have to develop them as the need comes to transport and figure out how and where to bury, burn or ship the waste; Japan has no storage capability currently to contain the highly radioactive core and SFP debris.[11]"

The types of isotopes found offsite in Japan show what can be expected to be found in a severe accident here and represent unique waste disposal challenges. Japan Discovers Plutonium Far From Crippled Reactor, Wall Street Journal, Toko Sekiguchi, Oct 1, 2011 reported that, "TOKYO—Trace amounts of plutonium were found as far as 28 miles from the damaged Fukushima Daiichi nuclear-power plant, the first time that the dangerous element released from the accident was found outside of the immediate area of the plant."

In the meantime absent an acceptable storage facility for the waste, public health and the environment are impacted that will result in increased offsite costs. The same would happen here. Today, neither New Hampshire nor Massachusetts has access to a low-level radioactive waste disposal facility.

Japan faces costly, unprecedented radiation cleanup,[12] Yoko Kubota,TOKYO, Thu Aug 25, 2011 8:25am EDT

> Another major headache is where to store the radioactive waste like dirt and water generated from cleanup work.
>
> Currently, as with Takita's efforts, the waste is stored within the property where the cleanup took place. Some schools have a heap of radioactive dirt in the corner of their playgrounds, covered with plastic sheets, and residents bury sacks of contaminated waste in their yards.

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[11] The Enormity Of Decontaminating Japan And Decommissioning Fukushima, Fukushima Project, Reuters, May 17, 2011 (Hyperlink)

[12] Japan faces costly, unprecedented radiation cleanup", http://www.reuters.com/article/2011/08/25/us-japan-nuclear-decontamination-idUSTRE77O3LI20110825, Yoko Kubota,TOKYO | Thu Aug 25, 2011 8:25am EDT

> "The issue of disposal zones is the most important for decontamination and unless plans are made, it won't move forward," said Kunihiro Yamada, a professor at Kyoto Seika University who does cleanup work in Fukushima city.
>
> The amount of radioactive waste from decontamination is likely to be tens of millions of tonnes and the government in the long run plans to build an underground disposal facility to store this, though when and where is unclear. (Emphasis added)

NextEra's SAMA application does not specifically mention a waste disposal plan and estimated costs. Section F.3.4.2 says simply: Cost of farm decontamination for the various levels of decontamination ($/hectare) = $1,084 & $3,408; Cost of non- farm decontamination for the various levels of decontamination ($/person)=$3,779 & $13,412; Average cost of decontamination labor ($/person-year) =$ 67,427. And at F.4.2 Offsite Economic Costs, it says that the process for cleanup and refurbishment or decontamination; but the total estimated cost for each process is not provided. Also, the SEIS fails to provide any information. 013-14

Background: For context, it is important to understand that the MACCS2 code assumptions were based upon a weapons event. In a weapon's event the waste could be shipped to Utah *or to the* Nevada Test Site. *The Greater- than- Class C waste expected in a reactor* accident would not have a repository likely available to receive such a large quantity of material in the foreseeable future. Like in Japan, it would be orphaned.

Also, the costs incurred for safeguarding the wastes and preventing their being re-suspended or seeping through to the groundwater is not accounted for in the model. Even optimistically assuming a repository becoming available, (Utah' site is approximately one-square mile and the volume of waste from a severe accident at NextEra, as we have seen from Fukushima would likely require an unimaginably larger facility) it seems unlikely that there would be a sufficient quantity of transport containers and communities not objecting to the hazardous materials going over their roads and through their communities. Fukushima is now 013-14

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showing that leaving it in piles covered by tarps does not isolate it from the environment-groundwater or air.

Radioactive waste disposal conundrum slowing recovery efforts, Mainichi, Sept 5, 2011

> FUKUSHIMA -- The law had not anticipated the radioactive contamination beyond the gates of nuclear power plants, and has left not only Fukushima Prefecture but also municipalities in the Tokyo metropolitan area with radiation-tainted waste that has no place to go.
>
> In Fukushima Prefecture, the need to decontaminate residences and roads has become increasingly urgent, while little headway has been made in securing temporary storage for radiation-tainted mud. And while the central government is hoping to set up interim storage facilities in the prefecture, no concrete timeline has been established. In addition, rubble still litters Japan's northeastern coast.
>
> The Date Municipal Government has plans to decontaminate the entire city, which will involve the removal of mud and grass from gutters and gardens, where radioactive materials tend to accumulate. And while it is searching for waste storage locations in the five towns that existed before they were incorporated into the city, for the time being residents will be asked to keep the tainted materials on their property.
>
> Residents have been instructed by the city to store the waste in thick plastic bags, preventing the contents from seeping into groundwater. But those who use well water in their daily lives are not convinced of the measure's effectiveness.
>
> "We want the decontamination process to take place as soon as possible, and for the young people who have evacuated elsewhere to come back," Kanno said.
>
> Fukushima is the third largest prefecture in the country, with a large area of mountainous terrain. As a result, use of water mains stands at 92.4 percent of the population -- lower than the national average of 97.5 percent -- leaving many residents, like those in Kamiogani, worried about the effects of radioactive waste on their groundwater.
>
> The central government announced on Aug. 26 that "for the time being, it is realistic for cities, towns, villages and communities to set up temporary storage space for tainted waste that is left over from decontamination measures." While the government's nuclear disaster headquarters is aware that local governments are having difficulty securing temporary storage sites, it says, "We have no choice but to ask each municipality to make those decisions."
>
> "The government will likely force interim storage facilities onto the communities close to the nuclear power plant, where the chances of residents being able to return home are slim," one said.
>
> "It will take quite some time before (the government) earns the understanding and cooperation of residents. (Emphasis added)

Slow cleanup efforts and the absence of available interim secured waste disposal will result in recontamination of cleaned-up areas, increasing offsite costs.

O15-14

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Mainichi Japan reported, October 11, 2011, *Residents near Fukushima mountains face nuclear recontamination every rainfall* reported that:

> ...worries are growing particularly among Fukushima Prefecture residents over drawn-out and in some cases apparently futile nuclear decontamination operations.
>
> The unease is especially strong in areas in and around mountains that must be repeatedly decontaminated, as every rainfall brings a new batch of radioactive substance-contaminated leaves and soil washing down from the hills. **(Seabrook's LRA, 2.10 "The terrain varies from hilly to mountainous except along the coast.")**
>
> "There's no point in doing just one round of official decontamination," he told the Mainichi. "We residents will get nowhere near anything like peace of mind if decontamination operations can't be done regularly."
>
> According to guidelines in a Ministry of Agriculture, Forestry and Fisheries study released on Sept. 30, removing fallen leaves and other natural forest debris from the area within about 20 meters of residential properties is effective in keeping contamination at bay. However, the guidelines also warn that "conifer needles also accumulate radioactive cesium over time, and can normally be expected to fall after three to four years," signaling a constant and long-term need to keep clearing properties of fallen needles. **(SAMA does not consider)**
>
> Furthermore, the problem of where to put all the contaminated material collected in the cleanups remains a serious headache.
>
> On top of concerns about the sheer volume of contaminated material and manpower, there is also the issue of the important natural roles played by forests, such as collecting water that eventually ends up as well water.
>
> The village plans to decontaminate all the forest under its jurisdiction over the next 20 years, but "the village needs the forests to guarantee its source of fresh water," the decontamination project official said. "Is there no way to do decontamination while at the same time preserving the functions of the forest, without cutting down the trees?" **(Seabrook's LRA, F.4.2 implies 10 years for remediation/cleanup)**

Burning the contaminated materials, as we have seen in Japan, simply results in contaminating other areas and does not solve the waste problem due to the huge amount of "orphaned" radioactive ash.

Japan cities face growing radioactive ash, troubles ahead, Kiyoshi Takenaka, Reuters UK, October 17, 2011 reported that:

> Although the government aims to bring the Fukushima crisis under control by December, researchers say that problems arising from the radiation, scattered over mountains, rivers and residential areas, are set to persist for years.

"Residents say they are worried about their children's health and grandchildren's health. Faced with such pleas, we just cannot make a move," an Ohtawara city official said, explaining why the ash has not been taken to a nearby city dump.

Ohtawara has already cut the frequency of garbage collection by half to hold down the generation of radioactive ash, by-product of burning contaminated leaves and branches Nonetheless, fresh bags of radioactive ash will have to be left in empty outdoor space at the incineration facility with no proper shelter around them, the official said.

A draft plan by the Environment Ministry calls for the government to take responsibility for disposing of ash and sludge with radiation levels above 8,000 becquerels/kg, but a ministry official said nothing concrete has been decided.

Following hydrogen explosions at the Fukushima plant in March, rainfall has brought radiation down to the earth's surface.

In northern Japan, stored-up radioactive ash and dehydrated sludge from the sewage treatment process alone totalled 52,000 tonnes in mid-September, up 63 percent from levels at the end of July, data from the Transport Ministry showed.

The volume is still growing by about 360 tonnes a day.

The growing piles of radioactive ash are also causing financial headaches for local governments. "I doubt the problem will go away in a year or two. It takes 30 years for caesium 137 to decay by half. Each time it rains, caesium deposited in mountains will be washed down to where people live," Kobe University professor Tomoya Yamauchi said.

In the meantime absent an acceptable storage facility for the waste, public health and the environment are impacted that will result in increased offsite costs. The same would happen here. 013-14

Once again, there is no basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3)

d. Decontamination Methods Assumed in Model Ineffective – Costs Will Increase 013-15

The MACCS2 Decontamination Plan is described in part in the Code's Manual for MACCS2: Volume I, User's Guide (NUREG/CR-6613, Vol. 1) Prepared by D. Chanin and M.I.

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013-15 These comments express concerns that the decontamination methods assumed in the SAMA analysis are ineffective.

It is important to recognize that as an analysis performed to satisfy the requirements under the NEPA a SAMA analysis should not be based on either the best-case or the worst-case accident scenarios, but on mean accident consequence values, averaged over the many hypothetical severe accident scenarios. The SAMA analysis requires many individual inputs and as such it will always be possible to propose more conservative values which could result in greater estimated accident consequences. The question is not whether alternative inputs could be used but rather if the inputs in question were reasonable for use under the NEPA rule of reason.

A similar concern regarding the adequacy of the decontamination cost estimates used in the SAMA analysis was raised in a contention filed by the State of New York in the license renewal adjudicatory proceedings for Indian Point. The contention includes the criticisms mentioned by the commenter and was admitted for litigation by the ASLB. After evaluating the testimony of technical experts the ASLB concluded that the preponderance of evidence submitted supported the conclusion that the Indian Point SAMA analysis was a reasonable assessment under NEPA standards. Additional discussion of the decontamination cost estimates and their impact on the SAMA analysis has been provided in Chapter 5 and Appendix F of the SEIS.

It should be noted that the NRC is continuously evaluating the inputs used in the MACCS2 code, and is in the process of updating some of the values used in cost-benefit analysis.

Young, May 1998. Section 7.5 Decontamination Plan describes some of its cleanup assumptions. It says at 7-10 that, 013-15

> Many decontamination processes (e.g., plowing, fire hosing) reduce groundshine and resuspension doses by washing surface contamination down into the ground. Since these processes may not move contamination out of the root zone, the WASH-1400 based economic cost model of MACCS2 assumes that farmland decontamination reduces direct exposure doses to farmers without reducing uptake of radioactivity by root systems. Thus decontamination of farmland does not reduce the ingestion doses produced by the consumption of crops that are contaminated by root uptake. (Emphasis added)

The Japanese are using **hosing and plowing under fields** and demonstrate that this assumed method of cleanup, there and here, is not effective. Hosing and plowing do not remove the contamination; instead, it simply moves it to another place, such as the groundwater, to reappear at a later date and require more monies to either start again or bare the cost of writing off the area permanently.

True radiation decontamination still a long way away, Mainichi October 7, 2011

> The three main decontamination methods that have been highly publicized through media reports are: the stripping away of surface soil from school playgrounds and athletic fields, the removal of mud accumulated in gutters, and the washing of roofs using high-pressure water cleaners. While the first method is considered effective, the remaining two have been found to be effective only to a certain point, and some especially warn against overestimating the effects of high-pressure water cleaners.
>
> "It might make you feel like you're decontaminating, but there's a limit to the amount of radioactive cesium that's caked onto roofs that can be eliminated with high-pressure water cleaners," says Kunihiro Yamada, a professor of environmental science at Kyoto Seika University. "The water cleaners wash surface dirt off, but then that tainted water goes into sewers and can contaminate rivers, thereby affecting farm goods and seafood. If people in highly populated areas were to begin using water cleaners, we may end up finding people forcing tainted water onto each other."
>
> According to Yamada, ("Radiation Contamination and Recovery Project" with colleagues from Fukushima University and Osaka University) radioactive cesium is believed to exist in three states: dissolved in water, loosely bonded to organic materials such as moss and leaves, or tightly bonded to rock such as silicate salt. In other words, if soil is removed and washed away with high-pressure water cleaners, radioactive cesium found in surface soil and gutters can be eliminated. The cesium that has become affixed to roofs remains, however.
>
> "Apparently the roof had been cleaned using high-pressure water cleaners, but that was as low as the radiation levels got," says Yamauchi. "To bring the roof's radiation levels down, there's probably no other way but to replace the roof. First and foremost, we must aim to bring indoor radiation levels to 0.05 microsieverts, which they were before the disaster unfolded, and thereby creating safety zones."

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According to Yamauchi, just like what has happened with roofs, radioactive cesium has become stuck to asphalt on the road, concrete utters and cobblestones, and high-pressure water cleaners can only do so much.

At a lecture held at the Japan National Press Club in Tokyo on Sept. 30, Kodama explained that radiation decontamination referred to isolation of radioactive materials in the environment to await its radioactive decay, and that the "radiation decontamination" that he had thus far conducted at kindergartens and other facilities in the Fukushima Prefecture city of Minamisoma were not enough. "The decontamination I've done is a type of emergency measure to protect children and pregnant women, and not true decontamination." He continued: "Permanent decontamination requires the knowledge and technology of experts and corporations, and a massive amount of funds. It must not become an interest-driven public project."

"What residents want is not half the exposure to radiation," says Yamada. "What they want is for a return to levels that allow them to live with peace of mind. Massive amounts of radioactive materials have been spread across wide areas in the ongoing disaster, so we can't count on the weathering effect. There's also the possibility that radiation will not only spread, but will start to accumulate in large concentrations in certain places. The half life of cesium 137 is approximately 30 years, but that of cesium 134 is 2 years. What the government has said is the equivalent of saying that they won't engage in full-fledged decontamination activities."

With challenges such as the designation of temporary radioactive waste dumps and interim storage facilities yet unsolved, the road to true decontamination remains a long one gage in full-fledged decontamination activities."

Why did the MACCS2 code, NRC Staff, NextEra and Japanese authorities assume hosing and plowing under fields was cleanup? Again, there is no basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3) 013-15

The MACCS2 economic cost model, is based on WASH-1400; WASH-1400, in turn, was based on clean up after a nuclear explosion. However, cleanup after a nuclear bomb explosion is not comparable to clean up after a nuclear reactor accident and assuming so will underestimate cost. Nuclear explosions result in larger-sized radionuclide particles; reactor accidents release small sized particles. Decontamination is far less effective, or even possible, for small particle sizes. Nuclear reactor releases range in size from a fraction of a micron to a couple of microns; whereas nuclear bomb explosions fallout is much larger- particles that are ten to

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hundreds of microns. These small nuclear reactor releases get wedged into small cracks and crevices of buildings making clean up extremely difficult or impossible. 013-15

WASH-1400's referenced nuclear weapon clean up experiments involved cleaning up fallout involving large mass loading where the there was a small amount of radioactive material in a large mass of dirt and demolished material. Only the bottom layer will be in contact with the soil and the massive amount of debris can be swept up with brooms or vacuums resulting in a relatively effective, quick and cheap cleanup that would not be the case with a nuclear reactors fine particulate. The Japanese have learned the hard way that it is not possible to get the contaminants out of crevices and off roofs and roads, as those in Chernobyl before had discovered.

Third a weapon explosion results in non-penetrating radiation so that workers only require basic respiration and skin protection. This allows for cleaning up soon after the event. In contrast a reactor release involves gamma radiation and there is no gear to protect workers from gamma radiation. Therefore cleanup cannot be expedited, unless workers health shamefully and unethically is ignored. Decontamination is less effective with the passage of time.

e. <u>Topography- Areas Unlikely to be Decontaminated- Ignored</u>

Lessons learned from Fukushima show that forests and shorelines, for example, cannot realistically be cleaned up and decontaminated. The area within 50-miles of Seabrook Station is mountainous, hilly, and encompasses large and small waterways, miles of beaches, wetlands, forests and park land. If properly considered offsite costs will escalate. **Again, there is no basis for the Staff's assurance** that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3) 013-15

Forests: Institute probing radioactive contamination of Fukushima forests. Japan Times, Sep. 17, 2011

> In August, the government acknowledged difficulties in removing soil and ground cover from the forests, due mostly to the volume of radioactive waste that would be generated by the effort.
>
> "Huge volumes of soil and other (contaminated) items would be involved because the forests occupy a huge area."
>
> The government effectively shelved any approach to decontaminating forests when it said that removing both the contaminated soil and compost materials would strip the forests of important ecological functions, including water retention.

Ocean: Lessons learned from Fukushima shows that it is necessary to understand the ocean currents to determine whether or not the contamination will linger for years contaminating and re-contaminating beaches and marine life increasing costs from a continuous need to cleanup and pay for damages to the environment.[13] (Discussed above, page 9)

Urban areas: Fukushima also shows that urban areas will be considerably more expensive and time consuming to decontaminate and clean than rural areas. The LRA clearly shows urban areas within 50-miles likely to be contaminated in a release of long duration.

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[13] Fukushima's radioactive sea contamination lingers, Andy Coghlan, New Scientist, Sept 30, 2011; Radioactive cesium may be brought back by Ocean in 20-30 years, Tokyo Times, 09.16.11; *Radioactive plankton found near Fukushima plant*, Mark Willacy, ABC News, October 13, 2011

5. Costs Severe Accident Will Be Huge- What Federal Agency will be in Charge and Will Pay?

No third party (NRC, EPA, or FEMA) has clear authority to cleanup offsite after a severe accident at Seabrook; Cleanup Standards are not determined; and no funding source for cleanup is identified. 013-16

On November 10, 2010, Inside EPA released a report (published by Inside Washington, Inside EPA/s Superfund Report), *Agencies Struggle to Craft Offsite Cleanup Plan for Nuclear Power Accidents*, by Douglas Guarino, Associate Editor. The report, along with its supporting FOIAs, is available on line.[14] If there is no federal authority in charge cleanup will take longer and the longer it takes the more expensive the process will be and the less likely cleanup will occur. Also if EPA is in charge state and local governments and the public are required to be allowed to participate in decision-making. This will increase costs. The impact of no agreed upon cleanup standard is discussed above. No funding source for cleanup has obvious implications for the nation's economy as a whole. None of these issues are addressed by Staff.

Fukushima has the exact same issues and underscores that until these issues are resolved – who is in charge, who pays, and what are the cleanup standards- cleanup will be delayed and result in higher consequences and costs. Consequences and offsite costs are related to time. The following articles make this plain.

[14] http://environmentalnewsstand.com/Environmental-NewsStand-General/Public-Content/agencies-struggle-to-craft-offsite-cleanup-plan-for-nuclear-power-accidents/menu-id-608.html

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013-16 This comment expresses concern about what Federal agency would be in charge postaccident and who will pay for the cleanup.

This comment questions who will lead and who will fund the cleanup at a nuclear power plant in the event of an accident with significant amounts of radioactive material released offsite. With regards to the finding, funding to clean up after a major release of radioactivity would be as established by the Price-Anderson Act which became law on September 2, 1957. The Price-Anderson Act covers liability claims of members of the public for personal injury and property damage caused by a nuclear accident at a commercial nuclear power plant. The liability limit for a nuclear accident has increased over time to an insurance pool of more than $12 billion. Owners of nuclear power plants pay an annual premium of $375 million in private insurance for offsite liability coverage for each reactor site. If the cost of cleanup of the accident exceeds the $375 million, then each utility would be assessed a prorated share of the excess amount, up to $121 million per reactor. After this money is depleted, then Congress will determine whether additional disaster relief is required. NRC regulations (10 CFR 50.54(w)) require licensees to maintain a minimum of $1.06 billion in onsite property insurance at each reactor site. This requirement was added after the accident at Three Mile Island to ensure that licensees would be able to cover cleanup costs resulting from a nuclear accident.

With regards to who leads the federal response, President Obama signed Presidential Policy Directive (PPD)-8: National Preparedness in March 2011 to enhance the Nation's ability to prepare for and respond to the threats that pose the greatest danger to the United States. PPD-8 required the development of a National Planning System that integrates planning across all levels of government and with the private and non-profit sector to provide an agile and flexible approach to prevent, protect, mitigate, respond, and recover from threats that pose the greatest risk to the Nation, including severe accidents at nuclear power facilities. National Planning Frameworks that describe the key roles and responsibilities for delivering the capability to prevent, protect, mitigate, respond, and recover from serious threats are part of the National Planning System.

Tokyo Times **- TEPCO will need 1 trillion yen from the govt for compensation of disaster victims Oct 23, 2011 explained the current estimate- 4.5 trillion yen.**

> Tokyo Electric Power Co. intends to ask the government a sum of 1 trillion yen (US Dollars $13,027,611,657) to help in the immediate compensation of victims of the nuclear disaster in the Fukushima Daiichi power plant.
>
> The amount will cover compensation for mental sufferings of victims as a result of evacuation and to pay for the losses incurred by small businesses following the nuclear disaster.
>
> It is estimated that compensation for victims would cost TEPCO around 4.5 trillion yen in a two-year period. The 1 trillion yen sought from the government would cover the amount of compensation for victims for this fiscal year.

In the article, U.S. ill-equipped to deal with Japan-like nuclear meltdown, Eliot Caroom, Star-Ledger, September 201, 2011 quoting Howard Kunreuther, a Univ Pennsylvania Wharton School Professor, said:

> The disaster in Fukushima has laid bare one truth on which experts and officials from the Nuclear Regulatory Commission agree: A disaster here would result in losses requiring the government to make payouts of epic proportions.
>
> That's because ... the U.S. nuclear insurance fund, established by a 1957 law called the Price-Anderson Act, only has around $12.6 billion in reserve.
>
> "If you have an accident or something like Fukushima, then Price-Anderson can't handle those kinds of losses," said Wharton School professor Howard Kunreuther, who specializes in public policy.
>
> Even though U.S. plants aren't threatened by tsunamis like Japan's, they can still be damaged by hurricanes, terrorist attacks or earthquakes.
>
> The Associated Press reported this month that although the risk of an earthquake causing an accident at a U.S. nuclear plant is small, it's far greater than previously thought — 24 times as high in one case. Last week, staff at the NRC recommended nuclear power plant owners immediately re-evaluate earthquake and flooding hazards at their plants, following the advice of a task force created after Fukushima.
>
> If a catastrophe did strike and a nuclear accident rose to the level of Fukushima, who would pay the tab?The insurance mandated by the Price-Anderson act has more than $12 billion in it, an amount that has been raised over the years since the law was implemented in 1957.
>
> "If you broke down what the damage was, the cost of Fukushima, business interruption, supply chain problems, my guess is the (United States) government would not step in on any of that," said Kunreuther. "At the end of the day, there may very well be lawsuits or some kind of settlements with respect to what the government would have to do or the utilities would have to do."

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013-16 cont'd The National Recovery Framework (NRF) is the guide to how the Nation responds to all types of disasters and emergencies. The NRF uses the concepts identified in the National Incident Management System (NIMS) to align key roles and responsibilities. NIMS is a guide for how departments and agencies at all levels of government, nongovernmental organizations, and the private sector work together to manage incidents. In July 2015, the State of South Carolina is sponsoring the Southern Exposure 2015 Exercise which is designed to test and analyze the ability of State, Federal, and local governments, to respond to and recover from an emergency at a nuclear power plant. The Southern Exposure 2015 Exercise will coincide with the H.B. Robinson Nuclear Power Plant's biennial emergency preparedness exercise. The State of South Carolina, with a number of local governments and Federal agencies, such as NRC, U.S. Department of Energy, Federal Emergency Management Agency, and U.S. Department of Agriculture, will work together during a radiological release incident and afterwards during recovery activities.

The Nuclear/Radiological Incident Annex (NRIA) to the NRF describes the policies, situations, concepts of operations, and responsibilities of the Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving release of radioactive materials to address the consequences of the event. The purpose of this annex is to:

- Define the roles and responsibilities of Federal agencies in responding to the unique characteristics of different categories of nuclear/radiological incidents.
- Discuss the specific authorities, capabilities, and assets the Federal Government has for responding to nuclear/radiological incidents that are not otherwise described in the NRF.
- Discuss the integration of the concept of operations with other elements of the NRF, including the unique organization, notification, and activation processes and specialized incident-related actions.
- Provide guidelines for notification, coordination, and leadership of Federal activities.

Inside EPA's, referenced above, FOIA document NRC-FEMA-EPA White paper: Potential Authorities and/or Funding Sources for Off-site Cleanup Following a Nuclear Power Plant Accident, July 27, 2010, Pg., 6

013-16

> Findings:
>
> Potential Authorities and/or Funding Sources for Off-Site Cleanup Following a Nuclear Power Plant Incident
>
> - *Price-Anderson Act:*
>   - ANI does not cover environmental cleanup costs under their primary insurance policy. It is anticipated that the secondary insurance policy will behave in a similar manner.

Again, there is no basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3)

IV. ADDITIONAL DEFICIENCIES IGNORED BY NRC STAFF THAT MINIMIZED OFFSITE COSTS

The SAMA analysis for Seabrook minimized the potential amount of radioactive releases in a potential severe accident at Seabrook Station in additional ways, many underscored by Fukushima. They include the following and were not properly considered in the draft SEIS. Before finalizing the SEIS we respectfully request that Staff consider the following; if the Staff disputes the points raised we ask that a written response is provided that includes the bases for the dispute inclusive of all references and studies for independent verification.

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013-16 cont'd Because there are several categories of potential incidents and impacted entities, this annex identifies different Federal agencies as "coordinating agencies" and "cooperating agencies" and associated strategic concepts of operations based on the authorities, responsibilities, and capabilities of those departments or agencies. In addition, this annex describes how other Federal departments and agencies support the Department of Homeland Security (DHS) when DHS leads a large-scale multiagency Federal response.

Regarding cleanup standards, the EPA developed a manual entitled, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (EPA-400-R-92-001, May 1992) to assist public officials in planning for emergency response to radiological incidents. This Manual provides radiological protection criteria for application to all incidents that would require consideration of protective actions, with the exception of nuclear war. In March 2013 the EPA issued a draft update of this manual for public comment.

The EPA suggested levels for reentry following a radiological accident are 2,000 mrem (20 mSv) projected for the first year, and 500 mrem (5 mSv) per year projected in subsequent years. In this phase, scientists would run dose calculations using computer models such as RESRAD which is designed to estimate radiation doses and risks from residual radioactive materials. RESRAD and similar models allow users to choose sensitive age groups, or to enter more restrictive limits, if desired. Local decision makers can adapt the EPA guides with incident-specific considerations and implement variations as needed.

This comment provided no new information and, therefore, no changes were made to the SEIS.

A. Source Term

The source terms used by NextEra to estimate the consequences of severe accidents (radionuclide release fractions generated by the Modular Accident Analysis Progression, MAAP[15]) code, has not been validated by NRC. They are consistently smaller for key radionuclides than the release fractions specified in NUREG-1465 and its recent revision for high-burnup fuel. The source term used results in lower consequences than would be obtained from NUREG-1465 release fractions and release durations.

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It has been previously observed that MAAP generates lower release fractions than those derived and used by NRC in studies such as NUREG-1150. A Brookhaven National Laboratory study that independently analyzed the costs and benefits of one SAMA in the license renewal application for the Catawba and McGuire plants noted that the collective dose results reported by the applicant for early failures.

> …seemed less by a factor between 3 and 4 than those found for NUREG-1150 early failures for comparable scenarios. The difference in health risk was then traced to differences between [the applicant's definitions of the early failure release classes] and the release classes from NUREG-1150 for comparable scenarios … the NUREG-1150 release fractions for the important radionuclides are about a factor of 4 higher than the ones used in the Duke PRA. The Duke results were obtained using the Modular Accident Analysis Package (MAAP) code, while the NUREG-1150 results were obtained with the Source Term Code Package [NRC's state-of-the-art methodology for source term analysis at the time of NUREG-1150] and MELCOR. Apparently the differences in the release fractions … are primarily attributable to the use of the different codes in the two analyses.[16]

Thus the use of source terms generated by MAAP, a proprietary industry code that has not been independently validated by NRC, appears to lead to anomalously low consequences when compared to source terms generated by NRC staff. In fact, NRC has been aware of this

[15] See, for example, ER. E. F-32, F-45-48

[16] J. Lehner et al., "Benefit Cost Analysis of Enhancing Combustible Gas Control Availability at Ice Condenser and Mark III Containment Plants," Final Letter Report, Brookhaven National Laboratory, Upton, NY, December 23, 2002, p. 17. ADAMS Accession Number ML031700011.

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013-17 This comment generally expresses concern regarding the accuracy of the source terms and release fractions generated with the MAAP code that is used by the applicant for SAMA analysis.

There is a fundamental error issue in comparing NUREG-1465 release fractions to those calculated by MAAP for SAMA analyses. The source terms identified in NUREG-1465 are releases to the containment while the source terms identified in NextEra's SAMA are releases to the environment. Substantial amounts of the radionuclides released from a reactor during a severe accident would be expected to be captured and confined within the containment structure that is designed to isolate the reactor from the environment. Current severe accident codes such as MAAP and MELCOR account for these mechanisms.

The source terms described in NUREG-1465 were developed primarily to support reactor siting criteria wherein substantial meltdown into containment is postulated and the containment is assumed to leak at its maximum allowable leak rate. These source terms do not account for fission product removal, such as would occur if the release were into the containment. As such, use of the source terms proposed by the commenter represents an essentially bounding estimate of releases to the environment. Use of bounding assumptions is inconsistent with Commission policy on the use of PRA evaluations in support of regulatory decisions which states that such PRAs should be as realistic as practicable.

Regarding comparing NUREG-1150 (December 1990) release fractions to those calculated by MAAP for SAMA analyses, it should be noted that more recent severe accident analyses, such as the "State-of-the-Art Reactor Consequence Analyses Project," (SOARCA), documented in NUREG-1935 (June 2012) and NUREG/CR-7110 (May 2013), indicate that for the accident scenarios analyzed the magnitude of the radionuclide releases, especially with respect to the key radioisotopic (iodine and cesium) groups, is much smaller than estimated in prior studies.

The subject of this comment, accuracy of the source terms, was addressed in Contention 4B which was dismissed by the Board in a summary disposition on August 12, 2013.

The comment provides no new and significant information; therefore no changes were made in the SEIS in response to this comment.

discrepancy for at least two decades. In the draft "Reactor Risk Reference Document" (NUREG-1150, Vol. 1), NRC noted that for the Zion plant (a four-loop PWR), that "comparisons made between the Source Term Code Package results and MAAP results indicated that the MAAP estimates for environmental release fractions were significantly smaller. It is very difficult to determine the precise source of the differences observed, however, without performing controlled comparisons for identical boundary conditions and input data."[17] We are unaware of NRC having performed such comparisons. 013-17

The NUREG-1465 source term was also reviewed by an expert panel in 2002, which concluded that it was "generally applicable for high-burnup fuel."[18] This and other insights by the panel on the NUREG-1465 source term are being used by the NRC in "radiological consequence assessments for the ongoing analysis of nuclear power plant vulnerabilities."[19]

In light of this, it is clear that Next Era should not have used a MAAP-generated source terms in its SAMA analysis. It minimized consequences. NRC Staff is silent on this source of minimization and we request a response justifying their apparent approval of NextEra's choice of the MAAP code that has not been validated by NRC.

B. Meteorology

1. Straight-Line Gaussian Plume Model Used by NextEra is Deficient

Introduction

[17] U.S. NRC, "Reactor Risk Reference Document: Main Report, Draft for Comment," NUREG-1150, Volume 1, February 1987, p. 5-14.
[18] J. Schaperow, U.S. NRC, memorandum to F. Eltawila, "Radiological Source Terms for High-Burnup and MOX Fuels," December 13, 2002.
[19] J. Schaperow (2002), op cit.

The straight- line Gaussian plume model does not subsume all reasonably possible 013-11 meteorologic patterns, and is not appropriate for Seabrook's coastal location. It did not predict site-specific atmospheric dispersion. The MACCS2 code used by NextEra could not model many *site-specific* conditions and did not determine economic costs for Seabrook's affected area that includes within its 50-mile radius densely populated areas. Appendix E (2.2) says that, "There are two metropolitan areas within 50 miles of the site; Manchester, New Hampshire (31 miles west-northwest), and Boston, Massachusetts (41 miles south-southwest)."

The Gaussian plume model assumes that a released radioactive plume travels in a steady-state straight-line, i.e., the plume functions much like a beam from a flashlight. The MACCS2 code used by NextEra was based upon this straight-line, steady-state model; it also assumed meteorological conditions that are steady in time and uniform spatially across the study region. However, the assumption of a steady-state, straight-line plume are inappropriate when complex inhomogeneous wind flow patterns happen to be prevailing in the affected region. The meteorological inputs that NextEra's Gaussian plume model ignored or minimized by use of the mean include the variability of winds, sea breeze effects, the behavior of plumes over water, and re-suspension of contaminants.

Another significant defect in NextEra's model - its meteorological inputs (e.g., wind speed, wind direction, atmospheric stability and mixing heights) into the MACCS2 are based on data collected by Applicant at a single, on-site anemometer and that the data is from only one year.

2. Deficiencies of NextEra's Use of a Straight-Line Gaussian Plume Model to Characterize Consequences in Seabrook's SAMA analysis

NextEra's straight-line, steady-state Gaussian plume model does not allow consideration for the fact that the winds for a given time period may be spatially varying, and it ignores the presence of sea breeze circulations which dramatically alter air flow patterns. Because of these failings the straight-line Gaussian plume model is not appropriate for Seabrook's coastal location. The nearby presence of the ocean greatly affects atmospheric dispersion processes and is of great importance to estimating the consequences in terms of human lives and health effects of any radioactive releases from the facility, and that the transport, diffusion, and deposition of airborne species emitted along a shoreline can be influenced by mesoscale atmospheric motions. These cannot be adequately simulated using a Gaussian plume model. 013-11

3. Sea breeze effect

The sea breeze effect, ignored by NextEra's model, is a critical feature to consider at Seabrook's coastal location. The sea breeze circulation is well documented (Slade, 1968, Houghton, 1985, Watts, 1994, Simpson, 1994).... [T]he presence of a sea breeze circulation changes the wind directions, wind speeds and turbulence intensities both spatially and temporally through out its entire area of influence. The classic reference *Meteorology and Atomic Energy*, (Section 2-3.5) (Slade, 1968) succinctly comments on the importance of sea breeze circulations as "The sea breeze is important to diffusion studies at seaside locations because of the associated changes in atmospheric stability, turbulence and transport patterns. Moreover its almost daily occurrence at many seaside locations during the warmer seasons results in significant differences in diffusion climatology over rather short distances. Further "[t]The atmospheric model included in the [MACCS2] code does not model the impact of terrain effects on atmospheric dispersion." 1997 User Guide for MACCS2. 013-12

Regarding sea breeze it is clear that:

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- The meteorological data collected at the Seabrook site would not reflect the occurrence of the sea breeze in terms of wind speeds and direction is not necessarily true.
- A measurement at a single station tower will not provide sufficient information to allow one to project how an accidental release of a hazardous material would travel. Measurement data from one station will definitely not suffice to define the sea breeze.
- The sea breeze is not beneficial in dispersing the plume and in decreasing doses. In fact, the development of sea breeze flow that would transfer a release inland is the greatest danger. If the same meteorological conditions (strong solar insolation, low synoptic-scale winds) that are conducive to the formation of sea breezes at a coastal site occurred at a non coastal location, the resulting vertical thermals developing over a pollution source would carry contaminants aloft. In contrast, at a coastal site, the sea breeze would draw contaminants across the land and inland subjecting the population to potentially larger doses.

4. Behavior of Plumes over Water

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NextEra's Gaussian plume model assumed that plumes blowing out to sea would have no impact. A plume over water, rather than being rapidly dispersed, will remain tightly concentrated due to the lack of turbulence. The marine atmospheric boundary layer provides for efficient transport. Because of the relatively cold water, offshore transport occurs in stable layers. Wayne Angevine's (NOAA) research of the transport of pollutants on New England's coast concluded that major pollution episodes along the coast are caused by efficient transport of pollutants from distant sources. "The transport is efficient because the stable marine boundary layer allows the polluted air masses or plumes to travel long distances with little dilution or

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chemical modification. The sea-breeze or diurnal modulation of the wind, and thermally driven convergence along the coast, modify the transport trajectories." Therefore a plume will remain concentrated until winds blow it onto land. [Zager et al.; Angevine et al. 2006[20]). This can lead to hot spots of radioactivity in places along the coast. An alternative model that NextEra did not use, CALPUFF, could provide the ability to account for reduced turbulence over water and could be used for sensitivity studies. 013-11

5. Storms

The storm cycle consists generally of northeasters in the winter and spring and hurricanes sometimes occur in the late summer and fall. The accompanying strong and variable winds would carry a plume to a considerable distance. The storm cycle is projected to increase in frequency and in severity over the license renewal period - note noted by the Staff. 013-12

6. Geographical Variations, Terrain Effects, and Distance

The topography of a coastal environment plays an important role in the sea breeze circulation, and can alter the typical flow pattern expected from a typical sea breeze along the coastline. But "[t]The atmospheric model included in the [MACCS2] code does not model the impact of terrain effects on atmospheric dispersion." [1997 User Guide for MACCS2.] 013-11

The Gaussian plume model also does not take terrain effects, which have a highly complex impact on wind field patterns and plume dispersion, into account. Wind blowing inland will experience the frictional effects of the surface which decrease speed and direction. EPA has recognized that "geographical variations can generate local winds and circulations, and modify

[20] Angevine, Wayne; Tjernstrom, Michael; Žagar, Mark, Modeling of the Coastal Boundary Layer and Pollutant Transport in New England, Journal of Applied Meteorology and Climatology 2006; 45: 137-154

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the prevailing ambient winds and circulations" and that "*assumptions of steady-state straight-line transport both in time and space are inappropriate.*" [EPA Guidelines on Air Quality Models (Federal Register Nov. 9, 2005, Section 7.2.8, Inhomogeneous Local Winds, italics added EPA's November 9, 2005 modeling Guideline (Appendix A to Appendix W) lists EPA's "preferred model;" the Gaussian plume model used by NextEra (ATMOS) is not on the list. EPA recommends that CALPUFF, a non-straight-line model, be used for dispersion beyond 50 Km.[21]

The essential difference between the models that EPA recommends for dispersion studies and the two-generation-old Gaussian plume model (ATMOS) used by NextEra and the NRC is more than determining where a plume will likely to go. Major improvements in the simulation of vertical dispersion rates have been made in the EPA models by recognizing the importance of surface conditions on turbulence rates as a function of height above the ground (or ocean) surfaces. We know that turbulence rates and wind speeds vary greatly as a function of height above a surface depending upon whether the surface is rough or smooth (trees versus over water transport) (Roughness), how effectively the surface reflects or absorbs incoming solar radiation (Albedo) and the degree that the surface converts latent energy in moisture into thermal energy (Bowen ratio). These parameters are included in the AERMOD and CALPUFF models and determine the structure of the temperature, wind speed and turbulent mixing rate profiles as a function of height above the ground. NextEra's ATMOS model does not include these parameters. This is an especially important deficiency when modeling facilities located along coastlines, such as Seabrook.

[21] Appendix A to Appendix W to 40 CFR Part 51, EPA Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, November 9, 2005. http://www.epa.gov/ scram001/guidance/guide/appw_05.pdf.

7. NextEra's Inputs to the MACCS2 Code Are Deficient and Did Not Account for Site-Specific Conditions

a. Meteorological Inputs

One fundamental defect in NextEra's use of the MACCS2 code is that its meteorological inputs to that code are all based on the straight-line Gaussian plume model. This model does not allow consideration of the fact that the winds for a given time period may be spatially varying. The 1997 User Guide for MACCS2, SAND 97-0594[22] makes the point: "The atmospheric model included in the code does not model the impact of terrain effects on atmospheric dispersion." 013-11

Indeed, the MACCS2 Guidance Report, June 2004,[23] is even clearer that NextEra's inputs to the code do not account for variations resulting from *site-specific* conditions such as those present at Seabrook. (1)The "code does not model dispersion close to the source (less than 100 meters from the source)," thereby ignoring resuspension of contamination blowing offsite. (2) The code "should be applied with caution at distances greater than ten to fifteen miles, especially if meteorological conditions are likely to be different from those at the source of release." There are large potentially affected population concentrations more than 10-15 miles from Seabrook. (See LRA) (3) "Gaussian models are inherently flat-earth models, and perform best over regions where there is minimal variation in terrain." According to the Seabrook License Renewal Application, "The terrain varies from hilly to mountainous except along the coast." (ER. F, Section 2-10, pg., 2-70)

[22] Chanin, D.I., and M.L. Young, Code Manual for MACCS2:Volume 1, User's Guide, SAND97-0594 Sandia National Laboratories, Albuquerque, NM, (1997)
[23] MACCS2 Guidance Report June 2004 Final Report page 3-8:3.2 Phenomenological Regimes of Applicability

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A second defect in the Applicant's inputs into the MACCS2 code lies in the data itself. NextEra input meteorological data for only a single year and the data was collected from a *single, on-site* weather station.

One year of data would have been insufficient even if more than one station had been used. Seasonal wind distributions can vary greatly from one year to the next. "*The NRC staff considers 5 years of hourly observations to be representative of long-term trends at most sites,*" although "with sufficient justification [not presented by NextEra here] of its representativeness, the minimum meteorological data set is one complete year (including all four seasons) of hourly observations." (NRC Regulatory Guide 1.194, 2003)

The simple fact is that measurements from a single onsite anemometer will not provide sufficient information to project how an accidental release of a hazardous material would travel; certainly not for cases when the sea breeze was just developing and for cases when the onshore component winds do not reach entirely from the ground to the anemometer height. The occurrence of a sea breeze would not be identified. The anemometer would likely indicate an offshore wind indication. Further basing wind direction on the single on-site meteorological tower data ignores shifting wind patterns away from the Seabrook Plant including temporary stagnations, re-circulations, and wind flow reversals that produce a different plume trajectory. Since the 1970s, the USNRC has historically documented all the advanced modeling technique concepts and potential need for multiple meteorological towers especially in coastal regions. NRC Regulatory Guide 123 (Safety Guide 23) On Site Meteorological Programs 1972, states that, "at some sites, due to complex flow patterns in non-uniform terrain, additional wind and temperature instrumentation and more comprehensive programs may be necessary."[Ibid]; and an EPA 2000 report, Meteorological Monitoring Guidance for Regulatory Model Applications,

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EPA-454/R-99-005, February 2000, Sec 3.4 points to the *need for multiple inland meteorological monitoring sites*. See also Raynor, G.S.P. Michael, and S. SethuRaman, 1979, Recommendations for Meteorological Measurement Programs and Atmospheric Diffusion Prediction Methods for Use at Coastal Nuclear Reactor Sites. NUREG/CR-0936. 013-12

NextEra should have taken data from more locations over a longer period; and modified the MACCS2 code to account for the inability of the code that NextEra used to account for site-specific conditions. "The user has total control over the results that will be produced." [1997 User Guide, Section 6.10].

Finally, MACCS2 is not a state-of-the-art computer model. It does not rely upon or utilize current understandings of boundary layer meteorological parameterizations such as those adopted by the EPA in the models AERMOD OR CALPUFF (EPA, 2001). The Gaussian plume model employed in the Seabrook MACCS2 model may be the standard for NRC but it is not the basis for advanced modeling used by other US regulatory agencies. Computational time should not be a major factor in the choice of a dispersion model used for non-real time applications. The idea that randomly chosen meteorological conditions would give the same results as inputting meteorological conditions as a function of time is erroneous. To accommodate the real role of persistence in dispersion modeling EPA requires sequential modeling for all averaging times from 3 hour averages to annual averages. The fact that a model may seem to be conservative in particular applications or in limited data comparisons does not mean that the model is better or should be recommended. Models can be conservative but have incorrect simulations of the underlying physics. Sensitivity studies do not add useful information if the primary model is flawed.

b. The Affected Area

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NextEra's choice of a straight-line Gaussian plume rather than a variable trajectory model drastically reduced, to a wedge, the size of the area that might potentially be impacted by a release. NextEra's analyses also assumed a "small" accident that had no real impact beyond 10 miles. NextEra did not consider the potential of the by far largest, and perhaps also the most likely, potential radiological release – from the spent fuel pool. In addition, NextEra chose to use the MACCS2 Code that, *absent site specific modifications that NextEra chose not to make*, cannot provide credible cost estimates.

The use of a variable trajectory model, rather than the straight-line Gaussian plume, would have significantly increased the area potentially affected by a released radioactive plume, and thus would also greatly increase the size of the affected population and property, and the economic effect, beyond 10 miles. For example, NextEra's MACCS2 analysis does not assume an evacuation zone of greater than 10 miles. A second major defect in the MACCS2 inputs is that NextEra apparently assumed that the only source of radiation in the event of an accident would be from the reactor within the containment. The potentially far greater source of leaked radiation, the spent fuel pool, contains far more radioactive material. It was ignored.

Absent modifications to permit inputs that address the MACCS2 code limitations discussed above, the MACCS2 code used by NextEra is incapable of providing an accurate estimate of economic consequence.

8. NEPA's Rule of Reason

In another licensing decision, CLI-10-22, pg., 9, the Commission stated that NEPA requirements are "tempered by a practical rule of reason" and an environmental impact statement

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is not intended to be a "research document." If relevant or necessary meteorological data or modeling methodology prove to be unavailable, unreliable, inapplicable, or simply not adaptable for evaluating the SAMA analysis cost-benefit conclusions, there may be no way to assess, through mathematical or precise model-to model comparisons, how alternative meteorological models would change the SAMA analysis results." 013-11

The plume modeling advocated herein as appropriate for Seabrook's SAMA analysis, instead of NextEra's decision to use the straight line Gaussian model, are not techniques that require research. They are, in fact, established methods that are publically available, routinely used, and appropriate for quantifying atmospheric dispersion of contaminants. Although an effort may be required to adapt these methods for SAMA analyses, this would be very straightforward and research would not be required.

Appropriate meteorological data or modeling methodology is available. There is no shortage of appropriate meteorological data for a licensing model application. Alternative modeling methods that would use more extensive meteorological data are also available.

The applicant chose to use only one year of onsite data collected at the Seabrook's site. Meteorological data is also available from nearby airports and, importantly, processed data on a gridded basis can be obtained from NOAA to augment the onsite meteorological data relied upon for the SAMA analyses that have been provided by NextEra. For example, see Jennifer Thorpe[34] site-specific meteorological study. Also there are several publically available meteorological modeling methods that can simulate variable trajectory transport and dispersion

[34] Thorp, Jennifer E., Eastern Massachusetts Sea Breeze Study, Thesis Submitted to Plymouth State University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Applied Meteorology, May 2009, Appendix A

phenomena. MM5 is one which is routinely used nationally and internationally. There are other options as well. The present state of art of an appropriate meteorological model would use multi station meteorological measurement data as input to the meteorological model. The numerical computations, based upon numerical weather prediction techniques, would compute wind fields appropriate for modeling dispersion over a much larger geographic area than the a single measurement site would be appropriate for. 013-11

A second reasonableness criterion is that the modeling method must be reliable. The outputs from such meteorological models that are used to produce inputs for the dispersion models are well accepted and form the basis for the weather predictions provided by the national weather service as well as analyses of air pollution impacts of concern to regulatory agencies. These techniques have been proven to be reliable and acceptable for air quality permitting and policy applications in complex terrain and over large distances for the US EPA , the US Park Service as well as internationally. These techniques would be *more* reliable than using the straight line Gaussian model.

The third reasonableness criterion is that the modeling methods be applicable to SAMA analyses. The methods recommended herein are applicable because with straightforward modifications to incorporate nuclear radiation decay rates, they can produce the fields of concentration values and deposition rates needed for dosage calculations.

The fourth reasonableness criterion is that the modeling methodology be adaptable for evaluating SAMA analysis cost benefit conclusions. There is nothing inherent in variable trajectory models that would prohibit the output concentration and deposition fields from being applied to SAMA analyses.

None of the criteria cited would make the use of alternative models unreasonable to apply to the Seabrook's SAMA analyses. 013-11

Further there is no basis to the argument that there may be no way to assess through mathematical or precise model to model comparisons, how alternative meteorological models would change the SAMA analysis results. Some assessments may necessarily be qualitative, based simply upon expert opinion. But this argument seems to undercut the very value of mathematical simulation models in general as a method to assess the impacts of nuclear reactor emissions.

Last, the rationale offered that the use of advanced models would be computationally too expensive and/or burdensome to use are not justified by the actual run time shown in our review of MACCS2 output files. With modern computers, the use of inappropriate models on the basis of differences of computational costs is indefensible.

Invoking the "practical rule of reason" to the most appropriate modeling methodology for application to the Seabrook SAMA analyses would be blatantly dismissive of the concept that the present methods are inappropriate and outdated and that there are indeed alternative modeling available.

There is no basis for the Staff's assurance that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS." (Ibid, 5-3)

C. Averaging

NextEra fails to consider the uncertainties in its consequence calculation resulting from meteorological variations by only using mean values (LRA, Appendix E, 2.10) for population dose and offsite economic cost estimates. The Staff's SEIS analysis is inadequate in that it ignores (fails to justify and analyze the effect of) NextEra's choice of averaging in its SAMA. 013-12

Dr. Edwin S. Lyman, Senior Staff Scientist, Union of Concerned Scientists report commissioned by Riverkeeper, Inc., November 2007, A Critique of the Radiological Consequence Assessment Conducted in Support of the Indian Point Severe Accident Mitigation Alternatives Analysis[21] provides valuable lessons to apply to Seabrook's SAMA.

The consequence calculation, as carried out by the MACCS2 code, generates a series of results based on random sampling of a year's worth of weather data. The code provides a statistical distribution of the results. We find, based on calculations done at other reactors such as Indian Point, that the ratio of the 95th percentile to the mean of this distribution is typically a factor of 3 to 4 for outcomes such as early fatalities, latent cancer fatalities and off-site economic consequences.

NextEra admits (LRA, F.8.2- Uncertainty) that, ... the inputs to the PRA cannot be known with complete certainty, there is a possibility that the actual plant risk is greater than the mean values used in the evaluation of the SAMA described in the previous sections."

[21] Report available at NRC Electronic Library, Adams Accession Number ML073410093

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Kamiar Jamali[26] (*Use of risk in measures in design and licensing of future reactors,* Reliability Engineering and Safety System 95 (2010) 935-943 www.elsevier.com/locate/ress) makes the same observation. He says that,

> It is well- known that quantitative results of PRAs, in particular, are subject to various types of uncertainties. Examples of these uncertainties include probabilistic quantification of single and common cause hardware or software failures, occurrence of certain physical phenomena, human errors of omission or commission, magnitudes of source terms, radionuclide release and transport, atmospheric dispersion, biological effects of radiation, dose calculations, and many others. (935)."

Despite warning, NextEra describes an unconvincing sensitivity analysis (ER, F.8.2-Uncertainty) that they claim resolves the issue. They report, *absent any specifics* of the study, that "to consider the uncertainty, a sensitivity analysis was performed in which an uncertainty factor was applied to the frequencies calculated by the PRA and in subsequent upper bound (UB) benefits were calculated based upon the mean risk multiplied by the this uncertainty factor. The uncertainty factor applied to the ratio of the 95th percentile value of the CDF from the PRA uncertainty analysis to the mean value of the CDF. For Seabrook Station, the 95th percentile value of the CDF is 2.75 E-05/yr; therefore the uncertainty factor is 1.90." NextEra's approach at "proof" is not convincing.

Seabrook's SAMA cost-benefit evaluation should be based on the 95th percentile of the meteorological distribution to be consistent with the approach taken in the License Renewal GEIS, which refers repeatedly to the 95th percentile of the risk uncertainty distribution as an appropriate "upper confidence bound" in order not to "underestimate potential future

[26] Kamiar Jamali, DOE Project Manager for Code Manual for MACCS2: Vol. 1, User's Guide (NUREG/CR 6613/SAND 97-0594, Vol.1; DOE Project Manager for Code Manual for MACCS2: Vol. 2, Preprocessor Codes COMIDA A2, FGRDCF, DCF2 (NUREG/CR 6613/SAND 97-0594, Vol. 2); member of the working group for DOE Standard Guidance for Preparation DOE 5480.22(TSR) and DOE 5480.23 (SAR) Implementation Plans, November 1994.

environmental impacts."[27]

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Additional discussion of statistical analysis and its impact in provided above at 13. **Again, there is no basis for the Staff's assurance** in the draft SEIS that they "identified no new and significant information related to the postulated accidents of other available information. Therefore there are no impacts related to postulated accidents beyond those discussed in the GEIS" (Ibid, 5-3) because: Staff ignores the impact of NextEra's averaging choice, do not provide any justification for doing so, or justification of why the 95% would not be the appropriate choice, or show the difference using the 95% would make.

D. Economic Costs David Chanin author of the code's FORTRAN said, "If you want to discuss economic costs … the 'cost model' of MACCS2 is not worth anyone's time. My sincere advice is to not waste anyone's time (and money) in trying to make any sense of it." (and) "I have spent many many hours pondering how MACCS2 could be used to calculate economic costs and concluded it was impossible."

The ER is required to include "a consideration of alternatives to mitigate severe accidents (SAMA)." 10 CFR 51.53(c)(30(ii)(L) That analysis depends upon an accurate calculation of the cost of a severe accident in order to have a base line against which to measure proposed mitigation measures. NextEra, instead, severely minimized decontamination and clean-up costs, health costs (that includes inaccurately modeling evacuation time estimates), and minimized and ignored a myriad of other economic costs that belong in a SAMA analysis. NRC Staff's analysis appears to be unaware of these facts.

1. Decontamination/Cleanup Costs: Discussed in the foregoing at11-30.

[27] U.S. NRC, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, Vol. 1, May 1996, Section 5.3.3.2.1

2. Health Costs:

a. Value of Life: Health costs are an important part of economic consequences. NextEra's "life lost" value is much too low. U.S. agencies other than NRC place a value on human life of between $5 million and $ 9 million. NRC despite the Office of Management and Budget's warning that it would be difficult to justify a value below $5 million- has continued to value human life at $3 million since 1995.[28] There is no excuse for NRC Staff to allow this valuation for a LR extension 20 years hence. Bringing the valuation in line with other agencies today would have a major effect of justifying mitigations to reduce risk that now are considered too expensive in NextEra's underestimated SAMA.

b. The population dose conversion factor of $2000/person-rem used by NextEra to estimate the cost of the health effects generated by radiation exposure is based on a deeply flawed analysis and seriously underestimates the cost of the health consequences of severe accidents.

NextEra underestimates the population-dose related costs of a severe accident by relying inappropriately on a $2000/person-rem conversion factor. NextEra use of the conversion factor is inappropriate because it (i) does not take into account the significant loss of life associated with early fatalities from acute radiation exposure that could result from some of the severe accident scenarios included in NextEra's risk analysis; and (ii) underestimates the generation of stochastic health effects by failing to take into account the fact that some members of the public exposed to radiation after a severe accident will receive doses above the threshold level for application of a dose- and dose-rate reduction effectiveness factor (DDREF).

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[28] Appelbaum, B. 2011. A life's value: It may depend on the agency, NYT, Feb 17.

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013-18 This comment expresses concerns that the health costs used in the SAMA analysis are incorrect.

It is important to recognize that as an analysis performed to satisfy the requirements under the NEPA a SAMA analysis should not be based on either the best-case or the worst-case accident scenarios, but on mean accident consequence values, averaged over the many hypothetical severe accident scenarios. The SAMA analysis requires many individual inputs and as such it will always be possible to propose more conservative values which could result in greater estimated accident consequences. The question is not whether alternative inputs could be used but rather if the inputs in question were reasonable for use under the NEPA rule of reason. In addition, it should be noted that the NRC is continuously evaluating the inputs used in the MACCS2 code, and is in the process of updating some of the values used in cost-benefit analysis including the dollar cost per person rem discussed by the commenter.

013-18

The \$2000/person-rem conversion factor is intended to represent the cost associated with the harm caused by radiation exposure with respect to the causation of "stochastic health effects," that is, fatal cancers, nonfatal cancers, and hereditary effects.[29] The value was derived by NRC staff by dividing the Staff's estimate for the value of a statistical life, \$3 million (presumably in 1995 dollars, the year the analysis was published) by a risk coefficient for stochastic health effects from low-level radiation of 7×10^{-4}/person-rem, as recommended in Publication No. 60 of the International Commission on Radiological Protection (ICRP). (This risk coefficient includes nonfatal stochastic health effects in addition to fatal cancers.) But the use of this conversion factor in NextEra's SAMA analysis is inappropriate in two key respects. As a result NextEra underestimates the health-related costs associated with severe accidents.

First, the \$2000/person-rem conversion factor is specifically intended to represent only stochastic health effects (e.g. cancer), and not deterministic health effects "including early fatalities which could result from very high doses to particular individuals."[30] However, for some of the severe accident scenarios evaluated by NextEra at Seabrook, we estimate that large numbers of early fatalities could occur representing a significant fraction of the total number of projected fatalities, both early and latent. This is consistent with the findings of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437).[31] Therefore, it is inappropriate to use a conversion factor that does not include deterministic effects.

[29] U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy," NUREG-1530, 1995, p. 12
[30] U.S. NRC (1995), op cit., p. 1.
[31] U.S. NRC, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437, Vol. 1, May 1996, Table 5.3.

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013-18

According to NRC's guidance, "the NRC believes that regulatory issues involving deterministic effects and/or early fatalities would be very rare, and can be addressed on a case-specific basis, as the need arises."[32] Based on our estimate of the potential number of early fatalities resulting from a severe accident at Seabrook Station, this is certainly a case where this need exists.

Second, the $2000/person-rem factor, as derived by NRC, also underestimates the total cost of the latent cancer fatalities that would result from a given population dose because it assumes that all exposed persons receive dose commitments below the threshold at which the dose and dose-rate reduction factor (DDREF) (typically a factor of 2) should be applied. However, for certain severe accident scenarios at Seabrook evaluated by NextEra, we estimate that considerable numbers of people would receive doses high enough so that the DDREF should not be applied.[33] This means, essentially, that for those individuals, a one-rem dose would be worth "more" because it would be more effective at cancer induction than for individuals receiving doses below the threshold. To illustrate, if a group of 1000 people receive doses of 30 rem each over a short period of time (population dose 30,000 person-rem), 30 latent cancer fatalities would be expected, associated with a cost of $90 million, using NRC's estimate of $3 million per statistical life and a cancer risk coefficient of 1×10^{-3}/person-rem. If a group of 100,000 people received doses of 0.3 rem each (also a population dose of 30,000 person-rem), a DDREF of 2 would be applied, and only 15 latent cancer fatalities would be expected, at a cost of $45 million. Thus a single cost conversion factor, based on a DDREF of 2, is not appropriate when some members of an exposed population receive doses for which a DDREF would not be applied.

[32] U.S. NRC, "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy (1995), op cit., p. 13.
[33] The default value of the DDREF threshold is 20 rem in the MACCS2 code input

A better way to evaluate the cost equivalent of the health consequences resulting from a severe accident is simply to sum the total number of early fatalities and latent cancer fatalities, as computed by the MACCS2 code, and multiply by a readjusted value of life figure (> $3 million figure). Again, we do not believe it is reasonable to distinguish between the loss of a "statistical" life and the loss of a "deterministic" life when calculating the cost of health effects. 013-18

Another way to explain why NextEra's estimates of how many lives might be lost are too low is to look at the 1982 Sandia National Laboratory report, using 1970 census data, that estimated the number of cancer deaths at Seabrook in a severe accident to be 6,000; early fatalities 7,000; and early injuries 27,000. Peak fatalities were estimated by CRAC to occur within 20 miles of Seabrook; and peak injuries to occur with 65 miles of Seabrook from a core melt. (CRAC 2, Sandia, 1982[34]) The population of the affected area, no matter what model is used, has greatly increased during the intervening almost 40 years; SAMAs project forward to 2050 based on projected demographics. NextEra estimated the population within 50-miles (2050) to total 5185206. (LRA, Section F.3.4.1, Table F.3.4.1-1) Further CRAC was based on old, and now outdated, dose response models.

In the SAMA, cancer incidence was not considered; neither were the many other potential health effects from exposure in a severe radiological event (National Academy of Sciences, BEIR VII Report, 2005) and risk differentiated for women and children that BEIR VII reported were far more susceptible.

NextEra's cost-benefit analysis ignored a marked increase in the value of cancer mortality risk per unit of radiation at low doses (2-3 rem average), as shown by recent studies published on

[34] Calculation of Reactor Accident Consequences, U.S. Nuclear Power Plants (CRAC-2), Sandia National Laboratory, 1982

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013-18

radiation workers (Cardis et al. 2005[35]) and by the Techa River cohort (Krestina et al (2005[36]). Both studies give similar values for low dose, protracted exposure, namely (1) cancer death per Sievert (100 rem). According to the results of the study by Cardis et al. and use of the risk numbers derived from the Techa River cohort the SAMA analyses prepared for Seabrook needs to be redone. It seems clear that a number of additional SAMAs that were previously rejected by the applicant's methodology will now become cost effective.

Cancer incidence and the other many health effects from exposure to radiation in a severe radiological event (National Academy of Sciences, BEIR VII Report, 2005) must be considered; they were not. Neither did NextEra appear to consider indirect costs. Medical expenditures are only one component of the total economic burden of cancer. The indirect costs include losses in time and economic productivity and liability resulting from radiation health related illness and death.

Examination of NextEra's **Emergency Response analysis** (LRA, Appendix E, Section F.3.4.4), approved by the SEIS, shows that the Applicant's evacuation time input data into the code were unrealistically low and unsubstantiated; and that if correct evacuation times and assumptions regarding evacuation had been used, the analysis would show far fewer will evacuate in a timely manner, increasing health-related costs.

[35] Elizabeth Cardis, "Risk of cancer risk after low doses of ionising radiation: retrospective cohort study in 15 countries." *British Medical Journal* (2005) 331:77. Available on line at: http://www.bioone.org/doi/abs/10.1667/RR1443.1?cookieSet=1&prevSearch=

[36] Krestinina LY, Preston DL, Ostroumova EV, Degteva MO, Ron E, Vyushkova OV, et al. 2005.Protracted radiation exposure and cancer mortality in the Techa River cohort. Radiation Research 164(5):602-611. Available on line at: http://www.bioone.org/doi/abs/10.1667/RR3452.1

NextEra failed to reference specific KLD-type actual time estimates, instead references the "paper plan," Seabrook Station Radiological Emergency Response Plan, Rev. 56, July 2008. No indication is provided, for example, that the following site-specific variables that would slow response time were taken into consideration in the analysis: shadow evacuation; evacuation time estimates during inclement weather coinciding with high traffic periods such as commuter traffic, peak commute time, holidays, summer beach/holiday traffic; notification delay delays because notification is largely based on sirens that cannot be heard in doors above normal ambient noise with windows closed or air conditioning systems operating. 013-18

The Applicant (ER E., F-160) claims that they assumed no evacuation of the population in a seismically induced severe accident and found only a small increase to the overall total accident dose risk and no change in economic risk. We find that sensitivity studies do not add useful information if the primary model is flawed, as we have shown is true. Lessons learned from Fukushima add that the 10 mile EPZ, the distance that evacuation time estimates were measured, is not an adequate distance to assume health effects extend. *Panel proposes widening nuclear evacuation perimeter to 30 km* (18 miles), Mainichi News, October 20, 2011

3. A myriad of other economic costs were underestimated or totally ignored by the applicant that when added together would in all likelihood add up collectively to a significant amount. The NRC Staff's analysis in the Draft SEIS appears oblivious to these factors. 013-19

For example, NextEra did not appear to include in their economic cost estimates the business value of property and the incurred costs such as costs required from job retraining, unemployment payments, and inevitable litigation. They used an assumed value of non-farm

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013-19 This comment expresses concern that business value of properties and the incurred costs such as costs required from job retraining, unemployment payments, and inevitable litigation are not considered in the ER nor the SAMA.

It is important to recognize that as an analysis performed to satisfy the requirements under the NEPA, a SAMA analysis should not be based on either the best-case or the worst-case accident scenarios, but on mean accident consequence values, averaged over the many hypothetical severe accident scenarios. The SAMA analysis requires many individual inputs and as such, it will always be possible to propose more conservative values which could result in greater estimated accident consequences. The question is not whether alternative inputs could be used but rather if the inputs in question were reasonable for use under the NEPA rule of reason.

The SAMA analysis constitutes a systematic and comprehensive process for identifying potential plant improvements, evaluating the implementation costs and risk reduction for each SAMA, and determining which SAMAs may be cost beneficial to implement. The analysis is technically rigorous and consistent with the NEPA expectation that federal agencies take a "hard-look" at the environmental impacts of their proposed actions, including consideration of viable alternatives. The SAMA analysis can be viewed as a screening process to determine if a particular SAMA is potentially cost beneficial. In general the costs are underestimated and the benefits are overestimated which serves to flush out those SAMAs which have a potential for being cost beneficial. Further refinement beyond determining whether a SAMA is potentially cost beneficial is not necessary for an objective evaluation.

If a licensee chooses to perform a more detailed evaluation of a particular SAMA, the estimated costs would be expected to increase since the estimated costs in SAMA analyses typically do not include the cost of replacement power during implementation as well as the licensees' costs related to quality control, training, security, health physics coverage and radiological waste processing and storage. In addition, the calculated benefits in SAMA analyses include substantial uncertainty multipliers which increase the likelihood of a SAMA being found to be potentially cost beneficial and assume that the SAMA eliminates all risk associated with the proposed enhancement, which is an overestimation of the expected risk reduction.

013-19

wealth that appeared not justified by review of Banker and Tradesmen sales figures. NextEra appears to underestimate Farm Value, for example, by not considering the value of the farm property for development purposes as opposed to agricultural; and farm land assessments are intentionally very low to encourage farming and open space.

NextEra also appears to **ignore the indirect economic effects** or the "multiplier effects" from a delayed and incomplete cleanup. For example, depending on the business done inside the building contaminated, the regional and national economy could be negatively impacted. A resulting decrease in the area's real estate prices, tourism, and commercial transactions could have long-term negative effects on the region's economy.

For example since Fukushima some European countries have canceled orders for new nuclear reactors and decided to phase out of nuclear power completely – an indirect economic effect in NextEra's SAMA not modeled because it is outside the "50-mile area." Also reports in the Japanese press are replete with food products unsold, outside the 50-mile zone, simply for fear that they may be contaminated and distrust of Government reports. It is causing economic havoc to producers. For example: *Radiation Bankrupts Japanese Cattle Ranch With $5.6 Billion in Liabilities*, Bloomberg, 2001-08-15, reported that "Agura Bokujo, operator of a cattle ranch north of Tokyo, became Japan's biggest corporate failure this year after consumer fears over beef contaminated with radiation damaged sales, Tokyo Shoko Research said." Rice market turned upside down by radiation fears, Japan Times, Philip Brasor & Masako Tsubuku October 6, 2011 reported that, "Supposedly, the government checked much of the rice grown in the region when it was immature and decided it was safe, but a lot of people are far from being reassured by such announcements. Consequently, the market for rice has been knocked on its

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013-19 cont'd In the NextEra SAMA, these uncertainty multipliers amounted to an overall factor of 4.9 (2.1 for seismic uncertainty and 2.34 for overall uncertainty). Therefore, because SAMA implementation costs are typically underestimated and benefits are overestimated, the inclusion or exclusion of the indirect costs discussed by the commenter would not be expected to have a significant influence on the determination of potentially cost beneficial SAMA. Further if more detailed cost estimates were compared to a more realistic estimation of the actual benefits from implementation of a SAMA it is unlikely that the inclusion or exclusion of the indirect costs discussed by the commenter would have a significant influence on the determination of the whether a particular SAMA is actually cost beneficial.

head. New rice (preferred in Asia) from the Tohoku region, usually flying off shelves at this time of the year, is being avoided, while old rice from last year's stocks are in high demand." 013-19

V. CONCLUSION

A. MACCS2 Code

A fundamental problem with the SAMA missed by NRC Staff is that NextEra used the MELCOR Accident Consequence Code System (MACCS2) computer program.[37] There is no NRC regulation *requiring* the use of that code, or any other particular code. It was a choice by NextEra and the wrong choice, not appreciated by NRC Staff. The cost formula and assumptions contained in the MACCS2 underestimate the costs likely to be incurred as a result of a severe accident, most of which is explained above, and summarized below.

1. The code is not Quality Assured.[38] The MACCS & MACCS2 codes were developed for research purposes not licensing purposes – for that reason they were not held to the QA requirements of NQA-a (American Society of Mechanical Engineering, QA Program Requirements for Nuclear Facilities, 1994). Rather they were developed using following the less rigorous QA guidelines of ANSI/ANS 10.4. [American Nuclear Standards Institute and American Nuclear Society, *Guidelines for the Verification and Validation of Scientific and Engineering Codes for the Nuclear Industry*, ANSI/ANS 10.4, La Grange Park, IL (1987).
2. In addition to the meteorological inputs discussed above, important code input parameters include source, average (cumulative distribution function), probability, and a discount rate applied in CHRONC.

[37] ER.E E, Attachment F, F.3.4
[38] Chanin, D.I. (2005), "The Development of MACCS2: Lessons Learned," [written for:] *EFCOG Safety Analysis Annual Workshop Proceedings*, Santa Fe, NM, April 29–May 5, 2005. Full text: the development of maccs2.pdf (154 KB), revised 12/17/2009. http://chaninconsulting.com/index.php?resume. (Attachment 5, Exhibit 4)

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3. Source is chosen by NextEra and input to ATMOS. ATMOS outputs, based on NextEra's chosen source, are input into both EARLY and CHRONC which determine consequences of an accident from NextEra's chosen source. NextEra chose an unrealistically low source input for the purpose of avoiding having to take mitigation steps that would have to be taken if a realistic source input was used.
4. A discount rate is chosen by NextEra and input to CHRONC, which in determining consequences applies the discount rate to property that must be condemned. A discount makes little sense. Properties appreciate over 20 years, not depreciate.
5. The type of average and probability of an accident are also chosen by NextEra. The Output file "averages" consequences from EARLY and CHRONC and permits the user to "average" using any one of several percentiles, including "mean," 90^{th} percentile, and 95^{th} percentile. NextEra chose mean for the purpose of avoiding having to take mitigation steps that would have to be taken if a higher, i.e., 90^{th} or 95^{th} percentile had been chosen.
6. NextEra failed to consider the uncertainties in its consequence calculation resulting from meteorological variations by only using mean values for population dose and offsite economic cost estimates.
7. In the License Renewal GEIS refers repeatedly to the 95^{th} percentile of the risk uncertainty distribution as an appropriate "upper confidence bound" in order not to "underestimate potential future environmental impacts."[39]
8. The consequence calculation, as carried out by the MACCS2 code, generates a series of results based on random sampling of a year's worth of weather data. The code provides a statistical distribution of the results. Based on calculations done at other reactors such as

[39] U.S. NRC, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, Vol. 1, May 1996, Section 5.3.3.2.1.

Indian Point, the ratio of the 95th percentile to the mean of this distribution is typically a factor of 3 to 4 for outcomes such as early fatalities, latent cancer fatalities and off-site economic consequences.[40]

9. The Output file also multiplies the consequences resulting from NextEra's chosen consequence percentile by an assumed probability of an accident, which is also chosen by NextEra. NextEra improperly assumed, and chose, an extremely low probability for the purpose of avoiding having to take mitigation steps that would have to be taken if a probability that was realistic and would provide protection to the public had been chosen. The probabilities (CDF) do not stand post-Fukushima.

B. NEPA

As required by NEPA, the NRC Staff should consider the new and significant information arising from the Fukushima accident brought forward and totally reassess Section 5.0.

Respectfully submitted,

(Electronically signed)
Mary Lampert
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Duxbury, MA 02332
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October 26, 2011

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[40] Dr. Edwin S. Lyman, Senior Staff Scientist, Union of Concerned Scientists report commissioned by Riverkeeper, Inc., November 2007, A Critique of the Radiological Consequence Assessment Conducted in Support of the Indian Point Severe Accident Mitigation Alternatives Analysis; available at NRC Electronic Library, Adams Accession Number ML07341009З, Exhibit 12

B. Simon - 2 -

Please note that the period for public comment expires on October 26, 2011. If your office requires additional time, or if there are any other questions regarding this correspondence, please have your representative contact the Environmental Project Manager, Mr. Michael Wentzel, at 301-415-6459 or by e-mail at michael.wentzel@nrc.gov.

Sincerely,

David J. Wrona, Chief
Projects Branch 2
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
As stated

cc w/o encl: Listserv

CONCURRENCE: Brona Simon
9/1/11
BRONA SIMON
STATE HISTORIC
PRESERVATION OFFICER
MASSACHUSETTS
HISTORICAL COMMISSION

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RULES AND DIRECTIVES

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E-RIDS = ADM-03
Add = M. Wentzel (MSW2)

035-1 This comment acknowledges the opportunity to comment on the draft SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, Ilse. The next speaker is Herbert Moyer and after Herbert -- Marcia Bowen.

HERBERT MOYER: Thank you. Herb Moyer -- I live in Exeter. I'm a teacher. I was teaching at Winnacunnet when the plant first came online and we teachers were told we had to stay with students to evacuate through bus transportation in case of an accident. Of course, we now know the drivers of the buses have subsequently said they would not show up. So, I don't know really what plans the utility has actually made for evacuation in the case, admittedly -- unlikely, but possible. I'm not sure you all admit that it's possible there's a major accident at Seabrook that would happen and students would have to leave the area in some manner in order to avoid significant exposure.

But my question is and my comment is that in 2049 -- what kind of changes to the transportation network might we have encountered or done or clogged-up highways or increased in numbers of housing, so that we might not be able to realistically get people out of an area -- in the case of a crowded summer day at Hampton Beach? So, I'm wondering -- are you taking into account the increased construction, population increase and whether or not roadways would be able to capably handle evacuation if an accident were to occur in 2049 -- a year before the projected end of this theoretical license extension? So, that's what I'd like to know.

028-22

I also would like to know -- it's probably not germane to the relicensing but -- Chernobyl cost the Soviet Union $360 billion. Fukushima has cost $200 billion. The Price Anderson Act puts the utilities on the hook for $12 billion right now in some sort of an escrow account. And we the taxpayers would be liable for any damages to property, land, animals, farms, properties, etc., beyond that. So I'd like to know where that $12 billion resides now and is that even something one could count on if some sort of accident occurs -- serious accident? Thank you.

028-23

028-22 The commenter raises issues relating to emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-23 The commenter raises issues related to the Price-Anderson Act. The Price-Anderson Act is a Federal law that governs liability-related issues for all nonmilitary nuclear facilities in the United States. The main purpose of the Act is to provide prompt and orderly compensation to the public who may incur damages from a nuclear incident. Power reactor licensees are required to have the maximum level of primary insurance available from private sources (currently $375 million) and are also required to participate in a Secondary Financial Protection. Under this program, should an accident at any participating power reactor result in injury or damage in excess of the $375 million maximum level of primary insurance, all power reactor operators will be charged a retrospective premium, up to a maximum of $111,900,000 per reactor per incident. These insurance levels are subject to adjustments due to inflation at five-year intervals. The operating power reactors that participate in the Secondary Financial Protection program create a combined level of protection of approximately $12 billion. In the event of a nuclear incident involving damages in excess of the limits established in the Act, Price-Anderson does include a specific provision that obligates Congress to take appropriate action to assure full compensation for all unresolved public liability claims.

This comment provides no new information, and no changes have been made to this SEIS as a result.

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NextEra has completed a review of the Draft SEIS and generally finds the statements and conclusions clear and accurate with the exceptions noted below. As part of this review, NextEra analyzed conclusions of impact reached by the SEIS which differed from NextEra in the License Renewal Application Submittal (Reference 1). As part of this review NextEra solicited comments from our aquatic contractor Normandeau Associates. Comments from Normandeau Associates and associated analysis are provided in response to these differences for consideration by the NRC.

NextEra Energy Comments on Draft SEIS

General

Page xviii Abbreviations and Acronyms

EMS should be Environmental Management System 029-1

Page 2-8 Lines 22 - 25:

Under NHDES Hazardous Waste rules, Seabrook Station is classified as a Full Quantity Generator of hazardous waste in that it generate greater than 100 kg (220 lbs) of hazardous waste in any single calendar month. Under federal rules Seabrook Station is a Small Quantity Generator of hazardous waste which is greater than 100 kg but less than 1000 kg in any month. 029-2

Page 2-8 Line 32:

Should read: National Pollutant Discharge Elimination System Permit. 029-3

Page 2-17 Line 26:

Should read: Groundwater is removed from building dewatering points for dewatering and tritium plume control. 029-4

Page 2-18 Line 25:

Add: The US Coast Guard established a security zone around Seabrook Station in 2002 requiring access restriction signage along the banks of the Browns River and Hunts Island Creek. 029-5

Page 9-1 Lines 30 - 40:

The recommended mitigation is applicable to PSNH and National Grid and beyond the control of NextEra Energy Seabrook. 029-6

029-1 The acronym list was updated to correctly reflect that EMS, in the context of this SEIS, is the abbreviation for Environmental Management System.

029-2 The NRC staff revised section 2.1.3.1 in the final SEIS to include this information.

029-3 The text of the SEIS was updated as suggested to reflect the correct permit title.

029-4 The statement cited by the commenter in Section 2.1.7.2 of this SEIS has been revised for clarity, with the remaining paragraph in the section revised and expanded to provide additional information on dewatering.

029-5 The SEIS was updated to include the description of the security zone established by the U.S. Coast Guard around Seabrook.

029-6 The NRC recognizes that this mitigation measure is beyond the control of NextEra because Public Service Company of New Hampshire (PSNH) and National Grid—and not NextEra—are the owners and operators of the transmission lines associated with Seabrook. Sections 4.7.2 and 9.1 of the SEIS have been changed, accordingly.

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Tritium

Page 2-30 Line 30
Page 4-59 Line 17
Page A-10 Line 44

These three sections each state that onsite tritium remains above EPA's 20,000pCi/L standard. This statement does not accurately and clearly convey that there has never been a groundwater sample from a groundwater monitoring well at Seabrook that exceeded 20,000pCi/L. (Reference ER Section 2.3.2 Ground Water Monitoring Program).

The readings that exceeded 20,000pCi/L to which the Draft SEIS referred are monitoring locations within plant buildings associated with plant dewatering systems, specifically the Primary Auxiliary Building and Containment Ventilation Enclosure Area (Reference LRA-ER §2.3.3.1), which were installed to create a cone of depression to provide hydraulic containment. Since February 2011, these readings have trended below 20,000pCi/L and therefore the statement "*While onsite tritium remains above EPA's 20,000 pCi/L standard at one location by Unit 1 ...*" is no longer accurate as shown by the following table.

029-7

Table: Tritium Concentrations at Plant Dewatering Points

Date	PAB 7'	EFW	RHR	B Elect	CEVA
	Tritium	Tritium	Tritium	Tritium	Annulus H-3
	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
12/31/2009	1660				
1/20/2010	1170	576	582	580	14800
2/5/2010	1720				4240
2/23/2010	4020		582		7110
2/24/2010		553		558	
3/24/2010	4910	624		560	5700
3/25/2010			2310		
4/23/2010	298000	583	2680	586	19300
4/24/2010	63700				
4/25/2010	63300				
4/26/2010	57100				
4/29/2010	32300		1100		6170
5/3/2010	9700		595		9420
5/19/2010	9110	615	696		
5/20/2010				557	
5/21/2010	5710				9460
6/16/2010	4310	550	556	557	
7/21/2010	5460	810	577	591	8460
8/19/2010	5090	582	582	592	5180
9/14/2010		557			
9/22/2010		557			
10/20/2010	2750	577	580	586	5690
11/24/2010	2180	555	556	666	15100
12/23/2010	1970	577	572	580	59600
1/19/2011	2410	577	549	553	50000
2/23/2011	3720		580		11300

029-7 Section 2.2.5 of this final SEIS has been revised to incorporate the additional tritium monitoring data for dewatering points provided by the commenter. Sections 2.2.5 and 4.10 of this SEIS have also been updated to reflect the latest groundwater monitoring results for Seabrook. Consequently, associated findings statements have been revised as necessary in the affected sections.

Date	PAB 7	EFW	RHR	B Elect	CEVA
	Tritium	Tritium	Tritium	Tritium	Annulus H-3
	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
3/25/2011				553	
3/26/2011	4240		582		7760
4/21/2011			556		5880
4/23/2011				800	
4/25/2011					
5/18/2011	3440		522		5300
5/20/2011				537	
6/22/2011	2400		537	541	
6/23/2011					2370
7/20/2011			538	562	2150
8/17/2011				514	
8/24/2011					2340
8/26/2011	2080		538		
9/21/2011	2060		527	592	2500

Page 4-59 Line 23
Page A-11 Line 5

As noted above, there has never been a ground water sample at Seabrook that has exceeded 20,000pCi/L. Recommend changing the sentence as follows:

Groundwater samples from ***all*** ~~several~~ ground water monitoring wells ***have remained*** ~~are~~ well below 20,000 pCi/L and are not expected to impact human or biota receptors.

029-7

Effluent Releases

Page 4-46 Lines 5 – 25

Exponents listed should be should be negative " – " e.g. 8.17 v 10^{-4} mrem

029-8

029-8 The erroneous exponents have been corrected.

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Aquatic Impacts

Page 4-16 / 17 Tables 4.5-6 and 4.5-7

These tables compare the entrainment and impingement for a number of species at Seabrook Station verses Pilgrim Nuclear Generating Station. As reflected in the tables, the numbers of entrained and impinged rainbow smelt at Seabrook are significantly smaller than at Pilgrim, and yet the Draft SEIS explains that the impact finding for Pilgrim was MODERATE where the impact for Seabrook was determined as LARGE. See page 4-19. The Draft SEIS does not explain why the significantly smaller numbers of entrained and impinged rainbow smelt at Seabrook warrant a higher impact finding. 029-9

Page 4-20 Line 12.

This statement reflects that a t-test was performed. Instead, a mixed model analysis of variance was used to determine if there were significant differences between the preoperational and operational periods, among sampling stations, and in the interaction of these terms rather than a t-test. 029-10

Page 4-20 Line 17.

The line indicates silver hake were investigated. Trends in the abundance of silver hake were not investigated as this is not one of the selected species that are subject to extensive quantitative analysis. 029-11

Page 4-20 Lines 30 and 48.

The SEIS conclusion that there is large impact to winter flounder is based on the assumption that a discrete local subpopulation of winter flounder exists within 3-4 miles (5-8 km) of the Seabrook Station intake and discharge structures. As discussed below a recent study suggests that there is significant movement beyond this range.

There is little information on the movement of rainbow smelt in the marine environment after they exit estuaries, but the decrease in abundance at all stations is indicative of a regional effect (see the second response to Page 4-34, Line 20), rather than a decrease localized to area around the Seabrook Station intakes and discharges. 029-12

Winter flounder abundance decreased between the preoperational and operational periods at Station T2, was not significantly different between periods at Station T1, and increased between periods at Station T3 (NAI 2011). The two supposed impacts due to operation of the plant are entrainment and impingement. Although entrainment of eggs has occurred in some years with an average estimate of 90,000 eggs per year, this number is not likely to affect winter flounder populations for two reasons. First, entrainment of an average of 90,000 eggs annually would result in a negligible impact on the number of adult winter flounder, as described more fully in our response to Page 4-20, Lines 44-45. Second,

029-9 A comparison of the impingement rates, entrainment rates, and overall conclusions from Pilgrim and Seabrook was one of five lines of evidence that the NRC staff considered to assess the impacts from Seabrook. In addition to this comparison, the assessment considered the relative impingement and entrainment rates among the species found near Seabrook, the commonality of the impinged and entrained species in the area, the abundance trends near the intake and discharge structures and areas approximately 3–4 nautical mi (5–8 km) from the intake and discharge structures, and other regulatory reviews related to Seabrook's cooling system.

As described in Section 4.5, the NRC staff concluded that the impact to rainbow smelt is LARGE because the abundance of rainbow smelt has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system. In addition, rainbow smelt, is a National Marine Fisheries Service (NMFS) species of concern and it was the sixth most impinged species at Seabrook, with an annual average impingement rate of 1,093 fish per year. No change was made based on this comment.

029-10 Section 4.5.2 was revised to clarify that NAI (2010) used a mixed model analysis of variance to determine if there were statistically significant differences between the preoperational and operational monitoring periods, nearfield and farfield sampling stations, and in the interaction of these terms.

029-11 The commenter suggested that the DSEIS incorrectly stated that NAI (2010) investigated the statistical significance of the abundance changes for silver hake. However, Section 4.5.2 states that NAI (2010) did not test whether the trends for silver hake were statistically significant. No change was made as a result of this comment.

029-12–029-13 The NRC established three levels of significance for potential impacts- SMALL, MODERATE, and LARGE- as defined in Section 1.4 of the SEIS. A LARGE impact would occur if environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

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winter flounder larvae are planktonic and would be widely distributed in the vicinity of Seabrook Station. Entrainment of these planktonic stages would not result in the decrease in abundance of juvenile and adults observed at only one sampling station (T2), because these lifestages have not settled to the bottom yet and are likely to show significant movement before settlement.

The movements of juvenile and adult winter flounder in the marine environment are also not well known. However, a recent paper (Fairchild et al. 2011) submitted to Fisheries Science present the results of an acoustic tagging study in nearby Ipswich Bay. They found that winter flounder can undergo extensive migrations from nearshore spawning grounds. Only 5% of the fish tagged were recovered in Ipswich Bay and some were recovered as far as 43-57 km away for the tagging site. There was evidence that winter flounder return to the same area to spawn, but their movements between spawning periods may be greater than originally thought. 029-12

A localized decrease in abundance at Station T2 could only occur if the winter flounder impinged were going to reside in the vicinity of Station T2 and not move to other areas. The recent data of Fairchild et al. (2011) indicates that this is not the case and winter flounder can undergo significant movements. The impacts of entrainment and impingement are discussed further in our response to Page 4-20, Lines 44-45.

Page 4-20, Lines 44-45.

The SEIS concludes that there is a large impact on winter flounder due to entrainment and impingement. This conclusion does not consider the Equivalent Adult (EA) analysis of the impacts of entrainment and impingement (NAI 2011: Section 4.3.3.10). The estimated annual loss of equivalent adult winter flounder due to entrainment was 1,347/year for the years 1998-2010, and equivalent adult loss due to impingement was 85/year for the years 1994-2010. These combined losses of about 1,500/year can be put into context by comparison with the recreational catch of winter flounder. Between 1998 and 2009, an average of 16,000 fish/year were taken by recreational anglers from New Hampshire waters. The take of equivalent adults at Seabrook Station is less than 1/10 of the recreational catch in New Hampshire. Therefore, any supposed impact due to the operation of Seabrook Station is less than that of the recreational fishery in New Hampshire and should not be considered to be large. 029-13

Page 4-26 Line 14.

See comment on Page 4-20, Line 12. 029-14

Page 4-26 Lines 18-19.

See comment on Page 4-20, Line 17. 029-15

Page 4-28 Lines 5-7.

The SEIS presents no evidence to support the assumption that local subpopulations of 029-16

029-12–029-13 cont'd In Section 4.5, NRC staff defined the impingement and entrainment impact as LARGE if Seabrook monitoring data indicated that the abundance of a certain species or biological group increased or remained steady at sites further from the Seabrook cooling system and decreased near the cooling system or if the abundance of a species or biological group declined at all sites, but the decline was significantly greater closer to the Seabrook cooling system. In addition, NRC staff looked for a strong connection between the Seabrook cooling system and the biological group or species, such as high entrainment or impingement.

The commenter stated that the decrease in abundance for rainbow smelt "at all stations is indicative of a regional effect, rather than a decrease localized to area around the Seabrook Station intakes and discharges." In Section 4.5.5, NRC staff acknowledged that there has been a regional decline of rainbow smelt and that the abundance of rainbow smelt decreased at both the nearfield and farfield stations. However, an analysis of the trawl surveys indicated that the decrease at the nearfield station was significantly greater than the decrease at the farfield station. In addition, rainbow smelt is a NMFS species of concern and it was the sixth most impinged species at Seabrook, with an annual average impingement rate of 1,093 fish per year. Therefore, the monitoring and impingement results for rainbow smelt meet the definition of LARGE for the Seabrook analysis because the abundance of rainbow smelt has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system.

For winter flounder, trawl surveys indicated that the abundance of winter flounder significantly decreased at the nearfield site and increased at the farfield sites. In addition, winter flounder was the third most commonly impinged species. Therefore, the monitoring and impingement results for winter flounder meet the definition of LARGE for the Seabrook analysis because the abundance of winter flounder has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system. No change was made as a result of these comments.

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winter flounder larvae are planktonic and would be widely distributed in the vicinity of Seabrook Station. Entrainment of these planktonic stages would not result in the decrease in abundance of juvenile and adults observed at only one sampling station (T2), because these lifestages have not settled to the bottom yet and are likely to show significant movement before settlement.

The movements of juvenile and adult winter flounder in the marine environment are also not well known. However, a recent paper (Fairchild et al. 2011) submitted to Fisheries Science present the results of an acoustic tagging study in nearby Ipswich Bay. They found that winter flounder can undergo extensive migrations from nearshore spawning grounds. Only 5% of the fish tagged were recovered in Ipswich Bay and some were recovered as far as 43-57 km away for the tagging site. There was evidence that winter flounder return to the same area to spawn, but their movements between spawning periods may be greater than originally thought. 029-12

A localized decrease in abundance at Station T2 could only occur if the winter flounder impinged were going to reside in the vicinity of Station T2 and not move to other areas. The recent data of Fairchild et al. (2011) indicates that this is not the case and winter flounder can undergo significant movements. The impacts of entrainment and impingement are discussed further in our response to Page 4-20, Lines 44-45.

Page 4-20, Lines 44-45.

The SEIS concludes that there is a large impact on winter flounder due to entrainment and impingement. This conclusion does not consider the Equivalent Adult (EA) analysis of the impacts of entrainment and impingement (NAI 2011: Section 4.3.3.10). The estimated annual loss of equivalent adult winter flounder due to entrainment was 1,347/year for the years 1998-2010, and equivalent adult loss due to impingement was 85/year for the years 1994-2010. These combined losses of about 1,500/year can be put into context by comparison with the recreational catch of winter flounder. Between 1998 and 2009, an average of 16,000 fish/year were taken by recreational anglers from New Hampshire waters. The take of equivalent adults at Seabrook Station is less than 1/10 of the recreational catch in New Hampshire. Therefore, any supposed impact due to the operation of Seabrook Station is less than that of the recreational fishery in New Hampshire and should not be considered to be large. 029-13

Page 4-26 Line 14.

See comment on Page 4-20, Line 12. 029-14

Page 4-26 Lines 18-19.

See comment on Page 4-20, Line 17. 029-15

Page 4-28 Lines 5-7.

The SEIS presents no evidence to support the assumption that local subpopulations of 029-16

029-14 Section 4.5.2 was revised to clarify that NAI (2010) used a mixed model analysis of variance to determine if there were statistically significant differences between the preoperational and operational monitoring periods, nearfield and farfield sampling stations, and in the interaction of these terms.

029-15 The commenter suggested that the DSEIS incorrectly stated that NAI (2010) investigated the statistical significance of the abundance changes for silver hake. However, Section 4.5.2 states that NAI (2010) did not test whether the trends for silver hake were statistically significant. No change was made as a result of this comment.

029-16–029-19 The NRC established three levels of significance for potential impacts- SMALL, MODERATE, and LARGE- as defined in Section 1.4 of the SEIS. A LARGE impact would occur if environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. In Section 4.5, NRC staff defined the impingement and entrainment impact as LARGE if Seabrook monitoring data indicated that the abundance of a certain species or biological group increased or remained steady at sites further from the Seabrook cooling system and decreased near the cooling system or if the abundance of a species or biological group declined at all sites, but the decline was significantly greater closer to the Seabrook cooling system. In addition, NRC staff looked for a strong connection between the Seabrook cooling system and the biological group or species, such as high entrainment or impingement.

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winter flounder and rainbow smelt exist within 3-4 miles (5-8 km) of the Seabrook Station intakes or discharges. See comments on Page 4-20, Lines 30 and 48, and the second comment on Page 34 Line 20. 029-16

Page 4-34 Lines 20-21. 029-17

See comment on Page 4-20, Lines 30 and 48 and Page 4-20, Lines 44-45.

Page 4-34 Line 20.

The SEIS concludes that there is a large combined impact on rainbow smelt due to the operation of the Seabrook Station cooling water system. The two impacts considered are Entrainment (Section 4.5.2) and Thermal Shock (Section 4.5.3). However, the SEIS does not identify any impacts to rainbow smelt in the Summary of Entrainment and Impingement Impacts on page 4-20 or in Section 4.5.3. Therefore it is not clear how there can be any combined impacts on rainbow smelt due to these causes when there does not appear to be any individual impact from either entrainment and impingement, or thermal shock. 029-18

Page 4-34 Line 20.

The SEIS concludes that there is a large combined impact on rainbow smelt due to the operation of the Seabrook Station cooling water system. Abundance of rainbow smelt has decreased significantly at all three trawl stations from the period before plant operation (Preoperational Period) to the period after plant operation (Operational period). The BACI model has identified a greater decrease at the sampling station near the intakes and discharges than at the other two stations. However, this decrease by itself does not necessarily mean that operation of the cooling water system is the cause. Results of a BACI model must be put in context with regional trends to see if there are any region-wide causes that could result in what appears to be a local impact. For the remaining demersal selected species, commercial overfishing is a regional impact that has caused catch decreases at the three sampling stations to uniformly very low levels. In the case of rainbow smelt, there has been a regional decrease in abundance throughout the Gulf of Maine (NMFS 2007) unrelated to the operation of Seabrook Station. This unrelated regional decrease likely caused the reduction in abundance at all sampling stations. Rainbow smelt are currently declared a "species of special concern", and acid precipitation, spawning habitat degradation, overfishing, and dams and blocked culverts are suggested reasons for the regional decline in abundance (NMFS 2007). The operation of the Seabrook Station cooling water system does not contribute to any of these potential causes. The uniformly low abundance at all three stations suggests a regional decline in rainbow smelt stocks, consistent with the designation of rainbow smelt as a species of special concern (NMFS 2007). 029-19

Rainbow smelt are entrained and impinged at Seabrook Station, but in relatively low numbers. These losses can be put in context through comparison with New Hampshire recreational catch statistics. Rainbow smelt spawn in estuaries and their demersal and

029-16–029-19 cont'd The commenter stated that the decrease in abundance for rainbow smelt "at all stations is indicative of a regional effect, rather than a decrease localized to area around the Seabrook Station intakes and discharges." In Section 4.5.5, NRC staff acknowledged that there has been a regional decline of rainbow smelt and that the abundance of rainbow smelt decreased at both the nearfield and farfield stations. However, an analysis of the trawl surveys indicated that the decrease at the nearfield station was significantly greater than the decrease at the farfield station. In addition, rainbow smelt is a NMFS species of concern and it was the sixth most impinged species at Seabrook, with an annual average impingement rate of 1,093 fish per year. Therefore, the monitoring and impingement results for rainbow smelt meet the definition of LARGE for the Seabrook analysis because the abundance of rainbow smelt has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system.

For winter flounder, trawl surveys indicated that the abundance of winter flounder significantly decreased at the nearfield site and increased at the farfield sites. In addition, winter flounder was the third most commonly impinged species. Therefore, the monitoring and impingement results for winter flounder meet the definition of LARGE for the Seabrook analysis because the abundance of winter flounder has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system. No change was made as a result of these comments.

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adhesive eggs are not subject to entrainment. Rainbow smelt larvae can be subject to entrainment and an estimated annual average of 430,000 have been entrained between 1990 and 2010 (NAI 2011). Natural mortality would greatly reduce this estimate to a small number of adult reproductive fish. An estimated average 1,054 rainbow smelt are impinged each year. In comparison, recreational fishing in the nearby Great Bay removed an estimated average of 102,000 adult rainbow smelt each year between 1994 and 2010 (NAI 2010). These losses are much greater than those incurred at Seabrook Station.

The regional decrease in rainbow smelt abundance is the most likely cause for the decrease in rainbow smelt in the study area and in the vicinity of the Seabrook Station's intakes and discharges. The SEIS findings (page 4-34, line 23-24) also assume that a local subpopulation of rainbow smelts exists within 3-4 miles (5-8 km) of the cooling water intake and discharge structures, yet this assumption is not supported by objective evidence. The Gulf of Maine-wide decrease in rainbow smelt stocks coupled with the relatively small estimates of impingement and entrainment at Seabrook Station compared to the recreational catch, are not consistent with the finding of a large impact due to the operation of the cooling water system. 029-19

Page 4-34 Line 27.

The SEIS concludes that there is a large combined effect on *Laminaria digitata* and *Saccharina latissima* due to the operation of the Seabrook Station cooling water system. The two impacts considered are Entrainment (Section 4.5.2) and Thermal Shock (section 4.5.3). However, the SEIS does not identify any impacts on *L. digitata* and *S. latissima* in either of these sections. Therefore it is not clear how there can be any combined impacts on *L. digitata* and *S. latissima* due to these causes when there does not appear to be any individual impact from either entrainment and impingement, or thermal shock. 029-20

Page 4-34 Line 27.

The SEIS concludes that there is a large combined impact on *Laminaria digitata* and *Saccharina latissima* due to the operation of the Seabrook Station cooling water system. This conclusion does not consider the trend analysis (Table 5-12; NAI 2010) conducted on the annual density of *L. digitata* between 1982 and 2009 for the shallow subtidal stations and between 1978 and 2009 for the mid-depth stations. There has been a significant negative trend in *L. digitata* density throughout the entire time series at all four benthic stations (shallow subtidal: nearfield and farfield; mid-depth: nearfield and farfield). This is an indication that this is a long-term decline in abundance unrelated to the operation of Seabrook Station and may be a region-wide phenomenon because it occurred at both nearfield and farfield stations. Furthermore, there are habitat differences between the mid-depth stations that complicate the analysis. The habitat at the mid-depth nearfield station is less preferable for *L. digitata* due to the greater depth (12.2 m) compared to the nearfield station (9.4 m). 029-21

There was also a significant negative trend in the density of *Saccharina latissima* at the nearfield shallow subtidal station starting in 1982, indicating a long-term trend. This also

029-20–**029-21** As stated in Section 4.5.5, the combined impacts section examines the results of NextEra's monitoring data, which used a Before/After Control Impact (BACI) design to test for potential impacts from operation of Seabrook (NAI 2010). This monitoring design can be used to test the statistical significance of differences in community structure and abundance between the pre-operation and operational periods near Seabrook's intake and discharge structure and 3-4 mi (5-8 km) away from Seabrook. If a significant difference occurs, it could be due to entrainment, impingement, heat shock or a combination of the cumulative effects from Seabrook station.

NAI (2010) reported significantly higher *Laminaria digitata* density prior to than during operations. In the shallow and the mid-depth subtidal, the decline at the nearfield sampling site was significantly greater than the decline at the farfield station. In the nearfield mid-depth sampling site (B19), NAI (2010) did not identify *L. digitata* in 2008 or 2009. The NRC determined that the impact was LARGE because the decrease in *L. digitata* density was significantly greater at the nearfield sites and because sea belt density was lower during operations at the nearfield site but not at the farfield site in the shallow subtidal. These results suggest that the local populations of *L. digitata* and sea belt have been destabilized through operation of Seabrook's cooling water system, which meets the definition of a LARGE impact.

The commenter stated that NRC staff did "not consider the trend analysis (Table 5-12; NAI 2010) conducted on the annual density of *L. digitata* between 1982 and 2009 for the shallow subtidal stations and between 1978 and 2009 for the mid-depth stations." The NRC staff considered this trend in Section 4.5.5, which states that *L. digitata* and sea belt densities have decreased at both nearfield and far field stations, as described above. However, the statistical analyses in NAI (2010) indicated that the decrease at the nearfield station was significantly greater than the decrease at the farfield station. No changes were made as a result of these comments.

may be a region-wide phenomenon because it occurred at both nearfield and farfield stations.

Special studies conducted by NextEra indicate that thermal discharge from Seabrook Station is not responsible for the decline in kelp abundance (Section 5.4.2, NAI 2010; Section 5.5 NAI 2011). Possible reasons for a large scale decline in kelp abundance are:

1. a regional increase in water temperature (NAI 2009, NAI 2010),
2. turbidity, suspended sediment deposition and nutrient enrichment (McDowell 2009; NAI 1999),
3. changes due to storm action in 1991 (Hurricane Bob and the "Perfect Storm") and large scale biological disturbances, and
4. the effect of introduced species, particularly the bryozoan *Membranipora membranacea*.

029-21

Page 4-39, Lines 25-26.

The SEIS concludes that the impact on rainbow smelt for an additional 20 years of operation is large. Regarding potential impacts to rainbow smelt due to operation of Seabrook Station see comment on Page 4-34 Line 20.

029-22

Page 4-65, Lines 34-45.

The SEIS states that the incremental impacts from the operation of Seabrook Station would be large for winter flounder and rainbow smelt. As stated above in comments on Page 4-20 Lines 44-45, the combined losses of equivalent adult winter flounder due to entrainment and impingement are less than 1/10th of the losses due to the recreational fishery in New Hampshire alone, not to mention adjoining states and losses due to the commercial fishery. By any reasonable measure, these incremental losses due to operation of Seabrook Station are not large.

Similarly, in comments on Page 34, Line 20, the losses to rainbow smelt due to the operation of Seabrook Station are about 1% of the annual take of rainbow smelt in the Great Bay fishery alone, not to mention other recreational catches in tributaries of the Gulf of Maine. By any reasonable measure, these incremental losses due to operation of Seabrook Station are not large.

029-23

Page 4-65 Line 37.

The SEIS states that the operation of Seabrook Station has destabilized the local abundance of winter flounder and rainbow smelt and refer to Section 4.5. See comment on Page 4-20, Lines 30 and 48, and comment on Page 4-34, Line 20 for rainbow smelt.

029-24

029-22–029-24 The NRC established three levels of significance for potential impacts- SMALL, MODERATE, and LARGE- as defined in Section 1.4 of the SEIS. A LARGE impact would occur if environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. In Section 4.5, NRC staff defined the impingement and entrainment impact as LARGE if Seabrook monitoring data indicated that the abundance of a certain species or biological group increased or remained steady at sites further from the Seabrook cooling system and decreased near the cooling system or if the abundance of a species or biological group declined at all sites, but the decline was significantly greater closer to the Seabrook cooling system. In addition, NRC staff looked for a strong connection between the Seabrook cooling system and the biological group or species, such as high entrainment or impingement.

The commenter stated that the decrease in abundance for rainbow smelt "at all stations is indicative of a regional effect, rather than a decrease localized to area around the Seabrook Station intakes and discharges." In Section 4.5.5, NRC staff acknowledged that there has been a regional decline of rainbow smelt and that the abundance of rainbow smelt decreased at both the nearfield and farfield stations. However, an analysis of the trawl surveys indicated that the decrease at the nearfield station was significantly greater than the decrease at the farfield station. In addition, rainbow smelt is a NMFS species of concern and it was the sixth most impinged species at Seabrook, with an annual average impingement rate of 1,093 fish per year. Therefore, the monitoring and impingement results for rainbow smelt meet the definition of LARGE for the Seabrook analysis because the abundance of rainbow smelt has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system.

may be a region-wide phenomenon because it occurred at both nearfield and farfield stations.

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1. a regional increase in water temperature (NAI 2009, NAI 2010),
2. turbidity, suspended sediment deposition and nutrient enrichment (McDowell 2009; NAI 1999),
3. changes due to storm action in 1991 (Hurricane Bob and the "Perfect Storm") and large scale biological disturbances, and
4. the effect of introduced species, particularly the bryozoan *Membranipora membranacea*.

029-21

Page 4-39, Lines 25-26.

The SEIS concludes that the impact on rainbow smelt for an additional 20 years of operation is large. Regarding potential impacts to rainbow smelt due to operation of Seabrook Station see comment on Page 4-34 Line 20.

029-22

Page 4-65, Lines 34-45.

The SEIS states that the incremental impacts from the operation of Seabrook Station would be large for winter flounder and rainbow smelt. As stated above in comments on Page 4-20 Lines 44-45, the combined losses of equivalent adult winter flounder due to entrainment and impingement are less than 1/10th of the losses due to the recreational fishery in New Hampshire alone, not to mention adjoining states and losses due to the commercial fishery. By any reasonable measure, these incremental losses due to operation of Seabrook Station are not large.

Similarly, in comments on Page 34, Line 20, the losses to rainbow smelt due to the operation of Seabrook Station are about 1% of the annual take of rainbow smelt in the Great Bay fishery alone, not to mention other recreational catches in tributaries of the Gulf of Maine. By any reasonable measure, these incremental losses due to operation of Seabrook Station are not large.

029-23

Page 4-65 Line 37.

The SEIS states that the operation of Seabrook Station has destabilized the local abundance of winter flounder and rainbow smelt and refer to Section 4.5. See comment on Page 4-20, Lines 30 and 48, and comment on Page 4-34, Line 20 for rainbow smelt.

029-24

029-22–029-24 cont'd For winter flounder, trawl surveys indicated that the abundance of winter flounder significantly decreased at the nearfield site and increased at the farfield sites. In addition, winter flounder was the third most commonly impinged species. Therefore, the monitoring and impingement results for winter flounder meet the definition of LARGE for the Seabrook analysis because the abundance of winter flounder has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3–4 mi (5–8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3–4 mi (5–8 km), they have been destabilized through operation of Seabrook's cooling water system. No change was made as a result of these comments.

New Hampshire Department of Environmental Services

Seabrook Station, Seabrook, NH
Supplemental Environmental Impact Statement

U.S. Nuclear Regulatory Commission
(Docket # NRC-2010-0206-0013)

NH DES Comments on Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 46, Regarding Seabrook Station, Draft Report for Comment, July 2011 (SEIS)

October 25, 2011

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Surface Water Discharge

NH DES reviewed the SEIS sections related to cooling water, surface water (including the groundwater dewatering discharge to outfall 001), and aquatic resources. Its comments are as follows:

1. Section 2.2.6.3, Page 2-45, line 35 to 43. If any herbicides are used in the vicinity of surface waters during transmission line corridor maintenance then the owner and applicator may need to apply for coverage under the Pesticide General (NPDES) Permit soon to be issued by EPA. 011-1

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011-1 Section 2.2.6.3 of the SEIS has been revised to state that transmission line owners and herbicide applicators may need to apply for coverage under the Pesticide General (NPDES) Permit if any herbicides are to be applied in the vicinity of surface waters.

2. In Section 2.2.4 on page 2-27 in lines 38 and 39 it is reported that the discharge of radioactive effluents is allowed in accordance with NRC regulations. Section 2.2.5, beginning on page 2-29, reports that groundwater is being dewatered and discharged to outfall 001 and that the groundwater contains tritium. NRC should ensure that the discharge of tritium meets the NH surface water quality standard for Gross Beta Radioactivity, which is 1,000 pCi/L. An assumed dilution of the effluent by the diffusers of 10 was used during the last re-issuance of the NPDES permit and would be appropriate in this case until a more detailed evaluation of an appropriate mixing zone is conducted. 011-2

3. In the "Summary of Combined Effects" on page 4-34 it is reported that the operation of Seabrook Station's cooling system has a large impact on winter flounder, rainbow smelt and kelp (*L. digitata*) but there is no discussion or recommendation on mitigation of those impacts. Due to the reporting of these large impacts, Clean Water Act in Section 316(b) could trigger the need for EPA to require best technology available for minimizing any adverse environmental impacts, which could entail the installation of closed cycle cooling. Therefore, there may be a need to compare the impacts of continued operation of once-through cooling with those for the construction and operation of an appropriately sized closed cycle cooling system. Such a comparison would be needed to determine whether the impacts of construction and operation of closed cycle cooling outweigh the impacts of continued operation of the open cycle cooling system, which could lead to a conclusion as to whether there are any "adverse environmental impacts" under CWA Section 316(b). Such a comparison could be made if the continued operation of Seabrook Station with the installation of a closed cycle cooling system were added as a new alternative in Section 8 of the SEIS. 011-3

4. References to "Storm Water Pollution Prevention General Permit" (Section 8.1.3), and "General Stormwater Permit" (Sections 8.2.3 and 8.3.3) should more appropriately be to "Construction General Permit and the NHDES' Alteration of Terrain Permit." 011-4

5. Sections 8.2.3 (line 18) and 8.2.4.1 (line 27) refer to NPDES permits issued by NHDES. These sentences should be revised to refer to NPDES permits issued by the EPA, since NH has not taken delegation of the NPDES program, and all such permits for facilities in NH are issued by the EPA. 011-5

For more information, please contact:

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011-2 Radiation doses to members of the public from the current operations of Seabrook are evaluated in the SEIS in Section 4.8.1.2. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within dose standards specified in NRC's and EPA's dose standards.

National Pollutant Discharge Elimination System (NPDES) permits issued to Seabrook by the EPA to control effluent discharges are regulated and inspected by EPA and the state. Inspection of Seabrook's compliance with the EPA-issued NPDES permit is beyond the regulatory authority of the NRC.

This comment provides no new information, and no changes have been made to this SEIS as a result.

011-3 Section 4.6.4 of this SEIS has been revised to include an expanded discussion of potential mitigation options, including structural and operational modifications to the Seabrook cooling system. In addition, Chapter 8 of the SEIS has been revised to include an evaluation of a closed-cycle cooling alternative. In this analysis, the NRC staff compares the environmental impacts of the current once-through cooling system with a closed-cycle cooling system, such as the estimated impingement and entrainment rates.

011-4 As presented in Chapter 8, "Alternatives" of this SEIS, references to the types of permits and authorizations that would be required to construct and operate a natural-gas-fired combined cycle (NGCC) plant at the Seabrook site were intended to be generic in nature. This was done so as to be applicable to any site at which such a replacement power alternative could be constructed by NextEra within the ISO-NE service area. Nevertheless, the sections cited by commenter, and related discussions in the Chapter, have been revised as suggested for consistency and clarity with the nomenclature used by the U.S. EPA and New Hampshire Department of Environmental Services for their respective permitting programs.

011-5 The text of the SEIS was updated to reflect that the EPA is the NPDES permitting authority in New Hampshire.

Groundwater Quality / Tritium

Section 2.2.5 Groundwater Resources discusses radioactive liquid releases associated with the Unit 1 containment structure that resulted in detections of tritium in the onsite dewatering system and groundwater. Specifically, in 1999 a leak from the cask loading area and transfer canal adjacent to the spent fuel pool was discovered. In addition there is discussion of a dewatering system installed in 2000-2001 which consists of five dewatering points and withdraws approximately 3000 gallons per day. A groundwater monitoring network consisting of 22 wells has also been installed at the site and has been sampled for tritium. The SEIS reports that repairs were made to the stainless steel fuel pool liner and concentrations of tritium have declined over time. NH DES requests that additional information be included in the SEIS to provide a better understanding of: (1) the nature of the release; (2) the corrective actions taken to date; (3) the operation of the dewatering system; (4) geologic setting and proximity to bedrock; (5) the direction and rate of groundwater flow; and (6) the impact on groundwater quality. Following the review of the additional information, NH DES would be in a better position to further evaluate the conclusions outlined in the SEIS and provide recommendations for future actions, if warranted by the data. 011-6

For more information, please contact:

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011-6 This comment concerns the extent of information presented in Section 2.2.5 of this SEIS and the nature of radioactive liquid releases, particularly tritium, to groundwater. Section 2.2.5 summarizes the state of knowledge related to historical radionuclide releases to groundwater beneath the site, hydrogeologic investigations performed at the site, and the results from historical and ongoing groundwater monitoring. Section 4.10 of this SEIS presents the NRC staff's evaluation of the impacts of inadvertent releases of tritium with respect to groundwater quality and human health.

In preparing Section 2.2.5, NRC staff reviewed the 2009 site conceptual model commissioned by NextEra to characterize the hydrogeologic framework and historical releases of radionuclides to groundwater at Seabrook Station. This report is available to the public through the ADAMS electronic reading room on the NRC's website (www.NRC.gov). The ADAMS accession number for the site report is ML103360326. Sections 2.2.5 and 4.10 of this SEIS have been updated to reflect the latest groundwater monitoring results for Seabrook, which are documented in annual radioactive effluent release reports which are submitted to the NRC. The cited reports are listed at the back of Chapters 2 and 4 along with their respective ADAMS accession numbers. In addition, these reports, along with additional information on radiological monitoring conducted at Seabrook, can be found at http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/seab1.html. Based on the environmental review performed, the NRC staff has concluded that while inadvertent releases of liquids containing tritium (a radioactive isotope of hydrogen) have occurred to the subsurface at Seabrook, radioactivity levels in groundwater have remained well below the EPA's drinking water standard of 20,000 picocuries per liter, and no upward trend in tritium levels has been observed. Further, offsite water supply wells are located hydrologically upgradient from Seabrook and groundwater dewatering activities at the site otherwise provide hydraulic containment of tritium plumes beneath the site.

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August 17, 2011

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76FR 47612
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David Wrona, Chief
Projects Branch 2
Division of License Renewal
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Comment on DRAFT SEIS for the Seabrook Station License Renewal (R&C #863)

Dear Mr. Wrona:

Thank you for providing the Division of Historical Resources (Division) an opportunity to comment on the site specific DRAFT Supplemental Environmental Impact Statement (SEIS) submitted August 5, 2011. This letter is in response to your request pursuant to 36 CFR 800.8(c) for comments on the SEIS and the preliminary conclusions regarding historic properties

The Division concurs with the Commission's determination that no historic properties will be affected by the proposed action that is the license renewal for the Seabrook Station. It is the Division's understanding with this action there are no proposed plans for land disturbing activities in the sensitive areas previously defined within the Cultural Resource Management Plan for Seabrook Station. If and when ground disturbing activities are planned the Division anticipates consultation.

The Division has no substantive comment on the DRAFT SEIS. The Division does appreciate the opportunity to provide comment.

036-1

Sincerely,

Edna Feighner

Edna Feighner
NH Division of Historical Resources
Archaeologist/Review and Compliance Coordinator

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (mjw2)

036-1 This comment acknowledges the opportunity to comment on the draft SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

ATTORNEY GENERAL
DEPARTMENT OF JUSTICE
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CONCORD, NEW HAMPSHIRE 03301-6397

MICHAEL A. DELANEY
ATTORNEY GENERAL

ANN M. RICE
DEPUTY ATTORNEY GENERAL

October 26, 2011

Ms. Cindy Bladey, Chief
Rules, Announcements and Directives Branch
Division of Administrative Services
Office of Administration
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJ: Docket ID NRC-2010-0206

RE: Comments of the Office of the Attorney General for the State of New Hampshire on the NRC Draft Environmental Impact Statement (NUREG-1437, Suppl. 46) for the Renewal of the Operating License for the Seabrook Station

In July 2011 the U.S. Nuclear Regulatory Commission (NRC) issued Supplement 46 to NUREG-1437 as the draft Environmental Impact Statement (EIS) in support of the application for the renewal of the operating license for the Seabrook Station, which was submitted to NRC by NextEra Energy Seabrook, LLC (NextEra) on May 25, 2010. The draft EIS was published in the Federal Register on August 5, 2011 (76 Fed. Reg. 47,612) and is open for public comment until October 26, 2011. The Office of the Attorney General for the State of New Hampshire (NHAG) is pleased to submit the following comments on the Seabrook draft EIS.

As required by 10 C.F.R. § 51.53(c)(3)(ii)(L), NRC Staff has considered severe accident mitigation alternatives (SAMAs) at the Seabrook Station in Chapter 5 and Appendix F of the draft EIS. The NRC Staff evaluation consists of a review of the results of numerous probabilistic risk assessments (PRAs) and individual plant examinations (IPEs) that have been conducted by NextEra since as early as 1983 and updated as late as 2009. NRC Staff acknowledges that an updated version of NextEra's PRA model is scheduled to be issued in 2011 in order to address revised internal flooding requirements. The updated PRA model is known to require a new SAMA to mitigate the risk of flooding in the control building, *see* Draft EIS at p. 5-8 (lines 8-14), and NRC Staff has concluded the SAMA is cost-beneficial for implementation, *see id.* at p. 5-15 (lines 15-17 and 22-24), and Table 5.3-5 at p. 5-19 (SAMA #192). Since the Seabrook license renewal application is not expected to be issued until early 2013, sufficient time is available for the NRC Staff to fully review and to completely evaluate the updated PRA model when it is available. Accordingly, NHAG recommends that NRC Staff review NextEra's 015-1

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015-1 The commenter recommends incorporating the findings of the evaluation of NextEra's revised SAMA analysis into the final SEIS for the Seabrook LRA. By letter dated March 19, 2012, NextEra submitted a supplement to their environmental report, detailing changes to their SAMA analysis relating to the Seabrook LRA. In accordance with 10 CFR 51.72, the NRC prepared a supplement to the Seabrook draft SEIS, the focus of which was the NRC staff's evaluation of NextEra's revised SAMA analysis. Following completion of the public comment period, the supplement has since been incorporated into Chapter 5 and Appendix F of this SEIS.

updated PRA model when it is available, and that NRC Staff incorporate its findings regarding SAMAs from that review in the final EIS. 015-1

The draft EIS highlights, in general terms, a number of plant improvements already made by NextEra over the last 28 years based upon the results of the PRAs and IPEs. NRC Staff specifically notes, however, that NextEra has not yet implemented 14 plant improvements although each is supposedly addressed by a SAMA in the draft EIS.

- "Although no severe accident vulnerabilities were identified in the Seabrook IPE, 14 potential plant improvements were identified. Four of the improvements have been implemented. Each of the 10 improvements not implemented is addressed by a SAMA in the current evaluation." Draft EIS at p. 5-6 (lines 25-27)
- "The Seabrook IPEEE did not identify any vulnerability due to seismic events but did identify two plant improvements to reduce seismic risk. Neither of the two improvements has been implemented. Each of the two improvements is addressed by a SAMA in the current evaluation." Draft EIS at p. 5-9 (lines 2-5)
- "While no physical plant changes were found to be necessary as a result of the IPEEE fire analysis, potential plant improvements to reduce fire risk were identified, of which four have been implemented. The one improvement not implemented is addressed by a SAMA in the current evaluation." Draft EIS at p. 5-10 (lines 11-14)
- "The Seabrook IPEEE submittal also stated that, as a result of the Seabrook IPE, cost-benefit analyses were being performed for many potential plant improvements, which may also collaterally reduce external event risk. Four of these five potential plant improvements have been implemented, and the fifth is addressed by a SAMA in the current evaluation." Draft EIS at p. 5-11 (lines 22-26) 015-2

It is not clear from the discussion presented in the draft EIS what each of these plant improvements entails – either the improvements already implemented or, more significantly, the improvements that remain un-implemented. The draft EIS also does not explain why each of the 14 un-implemented plant improvements have not yet been yet implemented or whether any of these 14 un-implemented plant improvements needs to be implemented prior to the renewal of the Seabrook operating license. Likewise, the draft EIS does not indicate whether any of the 14 un-implemented plant improvements will ever be implemented in the future and if so by what date. Since NRC Staff took the effort to highlight these particular plant improvements (both those implemented and those that remain un-implemented) in Chapter 5 of the draft EIS, NHAG recommends that NRC Staff supplement the discussion of these plant improvements, particularly those plant improvements that remain un-implemented, to address these shortcomings (*i.e.*, the nature of the plant improvement, the reason(s) why an un-implemented plant improvement has not yet been implemented, the basis for a conclusion that an un-implemented plant improvement need not be implemented prior to license renewal, an explanation of whether the un-implemented plant improvement will ever be implemented, and if so the approximate date when the un-implemented plant improvement will be implemented).

According to the draft EIS statements quoted above, each of the 14 un-implemented plant improvements "is addressed by a SAMA in the current evaluation." However, from a review of Chapter 5 of the draft EIS it is not apparent where that discussion is presented (particularly since

015-2 The commenter requests additional information on the 14 unimplemented improvements identified during the Seabrook individual plant examination (IPE) and individual plant examination of external events (IPEEE) processes. While the referenced discussion in Chapter 5 of the SEIS made mention that these 14 improvements were covered by SAMAs, a more detailed discussion, including a discussion of which SAMAs corresponded to the improvements was included in Section F.3.2 of the SEIS. Specifically, of the 14 plant improvements identified during the IPE and IPEEE process, four were already implemented; eight were determined not to be cost beneficial during the SAMA analysis, and two were determined to be potentially cost beneficial. The two potentially cost beneficial SAMA, SAMAs 157 and 167, were determined not to be aging related and, therefore, need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

This comment provides no new information, and no changes have been made to this SEIS as a result.

Page 3 of 4

the nature of each of the 14 un-implemented plant improvements is not described). Although a general discussion of plant improvements appears on pages 5-13 through 5-20 in the draft EIS, and dozens of specific SAMAs have their cost-benefit analysis summarized in Table 5.3-5 of the draft EIS, no correlation has been provided between that information and the 14 un-implemented plant improvements. NHAG recommends that the NRC Staff supplement the information provided in the draft EIS to include a specific discussion of the SAMA for each of the 14 un-implemented plant improvements and to explain why such a discussion is needed (assumedly because the improvement will not be implemented as part of license renewal). 015-2

Based upon the information presented in the draft EIS, NRC Staff and NextEra apparently agree that the following four SAMAs should be implemented because the benefits derived from the specific plant improvement outweigh their cost to implement:

- SAMA 157 (provide independent AC power source for battery chargers)
- SAMA 169 (RWST fill from firewater during containment injection)
- SAMA 192 (install globe valve/flow limiting orifice upstream in fire protection system)
- SAMA 193 (hardware change to eliminate MOV AC power dependency)

See Draft EIS Table 5.3-5 (highlighted items). With regard to these four SAMAs, NRC Staff notes that "NextEra plans to enter [them] into the Seabrook long-range plan development process for further implementation consideration." Draft EIS at p. 5-15 (lines 23-24). From this statement, however, it is unclear whether, *in fact*, NextEra will be implementing the specific plant improvement at some point in the future (and if so approximately when) or merely "considering" whether to implement the specific plant improvement. Given the collective cost of all four SAMAs (approximately $580,000) and the collective value of all four SAMAs (39 percent reduction in core damage frequency and 51 percent reduction in population dose) as recounted in Table 5.3-5, NHAG recommends that all four SAMAs be implemented and implemented within a relatively short period of time. 015-3

Finally, with regard to the four above-identified SAMAs, the draft EIS reaches the following conclusion regarding the timing for their implementation:

> "As stated by the applicant, the four potentially cost beneficial SAMAs are not aging-related. The staff reviewed SAMAs 157, 165, 192, and 193. These mitigative alternatives do not involve aging management of passive, long-lived systems, structures, or components during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54."

Draft EIS at p. 5-20 (lines 26-30). However, nowhere in Chapter 5 are there specific details or discussions supportive of this general conclusion. NHAG recommends that the NRC Staff supplement the draft EIS to explain its reasoning behind the conclusion that each of the four cost-beneficial SAMAs is not aging-related and, therefore, none of them need to be implemented prior to the renewal of the operating license for the Seabrook Station.

015-3 The commenter raises questions pertaining to the four potentially cost-beneficial SAMAs (157, 165, 192 and 193) identified in the Seabrook draft SEIS, specifically whether or not the SAMAs will be implemented, and the methodology used to determine whether or not SAMAs are related to managing the effects of aging. These four potentially cost-beneficial SAMAs were determined not to involve aging management of passive, long-lived systems, structures and components during the period of extended operation, and therefore they do not need to be implemented as part of the license renewal process. NextEra has added these four SAMAs to their long-range planning process for further implementation consideration; however, because the SAMAs are not related to managing the effects of aging, the timeline for evaluation and any potential implementation is left to the discretion of NextEra.

Relative to the basis for the determination that these four potentially cost-beneficial SAMAs did not relate to managing the effects of aging, the NRC staff performed an engineering evaluation of the SAMAs in question. All four potentially cost-beneficial SAMAs involved the installation of new components for the purpose of eliminating, or reducing the consequences of particular failure mechanisms, rather than addressing aging-related degradation of passive, long-lived system, structures and components. Therefore, the NRC staff determined that none of these four potentially cost-beneficial SAMAs related to managing the effects of aging during the period of extended operation.

This comment provides no new information, and no changes have been made to this SEIS as a result.

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Fish and Game Department

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October 21, 2011

Cindy Bladey
Chief, Rules, Announcements, and Directives Branch
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Office of Administration
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Ms. Bladey,

The New Hampshire Fish and Game (NHF&G), Marine Fisheries Division has reviewed the subject document NUREG-1437-Supplemental 46 (NRC-2010-0206) and wants to comment on both multiple errors and omissions as well as one singular point that we consider of greatest importance.

This letter focuses on the single issue; that being what might be a measurable response by NextEra, Seabrook Station to mitigate NRC identified large cumulative impacts if the renewed operating license is to be issued. We will follow this communication with a more expansive letter of comment.

The NRC staff, in their review of the total record of environmental study that encompasses the first two decades of Seabrook Station operation, identifies three large cumulative impacts and these three may require some level of mitigation or correction should the station operate for an additional 20 years. Specifically theses large impacts are near-station decreases in:

-Winter Flounder
-Rainbow Smelt and
-Certain Kelp species

010-1

The impact of Seabrook Station operation on the abundance of certain fish species identified in the document is something that NHF&G as the state agency responsible for the protection of our wildlife resources must take seriously. The two species involved, Winter flounder and Rainbow smelt, are ones identified early on in the required environmental monitoring as species of special concern as they support both commercial and recreational fisheries in New Hampshire. Winter flounder is a species targeted by mobile gear and fixed gear commercial fishers as well as it being a very popular target

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010-1 The commenter raises the issue of potential mitigation options related to minimizing the aquatic impacts resulting from the operation of Seabrook. Section 4.6.4 of the SEIS has been revised to include an expanded discussion of potential mitigation options, including the two mitigation options suggested by New Hampshire Fish and Game Department (NHFGD).

species for recreational hook fishers and spearfishers. Rainbow smelt supports an ice fishing activity enjoyed by our states recreational anglers. In addition, smelt are an important prey item for Atlantic cod, striped bass, bluefish and seals and are listed as a Species of Concern by the National Marine Fishery Service. The loss of these fish as a result of Seabrook Station by entrainment and impingement should be addressed and NHF&G has two mitigation ideas that deserve further consideration. These are explained below:

1) **NextEra could fund activities and projects that would reduce the point and non-point sources of nitrogen loading in the Great Bay Estuary System (GBES) watershed.** GBES has been identified as nitrogen impaired by NH Department of Environmental Services. The increased levels of nitrogen have been identified as a potential cause of recent reductions in the abundance of eel grass in the GBES and eel grass is an important habitat for both juvenile winter flounder and rainbow smelt. Providing financial assistance to programs directed at reducing non-point sources of nitrogen and to municipal projects that reduce nitrogen input into GBES would be appropriate mitigation as it would improve conditions for growth and survival of eel grass that are important habitat for these species.

010-1

2) **NextEra Seabrook station could compensate businesses that rely on winter flounder catch for a portion of their annual income.** Possible mechanisms for such mitigation could include providing a financial donation to the permit bank for XI Northeast Fisheries Sector Inc.. This permit bank is used to purchase federal fishing permits with quota for groundfish species including winter flounder. The groundfish allocations (or quotas) associated with permits purchased by the permit bank would be distributed to members of New Hampshire's commercial groundfish sectors to help maintain the economic viability of the State's small boat commercial fishing fleet. In addition, some party and charter boat businesses in New Hampshire rely on winter flounder for a portion of their business. Those businesses with documented historical winter flounder harvest via federal vessel trip reports could also be compensated.

Finally, NHF&G, Marine Fisheries Division believes the localized loss of certain kelp species (i.e. Laminaria digitata and Saccharina lattisima) has been accurately documented. However, to suggest some form of mitigation for this seems to be of little importance because of the replacement of these species by other somewhat comparable kelps in the area (i.e. Agarum clathratum and Alaria esculenta). These replacement kelps probably provide comparable ecological services in comparison to the loss of abundance of L. digitata and S. lattisima including habitat formation, primary productivity, and as forage for coastal herbivores.

New Hampshire
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October 24, 2011

Cindy Bladey
Chief, Rules, Announcements, and Directives Branch
Division of Administrative Services
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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Ms. Bladey,

As indicated in our earlier communication to NRC relative to the Seabrook Station relicensing document NUREG-1437 Supplement 46 (Docket ID NRC 2010-0206), New Hampshire Fish and Game, Marine Fisheries Division now offers the following specific comments:

Section 1.7 Consultations-

Comment- NRC fails to mention NHF&G as a state agency consulted in its review of the Seabrook Station Environmental Monitoring Program. NHF&G staff met with NRC at the station in the fall of 2010 and offered their opinion of the overall environmental study program and its findings.

Page 1-8 Permits

Comment- The Permit to Display Finfish and Invertebrates issued by NHF&G shows the number MFD081. This permit expired at the end of 2008 and is reissued annually. The current permit for this is MFD1101.

010-2

Section 2 Page 2-15 Re: NPDES temperature limits.

Comment- The temperature limit is 5°F within 300 feet from the discharge. This is measured at the surface and the 5°F is for a monthly average.

p. 2-24 line 20-21

Comment- Peirce Island is the correct name.

p.2-31

Misspell of M. octodecemspinosus

p. 2-32

Misspell of C. maenas

p. 2-41 Re: cunner/yellowtail

Cunner/yellowtail eggs were lumped together because of uncertain differentiation between the two. It would be best not to express these two separated by a comma but with a slash.

010-3

010-2 The SEIS has been updated to include the New Hampshire Fish & Game Department in the Section 1.7 list of state agencies consulted. Additionally, the Permit to Display Finfish and Invertebrates information listed in Table 1.9-1 has been updated to reflect the current status.

010-3 Chapter 2 of the SEIS has been revised to clarify how the water temperature surrounding Seabrook's discharge structure is measured for the NPDES permit, to correct the name of Pierce Island, and to correct misspellings.

p. 2-48 line 7 Re: statement "Crane Pond hosts some spring- migrating waterfowl including woodcock, grouse and turkey."
This is a curious and confusing characterization of the term waterfowl as the three birds mentioned are not considered waterfowl. 010-4

Section 4 Line 44
Comment- NHF&G has several times, urged more sampling of fish likely to be exposed to discharge waters. These comments have been communicated to the Station in letters detailing our review of the Annual Radiological Program Reports. 010-5

4-66 Line 34
Misspell of Schiller Station 010-6

Section 8 p. 8-9 Re: Cooling tower blowdown
Comment- It should be mentioned that blowdown of hypersaline waters would alter the discharge plume dispersal. NHF&G has expressed this negatively buoyant sinking plume concern at other New Hampshire power plants. 010-7

p. 8-9 Lines 28-42 Re: Cooling tower terrestrial effects
Comment- Natural draft cooling towers were reviewed in the initial Seabrook licensing and the putative effects on near-by apple orchids, vehicular traffic on Rte I-95 and US 1 and a persistent cloud over Hampton Beach received attention. 010-8

This concludes our specific comment on Docket ID NRC 2010-0206. If you have questions do not hesitate to contact me.

Sincerely,

Douglas E. Grout
Chief of Marine Fisheries

DEG/bws/jld

Cc: Glenn Normandeau, Exec. Director
Carol Henderson

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010-4 The NRC staff acknowledges that this is a mischaracterization of woodcock, grouse, and turkey. The sentence has been revised to correct this error.

010-5 The NRC requires NextEra to conduct a radiological environmental monitoring program (REMP) to sample and analyze atmospheric, terrestrial, and aquatic media and biota in the environment around its facility for radiation and radioactivity that is released during the operation of the plant. The REMP conducted at Seabrook is based on NRC guidance regarding the types and numbers of environmental media to be collected and analyzed. The REMP provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposure to members of the public. It does not require that every type of environmental media or biota in the area be sampled and analyzed.

Based on the review of several years of data, the staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

This comment provides no new information, and no changes have been made to this SEIS as a result.

010-6 The spelling of Schiller Station has been corrected.

010-7 This comment concerns the effects of cooling tower blowdown that could be generated from operation of a natural-gas-fired combined cycle (NGCC) plant at the Seabrook site. The NGCC alternative is one of the reasonable alternatives evaluated by NRC in Chapter 8, "Alternatives" of this SEIS. In this chapter, the staff examines the potential environmental impacts of alternatives to license renewal for Seabrook, as well as alternatives that may reduce or avoid adverse environmental impacts from license renewal and when and where these alternatives are applicable. In its evaluation of reasonable alternatives, the NRC assumes that operators of replacement power facilities will comply with all applicable Federal, State, and local permits that the operators must obtain to operate its plant, including those that are required by the Clean Water Act and its implementing regulations. For example, licensees must obtain and comply with National Pollutant Discharge Elimination System permits and associated effluent limits, as noted in Section 8.1.3 of the SEIS.

p. 2-48 line 7 Re: statement "Crane Pond hosts some spring- migrating waterfowl including woodcock, grouse and turkey."
This is a curious and confusing characterization of the term waterfowl as the three birds mentioned are not considered waterfowl. 010-4

Section 4 Line 44
Comment- NHF&G has several times, urged more sampling of fish likely to be exposed to discharge waters. These comments have been communicated to the Station in letters detailing our review of the Annual Radiological Program Reports. 010-5

4-66 Line 34
Misspell of Schiller Station 010-6

Section 8 p. 8-9 Re: Cooling tower blowdown
Comment- It should be mentioned that blowdown of hypersaline waters would alter the discharge plume dispersal. NHF&G has expressed this negatively buoyant sinking plume concern at other New Hampshire power plants. 010-7

p. 8-9 Lines 28-42 Re: Cooling tower terrestrial effects
Comment- Natural draft cooling towers were reviewed in the initial Seabrook licensing and the putative effects on near-by apple orchids, vehicular traffic on Rte I-95 and US 1 and a persistent cloud over Hampton Beach received attention. 010-8

This concludes our specific comment on Docket ID NRC 2010-0206. If you have questions do not hesitate to contact me.

Sincerely,

Doug Grout

Douglas E. Grout
Chief of Marine Fisheries

DEG/bws/jld

Cc: Glenn Normandeau, Exec. Director
Carol Henderson

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010-7 cont'd This comment provides no new information, and no changes have been made to this SEIS as a result.

010-8 This comment indicates several possible natural draft cooling tower impacts. These impacts are consistent with those discussed in Section 8.1 that would result from a natural-gas-fired combine-cycle alternative. No changes to the SEIS have been made as a result of this comment.

the draft SEIS and the EFH Assessment are primarily based on a retrospective analysis of effects on NMFS trust resources and other ecosystem functions from Seabrook Station operations from 1990 to present. We do not believe that the draft SEIS and the EFH Assessment accurately characterize the biological community, federally-managed species and habitats, or the effects of the operations of Seabrook Station on these managed species and their habitats at the time the federal action is reported to occur, which is the year 2030. Further, we believe there are too many natural and anthropogenic variables that influence the characterization of biological communities to accurately assess and make a determination of the effects on the environment 18 years in advance of a significant action such as this. Uncertainties involving best available technologies, climate change, and the status of fishery stocks, for example, make evaluating the effects of the proposed action and alternatives under the National Environmental Policy Act (NEPA) extremely difficult, if not impossible, that far into the future. The Council for Environmental Quality (CEQ) has stated, in Question #32 of its *Forty Most Asked Questions Concerning CEQ's NEPA Regulations*, "As a rule of thumb, if the proposal has not yet been implemented, or if the EIS concerns an ongoing program, EISs that are more than 5 years old should be carefully reexamined to determine if the criteria in Section 1502.9 compel preparation of an EIS supplement." Considering that the SEIS in question will be 18 years old at the time the federal action occurs, it would be prudent to accept the guidance and apply the advice set forth by the CEQ.

For the reasons above, we believe the draft SEIS and EFH Assessment are insufficient under the required mandates of both the NEPA and MSA. Nonetheless, we are providing you with our comments under both NEPA and MSA to the best of our abilities given the limitations upon us.

General Comments

Seabrook Station's cooling water intake and discharge system is one of the main components of the facility most likely to have adverse effects on fisheries and other marine resources. As such, we have focused our comments on our review of this system and associated monitoring. The draft SEIS concludes that the impacts from operations of Seabrook Station's cooling water system on phytoplankton, zooplankton, invertebrates, and most fish species are "small" because the monitoring data suggests no noticeable alterations of these aquatic communities. However, for winter flounder and rainbow smelt, you conclude that the impacts are "large" because abundance of these species has decreased to a greater and noticeable extent near the intake and discharge structures (i.e., nearfield sampling stations) compared to 5-8 km away (i.e., farfield sampling stations). Although the abundance of silver hake declined at the nearfield stations and increased at the farfield stations, the draft SEIS states that you could not make a conclusion about impacts to this species because the statistical significance of these differences were not reported by the consultant, Normandeau Associates, Inc. (NAI). The Final SEIS needs to provide the necessary data and analysis to support an impact determination for silver hake. 016-1

Entrainment and Impingement

The draft SEIS and EFH Assessment reported entrainment of 901.2 million fish eggs per year and 269.4 million fish larvae per year, and 20,876 fish per year were impinged on intake screens of the cooling system between 1990 and 2009. Although some of the species reported to be entrained and impinged are not federally-managed species (e.g., cunner, Atlantic silverside, and rainbow smelt), many if not most of these species are prey for managed species or serve other 016-2

2

016-1 The NRC staff did not provide a conclusion on the impact of impingement and entrainment for silver hake because of the high variability observed in the trawl surveys. In the Essential Fish Habitat (EFH) Assessment, the NRC concluded that Seabrook operations may adversely affect EFH for silver hake eggs, larvae, juveniles, and adults. No change was made as a result of this comment.

016-2 The EFH assessment prepared for Seabrook describes the impacts on prey for EFH species, as the commenter suggests. No change was made to the SEIS as a result of this comment.

important ecological functions. Atlantic silverside was the most commonly impinged fish species, at over 2,400 per year; the eggs and larvae of cunner were the most commonly entrained stages of all species, at 387.4 million per year and 78.4 million per year, respectively. Eighteen federally-managed species were entrained and/or impinged in the Seabrook Station cooling water system. The entrainment and impingement of these large numbers of federally-managed species and forage species by the Seabrook Station cooling water system concerns us. In order to account fully for adverse impacts resulting from Seabrook Station, we believe the ecosystem and food web benefits foregone as a result of operational impacts on eggs and larvae should be evaluated further. Additional comments on impingement and entrainment are provided in the Essential Fish Habitat section below. 016-2

Thermal Effects

The National Pollutant Discharge Elimination System (NPDES) permit issued by the US Environmental Protection Agency limits the monthly mean water temperature in surface waters near the discharge plume to 5° F (2.8° C) above ambient. The EFH Assessment and draft SEIS states that the surface waters near the warm water discharge plume typically range as high as 18.8° C with a monthly mean increase in surface water temperatures for most months of less than 2° C, and a mean difference in bottom temperatures between nearfield and farfield temperature stations of 0.5° C. An increase in water temperature could adversely affect species found in this area. For example, Atlantic herring larvae occur at temperatures of 9-16° C (Reid et al. 1999); pollock eggs and larvae occur between 2-17° C (Cargnelli et al. 1999); silver hake eggs and larvae occur between 11-17° C and 10-16° C, respectively (Morse et al. 1999); and most winter flounder larvae occur between 6-10° C from March-July, and as high as 18° C in September (Pereira et al. 1999). Because the upper temperature range for these species may be exceeded in the project vicinity as a result of the warm water discharge plume, these species could be adversely affected by the thermal discharge. In particular, in light of projected increases in water temperatures in the Gulf of Maine as a result of climate change, the thermal limits of these and other species may be exceeded within the thermal discharge of Seabrook Station (more detailed comments on climate change are provided below). The Final SEIS needs to provide additional analysis on thermal impacts associated with living marine resources at Seabrook Station under existing conditions, as well as conditions that may be present in 2030 and beyond (i.e., reasonably foreseeable future). 016-3

Additionally, the EFH Assessment and draft SEIS conclude that thermal impacts from plant operations have not adversely affected sessile communities based upon comparisons of cold and warm water macroalgae species at sampling stations. Although analysis conducted by NAI concluded there were no clear trends in abundances of cold and warm water macroalgae species, they did report significant changes to kelp species in the near field stations compared to far field stations. *Laminaria digitata* and *Saccharina latissima* densities were reduced at near field stations compared to far field stations. In fact, *L. digitata* was completely absent in near field stations in 2008 and 2009. Consequently, the draft SEIS concludes that impacts from the operation of the Seabrook Station cooling system are "large" for *L. digitata* and sea belt (*S. latissima*). Macroalgae species such as these provide refuge and forage habitat for a number of fish species, including Atlantic cod, winter flounder, ocean pout, summer flounder, and pollock. Although the draft SEIS has determined that these species have been adversely affected through the operation of Seabrook Station's cooling water system, no causative agent has been identified. 016-4

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016-3 Section 4.11.3 has been revised to include an expanded discussion of climate change on aquatic resources near Seabrook.

016-4 Section 4.5.4 of the SEIS has been revised to include an expanded discussion of potential mitigation options, including the studies suggested by National Marine Fisheries Service (NMFS).

Thermal influences from the power plant are one possible factor, and further studies are needed to understand the changes in these macroalgae communities near the warm water discharge plume. 016-4

Seabrook Monitoring Data

NextEra has conducted monitoring of fish, shellfish, and other benthic communities since the 1970s, using a before-after control impact design to test for power plant-related impacts. Impacts to demersal fish are evaluated using otter trawls sampled at one near field site and two far field sites. According to Table 4.5-9 in the draft SEIS, these data indicate a reduction in abundance at the near field site compared to far field sites for winter flounder, silver hake, rainbow smelt, and windowpane flounder. In addition, abundances at far field sites have increased for winter flounder, windowpane flounder, and silver hake. The draft SEIS reported that NAI did not test the statistical significance of these data for silver hake, resulting in no species-specific conclusion for this species. In addition, the EFH Assessment (page D-1-64) reports that, although windowpane flounder abundance decreased at the near field site and increased at the far field sites, the confidence intervals reported by NAI overlapped, suggesting that this relationship would not be statistically significant. However, the draft SEIS and EFH Assessment also states that NAI did not report whether or not the relationship was statistically significant. Since important data were not analyzed completely, we have determined that the draft SEIS and EFH Assessment is insufficient in describing the effects of Seabrook Station on these species. It is critical that the appropriate analysis and statistical tests be performed and results provided in the Final SEIS for silverhake and windowpane flounder. 016-5

The monitoring data, combined with the large numbers of fish impinged and entrained in the Seabrook Station cooling water system, suggest that there are power plant-related effects to several commercially and recreationally-important species. In order to evaluate these effects and develop effective measures to reduce impacts on our trust resource, it is important to understand the primary causes of these effects. Specifically, we need to know whether these reductions in demersal species at the near field sites are a result of thermal effects from the discharge plume, such as avoidance of the thermal plume by various life stages, or stem from mortality/reduced fitness of egg and larval stages that may settle to the bottom in this area. Zooplankton sampling may not address these potential impacts, since this sampling method is not able to measure fitness or survival of fish eggs and larvae that drift into the thermal plume. In addition, we do not know whether or to what degree reduced abundances of fish measured by the trawl monitoring are a result of egg and larval mortality due to impingement and entrainment in the cooling water system. Unfortunately, the limited sampling with only one near field trawl site (2 km from intake and 1 km from discharge) and two far field trawl sites are unlikely to provide a finer resolution of data. It is also difficult to determine whether or not the nearfield sampling site locations are capable of distinguishing impacts from the cooling water intake to that of the thermal discharge plume. 016-6

Schedule for Final SEIS

CEQ regulations, at 40 CFR 1502.1, identify the purpose of Environmental Impact Statements as follows: 016-7

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016-5 The NRC staff did not provide a conclusion on the impact of impingement and entrainment for silver hake because of the high variability observed in the trawl surveys. In the EFH Assessment, the NRC concluded that Seabrook operations may adversely affect EFH for silver hake eggs, larvae, juveniles, and adults. No change was made as a result of this comment.

016-6 Section 4.5.4 of the SEIS has been revised to include an expanded discussion of potential mitigation options, including the studies suggested by NMFS.

The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document. It shall be used by Federal officials in conjunction with other relevant material to plan actions and make decisions.

The timing of the Final SEIS would seem to frustrate CEQ's regulation. According to the NRC website for the Seabrook Station licensing renewal application, NRC intends to issue the Final SEIS in March 2012. The proposed schedule is particularly confusing considering that the existing permit does not expire for 18 years in 2030. The draft SEIS, however, focuses its analysis upon environmental conditions as they exist today, in 2011. It remains unclear how a 2011 SEIS would be relevant and meaningful as a tool to inform the NRC when it makes its relicensing decision in 2030. Nor is it clear how such a document provides the public with a full and fair discussion of the impacts and alternatives that will exist in 2030. In fact the temporal discrepancies of the SEIS vis-à-vis the relicensing date are so great that many in public are probably not in a position to yet determine whether they are stakeholders. 016-7

We are concerned that this proposed timeframe to complete the environmental review for this project does not provide for a full and adequate study and analysis of impacts to our trust resources. We believe the analysis in the EFH Assessment and draft SEIS are insufficient in several important areas, such as statistical analysis of the monitoring data for species such as silver hake and windowpane flounder. In this regard, the current schedule for issuance of the Final SEIS does not appear to provide adequate time for NRC to study and analyze the impacts to our trust resources, or alternatives that may reduce or eliminate these adverse effects. For instance, the draft SEIS has determined that there are "large" impacts to winter flounder, rainbow smelt, and two species of macroalgae from operations of the Seabrook Station cooling water system, but there has been little analysis or specific studies identified in the draft SEIS to determine whether the impacts are related to thermal effects or impingement and entrainment, or both. In consideration of the draft SEIS determination that the project has resulted in "large" impacts to NMFS trust resources, we believe a reasonable range of alternatives should be analyzed that may reduce or eliminate these adverse effects. To this point, the Council on Environmental Quality NEPA Regulations at 40 CFR 1502.14 require the draft SEIS to "rigorously explore and objectively evaluate all reasonable alternatives, including reasonable alternatives not within the lead agency's jurisdiction or congressional mandate if applicable."

Essential Fish Habitat

The marine waters off Seabrook and the Hampton-Seabrook estuary have been designated as EFH under the MSA for a number of federally-managed species. As discussed in the EFH

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016-7 The commenter expresses concern about the timing of the issuance of the final SEIS in relation to the Federal action that precipitated it, in this case the decision whether or not to grant a renewed license. As stated in NRC regulations at 10 CFR 54.31(c), if the license renewal is granted, the renewed license would become effective immediately upon its issuance, thereby superseding the current operating license. Therefore, if the NRC decides to grant a renewed license for Seabrook, the Federal action would take place when the license renewal decision is made, rather than in 2030, the expiration of the current license.

This comment provides no new information, and no changes have been made to this SEIS as a result.

According to the EFH Assessment and draft SEIS, the surface waters near the warm water discharge plume typically range as high as 18.8° C. The EFH Assessment identified EFH for four managed species as potentially being adversely affected by thermal effects of the warm-water discharge (i.e., silver hake/whiting, Atlantic mackerel, Atlantic herring, and Atlantic cod). However, the draft SEIS did not consider egg and larval life stages of managed species if those life stages were not designated in the project area, even if the impingement and entrainment monitoring data indicated those life stages were present in large numbers in the project area. For example, the eggs and larvae of pollock, yellowtail flounder, haddock, and American plaice were impinged and/or entrained in the Seabrook Station cooling system and all life stages for these species have temperature tolerances below 18.8° C (EFH Source Documents). Consequently, the life stages for these managed species could be adversely affected by thermal discharges, particularly during warmer months of the year, and should be included in the analysis for project effects. Overall, the draft SEIS concludes that the thermal discharge plume has not adversely affected fish in the surrounding area because it would not block fish movement and fish can swim around the plume. While this may be true for juvenile and adult fish, pelagic eggs generally drift passively with ocean currents, and larvae have minimal mobility to move out of the area affected by the plume. We believe the analysis of thermal effects on managed species, as well as other species whose egg and larvae stages are found in the discharge plume, should be reevaluated.

We conclude that the EFH Assessment is insufficient in considering and analyzing the effects of the Seabrook Station on federally-managed species and their habitats over the 20-year period of operations. In addition, the EFH Assessment does not address the anticipated effects of Seabrook Station operations between 2012 and the time of relicensing in 2030. This is particularly problematic considering that a host of basic environmental conditions will likely change in the context of climate change and fishery stocks in the Gulf of Maine region over the next 18 years and into the foreseeable future.

Essential Fish Habitat Recommendations
To avoid and minimize the impacts on EFH, pursuant to Section 305(b)(4)(A) of the MSA, NMFS recommends that the following conservation recommendations be adopted in conjunction with the proposed federal action:

1. Further studies and analysis should be conducted to evaluate the reported reductions in abundances in demersal species at the nearfield sampling sites compared to farfield sites. Specifically, studies should be developed that test whether changes in these communities are the result of thermal effects from the discharge plume, such as avoidance of the thermal plume by juvenile and adult life stages or from mortality/reduced fitness of egg and larval stages that may settle to the bottom in this area, or a result of eggs and larvae that are lost to the general area from impingement and entrainment in the cooling water system. These studies should be concluded prior to the issuance of a final EIS on this action. 016-8

2. Since the draft SEIS concludes that the existing plant cooling system is having "large" adverse impacts on some fish species and habitats, subsequent NEPA documents should analyze a range of alternative plant cooling systems. In particular, alternatives should 016-9

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016-8 Section 4.5.4 of the SEIS has been revised to include an expanded discussion of potential mitigation options, including the studies suggested by NMFS.

The commenter also suggested that the NRC include the results of the suggested studies in the final SEIS. The NRC staff based its evaluation in the Seabrook SEIS on 20 years of entrainment studies, 16 years of impingement studies, over 20 years of monitoring studies, and related Federal and state regulatory reviews. The NRC staff determined that these studies and related regulatory reviews were sufficient to evaluate the level of impact on aquatic resources. The NRC staff also stated the limitations of such data and potential uncertainties that could affect its conclusions in the SEIS. Therefore, except as noted above, no further changes were made to the SEIS as a result of this comment.

016-9 Section 4.5.4 of this SEIS has been revised to include an expanded discussion of potential mitigation options, including structural and operational modifications to the Seabrook cooling system. In addition, Chapter 8 of the SEIS includes an evaluation of a closed-cycle cooling alternative. In this analysis, the NRC staff compares the environmental impacts of the current once-through cooling system with a closed-cycle cooling system. The comparison includes, for example, the estimated impingement and entrainment rates.

The identification and implementation of best technology available (BTA) is under the authority of the EPA under the Federal Water Pollution Control Act (the Clean Water Act; henceforth, CWA). EPA can require mitigation measures, such as requiring closed-cycle cooling, BTA, or other modifications of the cooling system to reduce impacts due to entrainment and impingement, under the NPDES permit for Seabrook.

It is beyond the NRC's regulatory authority to evaluate or recommend BTA. The limitation to the NRC's authority was previously described to NMFS in a letter regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2, dated June 15, 2011 (NRC 2011a). As described in that letter, Congress amended the CWA in 1972 to assign statutory authority over water quality matters to the EPA. Portions of the CWA specifically removed water quality oversight authority from other Federal agencies like the NRC, and, further, sought to prevent duplicative Federal oversight of CWA issues by specifically and solely vesting authority and expertise with EPA.

include an evaluation of the best available practicable technology to mitigate impingement, entrainment, and thermal impacts. 016-9

3. Because the Final SEIS and EFH Assessment for the relicensing of Seabrook Station will be approximately 18 years old at the time of relicensing, a new SEIS and EFH Assessment should be prepared in 2025, or no greater than 5 years before and no less than 1 year before a new license is granted. The Final SEIS and EFH Assessment should describe and evaluate the effects of the Seabrook Station operations on federally-managed species and their habitats and other NMFS trust resources at the time of the proposed action, i.e., in 2030 when a new license would potentially be issued. 016-10

Please note that Section 305(b)(4)(B) of the MSA requires that the you provide us with a detailed written response to the EFH conservation recommendation, including a description of the measures adopted by you for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with our recommendation(s), Section 305(b)(4)(B) of the MSA also indicates that the you must explain your reasons for not following the recommendation(s). Included in such reasoning would be the scientific justification for any disagreements with us over the anticipated effect of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects pursuant to 50 CFR 600.920(k).

Please note that a distinct and further EFH consultation must be re-initiated pursuant to 50 CFR 600.920(1), if new information becomes available or the project is revised in such a manner that it affects the basis for the above EFH conservation recommendation.

Fish and Wildlife Coordination Act

A number of species of finfish and invertebrates use the marine waters off Seabrook and the Hampton-Seabrook estuary for various stages of their life history, such as American lobster, shellfish, and blueback herring, alewife, and rainbow smelt. The draft SEIS has determined the impacts from Seabrook Station cooling water system to be "large" for rainbow smelt because the abundance has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 5-8 km away. In addition, the impingement sampling conducted by NextEra found the annual average impingement of rainbow smelt to be 1,093 fish per year. Since 2004, rainbow smelt has been designated as a "species of concern" by NMFS due to declining populations region-wide. Although a large degree of this decline is believed to be related to loss of spawning habitat, acid precipitation, dams, and fishing, additional losses such as through the Seabrook Station cooling water system are of concern to us. According to Table 4.5-4 of the draft SEIS, a number of shellfish larvae have been entrained in the cooling water system, including 5,754 billion blue mussel/year, 48.9 billion surf clam/year, 21.7 billion softshell clam/year, and 4.8 sea scallop/year. These losses to the marine ecosystem not only represent losses to fisheries, but also the Gulf of Maine ecosystem. Therefore, we recommend that further studies and analysis be conducted as described in the EFH Recommendations section above. 016-11

Cumulative Effects

CEQ regulations implementing NEPA define cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non- 016-12

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016-9 cont'd In EPA's comments on the Seabrook draft SEIS, EPA also suggested that the NRC consider alternative cooling system designs in the final SEIS. However, the EPA stated that "the FSEIS should not, however, purport to provide or suggest the answers to the ultimate permitting questions that EPA must address under the Clean Water Act"(EPA 2011).

016-10 As stated in the NRC's regulations at 10 CFR 54.17(c), licensees may apply for a renewed license up to 20 years prior to the expiration of their current operating license. In accordance with NRC regulations, NextEra submitted an application for a renewed operating license on May 25, 2010, thereby initiating the Federal action that led to the preparation of the SEIS and EFH Assessment that was submitted, as required, to NMFS. As stated in NRC regulations at 10 CFR 54.31(c), if the license renewal is granted, the renewed license would become effective immediately upon its issuance, thereby superseding the existing operating license. In 10 CFR 54.31(b), it states that the renewed license covers the period of time remaining on the original operating license plus the additional time requested in the license renewal (20 years in the case of Seabrook). While the final licensing decision has been delayed pending resolution of technical issues discovered during the license renewal process that are outside the scope of the NRC's NEPA review, the final decision on whether to grant a renewed license will likely occur in the next few years. Because licensees, rather than the NRC, operate nuclear power plants, no Federal action would occur in 2030. Therefore, to help inform the NRC Commissioners' decision whether or not to grant the license renewal, the final SEIS needs to be prepared in the current timeframe, rather than waiting until 2030. In the NRC's regulations implementing NEPA, 10 CFR 51.94 states that "the final environmental impact statement, together with any comments and any supplement, will accompany the application or petition for rule making through, and be considered in, the Commission's decisionmaking process." No changes were made to the SEIS as a result of this comment.

016-11 Section 4.5.4 of the SEIS has been revised to include an expanded discussion of potential mitigation options, including the studies suggested by NMFS.

Federal) or person undertakes such other actions." (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area. Unfortunately, the draft SEIS's cumulative impacts section is unable to characterize and analyze impacts as existing at the time of the Federal action in 2030 from a 2011 base of reference. In short, this 18-year time discrepancy is so great that "reasonably foreseeable future actions" identified in the document will actually be past actions by 2030 when NRC will actually be taking action. NMFS fears the draft SEIS' cumulative impacts section will have become stale, outdated and of little use to the NRC or public for the 2030 relicensing, particularly given the dynamic nature of fisheries and the consequences of climate change impacts on living marine resources. 016-12

Notwithstanding the SEIS' aforementioned temporal issue, NMFS also has the following specific comments on the substance of the cumulative impacts section. Section 4.11.3, Cumulative Impacts on Aquatic Resources, of the draft SEIS concludes the cumulative impacts from the proposed license renewal and other past, present, and reasonably foreseeable projects would be "moderate" for most species and "large" for winter flounder, rainbow smelt, and other species that would be adversely affected by climate change, such as lobster and Atlantic cod. We agree that these and others species could be significantly affected by the proposed license renewal and climate change. However, the draft SEIS did not examine the increased water temperature from the power plant discharges in the context of recent past and future projected water temperatures in the Gulf of Maine as a result of climate change. According to the 2008 Seabrook Station monitoring report (NAI 2009), the surface water temperature has increased by 0.6° C between the pre-operational and operational periods at the intake and far field temperature stations. Friedland and Hare (2007) reported increases in the range of maximum and minimum sea surface temperatures (SST) in recent decades in U.S. Continental Shelf waters. In addition, Gulf of Maine SST in 1999, 2002, and 2006 were the 4th, 5th, and 6th warmest years, respectively, in the record (Drinkwater et al. 2009). Projections from coupled results from coarse-scale climate models with much finer-scale models of regional ocean dynamics suggest that Gulf of Maine spring SSTs may increase by about 2.2°C in the Gulf of Maine in the 2080s under the high-emission scenarios, with greater projected increases in autumn (Frumhoff et al. 2007). Increased ocean temperatures due to climate change will exacerbate the adverse effects to aquatic organisms from localized power plant warm water discharges, and push temperatures above the thermal thresholds of many cold-water species. In addition, increased water temperatures in the Gulf of Maine from climate change will diminish power plant cooling water effectiveness in the future, requiring greater volumes of water to maintain effective power plant operations. This in turn, will increase the degree of impingement and entrainment and other impacts to marine organisms. Considering these climate change projections for the Gulf of Maine, and the proposed license renewal period from 2030 to 2050, these effects should be considered more thoroughly during the current license renewal phase. 016-13

Endangered Species Act

As noted in the draft SEIS, several species listed under our jurisdiction occur off the coast of New Hampshire. The information presented on the use of this area by listed species appears complete and accurate. The draft SEIS states that NRC has determined that no adverse effects to any NMFS listed species are likely to result from the continued operation of Seabrook. Based on recent conversations with Dennis Logan of your staff, we anticipate receiving a request for

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016-12 The commenter expresses concern relating to the currency of the evaluation contained in the draft SEIS related to the timing of the Federal action. As described in the response to comment 016-7, the Federal action will take place at the time the license renewal decision is made, rather than at the expiration of the current license in 2030. As a result, the SEIS is being prepared now to support the license renewal decision, rather than in 2030, hence the use of contemporary information in determining what future actions were reasonably foreseeable for analysis in this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

016-13 Section 4.12.3 has been revised to include an expanded discussion of climate change on aquatic resources near Seabrook.

informal ESA section 7 consultation from the NRC. We anticipate that this consultation will consider effects of the operations of Seabrook on listed whales and sea turtles.

On September 16, 2011, we published a proposed rule to list two distinct population segments (DPS) of loggerhead sea turtles as threatened and seven distinct population segments of loggerhead sea turtles as endangered. This rule becomes effective on October 25, 2011 and replaces the current listing of loggerheads as threatened worldwide. Loggerheads in the waters near Seabrook belong to the Northwest Atlantic DPS. We recommend that any reference to loggerhead sea turtles in the Final SEIS reflect this change in the listing. More information and a copy of the final listing rule can be found at: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm. 016-14

On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS) (75 FR 61872; 75 FR 61904). A final listing determination is anticipated in Fall 2011.

The marine range for all Atlantic sturgeon extends from Canada through Cape Canaveral, Florida. The information presented on Atlantic sturgeon in the draft SEIS appears complete and accurate. It is our understanding, based upon review of the draft SEIS, that no Atlantic sturgeon have been detected in any impingement or entrainment monitoring that has been carried out at Seabrook. Since no changes in operations are proposed during the extended operating period, the risk of impingement or entrainment would not change.

Any questions regarding listed species and/or the pending Section 7 consultation should be directed to Julie Crocker in our Protected Resources Division (978-282-8480 or Julie.Crocker@noaa.gov).

Marine Mammal Protection Act

Several species of marine mammals are common residents or occasional visitors to the waters of New Hampshire, including gray seals, harbor seals, and harbor porpoise. All marine mammals receive protection under the Marine Mammal Protection Act (MMPA) of 1972, as amended. The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. NMFS may issue permits under MMPA Section 104 (16 U.S.C. 1374) to persons that authorize the taking or importing of specific species of marine mammals. As you may know, an MMPA permit has been issued for the Seabrook facility in the past. We understand that additional mitigation measures have been put in place at Seabrook since an MMPA permit was last issued. As recommended in our August 5, 2010, scoping letter, we recommend that NextEra and/or the NRC discuss permitting needs with NMFS' Office of Protected Resources Permits, Conservation, & Education Division (301-713-2289) to determine if any additional coordination under the MMPA is necessary.

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016-14 Section 2.2.8 has been revised to state that the loggerhead turtles near Seabrook are considered part of the Northwest Atlantic Distinct Population Segment, which are considered Federally threatened.

CHRIS NORD: Actually, hang on to it. Let me open up my notebook. Thank you.

Well, my first comment is for the NRC to say that -- I think that it's plain that the NRC has a public relations problem and maybe most of all in the area around Seabrook. If you -- as staff members of the NRC -- are interested in helping that process along, it might help to convince the general public that you do actually care about the general public coming to meetings like this, if in fact the comments that were made and documents that were submitted to NRC actually got reviewed in time to be a part of reporting and so that comments such as my own and other peoples' that are coming forward somehow do get incorporated into your hearing process. I understand that's a possibly difficult task, but that is in fact the task that you are charged with. If you're interested in having the general public up here to make comments, I think the general public would like to see our comments being made a part of this process. In the spirit that that may in fact take place, I'm going to forge ahead by attempting to talk a little bit here about tritium. 028-1

Just as one example of many radionuclides that the general public remains at risk of being exposed to within the ingestion pathway -- that is within 50-miles of any reactor -- here or in Japan or anywhere that reactors operate in the world. The reason that I focus on tritium I hope to make obvious, but my first strong suggestion to NRC is that the owners of Seabrook should be required by NRC to show proof positive that leakages and emissions of nuclear radionuclides, such as tritium, have been prevented entirely into the atmosphere, into the air, into groundwater -- in keeping with conclusions drawn from the National Academies of Science BEIR VII Report -- that is the Biological Effects of Ionizing Radiation that was released a couple of years ago -- that a conclusion from that study can be made that there is no threshold below which radiation is safe. And if NRC were actually to enact their regulations based on the National Academies' findings, that should mean that nuclear plants -- atomic plants like Seabrook -- should not be emitting radionuclides.

Now, I'm focusing on tritium for good reason. There was a study conducted in the state of Massachusetts a number of years ago that focused on the Deerfield River Valley and was eventually signed-you off on by the State officials within the state Department of Public Health for the state of Massachusetts that showed statistical significance for things like certain cancers and Down's Syndrome in the Deerfield River Valley -- which was close to the Yankee Rowe plant before it closed. Apparently, those findings of cancer were eventually linked to exposures in the Deerfield River Valley to tritium. 028-2

I have in my possession a report that was done by a group out in western Mass. -- the Citizens Awareness Network -- that was involved in creating that study that talks about three very important effects of tritium -- it's carcinogenic, it's mutagenic, and it's teratogenic. Teratogenic meaning that it is possible that exposure to tritium will cause genetic defects down the line. The other two, I think, are self-explanatory.

The reason I'm bringing up tritium in relation to Seabrook in particular -- it could be Cesium-137, it could be Strontium-90 -- but here, word has come down to me that the owners of Seabrook have been boring test wells over the last -- in the recent past -- apparently looking for traces of tritium. I don't know whether the wells have been dug deeply enough -- I

028-1 The commenter feels that public comments should be part of the environmental review process. The NRC agrees that public participation is a vital part of the regulatory process. The results of public involvement in the Seabrook environmental review are captured in this Appendix. No changes have been made to this SEIS as a result of this comment.

028-2 The NRC's regulatory limits for radiological protection are specified in 10 CFR Part 20. The dose to members of the public from a nuclear plant is based on the amount of radioactive material that is released from the plant. The NRC requires each nuclear power plant to calculate the dose associated with the radioactive releases. Each nuclear power plant is also required to report the dose to members of the public from their radioactive releases in an annual report submitted to the NRC and publically available on the NRC's website. The NRC inspects the reported dose values to determine the licensee's compliance with its dose limits.

Radiation doses to members of the public from the current operations of Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section, the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radioactive leaks, and radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological doses to members of the public were within NRC's dose limits.

As discussed in Section 4.8.1.2 of this SEIS, the NRC staff also evaluated Seabrook's radiological environmental monitoring program (REMP). Based on the review of several years of data, the NRC staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation to humans. The limits are based on the recommendations of scientific standards-setting organizations, and reflect extensive scientific study by national and international organizations. The models recognized by the NRC for use by licensees to calculate dose incorporate conservative assumptions to ensure that workers and members of the public are adequately protected from radiation.

don't know anything about the wells -- and I don't know what's been found. I think that it should be part of the public record to know if tritium is actually leaking from the reactor at Seabrook. But, God save the people that are close to that nuclear reactor if tritium gets in the groundwater and travels. I think that the NRC should be holding, not only Seabrook, but all reactors to account for their releases of tritium.

And I'll say, finally, in relation to tritium -- that it does us on planet earth no good if we're using nuclear power as a way to bridge our energy toward a carbon-free future, if by doing so we've taken on this Faustian bargain of irradiating the earth in the process. 028-2

The next thing I wanted to say is -- why does the Nuclear Regulatory Commission not require independent monitoring of radiation that allows reactor community residents and first responders -- not only here, but all over the United States -- to know the real-time direction, location and intensity of radioactive plumes in the event of a radiological event.

If that had been put in place 15-years ago for reactors around the country -- such as Seabrook -- and the NRC was actually looking at that information as a part of its evaluation of relicensing -- then the NRC would have some strong data on which to base the actual safety of this plant. But, without that information -- what do you really have for data as far as the health and safety of the local environment, if you don't actually know what radiation is being emitted? So, that should be done not only here, but that should be done all over the world. 028-3

I want to point out for those of you that don't know that there's one group in this area -- the C-10 Research and Education Foundation out of Newburyport, Massachusetts -- that at this time has the model independent monitoring system in the entire United States and we have actually had visitors from Fukushima come to C-10 because people all over the world have suddenly become interested in how to properly monitor for radiation.

My last two-items have to do with hardened on-site storage of spent fuel. You should be requiring hardened on-site storage as a prerequisite for relicensing. 028-4 I'm also curious to know -- and I could just leave this as an open question -- if there's any consideration being given to the potential for inundation of coastal floodplains over the next 25-years? If you're considering relicensing at this time, then you have to be considering inundation in relation to global warming. Thank you. 028-5

028-2 cont'd Although radiation may cause cancers at high doses, currently there are no reputable scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 10 rem (0.1 Sv). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This is consistent with the information contained in the National Academy of Sciences' Biological Effects of Ionizing Radiation (BEIR) report cited in the comment. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit in 10 CFR Part 20 is 100 mrem (1 mSv) for all facilities licensed by the NRC, the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor has enforceable license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected.

On April 7, 2010, the NRC announced that it asked the National Academy of Sciences (NAS) to perform a state-of-the-art study on cancer risk for populations surrounding nuclear power facilities (ADAMS Accession No. ML100970142). The NAS study will update the 1990 U.S. National Institutes of Health National Cancer Institute (NCI) report, "Cancer in Populations Living Near Nuclear Facilities" (NCI 1990), which concluded there was no evidence that nuclear facilities may be linked causally with excess death from leukemia or from other cancers in populations living nearby. The study's objectives are to: 1) evaluate whether cancer risk is different for populations living near nuclear power facilities, 2) include cancer occurrence, 3) develop an approach to assess cancer risk in geographic areas that are smaller than the county level, and 4) evaluate the study results in the context of offsite doses from normal reactor operations.

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028-3 The comment relates to NRC's regulatory requirements for radioactive effluent monitoring at nuclear power plants and is out of scope for license renewal. Radiation doses to members of the public from radioactive effluent releases from Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section, the NRC staff discussed its review of five years of data from the licensee's annual radioactive effluent release reports (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities, and the calculated doses to members of the public). Based on its review, the NRC staff concluded that the radiological doses to members of the public were within NRC's dose limits.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-4 The commenter feels that applicants should be required to install hardened onsite storage facilities, often referred to as independent spent fuel storage installations, as a prerequisite for license renewal. The purpose of a license renewal review is to ensure the effects of aging on passive, long-lived systems, structures, and components are adequately managed through any period of extended operation. How an applicant manages their spent fuel is an issue that is addressed through the NRC's ongoing reactor oversight process, and is outside the scope of a license renewal review.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-5 The commenter feels that the NRC should consider the effects of rising sea levels resulting from climate change. Climate change and its potential impact on the environment around Seabrook, including the postulated rise in sea level in the vicinity of Seabrook, are discussed in Chapters 2 and 4 of this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

MICHAEL WENTZEL: I'm not really sure. I'm not a PRA expert. I'm definitely not a SAMA expert, so I can't answer that question specifically. I would be happy to -- I'm almost positive that we have that information either submitted through the applicant or in the EIS, but I can't point to it specifically. That's something that if you want to give me your contact information, I can find that out and let you know where that information can be found.

THOMAS POPIK: Okay, thank you. I have a follow-up. Seems to me that that would be critical information for the public to know, but I'll talk about that later on in my comment. I would ask -- as a follow-up question -- is the impact of a great geomagnetic storm -- similar to the Carrington event or other solar disturbances that we have had -- incorporated in any of the initiating event frequencies? 027-2

MICHAEL WENTZEL: Again, I'm not an expert on that. That's something else I can look into and let you know.

THOMAS POPIK: Okay, thank you.

BRIAN ANDERSON: Thank you, sir, for those comments. The next speaker will be Thomas Popik followed by Debbie Grinnell.

Before Mr. Popik speaks, I wanted to take the time to recognize two members of Senator Ayotte's staff that are here today -- Simon Thomson and Mike Scala -- in the back row. I wanted to make everybody aware that they're here today. Thank you gentlemen for joining us.

THOMAS POPIK: Hello. My name is Thomas Popik. I'm with the Foundation for Resilient Societies. I come here today with the concern of long-term loss of outside power to nuclear power plants. Many of you already know that nuclear power plants -- almost all of them -- require connection to a functioning electric grid to maintain operations. If they lose that connection, there are backup diesel generators, but they only have a seven-day -- in most cases -- supply of fuel on site.

For many of us, this is a major concern should we experience a power outage in excess of seven-days accompanied by difficulties in re-supplying diesel fuel. So, these type of issues have been examined at very high levels and I'm here today to read some excerpts from a letter written by Dr. Bill Graham, who was Chairman of the Electromagnetic Pulse Commission -- that's a Congressionally charged Commission -- as well as, previously, science adviser to the President. So, I'm going to read some of this letter, which was addressed to the Chairman of the NRC --

Dear Chairman Jaczko, I am writing you as the Chairman of the Congressionally mandated Commission to assess the threat to the United States from electromagnetic pulse attack, as well as the former science adviser to the President and director to the Office of Science and Technology Policy in the Executive Office of the President from 1986 to 1989. This letter is to urge you as you form plans to protect nuclear reactors from Fukushima-type disasters where electric power to support nuclear plant operations is lost for a protracted period to take account of the very real threats from a great geomagnetic storm and from a nuclear EMP attack.

027-10

An EMP can be generated naturally by a solar flare or coronal mass ejection from the sun, which can produce a great geomagnetic storm on the earth, similar to some aspects of an EMP attack from a high-yield nuclear weapon with similar catastrophic consequences. A great geomagnetic storm can cause collapse of the electric grid and other critical infrastructures -- transportation, communications, banking and finance, food and water -- for a protracted period of months or years.

Now, this is an important part here --

A study by the National Academy of Sciences independently confirmed the EMP Commission's assessment that if a great geomagnetic storm like the 1859 Carrington event recurred today, recovery of the national electric power grid could take four to ten-years. Such an event could also cause operators of the (108) nuclear plants in the United States to lose the ability to perform a safe controlled shutdown of their power reactors producing a Fukushima-like disaster on a large-scale. Although great geomagnetic storms are rare, estimated to occur about once a century, most experts assess that we are probably overdue.

Now, this isn't some fringe group that's coming up with a speculative scenario. These kind of events have already occurred in recorded history. There was another great

027-10 This comment urges the NRC staff to address the long term loss of power and resultant loss of long term cooling.

As mentioned in Comments 018-1, 027-28, and 006-1, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an extended period of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

geomagnetic storm in 1921. This is a former science adviser. This letter is copied to the current science adviser to the current President, who also has written an extensive editorial in the New York Times warning of this kind of potential event.

Now, I'm speaking mostly to the NRC staff here today. I urge you -- go back to your offices and please talk about this. This is not speculative. This is a real danger. When the probability of these kind of events is not included in Environmental Impact Statements, it affects the credibility of the NRC and it puts all of us at risk. These kind of events can be protected against, but not if we don't address them in the regulatory process. Thank you. 027-10

BRIAN ANDERSON: Doug -- thank you for those comments. The next speaker is Lee Roberts and we will then have Paul Gunter speak.

PAUL GUNTER: I'm speaking tonight. I didn't request to speak this afternoon.

BRIAN ANDERSON: I see that now, Paul. Thank you. I'll save this card for tonight.

LEE ROBERTS: Thanks. Hi, I've already spoken my piece, I realize. So, I will be very brief. I just want to say, as a layman, that I feel like what I've heard today tells me not only should we even consider this extension of the license -- as far as I feel, after hearing all that I heard today and I came in here concerned, but now I'm multi-concerned -- many, many worries. I feel as if everything should stop. That we're in danger now -- far more than any of us had thought. Never mind with an extension. There are just so many problems we've heard about today. It just doesn't seem that it makes any sense for us to have this even operating until all of these issues have been resolved. Thanks. 027-40

027-40 The commenter expresses opposition to the continued operation and relicensing of Seabrook. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Steven, thank you for those comments. The next speaker is Mary Ross and after Mary, William Harris will speak.

MARY ROSS: Thank you. I will be very brief. I have some questions. How can NextEra justify the Seabrook Station 10-mile Emergency Planning Zone or the 50-mile ingestion pathway when we know how widespread contamination can and would be given an accidental release of radioactivity?

We know that weapons testing in Nevada contaminated our entire country. We know that we have received and continue to receive fallout from Fukushima. How can NextEra say that protective measures are adequate for the immediate and greater communities? How can they justify the continued operation of an aging plant that has met its design age limit?

027-27

027-27 The commenter expresses concerns related to emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you, sir, for those comments. The next speaker is Paul Blanch -- is Mr. Blanch in the room? Is there anyone else named Paul that registered to speak? Okay. The next speaker is Thomas Saporito -- who I believe is on the phone. Mr. Saporito -- can you hear me?

THOMAS SAPORITO: Yeah. Can you hear me?

BRIAN ANDERSON: I can hear you. I'm going to try and place a microphone near the speakerphone to see if that'll better allow everyone else in the room to hear you. When you're ready to make your comments -- it's your time.

THOMAS SAPORITO: Can you hear me now? Can the court reporter hear me?

BRIAN ANDERSON: Yes, he can. You are on the record.

THOMAS SAPORITO: Okay. First of all, my name is Thomas Saporito. I am the senior consultant with Sapordani Associates and we're located in Jupiter, Florida. I have (4) points that I want to address to the NRC with respect to this relicensing issue.

However, before I get into that, I just want to follow-up on the prior speaker's comments on the NRC being premature in their endeavor to relicense this nuclear plant so far in advance.

It's my perspective, after monitoring the NRC for some 25-years, that the NRC is involved in a process of rubberstamping these 20-year license extensions to nuclear power plants that were only originally licensed to operate safely for 40-years. The NRC is aggressively rubberstamping these licenses because there are Senators and Congressmen who are actively trying to put a moratorium on relicensing nuclear power plants. So, now there is a race between Congress and the Nuclear Regulatory Commission with respect to this issue. So, that's the heart of it all right there. It's not the fact that the NRC's trying to protect public health and safety in this instance. In this instance, the NRC is in a footrace trying to rubberstamp these licenses without due process. 028-10

With respect to this specific plant and the relicensing issue here -- the NRC appears to have failed in its Environmental Review to consider the brittleness of the metal that comprises the reactor vessel. The Associated Press recently did a year-long investigation of the NRC and found the NRC to be complacent and found that these nuclear power plants were only licensed to safely operate for 40-years. The Associated Press investigation confirmed that the Agency is rubberstamping these license extensions at the peril of public health and safety.

So, I would encourage and request that the NRC require the licensee -- NextEra Energy -- to do destructive testing analysis of the metal which comprises the nuclear reactor vessel, to ascertain the exact degree of imbrittelment that may currently exist in that reactor vessel. Because if that reactor vessel cracks from the neutrons that are bombarding it -- you're going to have a loss of coolant accident that you could not recover from and you'd be melting down, just like the reactors in Japan. Once you do that analysis, then you can prorate that and see if that reactor vessel's going to crack if the license is extended 20-years beyond its 40-year license. 028-11

028-10 The commenter expresses negative statements related to the NRC's license renewal process. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

028-11 The commenter raises issues related to reactor vessel embrittlement during the term of a renewed license for Seabrook, which is outside the scope of the environmental review. Reactor embrittlement is evaluated as part of the license renewal safety review. The NRC requires that an applicant detect and mitigate the effects of aging, beginning with an examination and verification that the systems, structures, or components function as they were originally intended to and that their functions have not been compromised or degraded. The NRC staff's final determination relating to embrittlement will be documented in the final safety evaluation report for the Seabrook license renewal application.

This comment provides no new information, and no changes have been made to this SEIS as a result.

The next issue would be the alternatives. The NRC's Environmental Review and report is a joke on the alternatives. First of all, if the NRC would simply -- in their review -- have considered installation of on-demand electric water heaters for all the customers of NextEra Energy, you would reduce the grid's electrical load demand by 50 to 70% with the installation of just that one appliance. If you add solar systems to the customers of NextEra Energy -- you would have a zero footprint. You would actually -- those customers would actually be putting power into the grid and you wouldn't even need Seabrook. You would have surplus power with those two initiatives. You wouldn't need Seabrook to operate at all. 028-12

And that's required. Those analyses are required by the Agency to be part of their Environmental Report. I don't see it in there. And these are realistic, real-time -- if you go to our web site saporito-associates.com -- there's a hyphen between those two words -- you will see the evidence where those systems are already in place for many years -- they're not something new. This has been going on for years.

The next issue would be earthquakes. The NRC Environmental Report should have required the licensee to do a new seismic evaluation of the Seabrook facility. Just as recent as August the 23rd of this year, the North Anna Nuclear Power Plant experienced a seismic event outside its design basis. Okay? Outside its design basis. So, the NRC granted North Anna a license and had an earthquake event happen outside its design basis. Who's to say that there's not going to be a seismic event that's going to be outside the design basis of the Seabrook plant? That's something that's supposed to be in the NRC's Environmental Report and I don't think it's sufficiently in there -- if it's in there at all. 028-13

The final item I want to address to the NRC is with respect to the environmental consequences of the NRC's action allowing this nuclear plant to operate for 20 more years. It's going to adversely affect the environment because it's going to introduce millions and millions of BTUs worth of heat that would not otherwise be introduced into the environment because the reactor -- the fuel in the nuclear reactor core has to continuously be cooled by water and that heat is dumped into the environment. If that nuclear plant wasn't operating for 20 more years, you wouldn't have 20 more years of heat being dumped into the environment that wasn't there before. That all contributes to global warming. Okay? You may have a near zero carbon footprint with nuclear power production, but you damn sure have a lot of heat being unnecessarily put into the environment. 028-14

So, these issues I would hope and urge the NRC to take seriously and to incorporate them into their Environmental Report and I would hope that the interveners in the current licensing proceeding are addressing these issues, as well. Thank you very much.

028-12 The NRC staff considered demand-side management strategies in the Energy Conservation/Energy Efficiency Alternative in Section 8.4.12. Based on studies and projections by ISO-NE and the U.S. Federal Energy Regulatory Commission regarding the potential reductions in electricity demand, the NRC staff determined that only minor potential remains for an expansion of Energy Conservation and Energy Efficiency programs in the Seabrook service area. The Energy Conservation and Energy Efficiency programs described by the commenter are voluntary and it is unlikely that there would be one hundred percent participation and concurrent energy savings from such programs. Therefore, the NRC staff determined that Energy Conservation and Energy Efficiency would not be a reasonable alternative because such programs would be unlikely to replace the electric output provided by Seabrook, especially when considering future electricity demands.

In Section 8.4.2, the NRC staff determined that solar energy would not be a reasonable alternative to license renewal because of the modest levels of solar energy available throughout the ISO-NE service territory, the weather-dependent intermittency of solar power, the inefficiency of solar technologies, and the minor contribution of solar energy to the power generation in New Hampshire and most New England states.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-13 This comment expresses concern that earthquakes and tsunamis could affect the East Coast of the U.S. and could have similar impacts as the accident at the Fukushima Dai-ichi nuclear power plant had on the Japanese coast. Geologic and seismic conditions and related natural hazards were considered in the original siting and design of all nuclear power plants, including Seabrook, and are part of the current licensing bases for operating plants and, as such, are outside the scope of the license renewal environmental review. The NRC requires all licensees to take natural phenomena, including seismic activity and related effects, into account in order to maintain safe operating conditions at all nuclear power plants.

The next issue would be the alternatives. The NRC's Environmental Review and report is a joke on the alternatives. First of all, if the NRC would simply -- in their review -- have considered installation of on-demand electric water heaters for all the customers of NextEra Energy, you would reduce the grid's electrical load demand by 50 to 70% with the installation of just that one appliance. If you add solar systems to the customers of NextEra Energy -- you would have a zero footprint. You would actually -- those customers would actually be putting power into the grid and you wouldn't even need Seabrook. You would have surplus power with those two initiatives. You wouldn't need Seabrook to operate at all. 028-12

And that's required. Those analyses are required by the Agency to be part of their Environmental Report. I don't see it in there. And these are realistic, real-time -- if you go to our web site saporito-associates.com -- there's a hyphen between those two words -- you will see the evidence where those systems are already in place for many years -- they're not something new. This has been going on for years.

The next issue would be earthquakes. The NRC Environmental Report should have required the licensee to do a new seismic evaluation of the Seabrook facility. Just as recent as August the 23rd of this year, the North Anna Nuclear Power Plant experienced a seismic event outside its design basis. Okay? Outside its design basis. So, the NRC granted North Anna a license and had an earthquake event happen outside its design basis. Who's to say that there's not going to be a seismic event that's going to be outside the design basis of the Seabrook plant? That's something that's supposed to be in the NRC's Environmental Report and I don't think it's sufficiently in there -- if it's in there at all. 028-13

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So, these issues I would hope and urge the NRC to take seriously and to incorporate them into their Environmental Report and I would hope that the interveners in the current licensing proceeding are addressing these issues, as well. Thank you very much.

028-13 cont'd When new information becomes available, the NRC evaluates the new information to determine if any changes are needed at existing plants. After the Fukushima accident, a task force of senior NRC staff reviewed the circumstances of the event to determine what lessons could be learned. In July 2011, the task force provided recommendations to enhance U.S. reactor safety (ADAMS Accession No. ML111861807), and these became the foundation of the NRC's post-Fukushima activities. Two of the NRC's post-Fukushima activities are seismic reevaluation and flooding reevaluation. Since seismic and flooding hazards post-Fukushima are being reviewed and evaluated as part of the current licensing bases, these hazards are outside the scope of the license renewal environmental review.

Nevertheless, as part of characterizing the environmental baseline (affected environment) and associated resource conditions of the Seabrook site and vicinity, Section 2.2.3 of this final SEIS includes a discussion of the geologic environment including its seismic setting, although no impacts or hazard analysis has been performed. As cited by the commenter, Section 2.2.3 also includes a discussion of the Grand Banks earthquake and tsunami of 1924.

This comment provides no new information, and no changes have been made to this SEIS as a result of this comment.

028-14 The NRC staff evaluated the impact of the thermal discharge at Seabrook on the aquatic environment in Section 4.5.3 of this SEIS. Based on NextEra's compliance with Section 316(a) of the CWA, modeling of the thermal plume at Seabrook, and monitoring of cold water and warm water algae, the NRC staff concluded that thermal impacts on aquatic resources from the continued operation of Seabrook would be SMALL.

Climate change and its potential impact on the environment around Seabrook is discussed in Chapters 2 and 4 of this SEIS. However, as part of this analysis, the NRC did not specifically address whether the heated effluent from the operation of Seabrook is or could potentially be contributing to climate change, nor are there any major studies that conclusively indicate that the heated effluent from power plants are a contributor to climate change, on a global scale. Additionally, the regulation of Seabrook's once-through cooling system, including establishing the limits of heated effluent that may be discharged to the environment, is within the purview of the EPA rather than the NRC.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Paul -- thank you for those comments. Representative Schmidt and then we'll hear from Paul Blanch.

REP.PETER SCHMIDT: Thank you. I'm Peter Schmidt. I represent Dover, Wards 1 and 2. I am not a scientist -- and not even to say a nuclear scientist -- and I don't speak as a scientist, but rather as a policymaker. I've been in the legislature now for nearly 9-years and I was 3-years as a Dover City Council before that, so what I am in the business of is judgment with regard to policy.

I would have to say that just -- before I begin my more pertinent remarks -- that what Paul has just referred to, but also the questions with regard to contacting the public -- demonstrate either a somewhat willful disregard of some of the facts, which one could possibly attribute to somewhat of a silo-type of thinking -- you're focused on your specific bailiwick and not looking in the wider thing -- perhaps disregarding the information which Paul eluded to.

But with regard to trying to get the public to be informed -- the bottom line here is if you asked virtually any resident of the seacoast, certainly the elected representatives, with regard to contacting the public in this area -- I think they would've said that some of the publications you referenced would be useful, but by no means sufficient -- ads in the Union Leader, Portsmouth Herald, the Dover Foster's Daily Democrat and other more widely circulated papers would certainly have gotten you a lot more feedback from a much wider area, which is perhaps not within the evacuation zone, but would definitely be impacted by the relicensing of Seabrook. 028-7

I don't try to address the scientific aspects of this issue. I'd like to look at the larger picture because the fact of the matter is -- my greatest concern is not the possibility of terrorism or environmental disaster -- I think those are all much more on your mind and possibly more predictable. But, if I mention such things as Fukushima or Three-Mile Island or Chernobyl, or the Titanic disaster, for that matter -- I don't do so in order to create an alarmist sentiment, but rather because they demonstrate the fallibility of human design concepts, but also the unpredictability of future events. 028-8

And certainly, just in the last 10-years, we've seen Fukushima, we've seen the Twin-Towers and September 11th. And those things demonstrate that we're not very good at predicting the future. That there are all types of things that are happening and one of the concerns that we certainly have is global warming. Seabrook is very close to the ocean, obviously. I'm wondering -- we read recently, for example, that several nuclear power plants along the Missouri River were essentially isolated and may have experienced some flooding -- we're very concerned in this area what that type of thing might generate.

My primary concern here is that we are engaged in the relicensing process way too far in the future. I just cannot believe that it is appropriate to relicense Seabrook at this time when the current license is not even remotely ready to expire. What do we really know about what the situation is going to be. Some of the aspects have eluded to -- the possibility of degradation of the plant's infrastructure -- but all these other aspects, which I've just very briefly touched on -- suggest to me that this is -- a relicensing of Seabrook at this time -- is incredibly premature given all the things that we absolutely know are potential problems: a terrorist act, the storage aspect, the sea level rise and those types of things. Those are the types of things that 028-9

028-7 The commenter expresses concern relating to public involvement in the Seabrook license renewal process. Appendix A of this SEIS includes public comments received relating to the Seabrook license renewal environmental review, as well as the NRC staff's response to those comments. With regard to the public advertisement of the draft SEIS public meeting, multiple newspaper ads were placed in the Hampton Union, Exeter News-Letter, and the Seacoast Sunday, which is distributed to the area covering the Portsmouth Herald, Exeter News-Letter, and Hampton Union. Flyers advertising the meeting were distributed throughout the local area. Additionally, the NRC issued two different press releases related to the meeting which were picked up by various local media outlets, and even announced the meeting via Twitter. While there are always additional, and often costly, ways to inform the public, the NRC staff believes that the effort undertaken to make the public aware of the Seabrook draft SEIS meeting was a cost-effective approach that was sufficiently robust enough to inform a significant majority of people interested in participating.

This comment provides no new information, and no changes have been made to this SEIS as a result.

028-8 The commenter expresses concern about the predictability of future events. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

With respect to the potential for future flooding at Seabrook as a result of climate change, a discussion of climate change and its potential impact on the environment around Seabrook, including the postulated rise in sea level in the vicinity of Seabrook, can be found in Chapters 2 and 4 of this SEIS.

028-9 The commenter expresses concern about the timing of the license renewal process for Seabrook. As allowed by 10 CFR 54.17, NextEra submitted the Seabrook license renewal application 20 years before the expiration of their current license. The NRC has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Should the NRC grant NextEra's request for a renewed license, the NRC will continue to provide continuous oversight through its Reactor Oversight Process to verify that they are being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action is required to protect public health and safety. This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you for those comments. The next speaker is Raymond Shadis. After Raymond will be -- I believe it's Connie Wilkins and Doug Bogen after that.

RAYMOND SHADIS: I just have a few brief comments and they largely have to do with process and approach. First -- taking off from what Mr. Paul Gunter said about the schedule -- investigation of the lessons learned from Fukushima and so on and how they might apply in license renewal. I'd like to comment on one aspect of that asymmetrical approach where the process goes forward at a set pace, but the investigation on safety related and environmentally related issues -- it doesn't keep pace with the process.

That is the effect that -- if you go ahead at a careful methodical pace to investigate the Fukushima issues and I really think that's appropriate, then your findings -- your insights -- will not be available until after the proceeding is closed. I've heard it from NRC on the national level and also at our local annual site assessment meetings that -- We're studying this and we're going to put into effect whatever measures are necessary to address the lessons learned from Fukushima. Well, all well and good, except for its effect on the hearing rights of the citizens and the states.

Well, if the opportunity for a hearing has expired and the hearing itself is completed -- You can always bring your concerns to us via the 2.206 process or if it's a regulation that is at issue -- the 2.802 where you can do a rulemaking, whatever. The problem with the 2.206 process is that there are no standards for judgment or decision. The director's decision can be arbitrary and capricious. It is not reviewable. You cannot appeal a 2.206 decision. You have no rights of discovery. You have really no right to rebut. You cannot examine witnesses. There are none of the trappings of a real adjudicatory process. 027-29

So, what you're doing -- if you delay decisions that would affect the material issues in a hearing until after the hearing is over -- is you take away those hearing rights. And in effect, I guess the solution would be to grant the petitions that have been filed to say -- Please suspend the hearing process until these considerations are processed -- the Fukushima lessons learned.

Or offer a second opportunity for hearing after those things are registered. I'm hoping that I'm communicating the asymmetry here. You really are running two different time schedules.

The second part of my comments is specifically on the nature of the environmental study that you provided. And again the topic is time -- time and trending. I'm going to take an example out of the study. It would be section 8.4, which has to do with Alternatives. Within that section there're -- all the considerations of alternatives are contemporary to 2010. That's the last date of any number that's put in there. For example, in 2010 there were 35,000 Megawatts of wind capacity. Of which, I've personal knowledge about -- 30,000 of that was installed in the last 20-years, during which time, of course, there were 0 Megawatts of new nuclear installed. But, that's a comparison. That comparison should be in there because it speaks to the viability of wind and the lack of viability for new nuclear. Now, I know you're promising you're going to build some plants, but I haven't seen them yet. But we have seen the wind come in. 027-30

027-29 The commenter expresses concerns relating to the public involvement—specifically the hearing process—and how it relates to license renewal. For a member of the public to have an issue adjudicated as part of the hearing process associated with license renewal, he or she satisfy the requirements of 10 CFR 2.309, which include standards for relevance and timeliness, among other requirements. Under certain conditions, outlined in 10 CFR 2.309, petitions to intervene may be admitted for consideration in an adjudicatory proceeding after a notice for hearing has expired. Therefore, if a new issue arises during the course of a license renewal review, members of the public may be afforded an opportunity to participate in the hearing process, based on a determination of the ASLB.

Other NRC processes outside of license renewal also allow for public participation through the hearing process. For example, the NRC provides an opportunity to request a hearing for certain licensing actions, such as license amendments. For issues outside of a specific licensing action or rulemaking, the commenter correctly notes that a member of the public can request the NRC to take action through either 10 CFR 2.206 or 10 CFR 2.802.

Relative to follow-up actions resulting from the accident at Fukushima, which is being handled separately from the license renewal process, it would be premature to say that the public will not be afforded an opportunity to participate in a hearing process. For example, an opportunity for hearing may result from certain site-specific licensing actions that result from follow-up actions. Additionally, per 10 CFR 2.104, the Commission could make a determination at some point in the future that a public hearing is in the public interest for some, or all, follow-up actions that result from the review of lessons learned.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-30 The Commenter raises issues with the alternatives analysis in the Seabrook draft SEIS. Specifically the commenter claims that the NRC did not take into account the rate of change for both installed capacity and cost of alternative energy sources, such as wind and solar. As mentioned by the commenter, the NRC staff included discussion in Section 8.4 noting the annual change in installed capacity, where such discussion was meaningful, such as for wind power.

The other part of this -- the part that's missing because you can draw a progression -- in 2009 there were 9,000 some-odd Megawatts of new wind installed -- wind capacity. That was up 40% from 2008. Okay? You can also almost start to build a trend from that, but what's missing here is the trend from 20-years ago for new wind capacity. Not only that, you've got that motion -- the hand goes up. You know, Bob Dylan said -- The times they are a-changing. But he should've said -- The times they are a-changing and the rate at which the changes are taking place is also increasing. This is true across the board for alternatives. Your report doesn't consider any of it. The other thing that's missing, which you have in the SAMA considerations -- you've got a price on human life -- a cost-benefit analysis. That's there.

But, in your analysis of Alternatives -- there is little or no cost benefit analysis included. And further, in terms of cost, there's no trending. The price of installed solar has been going down. The price of installed wind power has been going down. There's no acknowledgment of that nor is there any acknowledgement of the rate of change in the decline of cost in these. And it's important because by doing an early license renewal, you're put in the preposterous position of trying to project out 20-years on this stuff. You know? If you went back 20-years -- and I have -- looking at all the DOE projections and everything for Alternatives 20-years ago -- in no way did they reflect the reality of what's happening in the marketplace today. 027-30

And you're trying to analyze for the period of extended operation -- you're forced to be looking 20-years ahead. Without including some trending. Without including trending on available capacity, on construction of transmission lines, on the cost of it. You've got nothing. I think the failure to include these completely invalidates your entire section on Alternatives. You really need to go back and talk to -- if you don't have the expertise at the Agency -- by the way, I am disappointed that you didn't bring experts to this meeting so that you could have answered the questions that were asked earlier -- you might anticipate those. But if you don't have experts in the Agency to go and get on and Google the numbers, then go to your sister agencies -- go to DOE or whoever and get the numbers. But they're not in your report. So that's my criticism on that.

The other thing is that when the Fukushima thing happened, we went right to the question -- the NRC nationally and locally has been saying -- Well, yes, but what are the chances that we're going to have an earthquake and a tsunami on the East Coast of the United States -- zero. Well, what we did is we went to the computer and if you do it and you go to the Maine Geodetic Survey at the state of Maine web site, you will find that in the early part of the last century -- I think it was 1924 -- there was a 4.2 earthquake and a consequent landslide on the Grand Banks and it resulted in a tsunami that when it hit the shores of Newfoundland and was driven up into the bays -- narrowed in the bays -- put up waves in excess of 95 feet. It's no joke and in geologic time, which you're supposed to be working in, it's a wink of an eye to yesterday. 027-31

So these are events that are now. Your report really should be and I guess this is part of it -- the comments -- but it should be a living document and you should be updating it. We shouldn't be looking at data from 2009 and data from 2010. And certainly sterling events like the Fukushima event should be a signal to go back to the drawing board and revamp the document. Thank you very much. 027-32

027-30 cont'd While renewable energy technologies have seen growth in installed capacity since 2007, each technology considered had inherent limitations that led the NRC staff to conclude that these technologies were unacceptable for consideration as discrete replacements for the power generated by Seabrook. Though not analyzed as a discrete replacement for Seabrook, wind power was analyzed as a combination alternative replacement in Section 8.3 of this SEIS.

As far as the rate of change of the costs associated with alternative energy sources, the commenter is correct that no analysis of this type was performed for this review, nor was one necessary. As stated in 10 CFR 51.71(b), a SEIS need not discuss the economic or technical benefits and costs of either the proposed action or alternatives except if benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation.

As described in Chapter 8, the purpose of the alternatives review is to help the NRC decide whether the adverse environmental impacts of license renewal are great enough to deny the option of license renewal for energy-planning decision makers. An analysis of installation costs, while useful for energy planning decisionmakers, would not be useful for assessing environmental impacts, and was not included in this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-31 This comment expresses concern that earthquakes and tsunamis could affect the East Coast of the U.S. and could have similar impacts as the accident at the Fukushima Dai-ichi nuclear power plant had on the Japanese coast. Geologic and seismic conditions and related natural hazards were considered in the original siting and design of all nuclear power plants, including Seabrook, and are part of the current licensing bases for operating plants and, as such, are outside the scope of the license renewal environmental review. The NRC requires all licensees to take natural phenomena, including seismic activity and related effects, into account in order to maintain safe operating conditions at all nuclear power plants.

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Nevertheless, as part of characterizing the environmental baseline (affected environment) and associated resource conditions of the Seabrook site and vicinity, Section 2.2.3 of this final SEIS includes a discussion of the geologic environment including its seismic setting, although no impacts or hazard analysis has been performed. As cited by the commenter, Section 2.2.3 also includes a discussion of the Grand Banks earthquake and tsunami of 1924.

This comment provides no new information, and no changes have been made to this SEIS as a result of this comment.

027-32 The commenter believes that the NRC should update the information in the Seabrook draft SEIS. Consistent with NRC regulations and policy, the NRC staff has incorporated any new or updated information throughout the Seabrook SEIS, where such updates were necessary.

No changes have been made to this SEIS as a result of this comment.

BRIAN ANDERSON: Thank you for those comments, Debbie. The next speaker will be Brian Stern followed by Marcia Bowen and then Steven Athearn.

BRIAN STERN: My name is Brian Stern. In your introductory remarks, you state that the public comment is very important. I believe that it is and I appreciate it, but I also think that the process is flawed for the lack of public comment on the safety portion. I understand that this meeting is limited to the environmental issues and that the Safety Evaluation Plan is not going to be subjected to this type of local hearing. 027-20

I think that the process is also flawed in that the topic is mired in technological issues and regulatory issues that are beyond the public's abilities to address. If we were dealing with a hazardous waste site -- which of course are of great environmental concern, but may pale compared to radiological issues -- the public could receive a technical assistance grant to be able to hire technical assistance to help them through the technological issues. In the nuclear field, there is -- in the NRC issues -- there is no similar TAG grant available, so you're relying upon the good graces of people to wade through hundreds of pages of technical documents to try to participate in this process. I've done my best, but I think it's a difficult process and I think it's flawed in those regards. 027-21

In reading through the documents, I have come across the phrase used by the NRC of 'unavoidable adverse impacts'. I'm shocked to hear that. This phrase is used in terms of "emissions and release of chemical and radiological constituents from the plant". There are chemical and radiological constituents released from the plant. That's acknowledged. That's 100% true. There's no question about it. And they are termed to be unavoidable adverse impacts. They're accepted. That's what comes along with it -- comes along with the plant. That turns the entire issue on its head. The matter is a question of licensing. That does not make it unavoidable. It's completely avoidable. How can you take the issue as to whether or not it's safe and say -- Well, these just come along with the plants, so it's unavoidable. The issue is -- it should not be licensed if these are avoidable adverse impacts, which they are. The alternative is to not extend the license. 027-22

We can look at these adverse impacts in a number of areas. In the groundwater, there is an acknowledged tritium leak. There is tritium in the groundwater. The EIS states that in order to control the tritium in the groundwater, there is water being pumped from the ground to the rate of 32,000 gallons a day for tritium plume control. That water, of course, would have an effect on the local groundwater and there is nothing in the report that I saw -- but again, I'm skimming through hundreds of pages -- that addresses the effect on local groundwater supplies. Nor does it predict the effect on local groundwater supplies as we go out 40-years.

Water becomes one of the key limited resources we're going to face in the future. That's pretty accepted wisdom. Water is gold and it will be gold in the future and 32,000 gallons a day now -- the plant was not designed to leak tritium. What are the predictions for an increase in the rate of tritium being leaked? The plant has already been increased in its Megawatts thermal and net electrical capacity -- I think by about 12%. And what is the increase going to potentially be in the future or not? The plant is running hotter than it was initially licensed for. What is the corroding material or something that's happening for the tritium release and these are not going to be linear degradations in plants. 027-23

027-20 The commenter expresses concern over the ability to provide comments on the NRC staff's license renewal safety evaluation report (SER). While the NRC does not typically issue license renewal SERs for public comment, public participation in the safety review is still an important part of the license renewal process. Members of the public typically get three opportunities to participate in the safety review for license renewal: the opportunity to request a hearing; during the Advisory Committee on Reactor Safeguards (ACRS) subcommittee meeting discussing the NRC staff's SER with open items; and the ACRS full-committee meeting discussing the NRC staff's final SER.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-21 The commenter points out the NRC's lack of technical assistance grants (TAGs) to support public involvement in NRC activities. TAGs, issued in support of the Superfund clean-up process, were created as part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The NRC is neither authorized, nor funded to issue grants similar to TAGs.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-22 The commenter expresses concern that Seabrook could be relicensed when relicensing would result in unavoidable adverse impacts. As described in Section 9.3.1, there will be both radiological and non-radiological impacts associated with renewing the Seabrook license. It is important to note that there would be unavoidable adverse environmental impacts for any power generation alternative to Seabrook. Impacts would vary by alternative, and would likely occur during both the construction and operation of the power source. This comment provides no new information, and no changes have been made to this SEIS as a result.

027-23 This comment expresses concern over the release of tritium-containing liquids to groundwater, the effect of plume control on local groundwater resources, the potential for future tritium leaks, and the need for groundwater pumping during decommissioning. As detailed in response to comment 011-6, Section 2.2.5 of this final SEIS describes the current state of knowledge regarding groundwater hydrology and

So, I've not seen in the report the projection of what the tritium release will be in the future. What the rate of groundwater pumping will be in the future. How long will that groundwater need to be pumped after decommissioning? So, I think there's a big failure in the report in that regard. 027-23

The groundwater -- 32,000 gallons a day -- that's being pumped from the plant is being put into the water discharged out to the ocean. I was shocked to hear that. I don't think most of the public knows that. Nor do I think that the fishermen or recreational people know that either. We have an enormous aquatic resource here that also does not stay local. Fish, shellfish -- whatever it may be -- move and water moves. There's dilution, but I did not see in the report what's being done to warn the public of the discharge of tritium in that area and concentrations. 027-24

I've not seen anything that assesses a bioaccumulation or long-term effect of tritium. I've not seen anything in the report talking about warning people -- warning fishermen. I have not seen anything where the fishermen that concentrate in that area -- or lobster traps in that area -- to test what's caught in that area or to test that the health of people that are regularly consuming resources from that area of the discharge of the pipe. So, I think that there are flaws or gaps or omissions in the Draft SEIS with regards to the tritium and the groundwater leak.

BRIAN ANDERSON: Brian, I'll ask that you take just one more minute to finish up your comments.

BRIAN STERN: I would ask for more time to speak. I'm trying to be concise. Each of my topics have a number of -- I'd like to move on now to air quality.

BRIAN ANDERSON: Brian, there are a lot of other people that have signed up to speak. I want to make sure that everybody has equal time. At the end, if you're not able to finish in the next minute, I'm happy to let you finish if there's more time left in the meeting.

BRIAN STERN: If you prefer that I will -- you're asking me to limit my remarks to another minute -- I'll do so, but I'll ask then a chance to speak again at the end and have an opportunity to say my remarks.

BRIAN ANDERSON: That's fine, thank you.

BRIAN STERN: With regard to air quality -- again, they're treated as unavoidable adverse impacts. There is a radiological environmental monitoring plan that I think is not adequate or if it is adequate it does not meet its objectives. The air quality is determined to be within limits based upon limited monitoring on-site and the off-site monitoring is not with regards to radiological components. I do not think that the air quality is adequately tested. I think that it is a very reasonable cost to have real-time monitoring in a number of areas within New Hampshire. I know that the C-10 group is doing it out of their own budget. You would assume that NextEra could handle it in their budget and that the NRC would require it as part of the Radiological Environmental Monitoring Program that's imposed on the licensee. 027-25

Without that data, I don't see how the Draft SEIS can pass off on the air quality as not impacted, when the data is not collected sufficiently. And then to the extent that it is

027-23 cont'd groundwater quality of the Seabrook site and vicinity. In addition, as detailed in response to comment 011-6, Section 4.10 of this SEIS presents the NRC staff's evaluation of the impacts of inadvertent releases of tritium with respect to groundwater quality and human health. Based on the environmental review performed, the NRC staff has concluded that while inadvertent releases of liquids containing tritium (a radioactive isotope of hydrogen) have occurred to the subsurface at Seabrook, levels in groundwater have remained well below the EPA drinking water standard of 20,000 picocuries per liter, and no upward trend in tritium levels has been observed. Further, offsite water supply wells are located hydrologically upgradient from Seabrook and groundwater dewatering activities at the site otherwise provide hydraulic containment of tritium plumes beneath the site. With respect to the impact of groundwater pumping (dewatering) on local groundwater, Section 4.4.1 of this SEIS presents the staff's analysis of Seabrook's groundwater withdrawals. As noted in Section 4.4.1, the issue of groundwater use conflicts from nuclear power plants withdrawing less than 100 gallons per minute (gpm) (380 liters per minute [L/min]) is considered a Category 1 issue, which was generically evaluated in the GEIS (NRC 1996) with an impact finding of SMALL. The GEIS further found that total onsite groundwater withdrawals of less than 100 gpm are not expected to cause any ground-water use conflicts with local water supplies. Total onsite groundwater withdrawal associated with dewatering and plume control at Seabrook is about 24 gpm (91 L/min). The staff did not identify any new and significant information during the review of NextEra's ER, the public scoping process, or as a result of the environmental site audit that would change the conclusions presented in the GEIS. Therefore, it is expected that were would be no impacts related to continued groundwater withdrawals at the site during the period of extended operation.

Regarding potential impacts related to Seabrook decommissioning, activities that would follow a decision to terminate Seabrook operations that focus on the direct impacts of plant shutdown are described in Section 8.6 of this SEIS. As noted in Section 8.6.2, tritium contamination would diminish over time but ongoing remediation and mitigation activities including dewatering could continue after plant shutdown. The environmental impacts from decommissioning and related activities have already been addressed in several other documents, including the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1; the license renewal GEIS (Chapter 7; NRC 1996); and Chapter 7 of this SEIS. This comment provides no new information, and no changes have been made to this SEIS as a result.

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Without that data, I don't see how the Draft SEIS can pass off on the air quality as not impacted, when the data is not collected sufficiently. And then to the extent that it is

027-24 NRC regulations require NextEra to monitor water discharged into the ocean for radioactive material. As part of the environmental review, the radiation doses to members of the public from the current operations of Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radioactive leaks, and radiological impacts from refueling and maintenance activities). Based on its review the NRC staff concluded that the radiological impacts to members of the public were within dose standards specified in NRC's and EPA's dose standards. As discussed in Section 4.8.2 of this SEIS, the NRC staff also evaluated several years' worth of data from NextEra's radiological environmental monitoring program (REMP). Based on the NRC staff's review of NextEra's radioactive effluent and radiological environmental monitoring programs, radioactive doses from effluents are within NRC dose limits and there were no measurable impacts to the environment. Therefore, no adverse impacts are expected from the consumption of local fish or lobsters and no warning signs are required.

The NRC staff discussed NextEra's groundwater protection program in Section 2.2.5 of this SEIS. As part of the NRC staff's review of groundwater monitoring wells used at Seabrook, the NRC staff also reviewed the issue of tritium leaks associated with Seabrook's containment building. The NRC staff discussed its assessment of the impacts from Seabrook operation on groundwater resources in section 4.5 of the SEIS and concluded that there would be no significant impacts related to groundwater issues.

Additionally, as part of the NRC's Reactor Oversight Process inspection program, the NRC routinely inspects NextEra's implementation of its groundwater protection program. NRC inspectors review records of any identified leakage and spill events to assess whether the source of the leak or spill was identified and mitigated, and to review any remediation actions taken for effectiveness. This comment provides no new information, and no changes have been made to this SEIS as a result.

027-25 The NRC's regulatory limits for radiological protection are specified in 10 CFR Part 20. The dose to members of the public from a nuclear plant is based on the amount of radioactive material that is released from the plant. The NRC requires each nuclear power plant to calculate the dose associated with the radioactive releases. Each nuclear power plant is also required to report the dose to members of the public from their radioactive releases in an annual report submitted to the NRC and publically available on the NRC's website.

collected and they do find radiological releases in the air, they're called unavoidable adverse impacts.

I'd like to just finish before I turn the mic over -- if I'm going to go over a minute -- to just finish on the air quality issue, then I can pick it up later on other issues.

I understand that radiological releases into the air are considered acceptable based upon the nature of the gases that are emitted, but I also understand that those gases then further breakdown to Strontium and Cesium. I did not see in the Draft SEIS any discussion of that fact and the acknowledgment or evaluation of the air releases -- what they break down into further components and if that's done, I think it will find that the components that they further breakdown into -- the Strontium and Cesium -- have higher health risks than are acknowledged in the report. 027-25

And I would like an opportunity after this to continue, since I'm being stopped at this point.

027-25 cont'd The NRC inspects the reported dose values to determine the licensee's compliance with its dose limits. NRC regulations require NextEra to monitor effluent discharges into the air and water for radioactive material. The radiation monitors are required to accurately detect and measure the specific radionuclides released by Seabrook. As part of the environmental review, the radiation doses to members of the public from the current operations of Seabrook were evaluated in the SEIS in section 4.8.1.1. In that section the NRC staff reviewed the radioactive releases from Seabrook (i.e., radioactive gaseous and liquid effluents, radiation from radioactive waste storage buildings, radiological impacts from refueling and maintenance activities). Based on its review, the NRC staff concluded that the radiological impacts to members of the public were within dose limits specified in NRC's and EPA's dose standards.

As discussed in Section 4.8.1.2 of this SEIS, the NRC staff also evaluated Seabrook's radiological environmental monitoring program (REMP). Based on the review of several years of data, the NRC staff concluded that there were no measurable impacts to the environment as a result of radioactive releases from Seabrook operations.

In addition to the review performed as part of the license renewal process, the NRC provides continuous oversight of each plant under the NRC's inspection and enforcement programs. The NRC's Reactor Oversight Process integrates the NRC's inspection, assessment, and enforcement programs. The assessment program collects information from inspections and performance indicators in order to enable the NRC to arrive at objective conclusions about a licensee's safety performance. Based on this assessment information, the NRC determines the appropriate level of agency response, including supplemental inspection and pertinent regulatory actions ranging from management meetings up to and including orders for plant shutdown. NextEra's radioactive effluent release and radiological environmental monitoring programs are subject to this inspection program. NRC inspectors review each program to independently verify that the gaseous and liquid radiation monitors are performing their function and that records of radioactive releases are properly documented and the doses are within limits. NextEra is required to submit its radioactive effluent and environmental data to the NRC annually. The reports are available to the public on the NRC website.

No changes have been made to this SEIS as a result of this comment.

BRIAN ANDERSON: Thank you for those comments. Brian --

BRIAN STERN: Thank you. I'm Brian Stern. I'd like to pick up on the issue of aquatic resources -- the acknowledged impact on winter flounder, rainbow smelt and kelp is Large. As I read the Draft SEIS, it talks about mitigation of the impact to those. And as I read it, the mitigation is that NextEra would monitor the effect on the species of concern in other locations, such as the transmission lines. I know that doesn't make sense, but that's how I read it. Certainly, correct me if I'm wrong on that. But it seems to be that there's actually no mitigation itself for the impact on rainbow smelt, winter flounder and kelp.

As I read again the Cumulative Impact on these -- it then concludes that the Cumulative Impact from all of the other factors, including Seabrook, then makes it a Small impact rather than a Large impact. I reject the premise that a species of concern can absorb the additional impact of the power plant since it already is stressed by these other factors and that looking at the cumulative factors is a poor excuse for accepting the impact. The Draft EIS recognizes that the species are very important to the area. They're very big in the area and impacted greatly. There's letters from state and federal agencies talking about the importance of the fishery in this area and they expressed great concern for the impact. So, you have the agencies charged with monitoring the marine fisheries expressing concern, yet in the NRC's conclusion, over those experts, are that it's -- I guess -- another unavoidable adverse impact. 027-43

I'd like to address wind as the alternative and it's dismissed as an alternative based upon it being intermittent. Yet, the report's discussion of wind says -- that wind has a relatively high reliability. It says that -- there are strategic and tactical options under development, currently. The conclusions that the NRC reaches concerning wind does not match its finding concerning wind. And it relies upon a finding that there's no combination of wind and compressed air storage that's yet been proposed and it's relying upon a 2008 study. A lot has happened in four-years.

The report notes that concern with intermittent wind can be addressed by combinations of onshore and offshore wind where offshore wind is blowing most all the time and the development of onshore wind -- I'm sorry -- of offshore wind is where a lot of the development is taking place in wind power because of the reliability of wind offshore. So, I think the report is in error to simply dismiss wind based on its intermittent nature when that can be addressed by the combination of onshore/offshore by variable locations and developments that have taken place in storage of energy capacity -- whether it's pumped hydro where water is pumped up the tanks for later disbursement or to reservoirs, batteries and compressed air storage. 027-44

I'd like to address the issue of spent fuel. The facility was not designed for on-site storage. It was not intended as a licensed storage facility. It's not designed for storage. It's not designed for long-term storage and the storage facility is not secured from the types of natural disasters we've discussed or from terrorist acts. The storage is not that. The stored fuel is expected to be kept on-site for 60-years after closure. I don't think that you can assume that you will have 60-years of management from NextEra going to 2110. I think that would be an 027-45

027-43 Section 4.6.4 of this SEIS has been revised to include an expanded discussion of potential mitigation options, including structural and operational modifications to the Seabrook cooling system. In addition, Chapter 8 of the SEIS has been revised to include an evaluation of a closed-cycle cooling alternative. In this analysis, the NRC staff compares the environmental impacts of the current once-through cooling system with a closed-cycle cooling system, such as the estimated impingement and entrainment rates.

The commenter stated that the NRC staff determined that the cumulative impacts to aquatic resources would be SMALL. However, the NRC staff concluded that the cumulative impacts from the proposed license renewal and other past, present, and reasonably foreseeable projects would be MODERATE for most species and LARGE for winter flounder, rainbow smelt, and other species that would be adversely affected from climate change, such as lobster and Atlantic cod.

027-44 The NRC staff discussed potential methods to overcome the intermittency of wind power for use as baseload power in its analysis of a combination alternative in Section 8.3 and in the alternatives dismissed analysis in Section 8.4.1. For example, in the combination alternative evaluated in Section 8.3, the NRC staff analyzed the approach of building a number of wind farms to operate in a coordinated fashion as a "virtual power plant." In addition, Section 8.4.1 of this final SEIS includes an updated discussion of complementary energy storage technologies, such as pumped hydroelectric storage or compressed air energy storage, and offshore wind projects near Seabrook. After updating these discussions and considering the initial analyses, the NRC staff determined that wind energy would not be a reasonable alternative to provide replacement baseload power as a standalone alternative, because the, despite the presence of a high-value wind resource, wind turbine technology advancements, an improved ability to forecast wind, and the introduction of interconnected wind farm strategies, wind energy alone was not a reasonable alternative to Seabrook due to the limited installed capacity, immature status of technology to store energy, high costs of constructing offshore wind farms, and limited projected growth of wind power projects within the ISO-NE service territory. However, due to the quality and constancy of wind power in the Seabrook service territory, NRC analyzed wind power as part of the combination alternative in Section 8.3.

BRIAN ANDERSON: Thank you for those comments. Brian --

BRIAN STERN: Thank you. I'm Brian Stern. I'd like to pick up on the issue of aquatic resources -- the acknowledged impact on winter flounder, rainbow smelt and kelp is Large. As I read the Draft SEIS, it talks about mitigation of the impact to those. And as I read it, the mitigation is that NextEra would monitor the effect on the species of concern in other locations, such as the transmission lines. I know that doesn't make sense, but that's how I read it. Certainly, correct me if I'm wrong on that. But it seems to be that there's actually no mitigation itself for the impact on rainbow smelt, winter flounder and kelp.

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027-45 NextEra is required to safely handle, process, store, and dispose of its radioactive waste in accordance with NRC regulations. Low level radioactive waste is handled onsite and is typically sent to an offsite waste vendor for processing where it is then either sent on to a licensed burial site or returned to the plant for storage until it can be shipped to a licensed burial site for disposal. Spent nuclear fuel is stored onsite in a combination of two types of NRC approved methods; storage in a pool and in dry casks. Both of these methods maintain the used fuel in a safe configuration. Additionally, to ensure the long-term safety of spent fuel, NextEra is required by the NRC regulations at 10 CFR 50.54(bb) to maintain adequate funding for the safe long-term storage of spent fuel on its site.

Regarding the long-term storage of spent fuel after the term of license renewal when the plant shuts down, on August 26, 2014, the Commission approved the Continued Storage Rule and associated "*Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*" (NUREG-2157). Subsequently, on September 19, 2014, the NRC published the final rule (79 FR 56238) in the *Federal Register* along with NUREG-2157 (79 FR 53238, 56263). The Continued Storage Rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license (i.e., those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor or away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available). The information in NUREG-2157 provides the appropriate NEPA analyses of the potential environmental impacts associated with the continued storage of spent fuel beyond the licensed life for reactor operations at Seabrook.

Chapter 6 of the Seabrook SEIS was revised to include a discussion, based on NUREG-2157, of the potential environmental impacts associated with the continued storage of spent nuclear fuel.

erroneous assumption to expect some corporate entity to exist and remain responsible for safe storage that long into the future.

The entire premise of safe operation is having to do with the spent fuel. I don't think that anyone can assume that the federal government will take this over. I think that the current assumption is that the federal government will not establish a repository sufficient for Seabrook. People talk about Yucca and even if Yucca was built, it would not have sufficient capacity for Seabrook. 027-45

I'd like to talk about the concrete issue. I don't know how you separate out safety issues from environmental issues because if there's a safety issue from concrete, it's obviously going to affect the environment. Your power plant cannot manage the effects of aging on the concrete. It will worsen. I don't think that the process is accurate when it assumes based upon a 20-year history we can predict the next 20-years of the existing license and another 20-year beyond that. There's not necessarily a linear degradation of the plant.

The licensing processes concerns the ability of the licensee to manage the aging plant components. When it comes to the concrete, it cannot do that. I think that the integrity of the company on this issue also has to be raised. NextEra was asked, I think up to 15-years ago, to assess the concrete and it failed to do so and failed to report to the NRC on that until it came up through this renewal process where it finally disclosed the problems with the concrete, which are significant. 027-46

There's also the question of the integrity in the building process. This goes to the heart of the matter. At the time that the plant was built, we all knew and heard the stories about all the crap that was dumped in the concrete. And it's coming back to haunt you. We heard all during the building process from our local neighbors about welds -- the x-raying and testing of welds -- being forged and fraudulently documented. So there is a question with regards to the integrity of the licensee to be able to manage this process and I don't know how the assumptions can be made for 60-years out from now -- I'm sorry -- 40-years out from now on the concrete. And the licensee has the burden of proof, has the obligation to prove the plant safe for this time period through -- I'm losing track now what years we're talking about -- through 2050. I don't think that can be done. The concrete raises such a high level of uncertainty that I don't think the burden of the applicant to prove the plant safe for this renewal period can be met.

I'd like to make one last comment. Each one of these issues seem to be taken in isolation. And there seems to be no analysis in the Draft EIS of the cumulative effect of these flaws. So, you can piecemeal this little issue, that little issue and this little issue and say --

Well, the air release is minimum. The tritium is a minimum issue. Spent fuel will be dealt with -- they'll design and build one as necessary. Well, earthquakes, you know, they're remote -- they could happen, but not likely. 027-47

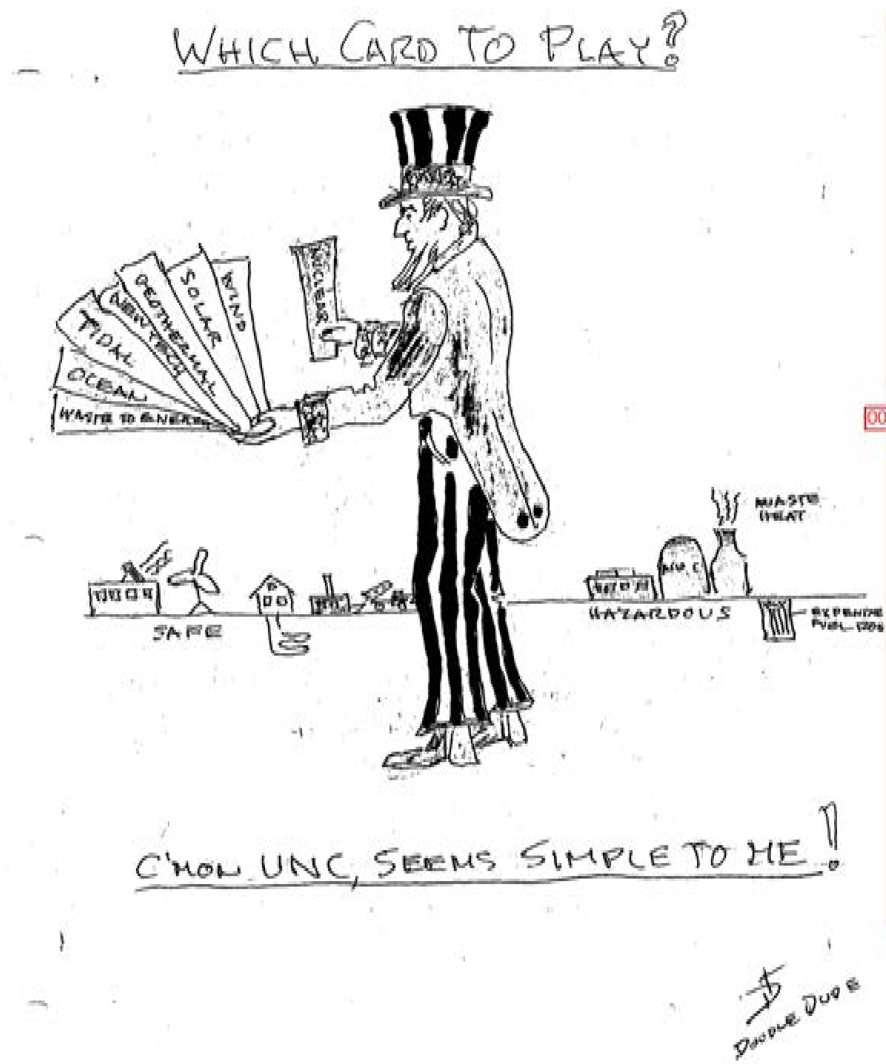
You know, and you add up all of these factors -- there's no analysis of the cumulative effect of these factors. There must be a way to do that and there should be a way to do it, otherwise I don't think the plant is taken in its totality and it exists as a total entity and the effects are a cumulative total effect on the residents of the area. Thank you.

027-46 The commenter raises issues related to the alkali silica reaction (ASR) that is occurring at Seabrook, and NextEra's ability to manage the effects of aging throughout the period of extended operation. While the impact of ASR on the structures at Seabrook is outside the scope of the environmental review for the Seabrook LRA, ASR and its impacts on the ability of NextEra to effectively manage the effects of aging on structures at Seabrook are under evaluation as part of the license renewal safety review. The NRC has delayed the license renewal safety review until NextEra completes its evaluation of the extent and impact of ASR, and addresses the NRC staff's questions related to NextEra's plan for managing the effects of aging of ASR-affected structures. The NRC will not make a decision on license renewal before it fully understands both the issue with ASR-affected structures and NextEra's plan to address the issue.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-47 The commenter raises issues related the cumulative effects associated with the operation of Seabrook. The staff evaluated potential cumulative impacts associated with the proposed relicensing of Seabrook in Section 4.12 of this SEIS, and determined that the potential cumulative impacts associated with the Seabrook license renewal would range from SMALL to LARGE, depending on the resource area. Table 4.12-1 summarizes the impacts by resource area.

This comment provides no new information, and no changes have been made to this SEIS as a result.



004-1

004-1 The commenter makes a general comment about alternatives to license renewal. The NRC staff's evaluation of alternatives to license renewal can be found in Chapter 8 of this SEIS. As described in Chapter 8, the NRC initially considered 16 different power generation alternatives to renewing the Seabrook license before narrowing the list to 3 alternatives that were considered in-depth. As a result of its analysis, the NRC staff concluded that there is no clear, environmentally-preferred alternative to license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

RULES / ... DIRECTIVES

NextEra Energy Resources LLC
700 Universe Blvd
Juno Beach, FL 33408

October 20, 2011

COPY NRC

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Subject: Seabrook N.H. Nuclear Power Plant

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During the NRC/Seabrook Power Plant public hearing, I attended here in Hampton on Sept 15, I became awakened to what is happening in the nuclear power business. It led me to investigate it, the NRC, and your company. I can't believe nuclear is better for making electricity than other methods. In general, because it's dangerous, complicated, too costly, storage problems, monitoring requirements, etc. I believe I read that only a fraction of the heat generated is needed with the rest going into the atmosphere. If so then it is inefficient, At Seabrook, I understand there are aquatic problems as well. Cracks have been found and at this writing cooling pumps have caused a shut-down. I am concerned. 022-1

It is beyond my comprehension that nuclear was allowed to invade us here in the first place. Mostly because New Hampshire has a very small coastline as compared to our neighbors. Just about all 20 miles of it is sunny beach area's that attract thousands of summer tourists. It didn't make sense initially and still doesn't because the area exit roads are not adequate to evacuate the beaches and towns in the event of a serious problem at the plant (specially during the summer months-150,000 to 200,000). Today's area population is now 2 ½ x what it was 20 years ago, so the problem is exacerbated. Also, the beach has nearly completed multi-million updating facilities and infrastructure, which will attract even more visitors in coming years. If you, the owner, and the NRC members haven't visited our beaches during a summer weekend, you should and try to envision an evacuation. See if you can continue to ignore this impossibility. 022-2

I see that NextEra is a leader in alternative energy sources--44% wind, for instance. Great! I hope you can keep your status. Perhaps one way would be for you to consider Seabrook an OPPORTUNITY. A chance for NextEra to show the world that they do care for people and their concern about preserving where they live--by retracting your request for re-licensing and start making plans for safe alternative retrofit. 022-3

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (mjw2)

The following are responses to comments, as they relate to Seabrook license renewal environmental review, from a letter sent by the commenter to NextEra and copied to the NRC.

022-1 The commenter expresses concern relative to nuclear power and specifically the operation of Seabrook. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

022-2 The commenter raises issues dealing with emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

022-3 The commenter raises the issue of alternatives to license renewal. The NRC staff's evaluation of alternatives to license renewal can be found in Chapter 8 of this SEIS. As described in Chapter 8, the NRC initially considered 16 different power generation alternatives to renewing the Seabrook license before narrowing the list to 3 alternatives that were considered in-depth. As a result of its analysis, the NRC staff concluded that there is no clear, environmentally-preferred alternative to license renewal.

This comment provides no new information, and no changes have been made to this SEIS as a result.

022-4 The commenter expresses concern about the timing of the license renewal process for Seabrook. As allowed by 10 CFR 54.17, NextEra submitted the Seabrook license renewal application 20 years before the expiration of their current license. The NRC has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Should the NRC grant NextEra's request for a renewed license, the NRC will continue to provide continuous oversight through its Reactor Oversight Process to verify that the plan is being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action is required to protect public health and safety.

This comment provides no new information, and no changes have been made to this SEIS as a result.

022-5 The commenter makes a general comment about the potential for severe accidents at Seabrook. The NRC staff's evaluation of severe accidents can be found in Chapter 5 of this SEIS. As discussed in Chapter 5, the NRC staff found no new and significant information that would challenge the conclusions of the GEIS that the probability-weighted consequences of severe accidents were of small significance.

This comment provides no new information, and no changes have been made to this SEIS as a result.

SEABROOK NUCLEAR POWER PLANT
(LICENSE TO OPERATE FROM 2030 TO 2050) Wha???

NRC
(SAYS NO PROBLEM)

Except for:

Possible earthquake*
(Plant built on fault line)
Impossible evacuation Plan**
(Area population much greater now
Over-storage of spent fuel rods already
(Now what?)
Plant near end of age it was designed for
(Structural problems found. Why *gamble* longer?)
Aquatic problems already
(From reactor ocean cooling water)

* Earthquake: In this regard we've been lucky for 20 years. We were forced to accept the plant initially. Now they want to force us again to be subjected to this very real possibility for many more tense years?

** Evacuation: Everyone who lives in this area knows it would impossible to evacuate 100,000 to 200,000 beach-goers and residents just from the beach on summertime weekends.

I feel nuclear has been tried, but it is too costly, complex, and dangerous to continue, especially here in this heavy tourist area. It's time close the plant or at least convert it to a SAFE option for making electricity.

Don Tilbury Hampton, NH

022-6

022-6 The commenter expresses opposition to the renewal of the Seabrook license, citing various reasons. With respect to the potential for earthquakes, Seabrook was originally sited using criteria set forth in 10 CFR Part 100, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. These regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tsunami, and other natural phenomena, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR). When new natural hazard information becomes available, the NRC evaluates the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

With respect to evacuation plans, for the reasons discussed in the response to comment 022-2 above, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS.

For the issue of the age of Seabrook, the purpose of the license renewal review is to ensure that NextEra will be able to effectively manage the effects of aging on certain passive, long-lived systems, structures and components. The NRC will not issue a renewed license unless there is reasonable assurance that the applicant has the ability to adequately manage the effects of aging on certain critical safety equipment throughout the period of a renewed license. The final results of the NRC staff's review will be documented in the final Safety Evaluation Report.

With respect to the issue of aquatic impacts, the NRC staff's evaluation of the impact of the operation of the Seabrook cooling system on the surrounding environment is found in Sections 4.6 and 4.8. As a result of its analysis, the NRC staff determined that the impact due to the operation of Seabrook's once-through cooling system is SMALL for most species and LARGE for winter flounder, rainbow smelt, and some kelp species.

022-6 cont'd For spent nuclear fuel, the NRC is aware that geologic disposal, at Yucca Mountain or elsewhere, may not be available in the timeframe that was originally envisioned. As an alternative, the Commission has considered the storage of spent nuclear fuel on reactor sites where it is generated. The impacts associated with onsite storage of spent nuclear fuel at nuclear power plant sites during the license renewal term are discussed in Section 6.4.6 of the GEIS. Based on its evaluation, the NRC concluded that the environmental impact associated with the onsite storage of spent nuclear fuel was small at all nuclear power plants.

For the disposition of spent fuel, in 1982 Congress enacted the Nuclear Waste Policy Act (NWPA), and on January 7, 1983, the President signed it into law. This legislation defined the Federal Government's responsibility to provide permanent disposal in a deep geologic repository for spent fuel and high-level radioactive waste from commercial and defense activities. Under amended provisions (1987) of this Act, the U.S. Department of Energy (DOE) has the responsibility to locate, build, and operate a repository for such wastes. The NRC has the responsibility to establish regulations governing the construction, operation, and closure of the repository, consistent with environmental standards established by the EPA.

Regarding the long-term storage of spent fuel after the term of license renewal when the plant shuts down, the Commission relied on its Waste Confidence rule (WCR), 10 CFR 51.23 to address the issues of safety of the on-site storage of the spent fuel and its final disposition in a DOE repository. The Commission's WCR, though applicable only to the period after the licensed life of a reactor, undergirds agency licensing decisions on reactor license renewal. In 2010, the Commission revised the WCR to reflect information gained based on experience in the storage of spent fuel and the increased uncertainty in the siting and construction of a permanent geologic repository for the disposal of spent fuel.

On June 8, 2012, the U.S. Court of Appeals for the District of Columbia, in response to a legal challenge to the WCR, vacated the 2010 Waste Confidence Decision and Consideration of Environmental Impacts of Temporary Storage of Spent Fuel After Cessation of Reactor Operation Rule (i.e., Temporary Storage Rule) (75 FR 81032 et seq.) based on grounds primarily relating to aspects of the National Environmental Policy Act (NEPA).

022-6 cont'd The court decision held that (1) the Waste Confidence Decision rulemaking is a major Federal action necessitating either an environmental impact statement (EIS) or a finding of no significant environmental impact (FONSI), and (2) the Commission's evaluation of the risks of spent nuclear fuel for at least 60 years beyond the licensed life for reactor operation (60-year post- operating period) is deficient.

In response to the court's ruling, the Commission issued an order (CLI-12-16), which stated that "…in recognition of our duties under the law, we will not issue licenses dependent upon the Waste Confidence Decision or the Temporary Storage Rule until the court's remand is appropriately addressed. This determination extends just to final license issuance; all current licensing reviews and proceedings should continue to move forward."

In addition, the Commission directed the NRC staff to proceed with the development of an environmental impact statement (EIS) to support an updated Waste Confidence and Temporary Storage Rule within 24 months (by September 2014). The EIS and the rule must encompass the deficiencies identified in the D.C. Circuit's remand and the entire scope of the 2010 Waste Confidence decision and temporary storage rule. The NRC staff plans to address the waste confidence-related issues as part of the ongoing rulemaking. The updated rule and supporting EIS will provide the necessary NEPA coverage of waste confidence-related human health and environmental issues for license renewal. To the extent that the waste confidence impacts are not fully addressed as a result of the rulemaking, the NRC staff will revise or supplement, as necessary, a license renewal SEIS to address any unresolved issues. As directed by the Commission, the NRC will not issue a renewed license to Seabrook Station prior to the resolution of waste confidence-related issues. This will ensure that there would be no irretrievable or irreversible resource commitments or potential harm to the environment before waste confidence impacts have been addressed.

022-6 cont'd On August 26, 2014, the Commission approved the Continued Storage Rule and associated "*Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel*" (NUREG-2157). Subsequently, on September 19, 2014, the NRC published the final rule (79 FR 56238) in the *Federal Register* along with NUREG-2157 (79 FR 53238, 56263). The Continued Storage Rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license (i.e., those impacts that could occur as a result of the storage of spent nuclear fuel at at-reactor or away-from-reactor sites after a reactor's licensed life for operation and until a permanent repository becomes available). The information in NUREG-2157 provides the appropriate NEPA analyses of the potential environmental impacts associated with the continued storage of spent fuel beyond the licensed life for reactor operations at Seabrook.

Chapter 6 of the Seabrook SEIS was revised to include a discussion, based on NUREG-2157, of the potential environmental impacts associated with the continued storage of spent nuclear fuel.

COMMENTS OR SUGGESTIONS: (Continued)

EARTHQUAKE POSSIBILITY MAJOR CONCERN OF CITIZENS AT MEETING. IT IS NOT HARD TO UNDERSTAND THEIR CONCERNS. SHALL WE SAY WE WHO LIVE CLOSE TO THE PLANT CONSIDER OURSELVES LUCKY THAT THERE HAS BEEN NO EARTHQUAKES IN THE 20 OR SO YEARS THE PLANT HAS BEEN OPERATING. WE NOW FEEL OPERATING ANY LONGER IS A GAMBLE. QUIT WHILE WE'RE AHEAD!! 025-1

EVACUATION IS AND HAS BEEN MY CONCERN. EVACUATION IS PRACTICALLY IMPOSSIBLE. NRC KNOWS IT. NEXTERA KNOWS IT. IT WASN'T POSSIBLE 20 YRS AGO AND THE POPULATION IS MORE DENSE NOW. YET YOU CONSIDER RELICENSING. STOP IT NOW. GO ONTO SAFER ALTERNATIVES!! 025-2

UNITED STATES
NUCLEAR REGULATORY
COMMISSION
WASHINGTON DC 20555-0001

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WASHINGTON DC 20555-0001

025-1 The commenter expresses concern about a possible seismic event in the area of Seabrook. While Chapter 2 contains a description of the geologic environment in the vicinity of Seabrook, the NRC did not perform an evaluation of seismic hazards at Seabrook, as it is outside the scope of the license renewal environmental review.

Seabrook was originally sited using criteria set forth in 10 CFR Part 100, and designed and constructed in accordance with 10 CFR Part 50, Appendix A. These regulations require that plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes, tsunami, and other natural phenomena, without loss of capability to perform safety functions. Site-specific analyses of natural disasters considered for Seabrook can be found in Seabrook's Updated Final Safety Analysis Report (UFSAR). When new natural hazard information becomes available, the NRC evaluates the new information through the reactor oversight process and other NRC safety programs, such as the Generic Issues Program, to determine if any changes are needed at one or more existing plants. These processes are separate from the license renewal process.

This comment provides no new information, and no changes have been made to this SEIS as a result.

025-2 The commenter raises a concern with emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal, therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

DON TILBURY: Do I come up to the --

BRIAN ANDERSON: Mr. Tilbury -- yes, sir.

DON TILBURY: First of all, I'm against nuclear power. So, that's a bad start -- right? Then I'll make comments on the local situation.

But just simply -- how many people here like the power plant at Niagara Falls? How about the one -- the tidal one -- up in Canada? Well, this is a good way to understand that there are other ways to make electricity -- and safer ways. So, with that said, I'll just go on here --

I feel that nuclear came, has been tried and now the problems outweigh the benefits. First of all, I sold thickness gauges -- nuclear thickness gauges -- in my sales work. And I thought -- Boy, this is great. You get a little pellet that would fit into a drill and you'd be able to drill the rest of your life with that one pellet. And then all the other kind of possibilities -- that you could run some of these things with a little nuclear pellet. Well, it was okay for thickness gauges, but after hearing all of the problems with it and so forth, I gave it up. I didn't want to sell it anymore.

Okay -- now the issue that's already here. The Seabrook Power Plant is here and whether I like nuclear power -- that doesn't matter. Whether it should continue to be licensed -- I am concerned about that. I definitely feel that it is not. I just don't understand -- my car that's sitting outside is 12-years old -- it's got 150,000 miles on it. Should I just figure it's going to go another 12-years? To me, that's a simple comparison perhaps, but I feel that with all the problems that have come up and all of the things that you're trying to do to keep it going -- it just doesn't make sense at all in my mind. 027-3 Now, some of the things about this -- when the Seabrook Plant was built, the population density here was a lot less. It's probably three times that it was 20-years ago. So, does the density enter into your equation now -- as you work out this next 20-years? I should think it would.

If it brings up evacuation, in the case of a problem at the plant, both local residents and beach population -- and if you go down to the beach on the weekend and try to think -- what would happen if there was some kind of nuclear problem? No way -- there would be 100,000 people that would die. 027-4

And how much electricity is generated -- and here's another one of my questions. How much of the electricity is generated here, stays here and how much goes on to the grid? Now, the reason for asking that is that it seems that the locals are at risk to provide electricity to those elsewhere. Now, can I get an answer on that? What percentage of the electricity stays here and what percentage goes on the grid? Well, that's it. 027-5 That's how I feel. And I do have a little drawing here that shows -- Making Decisions. One of them is the nuclear and all these others are various ways to make electricity -- wind, solar, geothermal, tidal, ocean, waste-to-energy -- and that's what we should be looking at. I feel that nuclear has come and should be gone. Let's get on with the other sources.

027-3 The commenter expresses opposition to relicensing Seabrook. The comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

027-4 The commenter raises a concern with emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal, therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

027-5 The commenter raises issues related to licensee economics, and specifically where the power generated by Seabrook goes. The issue of licensee economics is outside the scope of license renewal and was not evaluated in this SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Thank you for that perfect segue. There is extra time left in the meeting. I know that Brian had asked for additional time to finish some comments. And I had one other gentleman that also asked for an extra two-minutes to provide his extra comments. Since the meeting agenda can accommodate that, what I'd like to do is have Mr. Tilbury get two-minutes to provide his last comments and then we'll finish with five more minutes to Brian Stem.

Mr. Tilbury --

DON TILBURY: Thank you very much. This had nothing to do with just your nuclear power plant. Just in listening to everything, it occurred to me that at our men's meeting at our church, most of the men were in their 80's. We had a seventh grader that came and talked to us. All he said, very briefly -- as I look around -- he said -- I see that when you were my age, there was no nuclear power. There was no TV. There was no cell phone. None of that. I can only imagine that when I'm your age, I don't know what it's going to be, but it will be all different. And I thought that was very, very deep. So, even what we do here might be all different -- there may be a whole new way to have energy later on -- who knows? Nobody knows. Thank you. 027-42

027-42 This comment is general in nature and provides no new information, and no changes have been made to this SEIS as a result.

8/5/2011
76FR 47612

RULES AND DIRECTIVES

RECEIVED

28

March 12, 2012

Nuclear Regulatory Commission
Chief Rules and Directive Branch
Division of Administrative Services
Mailstop TWB-05B01M
Washington, DC 20555-0001

Subject: Seabrook NH Nuclear Power Plant

Despite being subject to earthquake (built on fault line), existing foundation cracks, an inadequate evacuation plan, over storage of spent fuel rods, ocean aquatic problems, and being behind on their Decommissioning Trust Fund payments*, NextEra (owner of Seabrook Nuclear Plant) has the untimely audacity to request having their operating license extended again. This time to 2050. Ridiculous!

Why is the Nuclear Regulatory Commission even considering their request this far in advance? It does not make sense. A simple refusal to address their request, based on the fact that it is too far in advance, is in order.

You should also advise NextEra to first resolve the known problems at the plant and also to catch up on their decommission payments.

The plant was to be decommissioned in 2020, but somehow got a 10 year operating extension pushing decommissioning off to 2030 which is 18 more years for local skeptics to keep their fingers crossed that there will be no serious problems. To make the 38 more years is more irresponsible.

I write imploring you to deny this latest license extension request!! 030-1

Donald E Tilbury

Donald Tilbury
15 Bride Hill Drive
Hampton, NH 03842

* State of NH Nuclear Decommissioning Docket No. 2010-1

File:Seabrknuc

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (MJW2)

030-1 The commenter expresses opposition to license renewal and urges the NRC not to issue a renewed license for Seabrook.

Relative to the timing of NextEra's license renewal request, NextEra submitted the Seabrook license renewal application 20 years before the expiration of their current license, as allowed by 10 CFR 54.17. The NRC has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Should the NRC grant NextEra's request for a renewed license, the NRC will continue to provide continuous oversight through its reactor oversight process to verify that they are being operated and maintained in accordance with NRC regulations. Should it be necessary, the NRC has full authority to take whatever action is required to protect public health and safety. Additionally, NextEra has not previously been granted a renewed license as mentioned by the commenter.

The status of decommissioning funding is reviewed on an ongoing basis as part of the ongoing reactor oversight process, and, as a result, is outside the scope of a license renewal review. As required by 10 CFR 50.75, licensees are to provide reasonable assurance that funds will be available for the decommissioning process. As part of providing assurance, licensees are required at least once every two years to report on the status of its decommissioning funding. These reports, referred to as decommissioning funding status (DFS) reports, are available on the NRC website.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Raymond -- thank you for those comments. The next speaker is Connie Wilkins, who will be followed by Doug Bogen and then Lee Roberts.

CONNIE WILLIAMS: I'm Connie Williams from -- sorry --

BRIAN ANDERSON: I'm sorry, Connie.

CONNIE WILLIAMS: -- from Kittery, Maine and my concerns are around safety and the evacuation process in the case there is an event. On summer weekends, I avoid as much as possible getting into my car in the Kittery, Maine area. One Saturday this summer coming home from just a 10-minute trip to the grocery store over to Portsmouth, it took me 45-minutes to come home. Any of you who will drive around Route 95 in the summertime and you can see cars stationary for long periods of time.

I'm concerned about the safety plans that have been made and -- are they updated and what are they? I used to live in Newbury, Massachusetts and after Seabrook was built, regulations came out about safety plans and evacuation. 027-33

Faculty at a private boarding school were listed as being in charge of evacuating all the students in the school. This was the first time the faculty heard about that. No one was consulted. No one was trained. I asked faculty how they responded to this and what they would do. They said they would do the natural thing -- they would go for their families and get their families out of there. Not only that, there is absolutely no means of transportation to get the students out of there. So, what I'm asking is -- what is the plan for evacuation? In this area, the population has increased by 62%. So, what is the written plan? Who is being trained to help in this? Who is working the roadways for a decent evacuation? Thank you.

027-33 The commenter raises issues related to emergency planning. Emergency planning programs are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are in the regulations at 10 CFR Part 50.47 and Appendix E to 10 CFR Part 50. These requirements, which include the performance of a full-scale exercise at least once every two years in order to maintain the skills of the emergency responders and to identify and correct weaknesses, apply to all operating licenses and will continue to apply to facilities with renewed licenses. As such, the NRC, in 10 CFR Part 50.47, has determined that there is no need for a special review of emergency preparedness issues in the environmental review for license renewal. Therefore, no evaluation of this issue was performed in the Seabrook SEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

8/5/2011

76 FR 47612

RULES AND DIRECTIVES BRANCH

Oct.25,2011

(13)

2011 OCT 27 AM 9 30

TO: Nuclear Regulatory Commission Docket ID NRC-2010-0206

FROM: Robin D. Willits

RECEIVED

SUBJECT: Citizen comment on DEIS of Seabrook Nuclear Power Plant in New Hampshire

As a resident of Exeter, NH, I am on the 10 mile zone around the Seabrook nuclear power plant and I am deeply concerned about Seabrook's environmental impact.

The Draft of the Environmental Impact Statement suffers from its failure to deal with the reality of ongoing expected, such as with shutdowns, radioactive emissions, and the unexpected emissions, such as occur with breakdown of valves, cracks in piping, etc. Both the expected and the unexpected add pollution to the environment. What is being done to reduce the expected? It seems logical to believe that both will increase with aging. Why does NRC believe otherwise? 020-1

Also there is the radioactive tritium leakage that the DEIS doesn't discuss how to decrease.

Finally, there is risk of more serious events, such as an earthquake of magnitude (as in Virginia this summer) or even a terrorist explosion of the spent fuel rod storage tank on site. While such events are of relatively low risk, the fiscal costs, loss of life, injury and even the creation of land that is unsafe to enter (such as Chernobyl) would be huge. In other words, the "expected value" (risk times potential loss) of that combination low risk but huge costs, is still enormous. 020-2

The importance of a risk situation can be better understood with an expected value analysis than just considering risk. The expected value of the Seabrook's environmental impact is severe and is an important factor to include in your DEIS. Please consider this.

Thank you for the opportunity to express my concern and views.

Robin D. Willits

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = M. Wentzel (MJW2)

020-1 The NRC has requirements to ensure adequate protection and no undue risk to public health and safety through design, construction operation, maintenance, modification, and quality assurance measures. The NRC's ongoing safety program focuses on prevention of safety problems so that potential issues do not lead to accidents and inadvertent releases requiring cleanup. The NRC requires licensees to test, monitor, and inspect the condition of safety equipment and to maintain that equipment in reliable operating condition over the operating life of the plant, including the term of license renewal. The NRC also requires licensees to continuously correct deficiencies that could impact plant safety (e.g., leaking valves, degraded or failed components due to aging or operational events). Over the years, licensees have replaced or overhauled plant equipment as needed. As appropriate, licensees have also upgraded equipment or installed new equipment to replace or supplement original systems. The testing, monitoring, inspection, maintenance, and replacement of plant equipment provides reasonable assurance that this equipment will perform its intended safety functions during the license period. This discussion applies both to operations under the current license and operations under the term of license renewal.

The NRC provides continuous oversight of each plant under the NRC's inspection and enforcement programs. The NRC's Reactor Oversight Process integrates the NRC's inspection, assessment, and enforcement programs. The operating reactor assessment program evaluates the overall safety performance of operating commercial nuclear reactors and communicates those results to licensee management, members of the public, and other government agencies. The assessment program collects information from inspections and performance indicators in order to enable the NRC to arrive at objective conclusions about a licensee's safety performance. Based on this assessment information, the NRC determines the appropriate level of agency response, including supplemental inspection and pertinent regulatory actions ranging from management meetings up to and including orders for plant shutdown. The NRC conducts follow-up actions, as applicable, to ensure that the corrective actions designed to address performance weaknesses were effective.

This comment provides no new information, and no changes have been made to this SEIS as a result.

020-2 The commenter raises issues related to the analysis of severe accidents. As discussed in Chapter 5 of this SEIS, the NRC staff performed an evaluation of severe accidents for all nuclear power plants in the GEIS. Based on this information, the NRC staff concluded that the probability-weighted consequences of severe accidents—including those that result from events such as flooding, earthquake, and fire—are of small significance for all plants. The NRC staff identified no new and significant information related to severe accidents during the environmental review process for the Seabrook LRA that would call into question the conclusions of the GEIS, as they relate to Seabrook. Therefore, there are no impacts related to severe accidents for Seabrook beyond those discussed in the GEIS.

This comment provides no new information, and no changes have been made to this SEIS as a result.

BRIAN ANDERSON: Okay. Thank you. The next speaker is Robin Willits and after Robin -- Ilse Andrews.

ROBIN WILLITS: I will be very brief. I just want to add to what's been said. I have never heard who benefits from continuing the plant another 20-years. Is there any public benefit? And I think I can think of reasons that there might be benefits to the corporation, but I want to know why the NRC is supporting extension without defining what is the benefit to the public. 028-20

028-20 The commenter raises issues related to the public benefit of license renewal. The purpose of the NRC's license renewal review is to determine whether a nuclear facility, in this case Seabrook, can continue to operate safely and whether the protection of the environment can be assured during the 20-year period of extended operation. The decision to seek a license renewal rests solely with the nuclear power facility's owners, in this case NextEra. The need for the power generation capability supplied by Seabrook is determined by other energy-planning decision makers, such as State, utility, and, where authorized, Federal agencies (other than NRC). Any determination of benefit to the public would likely be taken into consideration by energy planning decisionmakers when reaching a decision to continue operation of Seabrook, however, this benefit determination is outside the scope of NRC's license renewal review.

This comment provides no new information, and no changes have been made to this SEIS as a result.

A.2.2 Comments Received on the Supplement to the Draft SEIS

On April 26, 2013, the NRC issued the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station*, Draft Report for Comment (NUREG 1437, Supplement 46, Volume 1, referred to as the draft supplement to the DSEIS) to Federal, state and local government agencies and interested members of the public. The EPA issued its Notice of Availability on May 3, 2013 (78 FR 26027). The public comment period ended on June 30, 2013. As part of the process to solicit public comments on the draft supplement to the DSEIS, the NRC did the following:

- placed a copy of the draft SEIS at the Seabrook Library in Seabrook, New Hampshire, and at the Amesbury Public Library in Amesbury, Massachusetts;
- made a copy of the draft SEIS available in the NRC's Public Document Room in Rockville, Maryland;
- placed a copy of the draft SEIS on the NRC website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement46/v1/;
- provided a copy of the draft SEIS to any member of the public that requested one;
- sent copies of the draft SEIS to certain Federal, tribal, state, and local government agencies;
- published a notice of availability of the draft SEIS in the *Federal Register* on May 7, 2013 (78 FR 26662); and
- filed the draft SEIS with the EPA.

During the public comment period, the NRC staff received comments from three individuals or groups. To identify each individual comment, the NRC staff reviewed the transcript of the public meetings, and each letter and e-mail received related to the draft supplement to the DSEIS, all of which are accessible in ADAMS. The NRC staff identified statements related to the proposed action and recorded the statements as comments.

Table A–4 lists each individual that provided a comment during the comment period, and their corresponding correspondence identification number. Each comment identified by the NRC staff was assigned a specific comment identification number consisting of the correspondence identification number, and a number associated with the sequential order of the comment within the specific document. Table A–5 lists the comments, grouped by category, and where the comment and response can be found within this appendix.

Table A–4. Individuals Providing Comments During the Comment Period on Supplement to the Draft SEIS

Commenter	Affiliation (if stated)	Comment source (ADAMS Accession #)	Correspondence ID	Starting page
Timothy W. Drew	NH Department of Environmental Services	Comment letter ML13184A156	037	A259
Timothy Timmermann H. Curtis Spalding	U.S. EPA	Comment letter ML13189A128	038	A-261
William R. Harris	Foundation for Resilient Societies	Comment letter ML13190A011	039	A-263

Table A–5. Comments by Category

Comment Category	Page	Commenter (Comment ID)
Aquatic	A-260	NHDES (037-2)
Postulated Accidents	A259	Timothy W. Drew (037-1, 037-2)
	A261	Timothy Timmermann (038-1)
	A-263	William R. Harris (039-1, 039-2 039-3 039-4)

A.2.3 Public Comments Draft Supplement to the DSEIS and NRC Staff Responses

New Hampshire Department of Environmental Services

Seabrook Station, Seabrook, NH

Supplement to the Draft Supplemental Environmental Impact Statement

U.S. Nuclear Regulatory Commission
(Docket # NRC-2010-0206)
http://www.nrc.gov/site-help/search.cfm?q=ML13113A174&s

NH DES Comments on Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 46, Regarding Seabrook Station, Second Draft Report for Comment, April 2013

June 27, 2013

NH DES point of contact:

Timothy W. Drew
Administrator
Public Information and Permitting Unit
Office of the Commissioner
NH Department of Environmental Services
P.O. Box 95
29 Hazen Drive
Concord, NH 03302-00905

Tel: (603) 271-3306
Fax: (603) 271-2867
E-mail: Timothy.Drew@des.nh.gov

Surface Water Resources

NH DES reviewed the SEIS sections related to cooling water, surface water (including the groundwater dewatering discharge to outfall 001), and aquatic resources. Its comments are as follows:
1. The report states that there are no changes to the August 2011 DSEIS for Section 2.0 (Affected Environment), 4.4 (Surface Water Resources) and 4.6.3 (Entrainment and Impingement). Further, in Section 4.6 (Aquatic Resources) it is stated that impacts to aquatic resources are "SMALL." It is surprising that the there are no changes to Sections 2.0, 4.4 and 4.6.3 or that the impacts to aquatic 037-1

Seabrook Station – Supplement to Draft Supplemental Environmental Impact Statement
NH DES Comments
June 27, 2013
Page 1 of 2

037-1 This comment concerns comments submitted by NHDES on the August 2011 draft SEIS. The purpose of the supplement to the draft SEIS, which was published in May 2013, was to consider new information that became known after the issuance of the August 2011 draft SEIS: NextEra's revised SAMA analysis and new and revised Category 1 and 2 issues resulting from the publication of the final rule (78 FR 37282, June 20, 2013) revising 10 CFR Part 51. The 2011 NHDES comments are addressed in this final SEIS. Specific responses to NHDES comments can be found in Appendix A, Section A.2, "Comments Received on the Draft SEIS."

resources (Section 4.6) are considered "SMALL," in light of 1) my comments the NH DES letter to the NRC dated October 25, 2011 (enclosed) and 2) the fact that the DSEIS states that the impacts to winter flounder, rainbow smelt and kelp (*L. digitata*) are "LARGE." Also, does the NRC review process include any response to public comments document? 037-1 cont

2. Page 4-3, Section 4.5.3, line 28. The value of the detection limit for tritium should be stated. Also relative to the statement that the tritium contaminated groundwater is discharged under the NPDES permit and NRC requirements see my second comment in your letter to NRC dated October 25, 2011 in which I recommend that "NRC should ensure that the discharge of tritium meets the NH surface water quality standard for Gross Beta Radioactivity, which is 1,000 pCi/l." 037-2

For more information, please contact:

Jeffrey G. Andrews, P.E.
Sanitary Engineer
Wastewater Engineering Bureau
NH Department of Environmental Services
P.O. Box 95
29 Hazen Drive
Concord, NH 03302-0095

Tel: (603) 271-2984
Fax: (603) 271-4128
E-mail: Jeffrey.Andrews@des.nh.gov

Groundwater Quality

No new comments

Air Quality/Emissions

No issues of concern were detected by the NH DES Air Resources Division.

Underground Petroleum Storage Tanks

No comments.

New Hampshire Geological Survey

No comments.

Coastal consistency

No comments

Wetlands

No comments.

037-2 This comment addresses comments submitted by NHDES on the August 2011 draft SEIS. The purpose of the supplement to the draft SEIS, which was published in May 2013, was to consider new information that became known after the issuance of the August 2011 draft SEIS: NextEra's revised SAMA analysis and new and revised Category 1 and 2 issues resulting from the publication of the final rule (78 FR 37282, June 20, 2013) revising 10 CFR Part 51. The 2011 NHDES are addressed in this final SEIS. Specific responses to NHDES comments can be found in Appendix A, Section A.2, "Comments Received on the Draft SEIS."

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

OFFICE OF THE
REGIONAL ADMINISTRATOR

June 28, 2013

Chief, Rules, Announcements, and Directives Branch
Division of Administrative Services
Office of Administration
Mail Stop TWB-05-B01M
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 46 Regarding Seabrook Station, Second Draft Report for Comment, CEQ#20130103

Dear Sir/Madam:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the United States Environmental Protection Agency (EPA) has reviewed the Nuclear Regulatory Commission's (NRC's) Second Draft Supplemental Environmental Impact Statement (DSEIS) for the potential relicensing of the Seabrook Station Nuclear Power Station (Seabrook or Seabrook Station) in Seabrook, New Hampshire. The NRC has issued the supplement to the DSEIS for public comment in support of its decision on the application submitted by NextEra Energy Seabrook, LLC (NextEra) for relicensing Seabrook under the Atomic Energy Act. The NRC prepared the supplement to the DSEIS to provide new information NRC staff obtained since the DSEIS was published in August 2011.

The proposed action and purpose and need related to the NExtEra application for renewal of Seabrook's operating license for an additional 20 years remain unchanged from the DSEIS. Seabrook began commercial operation in 1990 and its existing license will expire in 2030. Seabrook's net electrical capacity is 1,245 megawatts-electric (MWe) and it is located approximately two miles west of the shore of the Atlantic Ocean.

038-1

EPA reviewed and commented on the DSEIS in 2011. Our detailed comments focused on a number of environmental issues including the effects of the facility's cooling system on the environment from water withdrawals and discharges and ways to avoid, reduce, and mitigate those impacts. Our comments also recommended a more complete consideration of alternative plant cooling system scenarios for the relicensing period and recommended that the EIS address other operational impacts, including the entrainment and impingement of fish and other aquatic organisms, and releases of tritium to groundwater.

Internet Address (URL) • http://www.epa.gov/region1
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038-1 This comment concerns comments submitted by the EPA on the August 2011 draft SEIS. The purpose of the supplement to the draft SEIS, which was published in May 2013, was to consider new information that became known after the issuance of the August 2011 draft SEIS: NextEra's revised SAMA analysis and new and revised Category 1 and 2 issues resulting from the publication of the final rule (78 FR 37282, June 20, 2013) revising 10 CFR Part 51. The 2011 U.S. EPA comments are addressed in this final SEIS. Specific responses to U.S. EPA comments on the 2011 draft SEIS can be found in Appendix A, Section A.2, "Comments Received on the Draft SEIS."

We reviewed new information regarding tritium releases contained in the supplement and note that our DSEIS comments on groundwater remain unchanged. Those comments suggested that information related to groundwater tritium contamination at Seabrook should be made easily accessible to the public. In response to the recent supplement, we re-emphasize that need. Although the supplement states that monitoring results are reported to the NRC, monitoring results should also be reported directly to the public, for example, through a dedicated website such as that used by Vermont Yankee and the VT Department of Health for tritium contamination at the Vermont Yankee site. Reporting this information publicly will ensure improved transparency on groundwater contamination issues and facilitate reviews of actions taken to monitor and contain contaminated groundwater. 038-1 cont

As the NRC prepares the Final Supplemental Environmental Impact Statement (FSEIS) for the project, we ask that both this letter, and our October 26, 2011 comments on the DSEIS be addressed. For the reasons discussed in our previous comments on the DSEIS and our comments above, EPA has rated this DSEIS "EC-2 Environmental Concerns-Insufficient Information" in accordance with EPA's national rating system, a description of which is attached to this letter. We look forward to reviewing responses to our comments in the FSEIS. EPA is available to provide additional input, as necessary, to help the NRC respond to our comments. Please feel free to contact Timothy Timmermann of the Office of Environmental Review at 617/918-1025 if you wish to discuss these comments further.

Sincerely,

H. Curtis Spalding
Regional Administrator

Attachment

2

The Foundation for Resilient Societies, a non-profit corporation organized in the State of New Hampshire, appreciates the opportunity to provide Supplemental Comments on environmental impacts and, more importantly, cost-effective risk mitigation options for Seabrook Station No. 1 in Seabrook, New Hampshire.

Our Foundation previously commented on both environmental risks and risk mitigation options in October 2011. Our primary concerns remain unaddressed in the Second Supplemental Draft Analyses (released in April 2013) for both severe accidents and alternative mitigation options.

We comment because nuclear power plants are integral to reliable operation of regional electric grids. One hundred and two currently-licensed nuclear power plants provide electricity generally at costs below most alternative sources of electric power; previously constructed power plants, if licensable for additional periods of operation, provide dispatchable baseload power critical to grid stability.

039-1

We understand that the risks of severe solar geomagnetic storms and of high altitude electromagnetic pulse (EMP) explosions were not risks included in the Design Basis for currently licensed nuclear power plants. Hence, these risks are not included in Section 5.1 of the Supplemental EIS analyses that reviews "Design Basis Accidents."

It is our understanding that – despite the bounds of Design Basis risk management – when the Commission initiated a post-Fukushima review of the need to reanalyze the scope and efficacy of safety regulation for nuclear power plants, the Commission made a commitment to address high-consequence, low-probability risks, even if some of these hazards were beyond Design Basis risks. The Miller Report of July 2012[1] proposed to broaden the scope of safety analyses for both operating and future licensable power plants.

However, the Commission's consideration of "Severe Accidents" that might affect Seabrook Station, as contained in Sections 5.2 and 5.3 of the Supplemental Severe Accident Analyses of April 2013, continues to exclude the substantial risk of solar geomagnetic storms.

[1] Charles Miller, et al., Recommendations for Enhancing Reactor Safety in the 21st Century, NRC, July 12, 2012. The Miller Report proposed inclusion of beyond Design Basis hazards, strengthening blackout mitigation capabilities, enhancing spent fuel makeup capability and instrumentation, and other defense-in-depth concepts.

2

039-1 As mentioned in response to comments 018-1, 027-28, 006-1, and 027-10 on the 2011 draft SEIS, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

039-1 cont

In April 2013, the owner-operator of Seabrook Station reported to a Space Weather Conference in Boulder, Colorado that NRC-licensed nuclear power plants at Seabrook Station in New Hampshire and at Point Beach, Wisconsin are "GIC hot spots" – meaning that northern latitude, soil conductivity, and transmission line topology combine to produce high observed GIC for Generator Step-Up (GSU) transformers. [2] According to multiple government and industry reports, high GIC can cause overheating and unexpected failure of GSU transformers. In turn, unexpected transformer failure during and after solar storms can cause reactor trips and attendant nuclear safety issues.[3]

In May 2013, Lloyd's of London, in collaboration with Atmospheric and Environmental Research, Inc. of Lexington, Massachusetts, released a risk assessment of U.S. electric grid vulnerability to severe solar geomagnetic storms.[4] AER corroborates that generation plants proximate to coastlines and high salinity water bodies have greater exposure to GIC.

During the period that the Commission has prepared its Supplemental Analyses for Seabrook Station's severe accident risks and mitigation alternatives, evidence has mounted that certain foreign nations – including North Korea and Iran – may be acquiring high altitude electromagnetic pulse (HEMP) weapons. Protections against both solar weather and a significant portion of man-made EMP hazards could be accomplished using the same mitigation equipment, a solution that could be both prudent and cost-effective.

Our Foundation encourages the Commission to address low probability hazards for which the consequences may be severe, but for which cost-effective remedies may also be available. Our Board is appreciative that the Commission has determined to proceed with analysis of Petition for Rulemaking PRM-50-96, a petition that

[2] Available on the internet is a NextEra Energy briefing by Kenneth R. Fleischer, "NextEra Nuclear GMD Mitigation," PowerPoint Presentation, Space Weather Workshop, Boulder, Colorado, April 16, 2012. See the www.swpc.noaa website. Specific NextEra view graphs form this presentation relating to Seabrook Station and Point Beach are reproduced as Appendix 2 of Foundation for Resilient Societies Comments, May 1, 2012, in FERC Docket RM12-22-000, 47 pp.

[3] The Foundation for Resilient Societies is currently conducting a study of reactor trips during solar storms and expects to publish the results in 2013.

[4] Solar Storm Risk to the North American Electric Grid, found at: http://www.lloyds.com/~/media/lloyds/reports/emerging%20risk%20reports/solar%20storm%20risk%20to%20the%20north%20american%20electric%20grid.pdf, last accessed June 30, 2013.

proposes on-site backup power to protect spent fuel pools during prolonged Loss of Outside Power (LOOP).[5]

039-2

In our current Comments we have added a request to consider the retrofit of the Seabrook spent fuel pool by adding elevated containers of water (possibly with soluble boron added), as a relatively low-cost complementary method of prolonging the availability of water makeup. Using gravity feed and manual turn-on, turn-off controls, these simple water storage containers could be both continuously available and immune to remote cyber-attack.

039-3

When considering severe accident mitigation alternatives (SAMAs) for solar geomagnetic storm risks, we request that the Commission consider the baseline threat to be the geomagnetic disturbance magnitude of the New York Central Railroad Storm of 1921, in addition to the Carrington Event of 1859. We have extrapolated from the March 13, 1989 Quebec solar storm that the New York Railroad Storm of 1921 might produce about 1,600 amps of GIC at Seabrook in a storm with magnitude of about 4,800 nanoTeslas/minute.[6] A storm of the magnitude of the New York Central Railroad storm of 1921 has not reoccurred for 92 years. This return period implies that the New England electric grid has risk of prolonged electric grid blackout at an estimated frequency of approximately 1-in-100 years.

039-4

We request that the Nuclear Regulatory Commission consider in its Final Supplemental Environmental Impact Statement for Seabrook Station Relicensing as Severe Accident Risks the hazards contained in the following Table, and also the proposed mitigation alternatives (SAMAs) explained in the first column of this Table. The Table is provided as an Appendix to our Comments.

[5] See NRC-PRM-50-96, and ruling of the NRC published at 77 Fed. Reg. 74788-74798 dated December 18, 2012.
[6] See Foundation for Resilient Societies, Interim Report, Solar Storm Risks for Maine and the New England Electric Grid, and Potential Protective Measures, March 19, 2013. This report is available on our Foundation website, http://www.resilientsocieties.org and is retrievable via FERC Docket RM12-22-000. The Report reviews current operating procedures of ISO-New England during warnings of solar geomagnetic storms and ensuing geomagnetic disturbances. It compares both transmission capabilities at-risk and generating facilities at-risk with operating reserves projected to be available. The report estimates the cost to protect the Maine grid against geomagnetic disturbance and compares this cost to the cost of a pending transmission upgrade to the Maine grid.

4

039-2 Cyberattacks are handled under Title 10 of the Code of Federal Regulations, Section 73.54, "Protection of Digital Computer and Communication Systems and Networks" (10 CFR 73.54) (Ref. 1). This rule requires, in part, that NRC licensees provide high assurance that digital computer and communication systems and networks are adequately protected against cyberattacks, up to and including the design-basis threat (DBT), as described in 10 CFR 73.1, "Purpose and Scope."

In particular, 10 CFR 73.54(a)(1) requires licensees to protect digital computer and communications systems and networks associated with the following categories of functions, from those cyberattacks identified in 10 CFR 73.54(a)(2):

- safety-related and important-to-safety functions,
- security functions,
- emergency preparedness functions, including offsite communications, and
- support systems and equipment which, if compromised, would adversely impact safety, security, or emergency preparedness functions.

10 CFR 73.54(a)(2) requires the licensee to protect such systems and networks from those cyberattacks that would act to modify, destroy, or compromise the integrity or confidentiality of data or software; deny access to systems, services, or data; and impact the operation of systems, networks, and equipment.

proposes on-site backup power to protect spent fuel pools during prolonged Loss of Outside Power (LOOP).[5]

In our current Comments we have added a request to consider the retrofit of the Seabrook spent fuel pool by adding elevated containers of water (possibly with soluble boron added), as a relatively low-cost complementary method of prolonging the availability of water makeup. Using gravity feed and manual turn-on, turn-off controls, these simple water storage containers could be both continuously available and immune to remote cyber-attack. 039-2

When considering severe accident mitigation alternatives (SAMAs) for solar geomagnetic storm risks, we request that the Commission consider the baseline threat to be the geomagnetic disturbance magnitude of the New York Central Railroad Storm of 1921, in addition to the Carrington Event of 1859. We have extrapolated from the March 13, 1989 Quebec solar storm that the New York Railroad Storm of 1921 might produce about 1,600 amps of GIC at Seabrook in a storm with magnitude of about 4,800 nanoTeslas/minute.[6] A storm of the magnitude of the New York Central Railroad storm of 1921 has not reoccurred for 92 years. This return period implies that the New England electric grid has risk of prolonged electric grid blackout at an estimated frequency of approximately 1-in-100 years. 039-3

We request that the Nuclear Regulatory Commission consider in its Final Supplemental Environmental Impact Statement for Seabrook Station Relicensing as Severe Accident Risks the hazards contained in the following Table, and also the proposed mitigation alternatives (SAMAs) explained in the first column of this Table. The Table is provided as an Appendix to our Comments. 039-4

[5] See NRC-PRM-50-96, and ruling of the NRC published at 77 Fed. Reg. 74788-74798 dated December 18, 2012.
[6] See Foundation for Resilient Societies, Interim Report, Solar Storm Risks for Maine and the New England Electric Grid, and Potential Protective Measures, March 19, 2013. This report is available on our Foundation website, http://www.resilientsocieties.org and is retrievable via FERC Docket RM12-22-000. The Report reviews current operating procedures of ISO-New England during warnings of solar geomagnetic storms and ensuing geomagnetic disturbances. It compares both transmission capabilities at-risk and generating facilities at-risk with operating reserves projected to be available. The report estimates the cost to protect the Maine grid against geomagnetic disturbance and compares this cost to the cost of a pending transmission upgrade to the Maine grid.

4

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On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

proposes on-site backup power to protect spent fuel pools during prolonged Loss of Outside Power (LOOP).[5]

039-2

In our current Comments we have added a request to consider the retrofit of the Seabrook spent fuel pool by adding elevated containers of water (possibly with soluble boron added), as a relatively low-cost complementary method of prolonging the availability of water makeup. Using gravity feed and manual turn-on, turn-off controls, these simple water storage containers could be both continuously available and immune to remote cyber-attack.

039-3

When considering severe accident mitigation alternatives (SAMAs) for solar geomagnetic storm risks, we request that the Commission consider the baseline threat to be the geomagnetic disturbance magnitude of the New York Central Railroad Storm of 1921, in addition to the Carrington Event of 1859. We have extrapolated from the March 13, 1989 Quebec solar storm that the New York Railroad Storm of 1921 might produce about 1,600 amps of GIC at Seabrook in a storm with magnitude of about 4,800 nanoTeslas/minute.[6] A storm of the magnitude of the New York Central Railroad storm of 1921 has not reoccurred for 92 years. This return period implies that the New England electric grid has risk of prolonged electric grid blackout at an estimated frequency of approximately 1-in-100 years.

039-4

We request that the Nuclear Regulatory Commission consider in its Final Supplemental Environmental Impact Statement for Seabrook Station Relicensing as Severe Accident Risks the hazards contained in the following Table, and also the proposed mitigation alternatives (SAMAs) explained in the first column of this Table. The Table is provided as an Appendix to our Comments.

[5] See NRC-PRM-50-96, and ruling of the NRC published at 77 Fed. Reg. 74788-74798 dated December 18, 2012.
[6] See Foundation for Resilient Societies, Interim Report, Solar Storm Risks for Maine and the New England Electric Grid, and Potential Protective Measures, March 19, 2013. This report is available on our Foundation website, http://www.resilientsocieties.org and is retrievable via FERC Docket RM12-22-000. The Report reviews current operating procedures of ISO-New England during warnings of solar geomagnetic storms and ensuing geomagnetic disturbances. It compares both transmission capabilities at-risk and generating facilities at-risk with operating reserves projected to be available. The report estimates the cost to protect the Maine grid against geomagnetic disturbance and compares this cost to the cost of a pending transmission upgrade to the Maine grid.

4

039-4 Regarding the comments on severe solar storms and man-made EPMs, as mentioned in response to comments 018-1, 027-28, 006-1, and 027-10 on the 2011 draft SEIS, the NRC is aware of the potential significance of EMP to the Nation's critical infrastructure and has reviewed the "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," issued in 2004. The NRC is also aware of the potential damage to the electric grid that can occur from geomagnetically-induced currents resulting from a significant solar storm.

On March 15, 2011, the NRC docketed a petition for rulemaking (PRM-50-96) submitted by the commenters here, requesting that the NRC amend its regulations to ensure long-term cooling and makeup water for SFPs at U.S. power reactors because of the possibility of a widespread and long-term loss of the electric power grid due to natural geomagnetic disturbances. The petition states that self-sufficiency is necessary since fuel resupply deliveries cannot be assured after a large induced current in the bulk power transmission system because of the disruption of petroleum and natural gas infrastructures caused by widespread and long-term loss of the electric power grid.

As a lesson learned from the Fukushima flooding from the tsunami which disabled internal electrical power systems after the earthquake had cut off external power sources, leaving the plants with only a few hours' worth of battery power, the NRC issued a Mitigation Strategies Order on March 12, 2012, requiring all U.S. nuclear power plants to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The NRC is working to codify the Mitigation Strategies Order in regulations through the rulemaking process, called the Station Blackout Mitigation Strategies (SBOMS). The SBOMS rulemaking will ensure that if a plant loses power, it will have sufficient procedures, strategies, and equipment to cope with the loss of power for an indefinite amount of time. All rulemaking related documents are available in Docket NRC-2011-0299 on www.regulations.gov.

Since the issue is being addressed generically through two different in rulemaking actions, no changes are necessary in this SEIS.

APPENDIX TABLE

UNADDRESSED SEVERE MITIGATION ALTERNATIVES (SAMAs) FOR SEABROOK STATION

RETROFIT OPTIONS	KEY UNADDRESSED RISKS IN SEABROOK STATION SUPPLEMENTAL EIS AND CORRESPONDING BENEFITS OF RETROFIT OPTIONS		
	SEVERE SOLAR STORM	MAN-MADE ELECTRO-MAGNETIC PULSE (EMP)	CYBER ATTACK
Option 1: Install Neutral Ground Blocking Device to protect GSU transformers against Geomagnetically Induced Current (GIC) during scheduled transformer replacement in April 2014; one blocking device required.	**Benefits:** 1. Eliminate half-cycle GSU transformer saturation and harmonic production. 2. Prevent GSU transformer overheating and vibration. 3. Reduce chance of unexpected GSU transformer failure and reactor trips during solar storms. 4. Enhance regional grid stability during solar storms and reduce risk of Loss of Outside Power. 5. Prevent harmonic injection into local grid and resulting Uninterruptible Power Supply (UPS) malfunction during solar storms, including UPS for station power.	**Benefits:** 1. Protect GSU transformers against E3 (long pulse) during nuclear EMP attack. 2. Optional installation of Metal Oxide Varistors (MOV) along with Neutral Ground Blocking Device could also protect against E1 (fast pulse). 3. Reduce recovery time for regional grid and reduce risks due to extended Loss of Outside Power in aftermath of nuclear EMP attack.	**Benefits:** None

6

039-4 cont

039-4 cont'd Regarding including cyberattacks in the SAMA analysis, cyberattacks are handled under Title 10, of the Code of Federal Regulations, Section 73.54, "Protection of Digital Computer and Communication Systems and Networks" (10 CFR 73.54) (Ref. 1). This rule requires, in part, that NRC licensees provide high assurance that digital computer and communication systems and networks are adequately protected against cyberattacks, up to and including the design-basis threat (DBT), as described in 10 CFR 73.1, "Purpose and Scope."

In particular, 10 CFR 73.54(a)(1) requires licensees to protect digital computer and communications systems and networks associated with the following categories of functions, from those cyberattacks identified in 10 CFR 73.54(a)(2):

- safety-related and important-to-safety functions,
- security functions,
- emergency preparedness functions, including offsite communications, and
- support systems and equipment which, if compromised, would adversely impact safety, security, or emergency preparedness functions.

10 CFR 73.54(a)(2) requires the licensee to protect such systems and networks from those cyberattacks that would act to modify, destroy, or compromise the integrity or confidentiality of data or software; deny access to systems, services, or data; and impact the operation of systems, networks, and equipment.

039-4 cont

Option 2: For planned GSU replacement in year 2014, install transformers with high GIC "withstand" rating.	**Benefits:** 1. Reduce core eddy currents and resulting transformer overheating. 2. Enable plant to operate through small-to-moderate solar storms without downrating.	**Benefits:** Due to high GIC during nuclear EMP attack, no significant benefit expected.	**Benefits:** None
Option 3: Install unattended backup power system for spent fuel pool cooling. See analysis in Petition for Rulemaking PRM-50-96 and NRC assessment dated December 18, 2012.	**Benefits:** 1. Prevent boil-off of spent fuel pool during long-term LOOP; reduce radiation from spent fuel pool and allow continuing access to site. 2. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during long-term LOOP.	**Benefits:** 1. Prevent boil-off of spent fuel pool during long-term LOOP; reduce radiation from spent fuel pool and allow continuing access to site. 2. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during long-term LOOP.	**Benefits:** 1. Backup power system would be unconnected to internet and therefore unaffected by cyber-attack. 2. Prevent boil-off of spent fuel pool during long-term LOOP caused by cyber-attack; reduce radiation from spent fuel pool and allow continuing access to site. 2. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during long-term LOOP caused by cyber-attack.

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Option 4: Install large tank with makeup water for spent fuel pools; tank to be elevated with gravity feed and manual valve system; water may contain soluble boron.	**Benefits:** 1. Delay boil-off of spent fuel pool during long-term LOOP from regional grid collapse; reduce radiation from spent fuel pool and allow continuing access to site. 2. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during LOOP of several weeks duration.	**Benefits:** 1. Delay boil-off of spent fuel pool during long-term LOOP from regional grid collapse; reduce radiation from spent fuel pool and allow continuing access to site. 2. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during LOOP of several weeks duration.	**Benefits:** 1. Manual valve system would be unconnected to internet and therefore unaffected by cyber-attack. 2. Delay boil-off of spent fuel pool during LOOP of several weeks duration; reduce radiation from spent fuel pool and allow continuing access to site. 3. Reduce risk of spent fuel pool fire and resulting contamination of surrounding land area during LOOP of several weeks duration.

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A.3 References

[EPA] U.S. Environmental Protection Agency, 2011, letter to NRC, “NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 46 Regarding Seabrook Station, Draft Report for Comment, CEQ #20110250,” October 26, 2011, ADAMS Accession No. ML11304A059.

[FPLE] FPL Energy Seabrook, LLC, 2008, “Seabrook Station Updated Final Safety Analysis Report,” Revision 12, August 1, 2008.

[NAI] Normandeau Associates, Inc., 2010, “Seabrook Station 2009 Environmental Monitoring in the Hampton—Seabrook Area: A Characterization of Environmental Conditions,” Prepared for NextEra Energy Seabrook, LLC., 2010, ADAMS Accession No. ML103360298.

[NCI] National Cancer Institute, 1990, “Cancer in Populations Living Near Nuclear Facilities,” NIH Publication 90-874.

[NEI] Nuclear Energy Institute, 2007, “NEI 07-07, Industry Ground Water Protection Initiative—Final Guidance Document,” Washington, D.C., August 1, 2007, ADAMS Accession No. ML091170588.

[NextEra] NextEra Energy Seabrook, LLC, 2010, “License Renewal Application, Seabrook Station,” Appendix E, “Applicant’s Environmental Report, Operating License Renewal Stage,” May 25, 2010, ADAMS Accession Nos. ML101590092 and ML101590089.

NextEra, 2011, letter to NRC, “Seabrook—Response to Request for Additional Information, NextEra Energy License Renewal Application,” January 13, 2011, ADAMS Accession No. ML110140810.

[NRC] U.S. Nuclear Regulatory Commission, 1996, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2, May 31, 1996, ADAMS Accession Nos. ML040690705 and ML040690738.

NRC, 1998, *Code Manual for MACCS2*, NUREG/CR-6613, Volumes 1 and 2, May 1998, ADAMS Accession No. ML063550020.

NRC, 2009, “Policy Issue Information, Subject: Evaluation of Radiological Consequence Models and Codes,” SECY 09-0051, March 31, 2009, ADAMS Accession No. ML090550608.

NRC, 2010, letter to NextEra Energy Seabrook, “Notice of Intent to Prepare an Environmental Impact Statement and Conduct the Scoping Process for Seabrook Station, Unit 1,” *Federal Register*, Vol. 75, No. 138, pp. 42168–42170, July 20, 2010.

NRC, 2010a, “Summary of Public License Renewal Overview and Environmental Scoping Meetings Related to the Review of the Seabrook Station License Renewal Application (TAC Nos. ME3959 and ME4028),” September 20, 2010, ADAMS Accession No. ML102520222.

NRC, 2010b, “Groundwater Task Force Final Report,” June 30, 2010, ADAMS Accession No. ML101740509.

NRC, 2010c, “Generic Issue 199, Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants,” Information Notice 2010-18, Office of Nuclear Reactor Regulation, Office of Nuclear Material Safety and Safeguards, Washington, D.C., September 2, 2010, ADAMS Accession No. ML101970221.

NRC, 2011, "Issuance of Environmental Scoping Summary Report Associated with the Staff's Review of the Application by NextEra Energy Seabrook, LLC for Renewal of the Operating License for Seabrook Station (TAC Number ME3959)," March 1, 2011, ADAMS Accession No. ML110100113.

NRC, 2011a, letter to NMFS, "Essential Fish Habitat Conservation Recommendations for Hope Creek Generating Station and Salem Generating Station, Units 1 and 2, License Renewal Review," June 15, 2011, ADAMS Accession No. ML11153A170.

NRC, 2012, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(F) Regarding Recommendations 2.1,2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident," March 12, 2012, ADAMS Accession Nos. ML12053A340 and ML12056A046.

[NREL] National Renewable Energy Laboratory, 2010, *Assessment of Offshore Wind Energy Resources for the United States*, Available URL: http://www.nrel.gov/docs/fy10osti/45889.pdf (accessed April 26, 2012).

NREL, 2010a, *Large-Scale Offshore Wind Power in the United States—Assessment of Opportunities and Barriers, Available URL:* http://www.nrel.gov/wind/pdfs/40745.pdf *(accessed April 26, 2012).*

Solomon, S., et al., eds., 2007, *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* IPCC, Cambridge University Press, Cambridge, UK, and New York, NY, Available URL: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm (accessed January 19, 2011).

Sovacool, B.K, 2008, "Valuing the Greenhouse Gas Emissions from Nuclear Power: A Critical Survey," Energy Policy 36: 2940–2953. Available URL: http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf (accessed September 14, 2012).

[USGCRP] U.S. Global Research Program, 2009, *Global Climate Change Impacts in the United States,* Cambridge University Press, Available URL: http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf (accessed January 20, 2011).

U.S. Nuclear Regulatory Commission (NRC), 1996, *"Generic Environmental Impact Statement for License Renewal of Nuclear Plants*," NUREG-1437, Volumes 1 and 2, May 31, 1996, ADAMS Accession Nos. ML040690705 and ML040690738.

NRC, 1998, *Code Manual for MACCS2*, NUREG/CR-6613, Volumes 1 and 2, May 1998. ADAMS Accession No. ML063550020.

NRC, 2009, "Policy Issue Information, Subject: Evaluation of Radiological Consequence Models and Codes," SECY 09-0051, March 31, 2009. ADAMS Accession No. ML090550608.

NRC, 2010, letter to NextEra Energy Seabrook, "Notice of Intent to Prepare an Environmental Impact Statement and Conduct the Scoping Process for Seabrook Station, Unit 1," *Federal Register*, Vol. 75, No. 138, pp. 42168–42170, July 20, 2010.

NRC, 2010a, "Summary of Public License Renewal Overview and Environmental Scoping Meetings Related to the Review of the Seabrook Station License Renewal Application (TAC Nos. ME3959 and ME4028)," September 20, 2010, ADAMS Accession No. ML102520222.

NRC, 2010b, "Groundwater Task Force Final Report," June 30, 2010, ADAMS Accession Number ML101740509.

NRC, 2010c. "Safety/Risk Assessment Results for Generic Issue 199, Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," Office of Nuclear Regulatory Research, Washington, D.C. September 2, 2012. ADAMS Accession No. ML100270582.

NRC, 2011, "Issuance of Environmental Scoping Summary Report Associated with the Staff's Review of the Application by NextEra Energy Seabrook, LLC for Renewal of the Operating License for Seabrook Station (TAC Number ME3959)," March 1, 2011, ADAMS Accession No. ML110100113.

NRC, 2011a, letter to NMFS, "Essential Fish Habitat Conservation Recommendations for Hope Creek Generating Station and Salem Generating Station, Units 1 and 2, License Renewal Review." June 15, 2011, ADAMS Accession No. ML11153A170.

NRC, 2012, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(F) Regarding Recommendations 2.1,2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident " March 12, 2012. ADAMS Accession Nos. ML12053A340, ML12056A046.

National Renewable Energy Laboratory (NREL), 2010, *Assessment of Offshore Wind Energy Resources for the United States*, Available URL: http://www.nrel.gov/docs/fy10osti/45889.pdf (accessed April 26, 2012).

NREL, 2010a, *Large-Scale Offshore Wind Power in the United States—Assessment of Opportunities and Barriers,* Available URL: http://www.nrel.gov/wind/pdfs/40745.pdf (accessed April 26, 2012).

APPENDIX B
NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (referred to as the GEIS), documents the results of the U.S. Nuclear Regulatory Commission (NRC) staff's systematic approach to evaluating the environmental impacts of renewing the licenses of individual nuclear power plants. Of the 92 total environmental issues that the NRC staff identified in the GEIS, the staff determined that 69 are generic to all plants (Category 1), while 21 issues must be discussed on a site-specific basis (Category 2). Two other issues, environmental justice and the chronic effects of electromagnetic fields, are uncategorized and must be evaluated on a site-specific basis.

The table below is a listing of all 92 environmental issues, including the possible environmental significance (SMALL, MODERATE, LARGE, or uncategorized) as appropriate. This table, provided in Section 9 of the GEIS, is codified in the NRC regulations as Table B-1 in Appendix B, Subpart A, to Title 10 of the *Code of Federal Regulations* (CFR) Part 51, and is provided here for convenience.

Table B–1. Summary of Findings on National Environmental Protection Agency (NEPA) Issues for License Renewal of Nuclear Power Plants

Issue	Category	Findings
Surface Water Quality, Hydrology, and Use (for all plants)		
Impacts of refurbishment on surface water quality	Generic	SMALL. Impacts are expected to be negligible during refurbishment because best management practices are expected to be employed to control soil erosion and spills.
Impacts of refurbishment on surface water use	Generic	SMALL. Water use during refurbishment will not increase appreciably or will be reduced during plant outage.
Altered current patterns at intake and discharge structures.	Generic	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered salinity gradients	Generic	SMALL. Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered thermal stratification of lakes	Generic	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Temperature effects on sediment transport capacity	Generic	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Scouring caused by discharged cooling water	Generic	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.
Eutrophication	Generic	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Discharge of chlorine or other biocides	Generic	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.
Discharge of sanitary wastes and minor chemical spills	Generic	SMALL. Effects are readily controlled through [National Pollutant Discharge Elimination System] NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term
Discharge of other metals in waste water	Generic	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.
Water use conflicts (plants with once-through cooling systems)	Generic	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

Issue	Category	Findings
Surface Water Quality, Hydrology, and Use (for all plants) (cont'd)		
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	Site-specific	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See § 51.53(c)(3)(ii)(A).
Aquatic Ecology (for all plants)		
Refurbishment	Generic	SMALL. During plant shutdown and refurbishment there will be negligible effects on aquatic biota because of a reduction of entrainment and impingement of organisms or a reduced release of chemicals.
Accumulation of contaminants in sediments or biota	Generic	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.
Entrainment of phytoplankton and zooplankton	Generic	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Cold shock	Generic	SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.
Thermal plume barrier to migrating fish	Generic	SMALL. Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Distribution of aquatic organisms	Generic	SMALL. Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.
Premature emergence of aquatic insects	Generic	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.
Gas supersaturation (gas bubble disease)	Generic	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Low dissolved oxygen in the discharge	Generic	SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

Issue	Category	Findings
Aquatic Ecology (for all plants) (cont'd)		
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	Generic	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Stimulation of nuisance organisms (e.g., shipworms)	Generic	SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See § 51.53(c)(3)(ii)(B).
Impingement of fish and shellfish	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See § 51.53(c)(3)(ii)(B).
Heat shock	Site-specific	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See § 51.53(c)(3)(ii)(B).
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Generic	SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Impingement of fish and shellfish	Generic	SMALL. The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Heat shock	Generic	SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

Issue	Category	Findings
		Ground-water Use and Quality
Impacts of refurbishment on ground-water use and quality	Generic	SMALL. Extensive dewatering during the original construction on some sites will not be repeated during refurbishment on any sites. Any plant wastes produced during refurbishment will be handled in the same manner as in current operating practices and are not expected to be a problem during the license renewal term.
Ground-water use conflicts (potable and service water; plants that use <100 [gallons per minute] gpm)	Generic	SMALL. Plants using less than 100 gpm are not expected to cause any ground-water use conflicts.
Ground-water use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	Site-specific	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users. See § 51.53(c)(3)(ii)(C).
Ground-water use conflicts (plants using cooling towers withdrawing make-up water from a small river)	Site-specific	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other ground-water or upstream surface water users come on line before the time of license renewal. See § 51.53(c)(3)(ii)(A).
Ground-water use conflicts (Ranney wells)	Site-specific	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C).
Ground-water quality degradation (Ranney wells)	Generic	SMALL. Ground-water quality at river sites may be degraded by induced infiltration of poor-quality river water into an aquifer that supplies large quantities of reactor cooling water. However, the lower quality infiltrating water would not preclude the current uses of ground water and is not expected to be a problem during the license renewal term.
Ground-water quality degradation (saltwater intrusion)	Generic	SMALL. Nuclear power plants do not contribute significantly to saltwater intrusion) intrusion.
Ground-water quality degradation (cooling ponds in salt marshes)	Generic	SMALL. Sites with closed-cycle cooling ponds may degrade ground-water quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes.
Ground-water quality degradation (cooling ponds at inland sites)	Site-specific	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See § 51.53(c)(3)(ii)(D).

Issue	Category	Findings
Terrestrial Resources		
Refurbishment impacts	Site-specific	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See § 51.53(c)(3)(ii)(E).
Cooling tower impacts on crops and ornamental vegetation	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling tower impacts on native plants	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Bird collisions with cooling towers	Generic	SMALL. These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling pond impacts on terrestrial resources	Generic	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.
Power line right-of-way management (cutting and herbicide application)	Generic	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.
Bird collision with power lines	Generic	SMALL. Impacts are expected to be of small significance at all sites.
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	Generic	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.
Floodplains and wetland on power line right of way	Generic	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.
Threatened or Endangered Species (for all plants)		
Threatened or endangered species	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See § 51.53(c)(3)(ii)(E).

Issue	Category	Findings
		Air Quality
Air quality during refurbishment (nonattainment and maintenance areas)	Site-specific	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage. See § 51.53(c)(3)(ii)(F).
Air quality effects of transmission lines	Generic	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
		Land Use
Onsite land use	Generic	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.
Power line right of way	Generic	SMALL. Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

Issue	Category	Findings
		Human Health
Radiation exposures to the public during refurbishment	Generic	SMALL. During refurbishment, the gaseous effluents would result in doses that are similar to those from current operation. Applicable regulatory dose limits to the public are not expected to be exceeded.
Occupational radiation exposures during refurbishment	Generic	SMALL. Occupational doses from refurbishment are expected to be within the range of annual average collective doses experienced for pressurized-water reactors and boiling-water reactors. Occupational mortality risk from all causes including radiation is in the mid-range for industrial settings.
Microbiological organisms (occupational health)	Generic	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	Site-specific	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See § 51.53(c)(3)(ii)(G).
Noise	Generic	SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.
Electromagnetic fields, acute effects (electric shock)	Site-specific	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See § 51.53(c)(3)(ii)(H).
Electromagnetic fields, chronic effects	Uncatego-rized	UNCERTAIN. Biological and physical studies of 60 - Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.[a]
Radiation exposures to public (license renewal term)	Generic	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.
Occupational radiation exposures (license renewal term)	Generic	SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.

Issue	Category	Findings
		Socioeconomics
Housing impacts	Site-specific	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See § 51.53(c)(3)(ii)(I).
Public services: public safety, social services, and tourism and recreation	Generic	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.
Public services: public utilities	Site-specific	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See § 51.53(c)(3)(ii)(I).
Public services, education (refurbishment)	Site-specific	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors.
Public services, education (license renewal term)	Generic	SMALL. Only impacts of small significance are expected.
Offsite land use (refurbishment)	Site-specific	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See § 51.53(c)(3)(ii)(I).
Offsite land use (license renewal term)	Site-specific	SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal. See § 51.53(c)(3)(ii)(I).
Public services, Transportation	Site-specific	SMALL, MODERATE, OR LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the license renewal are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J).
Historic and archaeological resources	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See § 51.53(c)(3)(ii)(K).
Aesthetic impacts (refurbishment)	Generic	SMALL. No significant impacts are expected during refurbishment.
Aesthetic impacts (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.
Aesthetic impacts of transmission lines (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.

Issue	Category	Findings
		Postulated Accidents
Design basis accidents	Generic	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.
Severe accidents	Site-specific	SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(3)(ii)(L).
		Uranium Fuel Cycle and Waste Management
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste	Generic	SMALL. Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S - 3 of this part [10 CFR Part 54]. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.
Offsite radiological impacts (collective effects)	Generic	The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of ears are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations. Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

Issue	Category	Findings
Uranium Fuel Cycle and Waste Management (cont'd)		
Offsite radiological impacts (spent fuel and high level waste disposal)	Generic	For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 3×10^{-3}.

Issue	Category	Findings
Uranium Fuel Cycle and Waste Management (cont'd)		
Offsite radiological impacts (spent fuel and high level waste disposal) (cont'd)		Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood an consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, [U.S. Environmental Protection Agency's] EPA's generic repository standards in 40 CFR part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range of between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths worldwide for a 100,000 metric tonne [of heavy metal] (MTHM) repository. Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts pf spent fuel and high level waste disposal, this issue is considered in Category 1.
Non-radiological impacts of the uranium fuel cycle	Generic	SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

Issue	Category	Findings
Uranium Fuel Cycle and Waste Management (cont'd)		
Low-level waste storage and disposal	Generic	SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
Mixed waste storage and disposal	Generic	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
On-site spent fuel	Generic	SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.
Nonradiological waste	Generic	SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.
Transportation	Generic	SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 [megawatt days per metric ton uranium] MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S–4—Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water- Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.

Issue	Category	Findings
		Decommissioning
Radiation doses	Generic	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.
Waste management	Generic	SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.
Air quality	Generic	SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.
Water quality	Generic	SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.
Ecological resources	Generic	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.
Socioeconomic impacts	Generic	SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.
		Environmental Justice
Environmental justice	Uncatego-rized	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.

[a] If, in the future, the Commission finds that, contrary to current indications, a consensus has been reached by appropriate Federal health agencies that there are adverse health effects from electromagnetic fields, the Commission will require applicants to submit plant-specific reviews of these health effects as part of their license renewal applications. Until such time, applicants for license renewal are not required to submit information on this issue.

APPENDIX C
APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

The Atomic Energy Act (42 *United States Code* (USC) § 2021) authorizes the U.S. Nuclear Regulatory Commission (NRC) to enter into agreement with any state to assume regulatory authority for certain activities. For example, through the Agreement State Program, New Hampshire assumed regulatory responsibility over certain byproduct, source, and quantities of special nuclear materials not sufficient to form a critical mass. The New Hampshire State Agreement Program is administered by the Radiological Health Section, Division of Public Health Services, New Hampshire Department of Health and Human Services.

In addition to carrying out some Federal programs, state legislatures develop their own laws. State statutes supplement, as well as implement, Federal laws for protection of air, water quality, and groundwater. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The Clean Water Act (CWA) allows for primary enforcement and administration through state agencies, provided that the state program is at least as stringent as the Federal program. The state program must conform to the CWA and to the delegation of authority for the Federal National Pollutant Discharge Elimination System (NPDES) Program from the U.S. Environmental Protection Agency (EPA) to the state. The primary mechanism to control water pollution is the requirement for direct dischargers to obtain an NPDES permit or, in the case of states where the authority has been delegated from the EPA, a State Pollutant Discharge Elimination System (SPDES) permit, under the CWA. In New Hampshire, the EPA issues and enforces NPDES permits.

One important difference between Federal regulations and certain state regulations is the definition of waters regulated by the state. Certain state regulations may include underground waters while the CWA regulates only surface waters.

C.1 State Environmental Requirements

Certain environmental requirements, including some discussed earlier, may have been delegated to state authorities for implementation, enforcement, or oversight. Table C-1 provides a list of representative state environmental requirements that may affect license renewal applications for nuclear power plants.

Table C–1. State Environmental Requirements

Seabrook is subject to state requirements regarding its environmental program. Those requirements are briefly described below. See supplemental environmental impact statement (SEIS) Section 1.9 for Seabrook's compliance status with these requirements.

Law/Regulation	Requirements
Air Quality Protection	
Federal Clean Air Act (42 USC 7401 et seq.), New Hampshire Revised Statutes Annotated (RSA), Chapter 125-C, *Air Pollution Control*	An operating permit is required for air emissions and is issued by the New Hampshire Department of Environmental Services (NHDES). RSA Chapter 125-C establishes the policies by which the state administers the Title V permit program under the *Clean Air Act*.
Federal Clean Air Act (42 USC 7401 et seq.), New Hampshire Code of Administrative Rules (CAR), Part ENV-A 610, *General State Permits and General Permits Under Title V*	A general permit is required for air emissions and is issued by NHDES. CAR ENV-A 610 establishes permit procedures by which the state administers the Title V permit program under the *Clean Air Act*.
New Hampshire CAR, Part ENV-A 1205, *Prevention, Abatement, and Control of Stationary Source Air Pollution*	This law regulates emissions of volatile organic compounds (VOCs) from gasoline storage tanks, gasoline dispensing facilities, bulk gasoline plants, and cargo trucks in accordance with Sections 182(b)(3) and 184 of the *Clean Air Act*.
Waste Management and Pollution Prevention	
New Hampshire CAR, Part ENV-WM 300, *Permits*	This law establishes the procedures and requirements used in permitting hazardous waste management facilities. It requires facilities to obtain a permit prior to constructing, modifying, or operating a facility.
New Hampshire CAR, Part ENV-WM 1400, *Petroleum Storage Facilities*	This law establishes the procedures and requirements for facilities that use petroleum storage tanks. It requires facility owners to register all petroleum storage facilities.

C.2 Operating Permits and Other Requirements

Several operating permit applications may be prepared and submitted, and regulator approval, permits or both would be received prior to license renewal approval by the NRC. Table C-2 lists representative Federal, state, and local permits.

Table C–2. Federal, State, and Local Permits and Other Requirements

Seabrook is subject to other requirements regarding various aspects of their environmental program. Those requirements are briefly described below. See SEIS Section 1.9 for Seabrook's compliance status with these requirements.

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Water Resources Protection			
NPDES Permit: Industrial Facility Storm Water	EPA	CWA (33 USC 1251 et seq.); 40 CFR Part 122	Storm water would be discharged from the nuclear power plants during operations. Storm water would discharge through existing outfalls covered by a permit.
NPDES Permit: Process Water Discharge	EPA	CWA (33 USC 1251 et seq.); 40 CFR Part 122	Process industrial wastewater would be discharged through existing outfalls covered by the permit.
Waste Management and Pollution Prevention			
Registration for transportation of radioactive material in Virginia	Virginia Department of Emergency Management	Title 44, Code of Virginia, Chapter 3.3, Section 44-146.30	Commonwealth of Virginia requires shippers of hazardous radioactive materials to register with the Virginia Department of Emergency Management.
License to deliver radioactive material to a processing facility in Tennessee	Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	Seabrook radioactive material is delivered to a processing facility in Tennessee.
Permit to deliver radioactive material to a disposal facility in Utah	Utah Department of Environmental Quality	Utah Rule 313-26	Seabrook radioactive material is shipped to a disposal facility in Utah.
Emergency Planning and Response			
Transportation of hazardous material registration	U.S. Department of Transportation	*Hazardous Material Transportation Act* (49 USC 1501 et seq.); 49 CFR Part 107	Seabrook hazardous materials shipments comply with U.S. Department of Transportation packaging, labeling, and routing requirements.

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Biotic Resource Protection			
Threatened and endangered species consultation	U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS)	*Endangered Species Act of 1973*, as amended (16 USC 1531 et seq.)	NRC consults with FWS and NMFS regarding the impact of license renewal on threatened or endangered species or their critical habitat.
Coastal zone management certification	NHDES	*Coastal Zone Management Act* (16 USC 1451)	An applicant is required to provide certification to the Federal agency that license renewal would be consistent with the Federally approved state coastal zone management plan.
Permit to display finfish and invertebrates	New Hampshire Fish and Game Department	New Hampshire RSA 214:29	An applicant is required to obtain a permit to display finfish and invertebrates at the Seabrook Science and Nature Center.
Cultural Resources Protection			
Archaeological and historical resources consultation	State Historic Preservation Officer	*National Historic Preservation Act* of 1966, as amended (16 USC 470 et seq.)	NRC consults with the SHPOs regarding the impacts of license renewal and the results of archaeological and architectural surveys of nuclear power plant sites.

APPENDIX D
CONSULTATION CORRESPONDENCE

CONSULTATION CORRESPONDENCE

The Endangered Species Act of 1973, as amended; the Magnuson–Stevens Fisheries Management Act of 1996, as amended; and the National Historic Preservation Act of 1966 require that Federal agencies consult with applicable state and Federal agencies and groups prior to taking action that may affect threatened or endangered species, essential fish habitat, or historic and archaeological resources, respectively.

Table D-1 provides a list of the consultation documents sent between the U.S. Nuclear Regulatory Commission (NRC) and other agencies. All consultation correspondence is publicly available through the NRC's web-based Agencywide Documents Access and Management System (ADAMS) (http://www.nrc.gov/reading-rm/adams.html) and can be found by searching for the specific ADAMS Accession Number.

Table D–1. Consultation Correspondence

Author	Recipient	Date of Correspondence (ADAMS Accession No.)
Simon, B., Massachusetts Historical Commission	Holian, B., NRC	March 3, 2010 (ML100880129)
Pham, B., NRC	Nelson, R., Advisory Council on Historic Preservation	July 16, 2010 (ML101760128)
Pham, B., NRC	Kurkul, P., National Marine Fisheries Service (NMFS), Northeast Region	July 16, 2010 (ML101760221)
Pham, B., NRC	Muzzey, E., New Hampshire Division of Historical Resources	July 16, 2010 (ML101790273)
Pham, B., NRC	Moriarty, M., U.S. Fish and Wildlife Service (FWS), Northeast Region	July 16, 2010 (ML101790278)
Feighner, E., New Hampshire Division of Historical Resources	Pham, B., NRC	July 27, 2010 (ML102160299)
Kurkul, P., NMFS, Northeast Region	Pham, B., NRC	August 5, 2010 (ML102240108)
Pham, B., NRC	Coppola, M., New Hampshire Natural Heritage Bureau	August 26, 2010 (ML102290417)
Chapman, T., FWS, Northeast Region	Pham, B., NRC	September 1, 2010 (ML102630180)
Coppola, M., New Hampshire Natural Heritage Bureau	Susco, J., NRC	September 7, 2010 (ML102520087)
Coppola, M., New Hampshire Natural Heritage Bureau	Susco, J., NRC	September 13, 2010 (ML102600341)
Pham, B. NRC	Keel, M. F., Bureau of Indian Affairs	October 15, 2010 (ML102730657)
Pham, B. NRC	Andrews-Maltais, C., Wampanoag Tribe of Gay Head-Aquinnah	October 15, 2010 (ML102730657)
Pham, B. NRC	True, C., Abenaki Nation of New Hampshire	October 15, 2010 (ML102730657)
Pham, B. NRC	St. Francis-Merril, A., Abenaki Nation of Missisquoi, St. Francis/Sokoki Band	October 15, 2010 (ML102730657)
Pham, B. NRC	Pouliot, P., Cowasuck Band of the Pennacook–Abenaki People	October 15, 2010 (ML102730657)
Wrona, D., NRC	Muzzey, E., New Hampshire Division of Historical Resources	August 1, 2011 (ML11131A118)
Wrona, D., NRC	Simon, B., Massachusetts Historical Commission	August 1, 2011 (ML11131A118)
Wrona, D., NRC	Chapman, T., FWS, Northeast Region	August 2, 2011 (ML11131A004)
Wrona, D., NRC	Colosi, P., Northeast Region, NMFS	August 2, 2011 (ML11126A365)
Wrona, D., NRC	U.S. Environmental Protection Agency (EPA)	August 2, 2011 (ML11137A158)
Feighner, E., New Hampshire Division of Historical Resources	Wrona, D., NRC	August 17, 2011 (ML11242A111)

Author	Recipient	Date of Correspondence (ADAMS Accession No.)
Simon, B., Massachusetts Historical Commission	Wrona, D., NRC	September 1, 2011 (ML11257A088)
Raddant, A., U.S. Department of the Interior	Bladey, C., NRC	October 25, 2011 (ML11301A099)
Grout, D., New Hampshire Fish & Game Department	Bladey, C., NRC	October 26, 2011 (ML11301A074)
Colosi, P., Northeast Region, NMFS	Bladey, C., NRC	October 26, 2011 (ML11304A057)
Spalding, H., EPA, Region 1	[Bladey, C.,]NRC	October 26, 2011 (ML11304A059)
Imboden, A., NRC	Colosi, P., Northeast Region, NMFS	November 17, 2011 (ML11322A094)
Imboden, A., NRC	Kurkul, P., Northeast Region, NMFS	December 29, 2011 (ML11343A025)
Bullard, J., Northeast Region, NMFS	Hull, A., NRC	October 10, 2012 (ML12285A250)

APPENDIX D-1
ESSENTIAL FISH HABITAT ASSESSMENT

Essential Fish Habitat Assessment Seabrook Station, Unit 1 License Renewal

May 2011

Docket Number 50-443

U.S. Nuclear Regulatory Commission
Rockville, Maryland

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ac	acre
ADAMS	Agencywide Documents Access and Management System
BACI	before-after control-impact
CFR	*U.S. Code of Federal Regulations*
cfs	cubic feet per second
CL	confidence limit
cm	centimeter
CO_2	carbon dioxide
CPUE	catch per unit effort
CV	coefficient of variation
CWA	Clean Water Act
DFO	Fisheries and Oceans Canada
EEP	Estuary Enhancement Program
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
FPLE	Florida Power Light Energy Seabrook
fps	feet per second
FR	*Federal Register*
ft	foot
FMP	fishery management plan
GEIS	generic environmental impact statement
gpm	gallons per minute
ha	hectare
in.	inch
kg	kilogram
km	kilometer
lb	pound
m	meter
m/s	meters per second
m^3	cubic meters
m^3/day	cubic meters per day
m^3/s	cubic meters per second
m^3/yr	cubic meters per year
MAFMC	Mid-Atlantic Fishery Management Council
MARMAC	Marine Resources Monitoring, Assessment, and Prediction
MDS	multi-dimensional scaling
mgd	million gallons per day
mi	mile

mm	millimeter
MSA	Magnuson–Stevens Fishery and Conservation Management Act
MSL	mean sea level
MT	metric tons
NAI	Normandeau Associates, Inc.
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fishery Science Center
NEPA	U.S. National Environmental Policy Act of 1969
NextEra	NextEra Energy Seabrook, LLC
NPDES	National Pollutant Discharge Elimination System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Nuclear Regulatory Commission
PIC	proposal for information collection
ppt	parts per thousand
Seabrook	Seabrook Station, Unit 1
SEIS	supplemental environmental impact statement
USGCRP	U.S. Global Change Research Program

ESSENTIAL FISH HABITAT ASSESSMENT FOR THE PROPOSED LICENSE RENEWAL OF SEABROOK STATION

D-1.1 Introduction

In compliance with Section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), the U.S. Nuclear Regulatory Commission (NRC) prepared this Essential Fish Habitat (EFH) assessment for the proposed Federal action: NRC's decision whether or not to renew the operating license for Seabrook Station (Seabrook), Unit 1. Seabrook is located in Rockingham County, NH, on the shore of the Hampton-Seabrook Estuary and the Gulf of Maine.

Pursuant to the MSA, NRC staff requested, via letter dated July 16, 2010 (NRC 2010), that the National Marine Fisheries Service (NMFS) provide information on EFH near the Seabrook site. In their response to NRC, NMFS (2010) indicated that marine waters off Seabrook and the Hampton-Seabrook Estuary have been designated as EFH for 23 Federally managed species and directed the NRC to prepare an EFH assessment as part of the EFH consultation process.

Accordingly, this EFH assessment does the following:

- describes the proposed action,
- identifies relevant commercial, Federally managed species within the vicinity of the proposed site,
- assesses if the proposed action may adversely affect any designated EFH, and
- describes potential measures to avoid, minimize, or offset potential adverse impacts to EFH as a result of the proposed action.

D-1.2 Description of the Proposed Action

The proposed Federal action is NRC's decision of whether or not to renew the operating license for Seabrook for an additional 20 years beyond the original 40-year term of operation.

NextEra Energy Seabrook, LLC (NextEra) initiated the proposed Federal action by submitting an application for license renewal of Seabrook, for which the existing license, NPF-86, expires on March 15, 2030. If NRC issues a renewed license for Seabrook, NextEra could continue to operate until the 20-year terms of the renewed license expire in 2050. If the operating license is not renewed, then the facility must shut down on or before the expiration date of the current operating license (March 15, 2030).

Pursuant to the NRC's environmental protection regulations in Title 10 of the *U.S. Code of Federal Regulations* (CFR) Part 51, which implement the U.S. National Environmental Policy Act of 1969 (NEPA), the NRC is publishing this supplemental environmental impact statement (SEIS) for Seabrook concurrent with this EFH Assessment. The SEIS is a site-specific supplement to the *Generic Environmental Impact Statement [GEIS] for License Renewal of Nuclear Plants*, NUREG-1437 (NRC 1996).

NextEra (2010) has proposed no major construction, refurbishment, or replacement activities associated with the proposed Federal action. During the proposed license renewal term, NextEra would continue to perform site maintenance activities as well as vegetation management on the transmission line right-of-ways that connect Seabrook to the electric grid.

D-1.2.1 Site Location and Description

Seabrook is located in the Town of Seabrook, Rockingham County, NH, 2 mi (3.2 km) west of the Atlantic Ocean. Seabrook is approximately 2 mi (3.2 km) north of the Massachusetts state line, 15 mi (24 km) south of the Maine state line, and 10 mi (16 km) south of Portsmouth, NH. Two metropolitan areas lie within 50 mi (80 km) of the site: Manchester, NH (31 mi (50 km) west-northwest) and Boston, MA (41 mi (66 km) south-southwest). Figure D-1-1 and Figure D-1-2 present the 6-mi (10-km) and 50-mi (80-km) area surrounding Seabrook, respectively.

The Seabrook site spans 889 acres (ac) (360 hectare (ha)) on a peninsula of land bordered by Browns River on the north, Hunts Island Creek on the south, and estuarine marshlands on the east. Two lots divide the site. The joint owners of Seabrook own Lot 1, which encompasses approximately 109 ac (44 ha). The majority of the operating facility is located on this mostly developed lot. Site structures include the Unit 1 containment building, primary auxiliary building, fuel storage building, waste processing building, control and diesel generator building, turbine building, administration and service building, ocean intake and discharge structures, circulating water pumphouse, and service water pumphouse (NextEra 2010). NextEra originally planned to construct two identical units at the Seabrook site but halted construction on Unit 2 prior to completion and uses the remaining Unit 2 buildings primarily for storage.

NextEra owns Lot 2, which is approximately 780 ac (316 ha). Lot 2 is mainly an open tidal marsh area with fabricated linear drainage ditches and tidal creeks, and it is available habitat for wildlife resources (NextEra 2010). The site boundary is also the exclusion area. Figure D-1-3 provides a general layout of the Seabrook site.

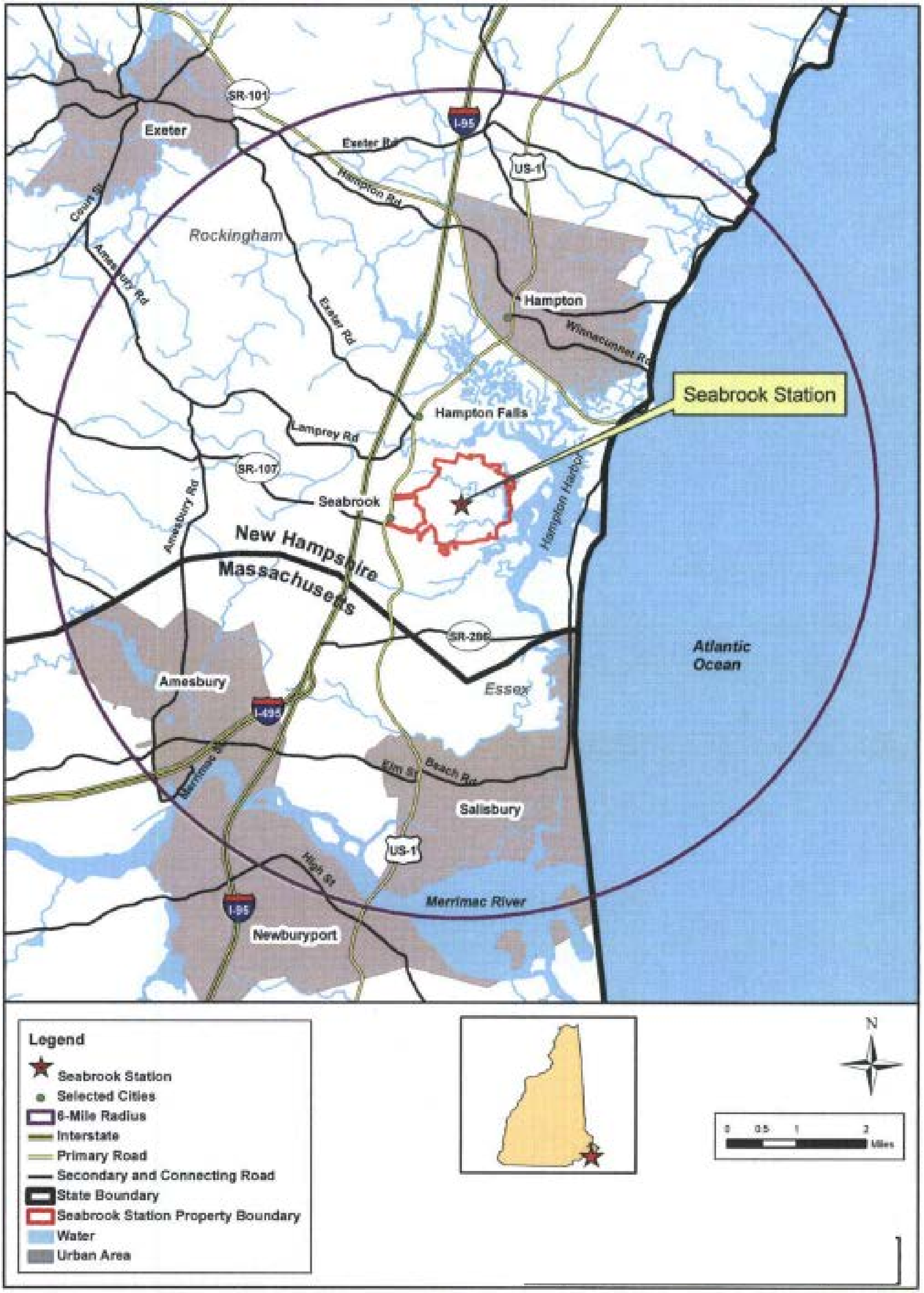
The Seabrook cooling water comes from an intake structure located 60 ft (18.3 m) below mean lower low water in the Gulf of Maine (see Section D-1.2.1.1). The seafloor in this area is relatively flat, with bedrock covered by sand, algae, or sessile invertebrates (NAI 2010). The immediate vicinity surrounding the Seabrook plant is the Hampton-Seabrook Estuary. No intake or discharge structures are located in the estuary. From construction until 1994, Seabrook discharged to an onsite settling basin into the Browns River.

The Gulf of Maine and Hampton-Seabrook Estuary are complex water bodies with many individual species performing different roles in the system, and, often, species perform several ecological roles throughout their lifecycles. Major assemblages of organisms within the marine and estuarine communities include plankton, fish, benthic invertebrates, and algae. Section 2.2.6 in the SEIS describes these assemblages and typical habitat types in the nearshore of the Gulf of Maine and within Hampton-Seabrook Estuary.

D-1.2.1.1 Cooling and Auxiliary Water Systems

Seabrook uses a once-through cooling system that withdraws water from the Gulf of Maine and discharges to the Gulf of Maine through a system of tunnels that have been drilled through ocean bedrock. Unless otherwise cited, the NRC staff drew information about Seabrook’s cooling and auxiliary water systems from the National Pollution Discharge Elimination System (NPDES) Permit (EPA 2002a) and the applicant’s Environmental Report (ER) (NextEra 2010).

Figure D-1-1. Location of Seabrook, 6-mi (10-km) Region

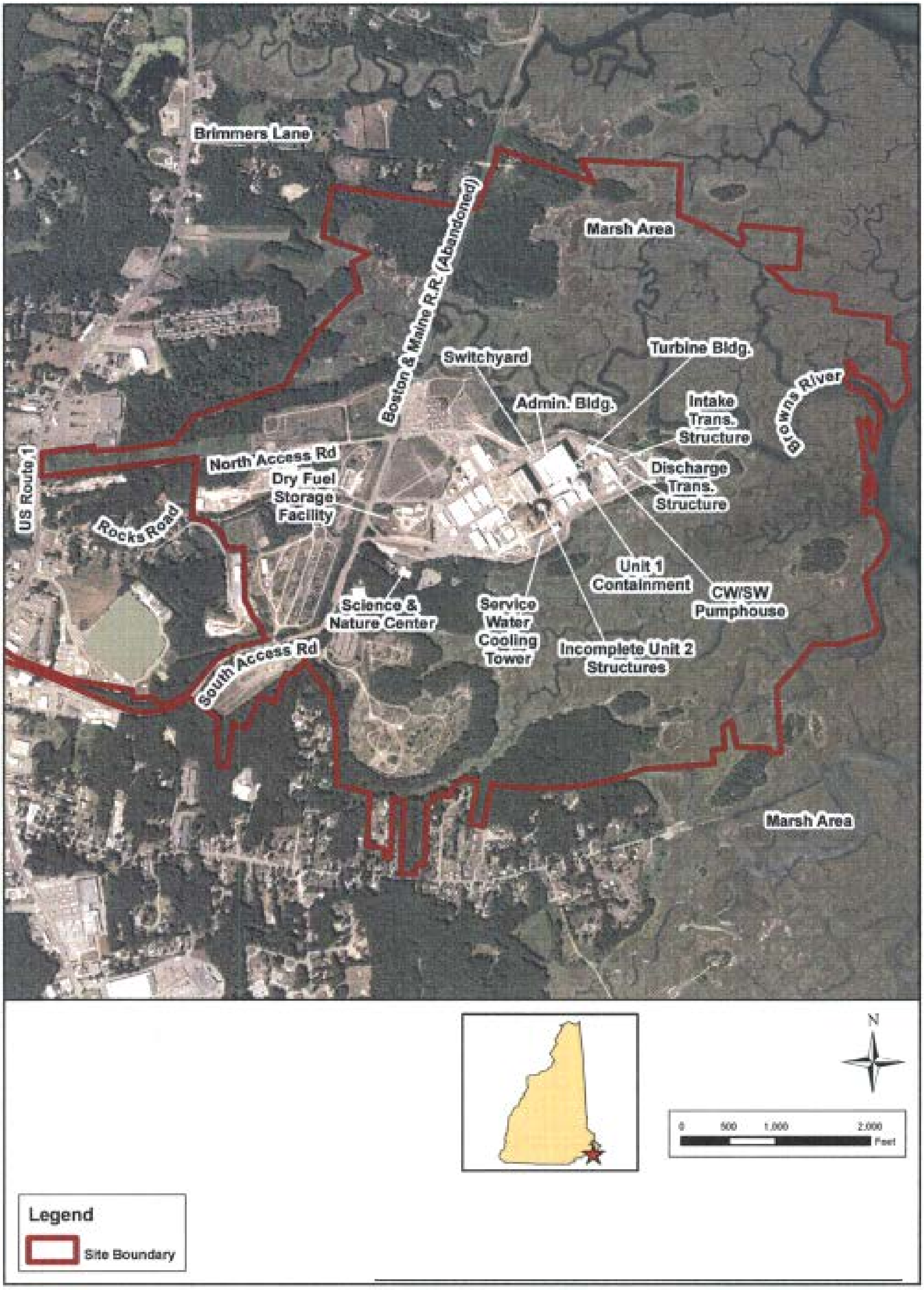


Source: (NextEra 2010)

Figure D-1-2. Location of Seabrook, 50-mi (80-km) Region

Source: (NextEra 2010)

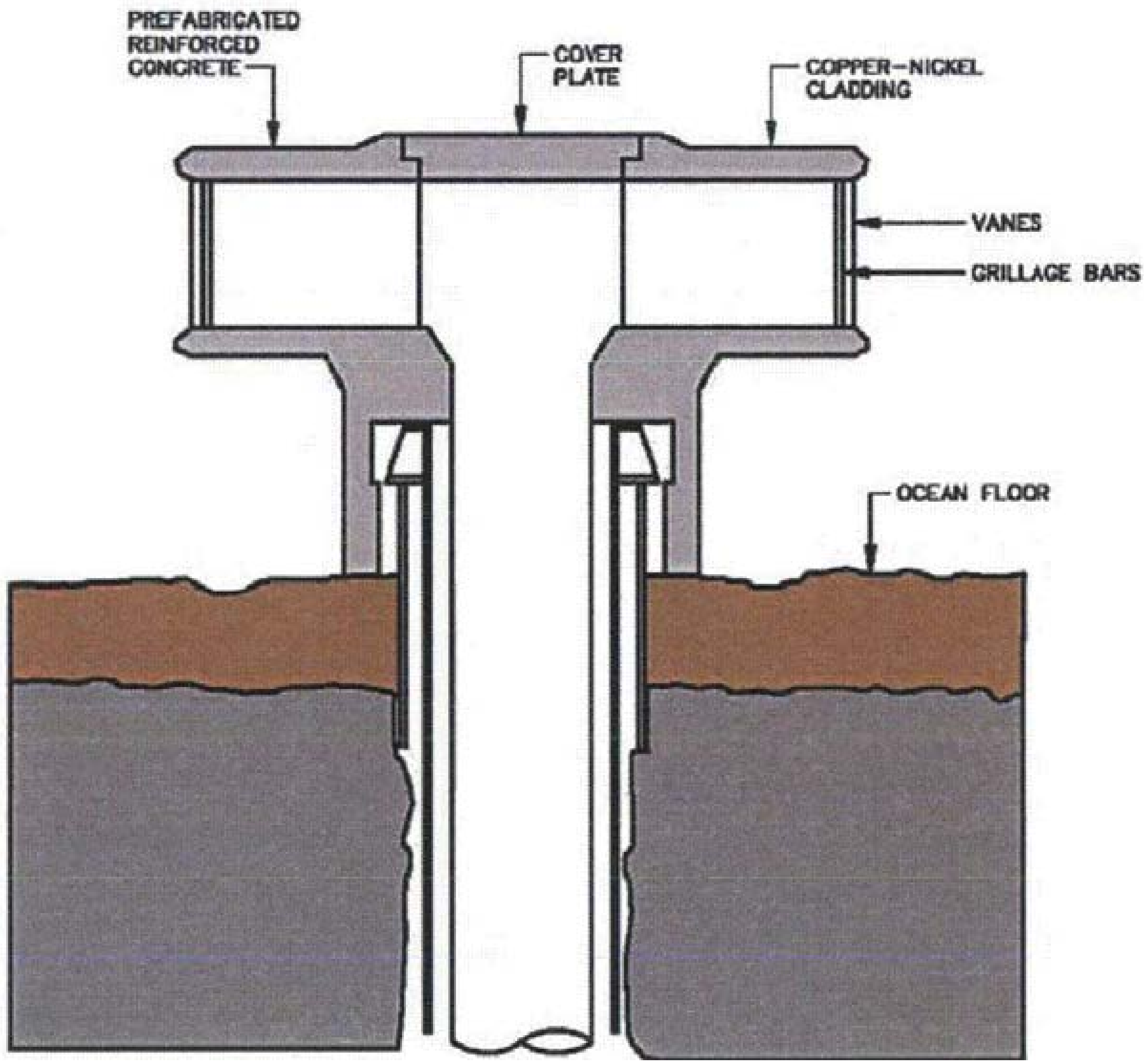
Figure D-1-3. Seabrook Site Boundary and Facility Layout



Source: (NextEra 2010)

Water is drawn from the Gulf of Maine through three concrete intake structures that are located at the end of an intake tunnel in approximately 60 ft (18 3 m) of water depth. Each intake shaft extends up from the intake tunnel to above the bedrock, and a velocity cap sits on top (Figure D-1-4). NextEra implemented this structural design to reduce the intake velocity, thereby minimizing fish entrapment. In 1999, NextEra modified the intakes with additional vertical bars to help prevent seals from getting trapped (NMFS 2002). The NPDES permit limits the intake velocity to 1.0 feet per second (fps) (0.3 meters per second (m/s)) (EPA 2002a).

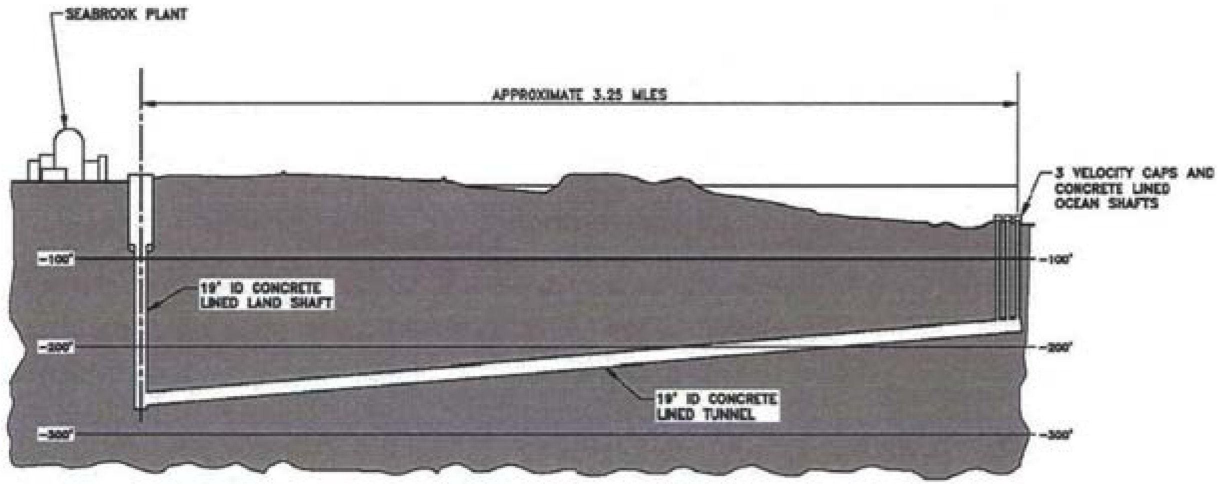
Figure D-1-4. Intake Shafts and Caps at Seabrook



Source: (ARCADIS et al. 2008)

Water flows from the intake structures through a 17,000-ft (5,182-m) intake tunnel that was drilled through the ocean bedrock. The beginning of the intake tunnel is 7,000 ft (2,134 m) from the Hampton beach shoreline. The tunnel descends at a 0.5 percent grade from the bottom of the intake shaft, which is 160 ft (49 m) below the Gulf of Maine, to 240 ft (73 m) below mean sea level (MSL) at Seabrook (Figure D-1-5). Concrete lines the 19-ft (5.8-m) diameter tunnel.

Figure D-1-5. Profile of Intake Tunnel and Shafts at Seabrook



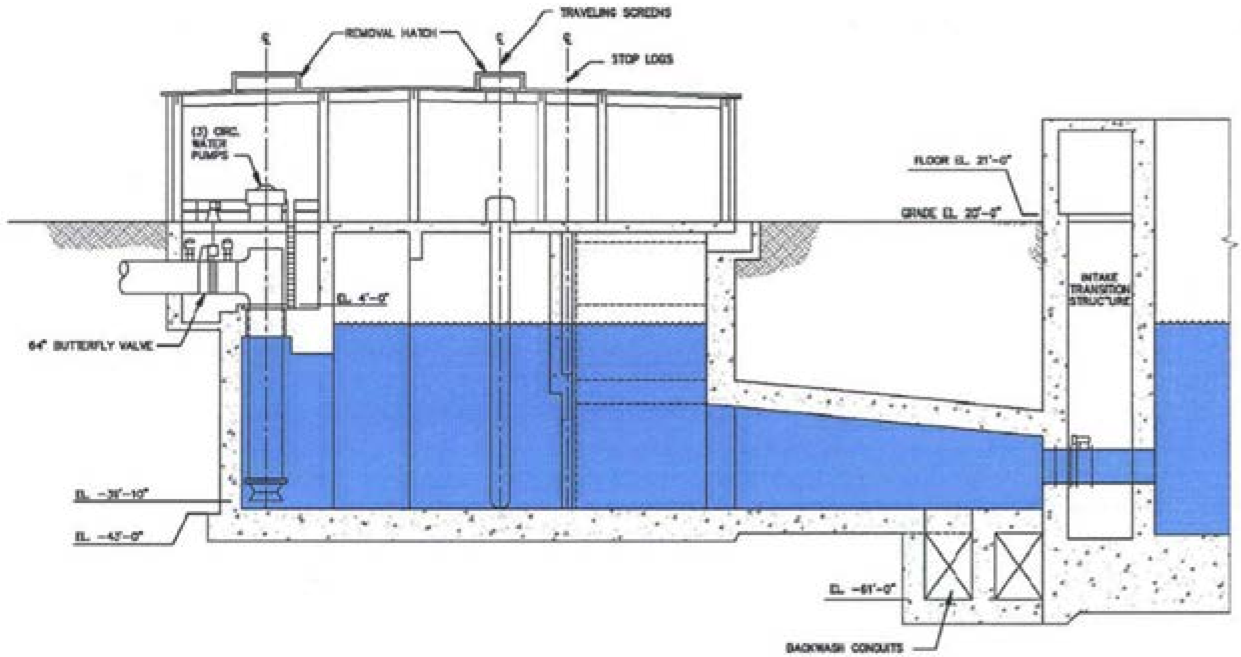
Source: (ARCADIS et al. 2008)

An intake transition structure, which includes three circulating water pumps that transport the water, is located beneath Seabrook (Figure D-1-6). Butterfly valves, 11-ft (3.4-m) in diameter, direct the water flow from the transition structure to the circulating water pumphouse. The water then passes through three traveling screens with a $^{3}/_{8}$-inch (0.95-cm) square mesh (NextEra 2010a). The traveling screens remove fish, invertebrates, seaweed, and other debris before the water is pumped to the main condensers and the service water system. The ocean debris is disposed as waste; therefore, none is discharged to the Gulf of Maine. The water passes to the condensers to remove heat that is rejected by the turbine cycle and auxiliary system. During normal operations, the circulating water system provides a continuous flow of approximately 390,000 gallons per minute (gpm) (869 cubic feet per second (cfs) or 24.6 cubic meters (m^3) per second (m^3/s)) to the main condenser and 21,000 gpm (47 cfs or 1.3 m^3/s) to the service water system.

Water that has passed through Seabrook discharges to the Gulf of Maine through a 16,500-ft (5,029-m) long discharge tunnel, which has the same diameter, lining, depth, and percent grade as the intake tunnel. The end of the discharge tunnel is 5,000 ft (1,524 m) from the Seabrook beach shoreline. Eleven 70-ft (21-m) deep concrete shafts about 100 ft (30 m) apart discharge the effluent. Each shaft terminates in a pair of nozzles that are pointed up at an angle of about 22.5 degrees (NAI 2001). The nozzles are located 6.5 to 10 ft (2 to 3 m) above the seafloor in depths of approximately 49 to 59 ft (15 to 18 m) of water (NAI 2001). To increase the discharge velocity and more quickly diffuse the heated effluent, a double-nozzle fixture tops each shaft. The NPDES permit limits this discharge flow to 720 million gallons per day (mgd) (2.7 million m^3/day), and the monthly mean temperature rise may not exceed 5° F (2.6 ° C) at the surface of the receiving water (EPA 2002a).

Barnacles, mussels, and other subtidal fouling organisms can attach to concrete structures and potentially limit water flow through the tunnels. To minimize biofouling within the intake and discharge tunnels, NextEra uses a combination of physical scrubbing and a chlorination system (NextEra 2010a). Divers physically scrub the intake structures biannually to remove biofouling organisms—such as barnacles, mussels, or other organisms—that attach to hard surfaces to grow. During outages, the inside of the intake structures are physically scrubbed up until the point that chlorine is injected into the tunnels, approximately 6 ft (1.8 m) into the intake shaft. In addition, NextEra inspects the discharge diffusers during outages. The circulating water pumphouse, pipes, and condensers are dewatered, inspected, and cleaned as needed (Seabrook 2008). NextEra injects chlorine and other water treatment chemicals in accordance with NPDES permit limits (EPA 2002a).

Figure D-1-6. Circulating Water Pumphouse at Seabrook



Source: (ARCADIS et al. 2008)

As described above, the Gulf of Maine provides water for both the circulating water system and the service water system. Water flows from the intake structures to the service water pumphouse, which is separated from the circulating water system portion of the building by a seismic reinforced concrete wall. In the event that the regular supply of cooling water from the service water pumphouse is unavailable, NextEra would use a standby mechanical draft evaporative cooling tower (service water tower) and 7-day makeup water reservoir. This makeup water reservoir is from the Gulf of Maine and stored in the service water tower. If this makeup reservoir is unavailable, or additional water is required, NextEra would access emergency makeup water from the domestic water supply system or from the Browns River via a portable pump (FPLE 2008).

Sections 2.1.1 through 2.1.5 of the SEIS provide additional information regarding the reactor and containment systems, other systems at Seabrook, and plant operations. Sections 2.1.7 and 2.2.5 provide additional information on Seabrook's surface water use and a description of the NDPES permit.

D-1.3 Essential Fish Habitat Species Near the Site and Potential Adverse Effects

D-1.3.1 Essential Fish Habitat Species Identified for Analysis

The waters and substrate necessary for spawning, breeding, feeding, or growth to maturity are considered EFH (16 U.S.C. 1802(10)). The portion of the Gulf of Maine and Hampton-Seabrook Estuary adjacent to Seabrook, and its intake and discharge structures, contains designated EFH for several fish species and life stages.

In its *Guide to Essential Fish Habitat Designations in the Northeastern United States*, NMFS (2011a) identifies EFH by 10-minute squares of latitude and longitude as well as by major estuary, bay, or river for estuarine waters outside of the 10-minute square grid. The waters near Seabrook are within the "Gulf of Maine" EFH Designation that extends from Salisbury, MA, north to Rye, NH and includes Hampton Harbor, Hampton beach, and Seabrook beach. The 23 species with designated EFH in this area appear in Table D-1-1.

Table D-1-1. Species of Fish With Designated EFH in the Vicinity of Seabrook

Species	Eggs	Larvae	Juveniles	Adults
American plaice (*Hippoglossoides platessoides*)			x	x
Atlantic butterfish (*Peprilus triacanthus*)	x	x	x	x
Atlantic cod (*Gadus morhua*)	x	x	x	x
Atlantic halibut (*Hippoglossus hippoglossus*)	x	x	x	x
Atlantic herring (*Clupea harengus*)			x	x
Atlantic mackerel (*Scomber scombrus*)	x	x	x	x
Atlantic sea scallop (*Placopecten magellanicus*)	x	x	x	x
Bluefin tuna (*Thunnus thynnus*)				x
Haddock (*Melanogrammus aeglefinus*)			x	
Longfin inshore squid (*Loligo pealei*)			x	x
Monkfish/Goosefish (*Lophius americanus*)	x	x	x	x
Northern shortfin squid (*Illex illecebrosus*)			x	x
Ocean pout (*Macrozoarces americanus*)	x	x	x	x
Pollock (*Pollachius virens*)			x	
Redfish (*Sebastes fasciatus*)		x	x	x
Red hake (*Urophycis chuss*)	x	x	x	x
Scup (*Stenotomus chrysops*)			x	x
Summer flounder (*Paralicthys dentatus*)				x
Atlantic Surf clam (*Spisula solidissima*)			x	x
Whiting/Silver hake (*Merluccius bilinearis*)	x	x	x	x
Windowpane flounder (*Scopthalmus aquosus*)			x	x
Winter flounder (*Pleuronectes americanus*)	x	x	x	x
Yellowtail flounder (*Pleuronectes ferruginea*)			x	x

Source: (NMFS 2011b)

Seabrook has monitored fish and shellfish eggs, larvae, juveniles, and adults since the mid-1970s. In addition, Seabrook regularly records annual estimates of entrainment and impingement. Table D-1-2 presents a summary of the occurrence of EFH species within Seabrook's monitoring, entrainment, and impingement studies.

The NRC staff compared monitoring, entrainment, and impingement data with each of the EFH species listed in Table D-1-2. Seabrook regularly observed most EFH species within monitoring, entrainment, or impingement studies. However, Atlantic halibut, redfish, bluefin tuna, northern shortfin squid, and longfin inshore squid were rarely or occasionally identified during monitoring studies and were not entrained or impinged from 1990 to 2009. These fives species are analyzed in Section D-1.3.3.19 of this assessment. All other EFH species are analyzed in detail in Sections D-1.3.3.1 through D-1.3.3.18 of this assessment.

D-1.3.2 Potential Adverse Effects to Essential Fish Habitat

The provisions of the regulations implementing the MSA define an "adverse effect" to EFH as the following (50 CFR 600.810):

> *Adverse effect* means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

For purposes of conducting NEPA reviews, the NRC staff published the GEIS (NRC 1996), which identifies 13 impacts to aquatic resources as either "Category 1" or "Category 2." Category 1 issues are generic in that they are similar at all nuclear plants and have one impact level (SMALL, MODERATE, or LARGE) for all nuclear plants. Mitigation measures for Category 1 issues are not likely to be sufficiently beneficial to warrant implementation. Category 2 issues vary from site to site and must be evaluated on a site-specific basis. Table D-1-3 lists the aquatic resource issues as identified in the GEIS.

The GEIS classifies all impact levels for aquatic resources as "SMALL" except impingement, entrainment, and heat shock. NRC defines "SMALL" as "having environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource" (10 CFR 51, App. B, Table B-1). The NRC staff believes that stressors with "SMALL" levels of impact for the purposes of implementing NEPA would likely not adversely affect EFH. Therefore, this EFH Assessment will focus on the potential adverse effects of impingement, entrainment, and heat shock on EFH. **Impingement** occurs when aquatic organisms are pinned against intake screens or other parts of the cooling water system intake structure. **Entrainment** occurs when aquatic organisms (usually eggs, larvae, and other small organisms) are drawn into the cooling water system and are subjected the thermal, physical, and chemical stress. **Heat shock** is acute thermal stress caused by exposure to a sudden elevation of water temperature that adversely affects the metabolism and behavior of fish and other aquatic organisms. In addition to heat shock, increased water temperatures at the discharge can also reduce the available habitat for fish species if the discharged water is higher than the environmental preferences of a particular species. This issue will be discussed together with heat shock.

Table D-1-2. Relative Commonness of EFH Species in Seabrook Monitoring, Entrainment, and Impingement Studies

Species	Eggs		Larvae		Juveniles and Adults			
	Plankton monitoring	Entrainment studies	Plankton monitoring	Entrainment studies	Trawl monitoring	Gill net monitoring	Seine monitoring	Impingement studies
American plaice	Common[a]	Occasional	Common	Occasional[b]	Occasional			Rare[c]
Atlantic butterfish	Occasional	Rare	Occasional	Rare	Rare	Occasional	Rare	Rare
Atlantic cod [e]	Common	Common	Common	Rare	Common	Occasional	Rare	Rare
Atlantic halibut					Rare			
Atlantic herring			Common	Occasional	Occasional	Abundant	Occasional	Common
Atlantic mackerel	Abundant[d]	Abundant	Abundant	Rare	Rare	Common	Rare	Rare
Atlantic sea scallop				Rare				
Atlantic surf clam				Rare				
Bluefin tuna								
Haddock [e]	Common	Rare	Occasional	Rare	Common	Rare		Rare
Longfin inshore squid								
Monkfish/Goosefish	Rare	Rare	Occasional	Rare	Occasional	Rare		Rare
Northern shortfin squid								
Ocean pout			Occasional	Rare	Common	Rare		Rare
Pollock	Common	Rare	Common	Rare	Common	Common	Occasional	Common
Redfish [e]			Occasional					
Red hake [e]	Common	Common	Common	Occasional	Abundant	Occasional	Common	Common
Scup			Rare		Occasional	Rare		Rare
Summer flounder			Rare	Rare	Rare			Rare
Whiting/Silver hake	Common	Common	Common	Occasional	Common	Common	Rare	Rare
Windowpane flounder	Common	Occasional	Common	Rare	Common	Rare	Occasional	Common

Species	Eggs		Larvae		Juveniles and Adults			
	Plankton monitoring	Entrainment studies	Plankton monitoring	Entrainment studies	Trawl monitoring	Gill net monitoring	Seine monitoring	Impingement studies
Winter flounder		Rare	Common	Occasional	Common	Occasional	Common	Common
Yellowtail flounder [e]	Abundant	Occasional	Common	Rare	Abundant	Rare	Rare	Common

[a] Common: Occurring in >10% of samples but <10% of total catch; 5–10% of entrainment samples averaged over all years

[b] Occasional: Occurring in <10%–1% of samples; 1–5% of entrainment samples averaged over all years

[c] Rare: Occurring in <1% of samples; <1% of entrainment samples averaged over all years

[d] Abundant: >10% of total catch or entrainment over all years

[e] During monitoring surveys, NAI (2010) combined certain groups of species if eggs were morphologically similar and spawning periods overlapped during the sampling period. In such cases, the estimate for the entire group of species appears in the table above. Groups of species include Atlantic cod/haddock/witch flounder, cunner/yellowtail founder, red hake/white hake/spotted hake, and golden redfish/deepwater redfish/and Acadian redfish. For egg entrainment estimates of these groups of species, NextEra (2010b) estimated single species entrainment rates by applying the ratio of larval species to the egg species groups

Blank cells indicate the NAI (2010) did not identify the species within monitoring or entrainment studies.

Sources: (NAI 2010; NextEra 2010a)

Table D-1-3. Aquatic Resource Issues Identified in the GEIS

Issues	Category	Impact level
For all plants		
Accumulation of contaminants in sediments or biota	1	SMALL
Entrainment of phytoplankton & zooplankton	1	SMALL
Cold shock	1	SMALL
Thermal plume barrier to migrating fish	1	SMALL
Distribution of aquatic organisms	1	SMALL
Premature emergence of aquatic insects	1	SMALL
Gas supersaturation (gas bubble disease)	1	SMALL
Low dissolved oxygen in the discharge	1	SMALL
Losses from parasitism, predation, & disease among organisms exposed to sublethal stresses	1	SMALL
Stimulation of nuisance organisms	1	SMALL
For plants with once-through heat-dissipation systems		
Impingement of fish & shellfish	2	SMALL, MODERATE, or LARGE
Entrainment of fish & shellfish in early life stages	2	SMALL, MODERATE, or LARGE
Heat shock	2	SMALL, MODERATE, or LARGE

Source: (NRC 1996)

In addition to impingement, entrainment, and heat shock (or thermal impacts), the NRC staff will assess the impacts to EFH species' food (forage species) and loss of habitat-forming species (such as sessile invertebrates and algae). Information on these areas that is relevant to all EFH species is in Section D-1.3.2.1. In addition, Section D-1.3.2.2 presents NextEra monitoring data of selected groups prior to and during operations at sampling sites near the intake and discharge structures (nearfield sampling sites) and at sampling sites 3 to 4 mi (5 to 8 km) away (farfield sampling sites). Monitoring data may indicate whether the combined impacts (or cumulative impacts) from Seabrook operation has resulted in the decline of forage species, habitat-forming species, or EFH species due to a decline in habitat quantity or quality. The NRC staff's conclusions and information specific to each EFH species is in Sections D-1.3.3.1 through D-1.3.3.19. Section D-1.4 provides an analysis of cumulative impacts to EFH species or their habitat resulting from the past, present, and reasonably foreseeable future projects in the vicinity of Seabrook.

D-1.3.2.1 Information Related to Potential Adverse Impact on All Essential Fish Habitat Species

The section below provides information regarding potential adverse impacts to EFH that is relevant for the assessment of all 23 EFH species that may occur within the vicinity of Seabrook.

<u>Entrainment and Impingement</u>. Entrainment and impingement study results illustrate one type of operational impact on each species' habitat. Because the intake water is EFH, the ratio of specimens from a species impinged or entrained at Seabrook to the total number of impinged or entrained organisms provides some indication of how great the impact from the cooling system

will be on the corresponding EFH. The NRC staff obtained data on fish entrainment and impingement from Seabrook's Annual Biological Monitoring Reports, which summarize entrainment data from 1990 to 2009 and impingement data from 1994 to 2009 (NAI 2010).

NextEra conducted entrainment studies four times per month (NAI 2010). For fish eggs and larvae prior to 1998, NextEra collected three replicate samples using 0.02-in. (0.505-mm) mesh nets. Since 1998, NextEra collected samples using 0.01-in. (0.333-mm) mesh sizes throughout a 24-hour period. NextEra estimated entrainment rates by multiplying the density of entrained eggs or larvae within a sample by the volume of water pumped through the plant within the sample period (FPLE 2008; NAI 2010). Entrainment rates for commonly entrained species, EFH species, and common forage species are presented in Table D-1-4 for egg entrainment and Table D-1-5 for larvae entrainment.

NextEra conducted impingement monitoring once or twice per week by cleaning traveling screens and sorting fish and other debris (NAI 2010). Prior to 1998, NextEra did not sort some collections, and impingement estimates are based on the volume of debris (NAI 2010). Beginning in 1998, Seabrook staff sorted all collections and identified all impinged fish by species. Beginning in April 2002, NextEra collected two standardized 24-hour samples per week and multiplied by seven to estimate weekly impingement. Table D-1-6 shows impingement rates for commonly impinged species, EFH species, and common forage species.

NAI (2010) reported impingement estimates from 1994 to 2009. Prior to October 1994, NextEra determined that some small, impinged fish had been overlooked during separation procedures. NextEra enhanced the Impingement Monitoring Program in the end of 1994 to remedy this issue (NextEra 2010a).

NextEra also conducted entrainment studies for bivalve larvae (NAI 2010). In these studies, NextEra collected three replicates per sampling date using a 0.003-in. (0.076-mm) mesh. Table D-1-7 describes entrainment rates for bivalve larvae.

Thermal Impacts. Heat shock can injure or kill fish. In addition, aquatic species, including EFH species or prey of EFH species, may largely avoid effluents due to high velocities, elevated temperatures, and turbulence. Seabrook's discharge to the Gulf of Maine is permitted under its NPDES permit (EPA 2002a), issued April 1, 2002. The permit allows discharge of 720 mgd (2.7 million m^3/day) on both an average monthly and maximum daily basis. The permit also limits the rise in monthly mean temperature to 5° F in the "near field jet mixing region," or within waters less than 3.3 ft (1 m) from the surface. An EPA online database indicated that Seabrook has had no Clean Water Act (CWA) formal enforcement actions or violations related to discharge temperature in the last 5 years (EPA 2010). EPA's Regional Administrator determined that NextEra's NPDES permit provides a Section 316(a) variance that satisfies thermal requirements and that "will ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the near shore Atlantic Ocean" (EPA 2002a).

Table D-1-4. Number of Fish Eggs Entrained (in millions) for Most Common Egg Taxa Entrained and for EFH Species

Taxon[a]	1990[b]	1991[c]	1992[d]	1993[d]	1994[e]	1995[f]	1996	1997	1998	1999	2000	2001
American plaice	2.6	21.0	52.3	19.5	0.4	14.8	78.2	15.6	13.7	24.8	16.7	26.8
Atlantic cod	20.8	74.5	32.0	50.3	0.2	37.0	22.4	6.4	84.3	48.6	30.7	32.1
Atlantic mackerel	518.8	673.1	456.3	112.9	0.0	74.5	305.1	23.1	39.3	44.6	266.9	330.4
Butterfish	0	0	0	0	0	0	0.1	0	0	<0.1	0	0
Cunner	489.3	147.2	0	58.4	0	18.2	93.9	221.5	63.6	220.3	1,206.7	239.6
Fourbeard rockling	108.8	39.5	51.4	32.7	0.2	27.5	38.7	46.6	33.9	27.4	63.6	47.1
Haddock	0.0	0.0	7.4	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hake	50.1	2.6	0	1.6	0.6	29.3	213.2	71.8	7.5	6.2	295.2	4.4
Monkfish/Goosefish	0	0	0	0	0	0	0	0	0.9	0	0.9	0
Pollock	0	1.0	0.4	0.2	0.1	0.4	0.4	0.2	2.9	0.2	<0.1	0.3
Whiting/Silver hake	11.4	0.0	0.1	0.4	0.4	22.5	73.6	271.1	18.6	139.9	90.4	48.9
Windowpane	36.4	19.9	22.5	29.1	0.1	17.4	44.2	28.5	17.9	43.2	95.1	33.4
Winter flounder	0	0	0	0	0	0	0	0	0	0	0.3	0
Yellowtail flounder	1.2	569.2	198.6	0	0	0.6	17.9	0.5	1.9	33.8	2.8	8.4
Total (All Species)	1,247.7	1,551.3	822.6	315.6	4.8	255.9	926.4	692.7	286.7	593.9	2,104.4	775.1

[a] Normandeau Associates, Inc. (NAI) (2010) combined certain groups of species if eggs were morphologically similar and spawning periods overlapped during the sampling period. Groups of species include Atlantic cod/haddock, cunner/yellowtail founder, and hake/fourbeard rockling. NextEra (2010a) estimated entrainment rates for each species by applying the ratio of larval species to the egg species groups.

[b] NextEra sampled three months, August–October.

[c] NextEra sampled eight months, January–July, December.

[d] NextEra sampled eight months, January–August.

[e] NextEra sampled seven months, January–March, September–December.

[f] NextEra sampled 12 months per year.

Source: (NAI 2010; NextEra 2010a)

Table D-1-4. Number of Fish Eggs Entrained (in millions) for Most Common Egg Taxa Entrained and for EFH Species (cont.)

Taxon	2002	2003	2004	2005	2006	2007	2008	2009	Average	Percentage
American plaice	22.4	37.8	33.4	11.7	5.3	35.8	48.0	36.7	25.9	2.9%
Atlantic cod	77.8	15.5	9.3	16.0	15.7	15.1	48.0	15.4	32.6	3.6%
Atlantic mackerel	56.7	26.4	70.1	37.7	475.6	153.6	82.4	83.5	191.5	21.3%
Butterfish	0	0	0	0.4	0	0	0	0	<0.1	<0.1%
Cunner	1,395.7	143.9	518.1	251.2	489.4	295.0	444.5	1,451.2	387.4	43.0%
Fourbeard rockling	61.4	44.1	38.2	68.8	36.6	78.2	61.7	123.8	51.5	5.7%
Haddock	0	0	0	0.7	0	0	0	0	0.4	<0.1%
Hake	79.7	5.2	5.7	2.8	8.1	15.6	21.7	92.1	45.7	5.1%
Monkfish/Goosefish	0	0	0.1	0.1	0.1	0	0	0	0.1	<0.1%
Pollock	0.6	1.0	0.9	1.0	4.1	8.5	5.0	0.2	1.4	0.2%
Whiting/Silver hake	341.4	235.6	19.8	30.7	9.4	60.8	50.9	196.2	81.1	9.0%
Windowpane	39.1	15.5	18.2	26.2	24.7	34.7	25.9	61.8	31.7	3.5%
Winter flounder	0	0.3	0	0	0	0.2	1.1	<0.1	<0.1	<0.1%
Yellowtail flounder	3.9	0	0.1	5.0	1.1	7.8	0	4.1	42.8	4.8%
Total (all species)	2,086.8	529.4	723.7	454.4	1,075.4	714.7	790.6	2,072.5	901.2	100%

[(a)] Normandeau Associates, Inc. (NAI) (2010) combined certain groups of species if eggs were morphologically similar and spawning periods overlapped during the sampling period. Groups of species include Atlantic cod/haddock, cunner/yellowtail founder, and hake/fourbeard rockling. NextEra (2010a) estimated entrainment rates for each species by applying the ratio of larval species to the egg species groups.

[(b)] NextEra sampled 3 months, August–October.

[(c)] NextEra sampled 8 months, January–July, December.

[(d)] NextEra sampled 8 months, January–August.

[(e)] NextEra sampled 7 months, January–March, September–December.

[(f)] In 1995-2009, NextEra sampled 12 months per year.

Source: (NAI 2010; NextEra 2010a)

Table D-1-5. Number of Fish Larvae Entrained (in millions) for the Most Common Larval Taxa Entrained and for EFH Species

Taxon	1990[(a)]	1991[(b)]	1992[(c)]	1993[(d)]	1994[(e)]	1995	1996	1997	1998	1999	2000	2001
American plaice	0.4	1.0	0.8	0.7	0	7.9	8.1	7.0	2.9	4.9	1.6	8.7
American sand lance	0	37.3	18.1	12.0	8.3	9.5	14.0	10.1	10.7	7.8	1.0	5.3
Atlantic butterfish	0	0	0	0	0	0	0	0.1	0	0	0	0
Atlantic cod	0.7	1.5	0.4	0.1	0	2.3	0.3	0.7	2.2	1.0	0.4	2.5
Atlantic herring	0.7	0.5	4.9	9.6	0.1	11.2	4.3	2.1	9.5	8.6	0.2	15.2
Atlantic mackerel	0.2	4.7	0	0	0	0	0.1	0.4	0	0.1	0.3	0.1
Cunner	42.7	<0.1	0	4.7	0.1	4.4	9.2	203.8	8.4	4.7	111.0	13.6
Fourbeard rockling	37.9	0.5	0.1	2.2	0.0	3.9	11.7	22.4	13.1	21.0	8.2	19.6
Grubby	0	22.4	18.9	13.8	4.9	17.4	18.6	12.8	17.3	6.4	2.2	12.4
Haddock	0	0	0.1	0	0	0	0	0	0	0	0	0
Hake	4.8	0	0	0.1	0	0.7	12.3	1.7	<0.1	0.1	29.8	0
Monkfish/Goosefish	0.1	0	0	0	0	0	0	0	0	0	2	0
Ocean pout	0	0	0	0	0	0	0	0	0	0	0	0
Pollock	0.2	0	0.1	0	0	0	0	0	<0.1	0	0	0
Summer flounder	0	0	0	0	0	0	0	0	<0.1	0	0	0
Whiting/Silver hake	7.7	0	0	0.1	0	0.9	16.9	69.0	0.2	0.4	33.2	0.6
Windowpane	3.8	<0.1	0.1	0.1	<0.1	2.0	2.0	5.6	1.4	3.7	2.3	1.3
Winter flounder	3.2	9.0	6.2	2.9	0	8.0	10.3	2.2	4.7	7.4	14.3	14.3
Yellowtail flounder	0.1	0.3	0.1	0	0	0.1	1.6	0.5	0.3	0.8	0.3	0.5
Total (all species)	121.5	153.8	133.1	126.1	31.2	145.3	215.7	373.4	134.1	171.8	261.2	124.3

[(a)] NextEra sampled June–October.

[(b)] NextEra sampled the last week in April through the first week in August.

[(c)] NextEra sampled the third week in April through the third week in June.

[(d)] Unless otherwise denoted, NextEra sampled the third week in April through the fourth week in October.

[(e)] NextEra did not conduct bivalve larvae entrainment studies.

[(f)] NextEra sampled the fourth week in April through the fourth week in October.

[(g)] NextEra sampled the fourth week in April through the fourth week in September.

Source: (NAI 2010)

Table D-1-5. Number of Fish Larvae Entrained (in millions) for the Most Common Larval Taxa Entrained and for EFH Species (cont.)

Taxon	2002	2003	2004	2005[f]	2006[g]	2007	2008	2009	Average	Percentage
American plaice	11.3	9.1	2.6	1.4	0.6	2.6	3.5	11.5	4.3	1.6%
American sand lance	10.5	27.1	107.1	28.3	14.1	36.6	71.2	128.6	27.9	10.3%
Atlantic butterfish	0	0	0	0	0	0	0	0	<0.1	<0.1%
Atlantic cod	34.6	2.5	0.5	1.6	0.3	1.6	1.4	1.4	3.0	1.0%
Atlantic herring	11.7	15.3	8.8	9.7	12.8	11.5	28.2	27.7	9.6	3.6%
Atlantic mackerel	0.4	0	20.2	0.1	0.5	0	<0.1	25.7	2.6	1.0%
Cunner	391.1	22.5	451.2	2.5	8.8	97.7	86.2	105.7	78.4	29.1%
Fourbeard rockling	176.4	19.3	61.4	2.0	4.9	16.4	11.9	20.3	22.7	8.4%
Grubby	6.6	27.5	51.8	7.8	9.3	15.4	8.3	31.6	15.3	5.7%
Haddock	0	0	0	0.1	0	0	0	0	<0.1	<0.1%
Hake	0.3	0.1	1.0	0	0.2	0	0.2	4.0	2.8	1.0%
Monkfish/Goosefish	0	0	0.1	0	0	0	0	<0.1	0.1	<0.1%
Ocean pout	0	<0.1	0	0	0	0	0	0	<0.1	<0.1%
Pollock	<0.1	0.6	0.1	0.1	0.8	0.8	0.3	0.3	0.2	0.1%
Summer flounder	0	<0.1	0	0	0	<0.1	0	0	<0.1	<0.1%
Whiting/Silver hake	5.9	0.5	0.2	0	0.1	0	17.9	8.2	8.1	3.0%
Windowpane	6.5	0.5	0.4	0.5	0.5	2.6	11.4	1.9	2.3	0.9%
Winter flounder	4.5	20.0	34.8	4.9	7.2	15.8	0.1	15.2	9.2	3.4%
Yellowtail flounder	0.9	0	0.1	<0.1	<0.1	2.7	0	0.3	0.4	0.2%
Total (all species)	724.4	268.5	958.5	167.0	123.2	297.2	333.7	523.2	269.4	100%

[a] NextEra sampled June–October.

[b] NextEra sampled the last week in April through the first week in August.

[c] NextEra sampled the third week in April through the third week in June.

[d] Unless otherwise denoted, NextEra sampled the third week in April through the fourth week in October.

[e] NextEra did not conduct bivalve larvae entrainment studies.

[f] NextEra sampled the fourth week in April through the fourth week in October.

[g] NextEra sampled the fourth week in April through the fourth week in September.

Source: (NAI 2010)

Table D-1-6. Number of Impinged Fish for the Most Common Taxa Impinged and for EFH Species

Species	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Alewife	0	8	1,753	2,797	14	16	4	35	1	9	212	87
American plaice	0	0	0	0	0	2	0	0	0	0	0	3
American sand lance	1,215	1,324	823	182	708	234	423	114	245	3,396	665	1,029
Atlantic butterfish	3	14	3	223	9	5	1	28	1,170	4	35	54
Atlantic herring	0	0	485	350	582	20	5	11	159	198	118	93
Atlantic mackerel	0	0	1	0	0	0	0	1	0	0	4	4
Atlantic menhaden	0	7	97	0	1	957	142	19	1,022	7	361	7,226
Atlantic silverside	5,348	1,621	1,119	210	834	1,335	31	282	1,410	20,507	877	2,717
Atlantic cod	58	119	94	69	38	66	29	30	199	3,091	467	454
Cunner	32	342	1,121	233	309	255	324	341	291	554	625	893
Grubby	2,678	2,415	1,457	430	3,269	3,953	1,174	549	1,089	2,523	676	531
Haddock	0	1	397	0	1	3	2	1	0	0	0	7
Hakes	2,822	2,188	156	122	4	68	113	523	1,813	166	35	11
Monkfish/Goosefish	3	13	0	0	7	17	15	59	18	10	0	8
Northern pipefish	188	579	1,200	243	268	748	370	714	936	2,716	1,413	1,724
Ocean pout	0	6	1	0	7	3	2	21	1	13	3	3
Pollock	1,681	899	1,835	379	536	11,392	534	405	719	499	80	218
Rainbow smelt	545	213	4,489	365	535	100	8	65	323	3,531	2,085	3,314
Red hake	1	16	1,478	371	903	1,120	112	155	52	271	892	821
Rock gunnel	494	1,298	1,122	459	2,929	2,308	1,514	2,251	2,066	6,274	4,137	1,752
Sea raven	78	125	1,015	223	137	132	206	271	166	217	129	221
Scup	0	14	9	0	3	1	0	3	11	11	0	21
Shorthorn sculpin	14	156	282	123	190	296	923	621	642	7,450	876	2,214
Snailfishes	180	165	1,013	351	856	2,356	690	334	616	451	185	442
Summer flounder	3	0	0	0	0	0	0	0	0	0	0	0
Threespine stickleback	67	155	320	174	773	506	10	280	34	1,549	130	307
Whiting/Silver hake	0	49	58	108	13	100	41	5	1,177	22	212	306
Windowpane	980	943	1,164	1,688	772	692	251	161	2,242	4,749	936	2,034
Winter flounder	1,435	1,171	3,231	468	1,143	3,642	102	777	897	10,491	783	1,875
Yellowtail flounder	0	1,149	4	23	11	97	0	8	5	0	0	0
Total (All taxa)	19,212	15,940	26,825	10,648	15,198	31,241	7,281	8,577	18,413	71,946	16,696	29,368

Source: (NAI 2010)

Table D-1-6. Number of Impinged Fish for the Most Common Taxa Impinged and for EFH Species (cont.)

Species	2006	2007	2008	2009	Total	Percent of Total	Annual Average
Alewife	255	244	41	0	5,476	1.6%	342
American plaice	0	0	7	0	12	0.0%	0.75
American sand lance	213	2,073	758	796	14,198	4.3%	887
Atlantic Butterfish	44	199	7	29	1,828	0.5%	114
Atlantic herring	189	260	27	490	2,987	0.9%	187
Atlantic mackerel	0	0	0	0	10	0.003%	1
Atlantic menhaden	94	160	67	39	10,199	3.1%	637
Atlantic silverside	788	639	247	525	38,490	11.5%	2,406
Atlantic cod	113	178	73	147	5,225	1.6%	327
Cunner	687	922	731	837	8,497	2.5%	531
Grubby	235	869	3,919	521	26,288	7.9%	1,643
Haddock	3	25	0	15	455	0.1%	28
Hakes	6	1,184	3,216	1,427	13,854	4.1%	866
Monkfish/Goosefish	0	11	0	0	161	0.0%	10
Northern pipefish	1,288	2,374	1,082	698	16,541	5.0%	1,034
Ocean pout	6	3	0	0	69	0.0%	4
Pollock	73	340	123	657	20,370	6.1%	1,273
Rainbow smelt	878	572	421	43	17,487	5.2%	1,093
Red hake	546	1,389	14	0	8,141	2.4%	509
Rock gunnel	3,782	3,174	937	701	35,198	10.5%	2,200
Sea raven	138	164	138	79	3,439	1.0%	215
Scup	4	8	13	15	113	0.0%	7
Shorthorn sculpin	1,258	465	1,515	266	17,291	5.2%	1,081
Snailfishes	330	76	233	85	8,363	2.5%	523
Summer flounder	4	0	0	0	7	0.0%	0
Threespine stickleback	139	193	80	118	4,835	1.4%	302
Whiting/Silver hake	31	21	204	325	2,672	0.8%	167
Windowpane	572	1,502	1,640	427	20,753	6.2%	1,297
Winter flounder	767	3,949	1,920	655	33,306	10.0%	2,082
Yellowtail flounder	10	11	3	0	1,321	0.4%	83
Total (All taxa)	12,955	22,472	17,935	9,304	334,011	100.0%	20,876

Source: (NAI 2010)

Table D-1-7. Number of Bivalve Larvae Entrained (x 10^9)

Taxon	1990[a]	1991[b]	1992[c]	1993[d]	1995	1996	1997	1998	1999	2000	2001	2002	2003
Prickly jingle	1,691	250.8	6.9	3,923	8,906	23,522	2,883	3,827	36,495	7542	4,129	8,204	3,218.1
Bivalvia mussels	181.7	38.1	14.5	334.5	797.1	671.4	71.1	64.5	651.3	228.6	483	194.2	73.7
Rock borer	876.6	421.3	189.8	2,406	2,598	4,670	923.7	609.7	4,417	1,921	1,575	567.3	1,203.9
Northern horsemussel	909.7	160.2	0.3	1,284	546.4	5,145	614.7	241.7	2,376	2,521	251.6	776.4	240.8
Soft shell clam	8.1	0.6	0.2	22.5	4.3	33.2	53.7	11.4	45.7	23.9	26.4	60.2	5.1
Truncate softshell clam	249.2	6.5	1.1	2.1	27.6	123	0.8	8.3	66	34.9	26.3	1.9	13.8
Blue mussels	3,991	1,688	121.9	10,051	13,231	17,932	1745	1,493	22,374	10,255	9621	3,318	2,199
Atlantic Sea scallop	0.7	0.7	0.1	16.9	6.2	31	0.8	0.8	11.5	9.9	8.5	0.8	0
Solenidae clams	61.1	0	75.7	102.5	1092	241.9	49.5	20.9	773.2	150.4	922.9	150.8	85.5
Atlantic Surf clam	69	4.4	0	48.5	112.5	171.1	22.5	14.8	175.5	33.6	50.8	44.2	3.1
Shipworm	0.01	15.9	0	0	4.8	7.4	1.7	0.8	29.9	1.5	0.3	2.3	0.1
Total (all taxon)	8,039	2,586	410	18,190	27,327	52,547	6,366	6,293	67,415	22,721	17,095	13,320	7,043

(a) NextEra sampled June–October.

(b) NextEra sampled the last week in April through the first week in August.

(c) NextEra sampled the third week in April through the third week in June.

(d) In 1994, NextEra did not conduct bivalve larvae entrainment studies. Unless otherwise denoted for all other years,, NextEra sampled the third week in April through the fourth week in October.

(e) NextEra sampled the fourth week in April through the fourth week in October.

(f) NextEra sampled the fourth week in April through the fourth week in September.

Source: (NAI 2010)

Table D-1-7. Number of Bivalve Larvae Entrained (x 10^9) (cont.)

Taxon	2004	2005[e]	2006[f]	2007	2008	2009	Average
Prickly jingle	2,595	1,217	3,966	3,950	18,452	27,733	8,553.2
Bivalvia mussles	89.6	40.4	73.9	46.2	411.8	74.3	238.94
Rock borer	1,024	352.9	604.6	650.7	3,137	2,548	1,615.5
Northern horsemussel	843.2	292.9	715.1	172.5	2,270	1421	1,093.8
Soft shell clam	15.1	9.2	11.1	4.7	45.8	31.8	21.737
Truncate softshell clam	5.2	2.3	0.6	3	6.4	4.8	30.726
Blue mussels	1,526	921.5	1,351	834.4	2,700	3,974	5,754
Atlantic Sea scallop	0.7	0.1	0	0.1	0.3	1.2	4.7526
Solenidae clams	113.4	57.9	65.2	156.1	85.1	162.4	229.83
Atlantic Surf clam	10	14.5	20	2.8	100.7	31.5	48.921
Shipworm	0.6	0.3	0.8	0	1.8	2.3	3.7111
Total (all taxon)	6,223	2,909	6,809	5,820	27,211	35,983	17,595

[a] NextEra sampled June–October.

[b] NextEra sampled the last week in April through the first week in August.

[c] NextEra sampled the third week in April through the third week in June.

[d] In 1994, NextEra did not conduct bivalve larvae entrainment studies. In all other years, NextEra sampled the third week in April through the fourth week in October.

[e] NextEra sampled the fourth week in April through the fourth week in October.

[f] NextEra sampled the fourth week in April through the fourth week in September.

Source: (NAI 2010)

Padmanabhan and Hecker (1991) conducted a thermal plume modeling and field verification study. This study estimated a temperature rise of approximately 36 to 39° F (20 to 22° C) at the diffusers (Padmanabhan and Hecker 1991). Field and modeling data indicated that the water rose relatively straight to the surface and spread out within 10 to 16 ft (3 to 5 m) of the ocean surface. At the surface, Padmanabhan and Hecker (1991) observed a temperature rise of 3° F (1.7° C) or more in a 32-ac (12.9-ha) area surrounding the discharge. Padmanabhan and Hecker (1991) did not observe significant increases in surface temperature 1,640 ft (500 m) to the northwest of the discharge structure.

NextEra has conducted monitoring of water temperature at bottom and surface waters near the discharge structure during operations (NAI 2001, 2010). NextEra monitored bottom water temperature at a site 656 ft (200 m) from the discharge and at a site 3 to 4 nautical mi (5 to 8 km) from the discharge from 1989 to 1999 (NAI 2001). NextEra observed a significant difference in the monthly mean bottom water temperature between the two sites. The mean difference was less than 0.9° F (0.5° C) (NAI 2001). As required by Seabrook's NPDES permit, NextEra conducts continuous surface water monitoring. The mean difference in temperature between a sampling station within 328 ft (100 m) of the discharge and a sampling station 1.5 mi (2.5 km) to the north has not exceed 5° F (2.8° C) since operations began, which is the limit identified in the NPDES permit (EPA 2002a; NAI 2001, 2010). For the majority of months between August 1990 and December 2009, the monthly mean increase in the surface water temperature was less than 3.6° F (2.0° C).

Based on Seabrook's water quality monitoring and Padmanabhan and Hecker's (1991) study, the habitat most likely affected by the thermal plume would be the upper water column (10 to 16 ft (3 to 5 m) of the ocean surface) in the immediate vicinity of the discharge (less than 328 ft (100 m)). Fish may avoid this area, but the thermal plume would not likely block fish movement because fish could swim around the thermal plume. Pelagic fish species that may avoid this area are discussed, as appropriate, in the species analysis below (Sections D-1.3.3.1 through D-1.3.3.19). Benthic species, or species that primarily reside at the seafloor, may also avoid the immediate area surrounding the discharge structures due to higher temperature, velocities, and turbulence. This area should be considerably smaller than the area of increased temperature at the surface.

To examine the potential thermal impacts from plant operations on sessile species (and as an indicator of thermal impacts to other biological groups), NAI (2010) compared the abundance of cold water and warm water macroalgae species prior to and during operations at sites near the discharge structure (the nearfield site) and at sites approximately 3 to 4 nautical mi (5 to 8 km) from the intake and discharge structures (the farfield site). Benthic perennial algae are sensitive to changes in water temperature because they are immobile and live more than 2 years. Prior to operations, NAI (2010) collected six uncommon species not collected during operations, including the brown macroalgae *Petalonia fascia*, which is associated with cold-water habitat. During operations, NAI (2010) collected some typically warm-water taxa for the first time (e.g., the red macroalgae *Neosiphonia harveyi*), collected other warm-water taxa less frequently, and collected some cold-water taxa more frequently. NAI (2010) observed 10 species that only occurred during operations, and NAI (2010) reported that these species were within their geographic ranges. NAI (2010) concluded that the changes in community composition among cold and warm water species were relatively small, although NAI (2010) did not report the results of any statistical tests to examine the significance in such changes.

The NRC staff concluded in the SEIS that thermal impacts from Seabrook operations were SMALL, and operations have not noticeably altered aquatic communities near Seabrook. This conclusion was based on the findings that the thermal plume would not block fish passage and is within the limits of Seabrook's NPDES permit and that there were no clear patterns of emergent warm-water species or changes in the abundance of cold-water species.

Loss of Forage Species. Prey for the 23 EFH species includes phytoplankton, zooplankton (including fish and invertebrate eggs and larvae), juvenile and adult fish, and juvenile and adult invertebrates. Seabrook operations can adversely affect plankton prey if they are entrained in the cooling system or the thermal discharge significantly decreases the quality of the pelagic water habitat. Juvenile and adult fish prey could be affected by Seabrook operations if they are impinged in the cooling water system, if they avoid the area near the discharge because of the heated thermal effluent, or if bottom habitat (e.g., mussel beds or kelp forests) are adversely affected by Seabrook operations. Invertebrate prey could be affected by Seabrook operations if any of the following occurs:

- They are entrained in the Seabrook cooling system.
- They are mobile and impinged in the Seabrook cooling system.
- They are mobile and avoid the area near the discharge structures due to the discharge of heated thermal effluent.
- They are sessile, and growth is limited near the discharge structures due to the heated thermal effluent.

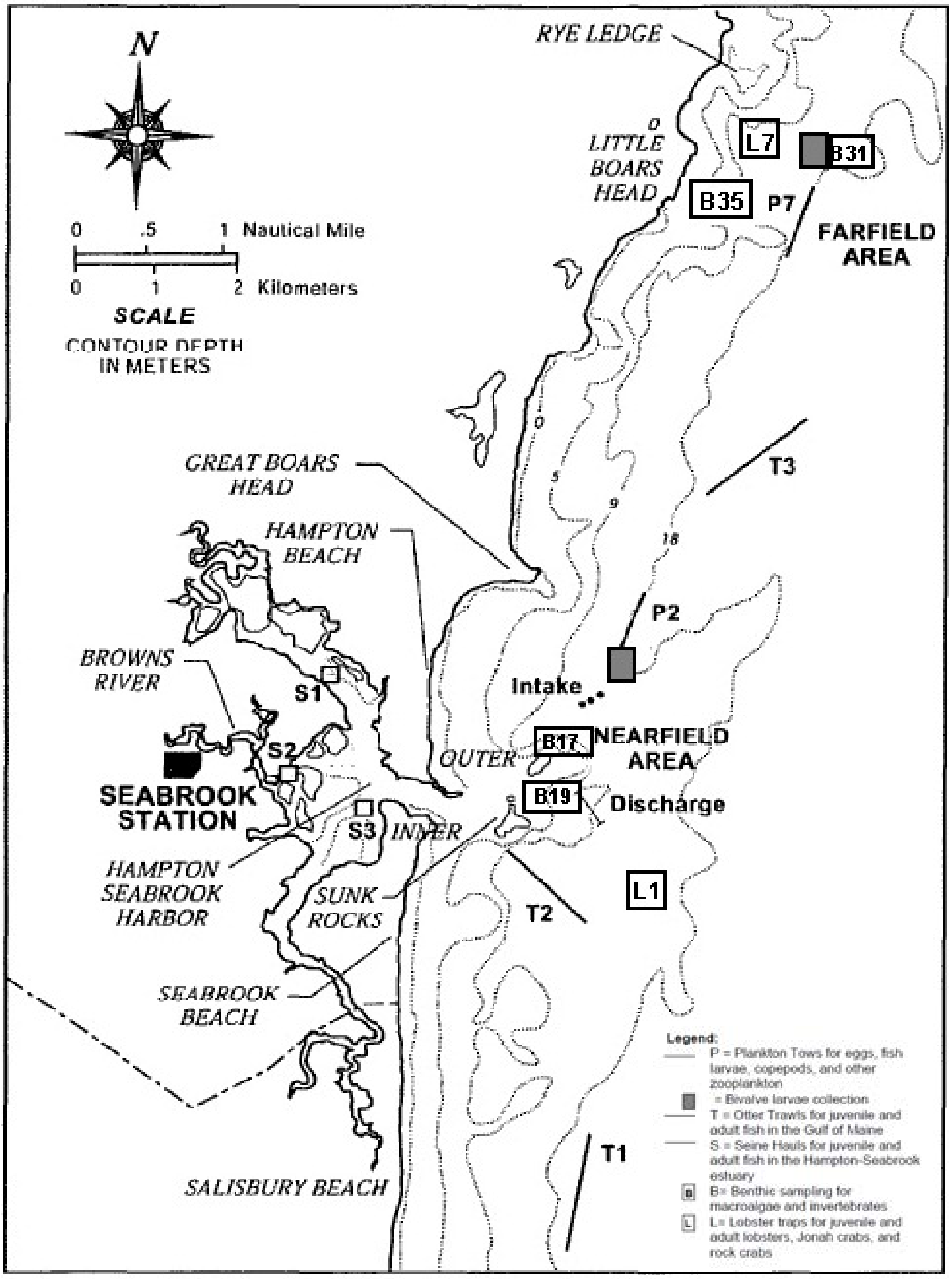
Loss of Habitat-Forming Species. In the Gulf of Maine, and the area in the vicinity of Seabrook's intake and discharge structures, rocky subtidal habitats are among the most productive habitats (Mann 1973; Ojeda and Dearborn 1989). Algae, mussels, oysters, and other sessile invertebrates attach to the bedrock on the seafloor and form the basis of a complex, multi-dimensional habitat for other fish and invertebrates to use for feeding and hiding from predators (Thompson 2010; Witman and Dayton 2001). Spawning fish, such as herring, shield eggs from currents and predators within rock crevices or sessile organisms attached to the bedrock (Thompson 2010). In soft sediment habitats, shellfish beds form the main biogenic habitats.

Kelp seaweeds, brown seaweeds with long blades, attach to hard substrates and can form the basis of undersea "forests," commonly referred to as kelp beds. The long blades of kelp—such as *A. clathratum*, *L. digitata*, and sea belt—provide the canopy layer of the undersea forest, while shorter foliose and filamentous algae, such as Irish moss, grow in between or at the bottom of kelp similar to the understory layer in a terrestrial forest (NAI 2010; Thompson 2010). The multiple layers of seaweeds provide additional habitat complexity for other fish and invertebrates to find refuge from predators and harsh environmental conditions, such as strong currents or ultraviolet light (Thompson 2010). Seabrook's heated effluent may affect growth of algae and sessile invertebrates. These groups may be particularly sensitive to changes in water quality because they are sessile and cannot move to avoid the area, sufficient light must reach the algae for the plant to photosynthesize, and particulars in the water can clog the feeding structures of sessile invertebrates that filter seawater for food.

D-1.3.2.2 Combined Impacts (Monitoring Data)

This section presents NextEra monitoring data of selected groups prior to and during operations at sampling sites near the intake and discharge structures (nearfield sampling sites) and at sampling sites 3 to 4 mi (5 to 8 km) away (farfield sampling sites) (Figure D-1-7). Monitoring data may indicate if the combined impacts (or cumulative impacts) from Seabrook operation have resulted in the decline of a species or biological group due to a decline in habitat quantity or quality.

Figure D-1-7. Sampling Stations for Seabrook Station Aquatic Monitoring



NAI (2010) used a before-after control-impact (BACI) design to test for potential impacts from operation of Seabrook. This monitoring design was used to test for the statistical significance of differences in community structure, species abundance, or species diversity between the pre-operational and operational period at the nearfield and farfield sites. Statistically significant differences could result from entrainment, impingement, thermal impacts, loss of forage species, loss of habitat-forming species, or any combination of these effects of Seabrook operations.

Working with NAI and Public Service of New Hampshire staff, NextEra selected farfield sampling sites that would likely be outside the influence of Seabrook operations (NextEra 2010a). The farfield sampling stations were between 3 and 4 nautical mi (5 and 8 km) north of the intake and discharge structures. NextEra selected a northern farfield location because the primary currents run north to south. NextEra selected specific farfield sampling sites based on similarities with the nearfield sampling sites regarding depth, substrate type, algal composition, wave energy, and other relevant factors (NextEra 2010a).

Sections 2.2.6.3 and 4.5.5 of the SEIS describe the sampling methods, statistical methods, and monitoring results. Below is a brief summary of the monitoring results for phytoplankton, zooplankton, fish, invertebrates, and macroalgae.

Phytoplankton. NAI (1998) found no significant differences in phytoplankton abundance or chlorophyll *a* concentrations between the nearfield and farfield sites or between before and during plant operation. NAI (1998) observed minimal changes in species composition prior to and during operations. These results suggest that Seabrook operations have not adversely affected phytoplankton abundance near Seabrook.

Zooplankton. NAI (2010) did not find a significant difference in the density of holoplankton or meroplankton taxa prior to and during operations or between the nearfield and farfield sampling sites. The average density of all hyperbenthos species at the nearfield site was generally an order of magnitude larger than the abundances found at the farfield site both prior to and during operations (NAI 2010).

When examining total bivalve larvae density, NAI (2010) did not find a significant difference between sampling sites prior to and during operations. For fish eggs and larvae, NAI (2010) observed no significant difference between sampling sites, but the study reported a significant difference prior to and during operations in the density of fish eggs and larval species (Table D-1-8).

Table D-1-8. Mean Density (No./1,000m^3) and Upper and Lower 95% Confidence Limits (CL) of the Most Common Fish Eggs and Larvae From 1982–2009 Monitoring Data at Seabrook

Taxon	Group 1[a]			Group 2 [a]		
	Lower 95% CL	Mean	Upper 95% CL	Lower 95% CL	Mean	Upper 95% CL
Eggs[b]						
Atlantic mackerel	650	1,009	1,369	1,344	1,941	2,538
Cunner/Yellowtail flounder	2,764	5,003	7,243	6,577	7,239	8,081
Hakes	235	1,226	2,217	332	488	643
Hake/Fourbeard rockling	45	215	386	503	626	749
Atlantic cod/haddock	79	153	226	63	92	120
Windowpane	73	147	221	160	232	304
Fourbeard rockling	168	248	328	34	49	65
Silver hake	45	77	109	149	322	494
Larvae[c]						
Cunner	143	425	707	828	1,386	1,945
American sand lance	57	182	307	160	234	308
Atlantic mackerel	28	179	330	65	121	176
Fourbeard rockling	40	68	96	56	78	99
Atlantic herring	37	68	99	23	29	35
Rock gunnel	14	31	49	32	42	52
Winter flounder	18	44	70	8	11	14
Silver hake	14	23	32	35	67	100
Radiated shanny	15	26	36	3	27	50
Witch flounder	9	18	28	3	5	6

[a] NAI (2010) determined groups using a cluster analysis (numerical classification) and non-metric multi-dimensional scaling (MDS) of the annual means (log (x+1)) of each taxon at each station.

[b] Egg Group 1 years = 1983, 1984, 1986, 1987; Group 2 years = 1988–2008

[c] Larvae Group 2 years = 1982–1984, 1986–1989; Group 2 years = 1989–1991, 1993–2009

Source: (NAI 2010)

Because changes in community structure occurred at nearfield and farfield sampling sites, these results suggest that Seabrook operations have not adversely affected zooplankton near Seabrook.

Juvenile and Adult Fish. NextEra monitored the abundance of juvenile and adult fish prior to and during operations at nearfield and farfield sites using benthic trawls (Table D-1-9), gill nets (Table D-1-10), and seine pulls in the Hampton-Seabrook Estuary (Table D-1-10). For the majority of fish species, the abundance was higher prior to operations than during operations at both the nearfield and farfield sites. The abundance of a few fish species increased during operations at both nearfield and farfield sites.

Table D-1-9. Geometric Mean Catch Per Unit Effort (CPUE) (No. per 10-minute tow) and Upper and Lower 95% CL During Preoperational and Operational Monitoring Years for the Most Abundant Species

Species	Sample site	Preoperational monitoring			Operational monitoring		
		Lower 95% CL	Mean	Upper 95% CL	Lower 95% CL	Mean	Upper 95% CL
Yellowtail flounder	Nearfield (T2)	2.7	3.7	5.0	0.1	0.2	0.3
	Farfield (T1)	15.7	20.6	26.9	1.8	2.4	3.1
	Farfield (T3)	6.6	9.2	12.8	1.4	2.1	3.0
Longhorn sculpin	Nearfield (T2)	0.6	1.0	1.5	0.4	0.6	0.8
	Farfield (T1)	2.3	3.2	4.5	2.3	3.1	4.1
	Farfield (T3)	4.2	6.1	8.5	4.8	6.4	8.4
Winter flounder	Nearfield (T2)	3.7	5.5	8.0	1.6	2.3	3.1
	Farfield (T1)	2.1	2.8	3.6	3.0	4.0	5.4
	Farfield (T3)	1.1	1.4	1.9	2.7	3.6	4.8
Hake	Nearfield (T2)	0.6	0.9	1.2	0.3	0.4	0.5
	Farfield (T1)	1.3	1.7	2.0	0.4	0.6	0.8
	Farfield (T3)	0.8	1.1	1.4	0.4	0.9	1.4
Atlantic cod	Nearfield (T2)	0.5	0.8	1.2	0.1	0.2	0.4
	Farfield (T1)	1.7	2.6	3.7	0.2	0.3	0.5
	Farfield (T3)	2.6	4.1	6.2	0.8	1.1	1.5
Raja sp.	Nearfield (T2)	0.4	0.6	0.7	0.4	0.7	0.9
	Farfield (T1)	0.8	1.4	2.3	1.6	2.2	2.9
	Farfield (T3)	2.0	2.6	3.2	2.6	3.5	4.7
Windowpane	Nearfield (T2)	0.8	1.2	1.6	0.7	1.0	1.3
	Farfield (T1)	1.1	1.6	2.3	1.4	1.8	2.2
	Farfield (T3)	0.6	0.9	1.4	1.0	1.7	2.6
Rainbow smelt	Nearfield (T2)	2.2	3.2	4.3	0.3	0.5	0.8
	Farfield (T1)	1.6	2.3	3.1	0.4	0.6	0.9
	Farfield (T3)	0.9	1.6	2.5	0.4	0.6	0.8
Ocean pout	Nearfield (T2)	0.6	0.8	1.0	0.2	0.2	0.3
	Farfield (T1)	0.6	0.7	1.0	0.1	0.1	0.2
	Farfield (T3)	1.4	1.8	2.3	0.1	0.2	0.3
Silver hake	Nearfield (T2)	0.0	0.1	0.1	0.0	0.0	0.1
	Farfield (T1)	0.1	0.2	0.4	0.3	0.6	0.9
	Farfield (T3)	0.1	0.2	0.3	0.1	0.3	0.6

Source: (NAI 2010)

Table D-1-10. Geometric Mean CPUE (No. per 24-hr surface and bottom gill net set) and Coefficient of Variation (CV) During Preoperational (1976–1989) and Operational Monitoring Years (1990–1996)

Species	Sample site	Preoperational monitoring		Operational monitoring	
		Mean	CV	Mean	CV
Atlantic herring	Nearfield (G2)	1.1	20	0.2	33
	Farfield (G1)	1.0	18	0.3	22
	Farfield (G3)	1.2	21	0.4	25
Atlantic mackerel	Nearfield (G2)	0.2	15	0.3	29
	Farfield (G1)	0.2	16	0.3	17
	Farfield (G3)	0.3	16	0.3	15
Pollock	Nearfield (G2)	0.3	10	0.3	16
	Farfield (G1)	0.2	17	0.2	18
	Farfield (G3)	0.3	13	0.2	13
Spiny dogfish	Nearfield (G2)	<0.1	35	0.1	41
	Farfield (G1)	<0.1	45	0.1	69
	Farfield (G3)	<0.1	27	0.2	47
Silver hake	Nearfield (G2)	0.2	35	0.1	60
	Farfield (G1)	0.2	34	0.1	40
	Farfield (G3)	0.3	31	0.1	31
Blueback herring	Nearfield (G2)	0.3	18	0.2	26
	Farfield (G1)	0.2	17	0.2	50
	Farfield (G3)	0.3	24	0.2	32
Alewife	Nearfield (G2)	0.1	14	0.1	21
	Farfield (G1)	0.1	17	0.1	34
	Farfield (G3)	0.1	21	0.1	35
Rainbow smelt	Nearfield (G2)	0.1	21	0.1	29
	Farfield (G1)	<0.1	26	0.1	40
	Farfield (G3)	0.1	21	0.1	39
Atlantic cod	Nearfield (G2)	<0.1	22	<0.1	63
	Farfield (G1)	0.1	18	<0.1	53
	Farfield (G3)	0.1	13	<0.1	63

Source: (NAI 1998)

NAI (2010) reported different trends at farfield and nearfield sites for winter flounder, silver hake, and rainbow smelt during trawling surveys (Table D-1-9). At the nearfield site (T2), the abundance of winter flounder significantly decreased over time from a mean CPUE of 5.5 prior to operations to 2.3 during operations. However, at both farfield sampling sites (T1 and T3), the mean CPUE increased from 2.8 and 1.4 prior to operations, respectively, to 4.0 and 3.6 during operations. This increase was statistically significant at one of the farfield sites (T3). Silver hake abundance also increased at farfield sampling sites and decreased at the nearfield sampling site. NAI (2010) did not report if these trends were statistically significant. Rainbow smelt abundance decreased at all sampling sites, but the decrease was significantly greater at the nearfield site compared to the farfield sites (NAI 2010).

NAI (2010) reported different trends at farfield and nearfield sites for American sand lance abundances during seine pulls in the Hampton-Seabrook Estuary (Table D-1-11). At the nearfield sampling station (S2), the abundance of American sand lance decreased over time from a mean CPUE of 0.2 prior to operations to 0.1 during operations. At both farfield sampling sites (S1 and S3), the mean CPUE increased from 0.1 prior to operations, to 0.2 and 0.6, respectively, during operations. NAI (2010) did not report if these trends were statistically significant.

Table D-1-11. Geometric Mean CPUE (No. per seine haul) and Upper and Lower 95% CL During Preoperational and Operational Monitoring Years

Species	Sample site	Preoperational monitoring			Operational monitoring		
		Lower 95% CL	Mean	Upper 95% CL	Lower 95% CL	Mean	Upper 95% CL
Atlantic silverside	Nearfield (S2)	5.1	6.8	9.1	2.4	3.1	4.1
	Farfield (S1)	5.1	7.2	10.2	3.6	4.8	6.2
	Farfield (S3)	4.0	6.7	10.7	2.1	2.9	3.9
Winter flounder	Nearfield (S2)	0.6	1.0	1.5	0.1	0.2	0.3
	Farfield (S1)	0.6	0.9	1.2	0.2	0.4	0.5
	Farfield (S3)	2.2	3.2	4.4	0.3	0.5	0.7
Killifishes	Nearfield (S2)	0.6	1.2	2.0	0.1	0.2	0.3
	Farfield (S1)	0.8	1.1	1.5	0.5	0.9	1.3
	Farfield (S3)	<0.1	<0.1	0.1	0.1	<0.1	0.1
Ninespine stickleback	Nearfield (S2)	0.3	0.8	1.6	<0.1	0.1	0.1
	Farfield (S1)	0.4	0.7	1.2	0.1	0.2	0.3
	Farfield (S3)	0.3	0.8	1.4	0.1	0.2	0.3
Rainbow smelt	Nearfield (S2)	<0.1	0.2	0.3	0.1	0.1	0.2
	Farfield (S1)	<0.1	0.1	0.2	<0.1	0.1	0.2
	Farfield (S3)	0.3	0.7	1.2	0.1	0.2	0.4
American sand lance	Nearfield (S2)	0.0	0.2	0.5	0.0	0.1	0.1
	Farfield (S1)	<0.1	0.1	0.2	0.1	0.2	0.3
	Farfield (S3)	<0.1	0.1	0.2	0.3	0.6	0.9
Pollock	Nearfield (S2)	<0.1	0.2	0.3	0.0	<0.1	<0.1
	Farfield (S1)	<0.1	0.1	0.2	<0.1	<0.1	<0.1
	Farfield (S3)	0.1	0.4	0.8	<0.1	0.1	0.1
Blueback herring	Nearfield (S2)	<0.1	0.1	0.1	<0.1	0.1	0.1
	Farfield (S1)	0.1	0.2	0.3	0.1	0.3	0.4
	Farfield (S3)	<0.1	0.1	0.3	<0.1	<0.1	0.1
Atlantic herring	Nearfield (S2)	0.1	0.3	0.5	<0.1	<0.1	0.1
	Farfield (S1)	0.0	0.1	0.5	0.1	0.2	0.3
	Farfield (S3)	0.1	0.1	0.2	<0.1	0.1	0.2
Alewife	Nearfield (S2)	0.0	0.1	0.2	<0.1	<0.1	<0.1
	Farfield (S1)	<0.1	0.1	0.2	0.1	0.2	0.4
	Farfield (S3)	<0.1	0.1	0.1	0.0	0.1	0.2

Source: (NAI 2010)

NextEra monitoring results suggest that Seabrook operations have not likely affected most fish species near Seabrook. However, the abundance of winter flounder and rainbow smelt has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3 to 4 mi (5 to 8 km) away. The local decrease suggests that, to the extent local subpopulations exist within 3 to 4 mi (5 to 8 km) of Seabrook, they have been adversely affected through operation of Seabrook's cooling water system.

Invertebrates. NAI (2010) reported similar trends of total invertebrate density and species diversity at the nearfield and farfield sampling sites before and during operations. Likewise, NAI (2010) reported similar trends at the nearfield and farfield sampling sites prior to and during operations for mytilid (mussel) spat, rock crabs, Jonah crabs, northern horse mussels, sea stars, green sea urchin, lobsters, and soft shell clams.

Macroalgae. NAI (2010) observed significant changes in kelp density prior to and during operations (Table D-1-12). NAI (2010) reported significantly higher *Laminaria digitata* density prior to than during operations. In the shallow and the mid-depth subtidal, the decline at the nearfield sampling site was significantly greater than the decline at the farfield station. In the nearfield mid-depth sampling site (B19), NAI (2010) did not identify *L. digitata* in 2008 or 2009. The density of *Agarum clathratum*, which competes with *L. digitata*, significantly increased over time in the mid-depth sampling stations, and density was significantly higher at the nearfield site (NAI 2010).

Table D-1-12. Kelp Density (No. per 100 m^2) and Upper and Lower 95% CL During Preoperational and Operational Monitoring Years

Kelp	Sample site	Preoperational monitoring			Operational monitoring		
		Lower 95% CL	Mean	Upper 95% CL	Lower 95% CL	Mean	Upper 95% CL
L. digitata	Nearfield Shallow (B17)	140.6	213.9	287.3	5.3	15.2	25.2
	Farfield Shallow (B35)	96.5	155.8	215.1	52.3	73.9	95.6
	Nearfield Mid-depth (B19)	81.5	139.9	198.3	3.1	7.5	11.9
	Farfield Mid-depth (B31)	401.6	500.2	598.7	106.0	157.7	209.5
Sea belt	Nearfield Shallow (B17)	270.7	415.1	559.4	66.1	137.9	209.7
	Farfield Shallow (B35)	210.9	325.7	440.5	247.8	326.0	404.2
	Nearfield Mid-depth (B19)	2.0	59.1	116.3	1.5	10.1	18.7
	Farfield Mid-depth (B31)	59.6	95.5	131.5	29.3	48.2	68.2
A. esculenta	Nearfield Mid-depth (B19)	0.0	2.4	7.2	0.3	2.3	4.2
	Farfield Mid-depth (B31)	19.9	75.2	130.5	20.3	40.0	59.6
A. clathratum	Nearfield Mid-depth (B19)	613.5	786.6	959.6	792.2	955.2	1,118.1
	Farfield Mid-depth (B31)	280.2	366.4	452.6	407.3	503.6	599.9

Source: (NAI 2010)

In the shallow subtidal, sea belt (*Saccharina latissima*) density was significantly lower during operations at the nearfield site, but there was no significant change at the farfield site (NAI 2010). In the mid-depth subtidal, sea belt density significantly decreased at both sampling sites (NAI 2010). In the mid-depth subtidal, *Alaria esulenta* significantly declined during operations at the farfield site and remained at a low density at the nearfield site prior to and during operations (NAI 2010). NAI (2010) did not identify *A. esulenta* at the nearfield sampling station over the past 4 years.

The decrease in *L. digitata* density was significantly greater at the nearfield sites, and sea belt density was lower during operations at the nearfield site but not at the farfield site in the shallow subtidal. These results suggest that the local population of *L. digitata* and sea belt has been adversely affected through operation of Seabrook's cooling water system.

D-1.3.3 Adverse Effects on Essential Fish Habitat by Species

*D-1.3.3.1 American Plaice (*Hippoglossoides platessoides*) (Juvenile and Adult)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated American plaice juvenile and adult EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed American plaice juveniles and adults or both in 1−10 percent of trawling samples from the 1970s through 2009 (Table D-1-2).

Species Description. American plaice are arctic-boreal pleuronectid flatfish (Johnson 1995). American plaice inhabit both sides of the Atlantic Ocean. In the western Atlantic, American plaice are common from Newfoundland, Canada to Montauk Point, NY (Bigelow and Schroeder 1953; Johnson 2005). EFH for American plaice juveniles and adults includes bottom habitats with fine-grained, sandy, or gravel substrates in the Gulf of Maine (NMFS 2011c). American plaice are relatively sedentary, and tagging studies have indicated that few migrate long distances. Fisheries and Oceans Canada (DFO) (1989, cited in Johnson 2005) recaptured the majority of tagged fish within 30 mi (48 km) of the tagging site after 7 to 8 years.

American plaice consume a wide-variety of prey and are opportunistic feeders, in that they will consume what is most available (Johnson 2005). Prior to settling on the ocean floor, juveniles feed on small crustaceans—such as cumaceans—and polychaetes (Bigelow and Schroeder 1953). Adults are primarily benthic but, at night, may migrate up into pelagic waters to prey on non-benthic species (DFO 1989, cited in Johnson 2005). During monitoring surveys, NAI (2010) did not observe American plaice in pelagic waters. Prey for adults include mostly echinoderms (e.g., sand dollars, sea urchins, and brittle stars) and crustaceans, cnidarians, and polychaetes (Johnson 2005). Redfish eat American plaice larvae, and goosefish, halibut, cod, and other bottom feeders prey on the adults (Johnson 2005).

Status of the Fishery. NMFS, the New England Fishery Management Council (NEFMC), and the Mid-Atlantic Fishery Management Council (MAFMC) currently manage the northeast multispecies fisheries management plan (FMP). The U.S. fishery for American plaice started to develop around 1975 in the Gulf of Maine, when other commercially desirable flatfish (e.g., yellowtail flounder, winter flounder, and summer flounder) began to decrease in abundance (Sullivan 1981, cited in Johnson 2005). American plaice populations in the western North Atlantic have declined dramatically since the early 1980s (Johnson 2005). Contributing factors to the decline are likely overfishing, changes in water temperature, and water pollution (Johnson 2005). American plaice is also bycatch for other fisheries. In New England, the mortality of American plaice bycatch was positively correlated with ondeck sorting time (Johnson 2005). In 2009, NEFMC considered American plaice overfished (NMFS 2010b).

Entrainment and Impingement at Seabrook. Although NMFS has not designated EFH for American plaice eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles and adults. Entrainment of American plaice eggs varied from 0.4 million in 1994 to 52.3 million in 1992 (NAI 2010). Annual average entrainment of American plaice eggs was 25.9 million per year (Table D-1-4). American plaice eggs comprised approximately 3 percent of the total fish eggs entrained at Seabrook.

Entrainment of American plaice larvae varied from 0 in 1994 to 11.5 million in 2009 (NAI 2010). Annual average entrainment of American plaice larvae was 4.3 million per year (Table D-1-5). American plaice larvae comprised approximately 1.5 percent of the total fish larvae entrained at Seabrook.

Impingement of American plaice varied from zero in several years to seven in 2008 (NAI 2010). Annual average impingement was less than one fish per year (Table D-1-6). American plaice comprised less than 1 percent of all impinged fish at Seabrook.

Because entrainment and impingement were relatively low for American plaice compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for juvenile and adult American plaice during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to juvenile or adult American plaice. American plaice are primarily benthic (Johnson 2005). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for juvenile and adult American plaice during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Juvenile and adult American plaice are opportunistic feeds that primarily consume invertebrates, including green sea urchins (*Strongylocentrotus droebachiensis*) (Johnson 2005). NextEra monitoring data show relatively similar trends of benthic invertebrate abundance, density, and species diversity—including the abundance of green sea urchins—prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for juvenile and adult American plaice during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-Forming Species. American plaice inhabit soft bottom areas, including soft bottom areas that border bedrock (Johnson 2005). Keats (1991) hypothesized that American plaice inhabited areas boarded by bedrock because bedrock is the preferred habitat for green sea urchins, an important prey species for American plaice. Because preferred habitat for American plaice are soft bottom substrates, such as fine sand or gravel, the NRC concludes that the potential loss of habitat-forming species is not likely to adversely affect EFH for juvenile and adult American plaice during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the abundance of juvenile and adult American plaice prior to and during operations (NAI 2010).

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect EFH for American plaice juveniles or adults for the following reasons:

- Impingement and entrainment are relatively low.
- The thermal plume rises quickly to the surface.

- Invertebrate forage species are not likely adversely affected by Seabrook operations.
- Preferred habitat does not include shellfish or kelp beds.

*D-1.3.3.2 Atlantic Butterfish (*Peprilus triacanthus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult Atlantic butterfish EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed Atlantic butterfish eggs and larvae in 1 to 10 percent of ichthyoplankton tows, juveniles and adults in 1 to 10 percent of gill net samples, juveniles and adults in less than 1 percent of trawling samples, and juveniles and adults in less than 1 percent of seine pull samples (Table D-1-2).

Species Description. Adult Atlantic butterfish are pelagic schooling fish that are ecologically important as a forage fish for many larger fishes, marine mammals, and birds. Atlantic butterfish inhabit the Atlantic coast from Newfoundland to Florida, but it is most abundant from the Gulf of Maine to Cape Hatteras (Cross et al. 1999; Overholtz 2006). Adult butterfish migrate seasonally. In the summer, they migrate inshore into bays, estuaries, and coastal waters of southern New England and the Gulf of Maine. In winter, they migrate to the edge of the continental shelf in the Mid-Atlantic Bight (Cross et al. 1999). Adults generally stay within 200 mi (322 km) of the shore.

Butterfish reach sexual maturity between ages 1 to 2 years and rarely live more than 3 years (Overholtz 2006). Adults are 5.9 to 9.1 in. (15 to 23 cm) long on average and can reach a weight of up to 1.1 lb (0.5 kg). Females are broadcast spawners and spawn in large bays and estuaries from June through August. Females generally release eggs at night in the upper part of the water column in water of 59° F (15° C) or more. Eggs are pelagic and buoyant (Cross et al. 1999). Butterfish eggs and larvae are found in water with depths ranging from the shore to 6,000 ft (1,828 m) and at temperatures between 53.6 and 73.4° F (12 and 23° C) for eggs and between 39.2 and 82.4° F (4 and 28° C) for larvae (Cross et al. 1999). Juvenile and adult butterfish are found in waters from 33 to 1,200 ft (10 to 366 m) deep and at temperatures ranging from 37 to 82° F (3 to 28° C) (Cross et al. 1999). In summer, juvenile and adult butterfish can be found over the entire continental shelf, including sheltered bays and estuaries, to a depth of 656 ft (200 m) over substrates of sand, rock, or mud (Cross et al. 1999).

Butterfish prey mainly on urochordates and mollusks, with minor food sources including squid; crustaceans, such as amphipods and shrimp; annelid worms; and small fishes (Bigelow and Schroeder 2002; Cross et al. 1999). In turn, many species—including haddock, silver hake, goosefish, bluefish, swordfish (*Xiphias gladuis*), sharks, and longfin inshore squid—eat adult butterfish (Cross et al. 1999).

Status of the Fishery. The Atlantic butterfish has been commercially fished since the late 1800s (Cross et al. 1999). By the mid-1900s, fishing fleets from Japan, Poland, the USSR, and other countries began to target the butterfish and caused a drastic increase in landings (Cross et al. 1999; Overholtz 2006). Landings peaked in 1973 at 75.6 million lb (34,300 metric tons (MT)) (Overholtz 2006). U.S. commercial landings averaged 7.1 million lb (3,200 MT) from 1965−2002 but have steadily decreased since 1985 (Overholtz 2006). In 2009, NOAA reported a cumulative landing of 0.95 million lb (430 MT), and, as of November 27, 2010, the reported landings for 2010 were 1.2 million lb (550 MT) (NOAA 2009, 2010). Butterfish are also caught as bycatch in other fisheries. Bycatch landings averaged 9.3 million lb (4,200 MT) per year from 1996 through 2002 (Overholtz 2006).

The MAFMC manages the Atlantic butterfish under an FMP that includes the Atlantic mackerel, squid, and butterfish. The Atlantic butterfish fishery is capped by an annual coast-wide quota.

A directed fishery for butterfish is open from January through August; however, most butterfish are harvested as bycatch in squid fisheries (NOAA 2010a). In 2009, NEFMC reported butterfish to be overfished (NMFS 2010b).

Entrainment and Impingement. Entrainment of Atlantic butterfish eggs varied from 0 in several years to 400,000 in 2005 (NAI 2010). Annual average entrainment of Atlantic butterfish eggs was 25,500 per year from 1990 through 2009 (Table D-1-4). Entrainment of Atlantic butterfish larvae varied from 0 in several years to 1.19 million in 2007 (NAI 2010). Annual average entrainment of Atlantic butterfish larvae was 90,000 per year from 1990 through 2009 (Table D-1-5). Atlantic butterfish eggs and larvae comprised less than 0.05 percent of the total fish eggs and larvae entrained at Seabrook from 1990 through 2009.

Impingement of Atlantic butterfish varied from 1 in 2000 to 1,170 in 2002 (NAI 2010). Annual average impingement was 114 fish per year from 1994 through 2009 (Table D-1-6). Atlantic butterfish comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for Atlantic butterfish compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for all life stages of Atlantic butterfish during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Impacts. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to butterfish eggs, larvae, juveniles, or adults. As described above, the habitat most likely affected by the thermal plume would be the upper water column (within 10 to 16 ft (3 to 5 m)) of the ocean surface) in the immediate vicinity of the discharge. At the surface, Padmanabhan and Hecker (1991) observed a temperature rise of 3° F (1.7° C) or more in a 32-ac (12.9-ha) area surrounding the discharge. Seabrook's NPDES permit limits the rise in monthly mean temperature to 5° F (2.8° C) in the "near field jet mixing region," or within waters less than 3.3 ft (1 m) from the surface. Butterfish are most common near Seabrook from August through November, when the surface temperature near Seabrook ranges from 46.4 to 65.8° F (8 to 18.8° C) (NAI 2001). Butterfish eggs and larvae are found in water at temperatures between 53.6 and 73.4° F (12 and 23° C) for eggs and between 39.2 and 82.4° F (4 and 28° C) for larvae (Cross et al. 1999). Juvenile and adult butterfish are found in waters at temperatures ranging from 37 to 82° F (3 to 28° C) (Cross et al. 1999). With a temperature rise of 3 to 5° F (1.7 to 2.8° C) at the surface near Seabrook, the thermal plume near the surface from August through November would be within the range of temperature that butterfish eggs, larvae, juveniles, and adults typically inhabit. Therefore, the NRC staff concludes that the increased temperatures of Seabrook's effluent are not likely to adversely affect EFH for all stages of Atlantic butterfish during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Atlantic butterfish primarily prey on invertebrates (Bigelow and Schroeder 2002; Cross et al. 1999). NextEra monitoring data show relatively similar trends of benthic invertebrate density and species diversity prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for Atlantic butterfish during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. All life stages of Atlantic butterfish are primarily pelagic (Cross et al. 1999), suggesting that they rarely use benthic habitats such as shellfish and kelp beds. Therefore, the NRC staff concludes that the potential loss of habitat-forming species is not likely to adversely affect EFH for all life stages of Atlantic butterfish during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Combined Impacts (Monitoring Data)</u>. Seabrook monitoring data do not provide data specific to the abundance of Atlantic butterfish eggs, larvae, juveniles, or adults prior to and during operations (NAI 2010).

<u>Conclusion</u>

Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect EFH for all life stages of Atlantic butterfish for the following reasons:

- Impingement and entrainment are relatively low for Atlantic butterfish.
- The increased temperature within the thermal plume at the surface would be with the range of temperatures that Atlantic butterfish inhabit.
- Invertebrate forage species are not likely to be adversely affected by Seabrook operations.
- Their preferred habitat does not include shellfish or kelp beds.

*D-1.3.3.3 Atlantic Cod (*Gadus morhua*) (All Life Stages)*

<u>Designated EFH in the Vicinity of Seabrook</u>. The NMFS has designated eggs, larvae, juvenile, and adult Atlantic cod EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed Atlantic cod eggs and larvae in greater than 10 percent of ichthyoplankton tows, juveniles and adults in greater than 10 percent of trawling samples, juveniles and adults in 1 to 10 percent of gill net samples, and juveniles and adults in less than 1 percent of seine pull samples (Table D-1-2).

<u>Species Description</u>. Atlantic cod are demersal and highly targeted commercially. Atlantic cod inhabit the northwestern Atlantic Ocean, from Greenland to Cape Hatteras, NC. In the U.S., the highest densities of Atlantic cod are on Georges Bank and the western Gulf of Maine, in waters between 33 and 492 ft (10 and 150 m) with rough bottoms and at temperatures between 32 and 50° F (0 and 10° C) (Lough 2004). Offshore New England, juvenile and adult Atlantic cod move seasonally in response to temperature changes, whereby Atlantic cod typically move into coastal waters during the fall and deeper waters during spring. At the extremes of their range, including Labrador and south of the Chesapeake, Atlantic cod migrate annually (Lough 2004).

In Gulf of Maine, Atlantic cod reach sexual maturity at 2.1 to 2.9 years at lengths between 13 and 17 in. (32 and 44 cm) (Lough 2004). Females spawn during winter and early spring in bottom waters generally between 41 and 44.6° F (5 and 7° C). A large female may produce as many as 3 to 9 million eggs (Lough 2004). Eggs and larvae for the first 3 months are pelagic (Lough 2004). Once larvae reach 1.6 to 2.4 in. (4 to 6 cm), they begin to descend towards the seafloor. As Atlantic cod develop into juveniles and adults, they are able to withstand deeper, colder, and more saline water, and they become more widely distributed (Lough 2004). Complex substrate and vegetation provides refuge from predators for juvenile cod (Lough 2004).

Forage species tend to vary by life stage and location (Lough 2004). Juveniles and younger adults tend to consume pelagic and benthic invertebrates, while adult cod feed on both crustaceans and other fish, including cancer crabs, brittle stars, American sand lance, Atlantic herring, and American plaice (Johnson 2005; Lough 2004; Witman and Sebens 1992). Atlantic herring and Atlantic mackerel can be important predators of Atlantic cod larvae (Lough 2004). Silver hake, sculpin, larger cod, and other fish consume juvenile Atlantic cod (Edwards and Bowman 1979, cited in Lough 2004). Winter skate, silver hake, sea raven, longfin inshore squid, Atlantic halibut, fourspot flounder, and large adult cod consume smaller adult cod (Lough 2004).

Status of the Fishery. Atlantic cod has been a highly targeted species since the 1700s. As a likely result of harvesting older and larger fish or due to intense exploitation in stock biomass, the size and age at maturity for Atlantic cod has declined in recent decades (Lough 2004). Currently, Atlantic cod is managed as two stocks within U.S. waters: (1) the Gulf of Maine and (2) Georges Bank and southward (Mayo 1995). In 2009, NEFMC reported Atlantic cod to be subject to overfishing (NMFS 2010b).

Entrainment and Impingement. Entrainment of Atlantic cod eggs varied from 0.2 million in 1994 to 77.8 million in 2002 (NextEra 2010a). Annual average entrainment of Atlantic cod eggs was 32.6 million per year from 1990 through 2009 (Table D-1-4). Atlantic cod eggs comprised 3.6 percent of the total fish eggs entrained at Seabrook from 1990 through 2009. Entrainment of Atlantic cod larvae varied from 0 in 1994 to 34.6 million in 2002 (NAI 2010). Annual average entrainment of Atlantic cod larvae was 2.8 million per year from 1990 through 2009 (Table D-1-5). Atlantic cod larvae comprised approximately 1 percent of the total fish larvae entrained at Seabrook from 1990−2009.

Impingement of Atlantic cod varied from 29 in 2000 to 3,091 in 2003 (NAI 2010). Annual average impingement was 327 fish per year from 1994 through 2009 (Table D-1-6). Atlantic cod comprised less than 2 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for Atlantic cod compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for Atlantic cod during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to Atlantic cod eggs, juveniles, or adults. Seabrook's thermal discharge may reduce available habitat to Atlantic cod larvae.

Atlantic cod eggs and larvae are pelagic (Lough 2004). NEFSC MARMAP ichthyoplankton surveys collected most eggs at temperatures ranging from 39 to 57° F (4 to 14° C), but collected eggs as high as 72° F (22° C) (Lough 2004). NEFSC MARMAP ichthyoplankton surveys collected most larvae from 39 to 52° F (4 to 11° C), but collected larvae as high as 66° F (19° C) (Lough 2004). Surface waters near the thermal plume typically range as high as 65.8° F (18.8° C) (NAI 2001). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface could exceed the typical range of temperatures that Atlantic cod larvae inhabit. The habitat affected at the surface would likely be 32 ac (12.9 ha) or less (Padmanabhan and Hecker 1991). Juvenile and adult Atlantic cod are primarily benthic (Lough 2004), meaning that they spend most of the time residing near the seafloor. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface and the temperature range of the thermal plume near the surface would be within the typical range for Atlantic cod eggs, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for Atlantic cod eggs, juveniles, or adults during the remainder of the facility's operating license or during the proposed license renewal term. Because the thermal plume could exceed the typical range of temperatures that larvae inhabit, the NRC staff concludes that the heated thermal effluent may have minimal adverse effects on Atlantic cod larvae.

Loss of Forage Species. Juveniles and younger adults consume pelagic and benthic invertebrates, while adult cod feed on both crustaceans and other fish (Lough 2004). In the Gulf of Maine, Bowman (1975, cited in Lough 2004) found Atlantic herring to be a primary prey item for Atlantic cod. Link and Garrison (2002) determined that preferred prey in the Gulf of Maine include American sand lance, cancer crabs, and Atlantic herring. NextEra monitoring data show relatively similar trends in the abundance and density of benthic invertebrates (including cancer crabs) and most fish species prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away (NAI 2010). Atlantic herring, a primary prey item for Atlantic cod in the Gulf of Maine, was the fifth most commonly entrained larval species, comprising 3.6 percent of all entrained larvae (NAI 2010) (Table D-1-5). Atlantic herring comprised less than 1 percent of all impinged fish (NAI 2010) (Table D-1-6). American sand lance, a preferred prey item for Atlantic cod, was the second most commonly entrained larval species, comprising 10 percent of all entrained larvae (NAI 2010) (Table D-1-5). American sand lance was the 10th most commonly impinged fish species, comprising 4.3 percent of all impinged fish (NAI 2010) (Table D-1-6).

Because some of the primary and preferred forage fish—such as Atlantic herring and American sand lance—are regularly entrained and impinged at Seabrook, operations at Seabrook may have a minimal adverse effect on prey abundance for Atlantic cod. Effects would likely be minimal since Atlantic cod consume a variety of species, many of which are not regularly entrained or impinged at Seabrook.

<u>Loss of Habitat-forming Species</u>. Complex substrate and vegetation provide refuge from predators for juvenile cod (Lough 2004). Therefore, juvenile cod likely use macroalgae and shellfish beds near Seabrook. Monitoring studies suggest that Seabrook operations have adversely affected the density of several kelp species near Seabrook. Therefore, Seabrook operations may have a minimal adverse effect on juvenile Atlantic cod habitat. Effects would likely be minimal since juvenile Atlantic cod inhabit a variety of substrates and vegetation to find refuge from predators.

<u>Combined Impacts (Monitoring Data)</u>. NextEra monitored the abundance of eggs, larvae, juvenile and adult Atlantic cod prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away. Ichthyoplankton studies indicated that the density of Atlantic cod larvae decreased significantly at both nearfield and farfield sampling sites (NAI 2010) (Table D-1-8). Monitoring data from trawl studies and gill net studies indicate that the abundance of juvenile and adult Atlantic cod also significantly decreased at both nearfield and farfield sampling sites (Tables D-1-9 and D-1-10). The decreased abundance at both nearfield and farfield sampling sites suggest that Seabrook operations have not adversely affected EFH for Atlantic cod within 3 to 4 mi (5 to 8 km) of Seabrook.

<u>Conclusion</u>. Based on the above analysis, the NRC staff concludes that Seabrook operations may have minimal adverse effects on EFH for Atlantic cod larvae, juveniles, and adults, because Seabrook's cooling system regularly entrains and impinges preferred forage fish for Atlantic cod, the thermal plume could exceed the typical range of temperatures that larvae inhabit, and because juveniles may use algal habitats that have declined near Seabrook since operations began. Impacts would likely be minimal since Atlantic cod are not commonly entrained or impinged in the Seabrook cooling system, the thermal plume rises quickly to the surface, invertebrate forage species are not likely adversely affected by Seabrook operations, and monitoring data show similar trends at nearfield and farfield stations prior to and during operations.

*D-1.3.3.4 Atlantic Herring (*Clupea harengus*) (Juvenile and Adult)*

<u>Designated EFH in the Vicinity of Seabrook</u>. The NMFS has designated juvenile and adult Atlantic herring EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed Atlantic

herring in 1 to 10 percent of trawling samples, greater than 10 percent of gill net samples, and in 1 to 10 percent of seine pull samples (Table D-1-2).

Species Description. Adult Atlantic herring are pelagic, schooling fish that inhabit both the eastern and western Atlantic Ocean (Stevenson and Scott 2005). Juveniles migrate nearshore to further offshore seasonally, whereas adult Atlantic herring migrate north-south along the U.S. and Canadian coasts for feeding, spawning, and overwintering.

Larvae develop into juveniles in the spring, at approximately 1.6 to 2.2 in. (40 to 55 mm) length (Stevenson and Scott 2005). Schooling behavior begins once Atlantic herring develop into juveniles (Gallego and Heath 1994). NOAA's Northeast Fishery Science Center (NEFSC) captured juveniles in waters from 35 to 54° F (2 to 12° C) in the spring and from 41 to 63° F (5 to 17° C) in the fall, during bottom trawl surveys from the Gulf of Maine to Cape Hatteras (Stevenson and Scott 2005). Adults occurred in waters from 35 to 55° F (2 to 13° C) in the spring and from 39 to 61° F (4 to 16° C) in the fall (Stevenson and Scott 2005).

Juvenile and adult Atlantic herring are opportunistic feeders and prey on zooplankton. The most common prey items for juveniles include copepods, decapods larvae, barnacle larvae, cladocerans, and molluscan larvae (Sherman and Perkins 1971, cited in Stevenson and Scott 2005). Common prey items for adults include euphausiids, chaetognaths, and copepods (Bigelow and Schroeder 1953; Maurer and Bowman 1975, cited in Stevenson and Scott 2005). Adults also prey upon fish eggs and larvae, including larval Atlantic cod, herring, sand lance, and silversides (Munroe 2002; Stevenson and Scott 2005).

Atlantic herring are an important component of the Gulf of Maine food web and are preyed upon throughout their life cycle (Stevenson and Scott 2005). Predators include a variety of fish (such as Atlantic cod, silver hake, thorny skate, bluefish, goosefish, weakfish, summer flounder, white hake, Atlantic halibut, red hake, and northern shortfin squid), marine mammals, and sea birds (Stevenson and Scott 2005).

Status of the Fishery. In U.S. waters, NEFMC manage Atlantic herring as a single stock (Stevenson and Scott 2005). In 2009, NEFMC did not consider Atlantic herring overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for Atlantic herring eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles and adults. NAI (2010) did not observe entrainment of Atlantic herring eggs from 1990 through 2009. Entrainment of Atlantic herring larvae varied from 0.1 million in 1994 to 28.2 million in 2008 (NAI 2010). Annual average entrainment of Atlantic herring larvae was 9.6 million per year from 1990 through 2009 (Table D-1-5). Atlantic herring larvae comprised approximately 3.6 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of Atlantic herring varied from 0 in 1994/1995 to 582 in 1998 (NAI 2010). Annual average impingement was 187 fish per year from 1994 through 2009 (Table D-1-6). Atlantic herring comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for Atlantic herring compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for juvenile and adult Atlantic herring during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. Seabrook's thermal discharges may reduce available habitat to juvenile and adult Atlantic herring. The habitat most likely affected by the thermal plume would be the upper water column (within 10 to 16 ft (3 to 5 m) of the ocean surface) in the immediate vicinity of the discharge. At the surface, Padmanabhan and Hecker (1991) observed a temperature rise of

3° F (1.7° C) or more in a 32-ac (12.9-ha) area surrounding the discharge. Seabrook's NPDES permit limits the rise in monthly mean temperature to 5° F in the "near field jet mixing region," or within waters less than 3.3 ft (1 m) from the surface. Adult and juvenile Atlantic herring are most common near Seabrook from April through May, when the surface temperature near Seabrook ranges from 41 to 51° F (5 to 10.7° C) and from October through December, when the surface temperature ranges from 42 to 57.7° F (5.6 to 14.3° C) (NAI 2001). NEFSC trawl surveys captured juveniles in waters up to 54° F (12° C) in the spring and 63° F (17° C) in the fall and adults up to 55° F (13° C) in the spring and up to 61° F (16° C) in the fall (Stevenson and Scott 2005). With a temperature rise of 3 to 5° F (1.7 to 2.8 ° C), the thermal plume near the surface could slightly exceed the typical range of temperature that Atlantic herring juveniles and adults inhabit. The habitat affected at the surface would likely be 32 ac (12.9 ha) or less (Padmanabhan and Hecker 1991). Therefore, the NRC staff concludes that the increased temperatures at Seabrook may have a minimal adverse effect on EFH for adult and juvenile Atlantic herring during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Juvenile and adult Atlantic herring are opportunistic feeders and prey on a wide variety of zooplankton. Adults prey upon fish eggs and larvae, including larval Atlantic cod, herring, sand lance, and silversides (Munroe 2002; Stevenson and Scott 2005). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the zooplankton (NAI 2010). American sand lance larvae, a common prey item for Atlantic herring, were the second most commonly entrained larval species, comprising 10 percent of all entrained larvae (NAI 2010) (Table D-1-5). Other common larval prey, such as Atlantic herring and Atlantic cod larvae, comprised approximately 1 percent or less of the total fish larvae entrained at Seabrook. The NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for adult and juvenile Atlantic herring during the remainder of the facility's operating license or during the proposed license renewal term. This conclusion is based on the fact that Atlantic herring prey upon a wide variety of fish larvae, and monitoring studies suggest that zooplankton abundance has not been adversely affected by Seabrook operations.

Loss of Habitat-forming Species. Adult and juvenile Atlantic herring are primarily pelagic (Stevenson and Scott 2005), suggesting that they rarely use benthic habitats such as kelp and shellfish beds. Therefore, the NRC staff concludes that the potential loss of habitat-forming species is not likely to adversely affect Atlantic herring during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of juvenile and adult Atlantic herring prior to and during operations at sampling sites in Hampton-Seabrook Estuary near a previous discharge location and at sites further away. Monitoring data indicate that the abundance of juvenile and adult Atlantic herring decreased at both nearfield and farfield sampling sites (Table D-1-11). Because NAI (2010) observed similar trends at all sampling sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for adult and juvenile Atlantic herring.

Conclusion. Because of the observations above, and because the thermal plume could increase the temperature near the surface to above the temperature range that Atlantic herring typically inhabit, the NRC staff concludes that Seabrook operations may have a minimal adverse effect on EFH for adult and juvenile Atlantic herring.

*D-1.3.3.5 Atlantic Mackerel (*Scomber scombrus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult Atlantic mackerel EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed Atlantic mackerel eggs and larvae in greater than 10 percent of ichthyoplankton tows, juveniles and adults in less than 1 percent of trawling samples, juveniles and adults in greater than 10 percent of gill net samples, and juveniles and adults in less than 1 percent of seine pull samples (Table D-1-2).

Species Description. Atlantic mackerel are pelagic, schooling fish that inhabit the western Atlantic Ocean from the Gulf of St. Lawrence to North Carolina (Studholme et al. 1999). Adults are highly mobile.

In reviewing multiple studies, Studholme et al. (1999) indicated that the age of maturation varies from 1.7 to 3 years of age, depending on the location, size of the year class, and size of the adult stock. In the Gulf of Maine, females spawn from mid-April through June as they migrate from the south (Berrien 1982, cited in Studholme et al. 1999). The Gulf of Maine is not one of the more important spawning grounds (Sette 1950, cited in Studholme et al. 1999). Eggs are pelagic and float in the upper 33 to 49 ft (10 to 15 m) of surface waters (Studholme et al. 1999). NEFSC collected eggs near the surface at temperatures ranging from 41 to 73° F (5 to 23° C) and larvae from 43 to 72° F (6 to 22° C) as part of the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton survey.

Juveniles exhibit schooling behavior at about 1.2 to 2 in. (30 to 50 mm) (Sette 1943, cited in Studholme et al. 1999). NEFSC captured juveniles from 39 to 72° F (4 to 22° C) and adults from 39 to 61° F (4 to 16° C) during 1963 through 1997 bottom trawl surveys. Overholtz and Anderson (1976, cited in Studholme et al. 1999) conducted field studies that indicated that adult Atlantic mackerel are intolerant of temperatures greater than 61° F (16° C).

Atlantic mackerel are opportunistic and filter feed or ingest prey. Larvae feed on copepod nauplii, copepods, and fish larvae (Studholme et al. 1999). Both juveniles and adults prey on a variety of crustaceans, although adults consume a wider variety of prey sizes and items, including fish. Peterson and Ausubel (1984) determined that fish greater than 0.2 in. (5 mm) feed on copepodites of *Acartia* and *Temora,* and fish greater than 0.24 in. (6 mm) feed on adult copepods.

Atlantic mackerel is prey to a wide variety of fish, sharks, squid, whales, dolphins, seals, porpoises. Common fish predators include other mackerel, dogfish, tunas, bonito, striped bass, Atlantic cod, swordfish, silver hake, red hake, bluefish, pollock, white hake, goosefish, and weakfish (Studholme et al. 1999).

Status of the Fishery. In U.S. waters, MAFMC and NMFS manage Atlantic mackerel as a single stock (Studholme et al. 1999). In 2009, MAFMC did not consider Atlantic mackerel overfished (NMFS 2010b).

Entrainment and Impingement. Entrainment of Atlantic mackerel eggs varied from 0 in 1994 to 673.1 million in 1991 (NAI 2010). Annual average entrainment of Atlantic mackerel eggs was 191.5 million per year from 1990 through 2009 (Table D-1-4). Atlantic mackerel eggs comprised approximately 21.3 percent of the total fish eggs entrained at Seabrook from 1990 through 2009. Entrainment of Atlantic mackerel larvae varied from 0 in several years to 25.7 million in 2009 (NAI 2010). Annual average entrainment of Atlantic mackerel larvae was 2.6 million per year from 1990 through 2009 (Table D-1-5). Atlantic mackerel larvae comprised approximately 1 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of Atlantic mackerel varied from 0 in several years to 4 in 2004 through 2005 (NAI 2010). Annual average impingement was less than three fish per year from 1994 through 2009 (Table D-1-6). Atlantic mackerel comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Entrainment of Atlantic mackerel larvae and impingement of Atlantic mackerel is small compared to other species impinged at Seabrook. However, Atlantic mackerel is the second most entrained egg species, comprising 21.3 percent of the total fish eggs entrained at Seabrook. Therefore, the NRC staff concludes that entrainment of Atlantic mackerel eggs may have minimal adverse effects on EFH for Atlantic mackerel during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of water (or habitat) entrained in the Seabrook cooling system would be a very small proportion of available habitat for Atlantic mackerel eggs.

Thermal Effects. Seabrook's thermal discharges may reduce available habitat to adult Atlantic mackerel. The habitat most likely affected by the thermal plume would be the upper water column (within 10 to 16 ft (3 to 5 m) of the ocean surface) in the immediate vicinity of the discharge. At the surface, Padmanabhan and Hecker (1991) observed a temperature rise of 3° F (1.7° C) or more in a 32-ac (12.9-ha) area surrounding the discharge. Seabrook's NPDES permit limits the rise in monthly mean temperature to 5° F in the "near field jet mixing region," or within waters less than 3.3 ft (1 m) from the surface. Atlantic mackerel are most common near Seabrook from June through November, when the surface temperature near Seabrook ranges from 46 to 66° F (8 to 18.8° C) (NAI 2001). During ichthyoplankton and trawling surveys, NEFSC captured eggs, larvae, and juveniles in waters up to 72° F (22° C) and adults in waters up to 61° F (16° C) (Studholme et al. 1999). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface could exceed the typical temperature range that adult Atlantic mackerel inhabit. The habitat affected at the surface would likely be 32 ac (12.9 ha) or less (Padmanabhan and Hecker 1991). Therefore, the NRC staff concludes that the increased temperatures at Seabrook may have a minimal adverse effect on EFH for adult Atlantic mackerel during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Atlantic mackerel are opportunistic feeders and prey includes plankton, small crustaceans (including copepods), and some fish for larger Atlantic mackerel (Studholme et al. 1999). NextEra's monitoring studies show similar trends prior to and during operations at nearfield and farfield sampling sites for changes in abundance, density, and species composition for phytoplankton, zooplankton (including copepods and fish larvae), invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for Atlantic mackerel during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Adult and juvenile Atlantic herring are primarily pelagic (Studholme et al. 1999), which suggests that they rarely use benthic habitats such as kelp and shellfish beds. Therefore, the NRC staff concludes that the potential loss of habitat-forming species is not likely to adversely affect EFH for Atlantic herring during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of Atlantic mackerel eggs, larvae, juveniles, and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Monitoring data indicate that the density of eggs and abundance of juveniles and adults increased or remained the same at both nearfield and farfield sampling sites (Tables D-1-8 and D-1-10). Larval density decreased at both nearfield and farfield sampling sites (Table D-1-8). Because NAI (2010) found similar trends at both the nearfield and farfield sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for Atlantic mackerel.

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations may have minimal adverse effects on EFH for Atlantic mackerel eggs and adults for the following reasons:

- The thermal plume could increase the temperature near the surface to above the temperature range that adult Atlantic mackerel typically inhabit.
- Atlantic mackerel is the second most entrained egg species, comprising 21.3 percent of the total fish eggs entrained at Seabrook.

The NRC staff concludes that Seabrook operations are not likely to adversely affect Atlantic mackerel larvae and juvenile for the following reasons:

- These life stages are not commonly entrained or impinged in the Seabrook cooling system.
- The thermal plume would not exceed the typical temperature range that juveniles inhabit.
- Forage species are not likely adversely affected by Seabrook operations.
- Monitoring data show similar trends at nearfield and farfield stations prior to and during operations.

*D-1.3.3.6 Atlantic Sea Scallop (*Placopecten magellanicus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult Atlantic sea scallop EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed a relatively low density of Atlantic sea scallop larvae in zooplankton tows (geometric mean density was approximately three to four scallops per 1,000 m^3 prior to 2001 and less than one scallop per 1,000 m^3 after 2001). Seabrook monitoring does not include juvenile and adult Atlantic sea scallops. Seabrook observations near the intake and discharge structures suggest that sea scallops are not common in this area (NAI 2001).

Species Description. Atlantic sea scallops are bivalve mollusks that occur along the Canadian and U.S. coasts from the Gulf of St. Lawrence south to Cape Hatteras, NC (Hart and Chute 2004).

Sea scallops produce gametes within the first or second year and are among the most fecund of bivalves (Langton et al. 1987). Spawning in Maine occurs from September through October. Eggs remain demersal until they develop into larvae. The first two larval stages are pelagic and drift with water currents (Hart and Chute 2004). Larvae settle on the sea floor as spat and remain there throughout adult life. Spat that land on sedentary branching plants, animals, or on any other hard surface may have a higher survival rate than those that land in sandy bottom habitats subject to burial (Larsen and Lee 1978).

Juvenile scallops move from the original substrate on which they have settled and attach to shells or bottom debris (Dow and Baird 1960, cited in Hart and Chute 2004). Juveniles also swim to avoid predators and other natural or human-induced disturbances. Tagging studies suggest that adults remain sedentary once an aggregation has formed (Hart and Chute 2004).

Sea scallops are filter feeders. Food particles filtered from water include phytoplankton, microzooplankton (such as ciliated protozoa), and particles of detritus, especially during periods of low phytoplankton concentrations (Shumway et al. 1987). Both fish and invertebrates prey upon Atlantic sea scallops (Hart and Chute 2004).

Status of the Fishery. The Atlantic sea scallop is one of the most economically important species in the northeast U.S. (Hart and Chute 2004). NEFMC manages the sea scallop fishery under the Sea Scallop Management Plan. In 2009, NEFMC did not consider the sea scallop fishery overfished (NMFS 2010b).

Entrainment and Impingement. NAI (2010) did not monitor entrainment of invertebrate eggs from 1990 through 2009. Entrainment of Atlantic sea scallop larvae varied from 0 in 2003 and 2006 to 31 million in 1996 (Table D-1-7) (NAI 2010). Annual average entrainment of Atlantic sea scallop larvae was 4.8 million per year from 1990 through 2009 (NAI 2010). Atlantic sea scallop larvae comprised less than 1 percent of the total invertebrate larvae entrained at Seabrook from 1990 through 2009.

Because adult Atlantic sea scallops are sessile benthic organisms, impingement is not likely, and NextEra did not monitor impingement of Atlantic sea scallops.

Because entrainment was relatively low for Atlantic sea scallops compared to other invertebrate species at Seabrook, and because impingement is not likely, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for Atlantic sea scallops during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to Atlantic sea scallop. Atlantic sea scallops are primarily benthic (Chute and Hart 2004), meaning that they spend most of the time residing near the seafloor. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for Atlantic sea scallops during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Atlantic sea scallops are filter feeders, and prey includes phytoplankton, microzooplankton (such as ciliated protozoa), and particles of detritus. NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for plankton (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for Atlantic sea scallops during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Survival of newly settled Atlantic sea scallop appears to be higher in complex habitats that include sedentary branching animals, plants, and other hard surfaces (Larsen and Lee 1978). Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began, but NextEra observed relatively similar trends for the density of benthic invertebrates at the nearfield and farfield sites prior to and during operations (NAI 2010). Because the density of kelp is lower since operations began at Seabrook but Atlantic sea scallops use complex habitats other than kelp, the NRC staff concludes that Seabrook operations may have minimal adverse effects on habitat for newly settled Atlantic sea scallops.

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the abundance of Atlantic sea scallop eggs, larvae, juveniles, or adults prior to and during operations. However, NextEra monitoring data show relatively similar trends of benthic invertebrate density prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away (NAI 2010).

Conclusion. Because spat appear to have higher survival rates in complex habitats, such as kelp forests, and because Seabrook monitoring data suggests that operations have adversely affected the density of several species of kelp, the NRC staff concludes that Seabrook operations may have minimal adverse effects on juvenile sea scallops. Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect EFH for eggs, larvae, and adult sea scallops for the following reasons:

- Entrainment and impingement are relatively low compared to other species at Seabrook.
- The thermal plume rises quickly to surface waters.
- Forage species are not likely to be adversely affected.
- Monitoring data show relatively similar trends of benthic invertebrate density prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away.

*D-1.3.3.7 Atlantic Surfclam (*Spisula solidissima*) (Juveniles and Adults)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile and adult Atlantic surf clam EFH in the vicinity of Seabrook (NMFS 2011b). Seabrook monitoring does not include juvenile and adult Atlantic surf clams (NAI 2010). NAI (2010) observed surface larvae near Seabrook and the geometric mean density was approximately 350 to 590 clams per 1,000 m^3 prior to 2001 and 120 clams per 1,000 m^3 after 2001.

Species Description. Atlantic surfclams are bivalve mollusks that inhabit sandy habitats from the southern Gulf of St. Lawrence to Cape Hatteras, NC (Merrill and Ropes 1969 in Cargnelli et al. 1999a). Clams feed by sucking in plankton, such as diatoms and ciliates, through their siphons (Cargnelli et al. 1999a). Predators include invertebrates (e.g., naticid snails, sea stars (*Asterias forbesi*), lady crabs (*Ovalipes ocellatus*), Jonah crabs (*Cancer borealis*), horseshoe crabs (*Limulus polyphemus*)) and fish (e.g., haddock and Atlantic cod) (see review in Cargnelli et al. 1999a).

Status of the Fishery. MAFMC manages the Atlantic surfclam under the Atlantic surfclam and ocean quahog FMP. In 2009, MAFMC did not consider the Atlantic surfclam fishery overfished (NMFS 2010b).

Entrainment and Impingement. NAI (2010) did not monitor entrainment of invertebrate eggs from 1990 through 2009. Entrainment of Atlantic surf clam larvae varied from 0 in 1992 and 2006 to 175.5 million in 1999 (NAI 2010). Annual average entrainment of Atlantic surf clam larvae was 48.9 million per year from 1990 through 2009 (Table D-1-7). Atlantic surf clam larvae comprised less than 1 percent of the total invertebrate larvae entrained at Seabrook from 1990 through 2009.

Because adult Atlantic surf clams are sessile benthic organisms, impingement is not likely, and NextEra did not monitor impingement of Atlantic surf clams.

Because entrainment was relatively low for Atlantic surf clams compared to other invertebrate species at Seabrook, and because impingement is not likely, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for Atlantic surf clams during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to Atlantic surfclams. Juvenile and adult Atlantic surfclams are benthic (Cargnelli et al. 1999a), meaning that they spend most of the time residing near the seafloor. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for Atlantic surfclam during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Atlantic surfclams feed on plankton, such as diatoms and ciliates. NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for plankton (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect Atlantic surfclam EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Preferred habitat includes sandy bottom areas. Surfclams are not dependent on kelp forests. Therefore, the NRC staff concludes that loss of kelp at Seabrook is not likely to adversely affect EFH for juvenile and adult Atlantic surfclams during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the abundance of Atlantic surfclams prior to and during operations. However, NextEra monitoring data show relatively similar trends of benthic invertebrate density prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away (NAI 2010).

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect juvenile and adult Atlantic surfclams for the following reasons:

- Entrainment and impingement are relatively low compared to other species at Seabrook.
- The thermal plume rises quickly to surface waters.
- Forage species are not likely to be adversely affected.
- Monitoring data show relatively similar trends of benthic invertebrate density prior to and during operations at sampling sites near the intake and discharge structures and 3 to 4 mi (5 to 8 km) away.

*D-1.3.3.8 Haddock (*Melanogrammus aeglefinus*) (Juvenile)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile haddock EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed haddock in greater than 10 percent of trawling samples and less than 1 percent of gill net samples (Table D-1-2).

Species Description. Haddock are demersal gadids that inhabit both sides of the North Atlantic Ocean (Brodziak 2005). In the northwest Atlantic, haddock can be found from Cape May, NJ to the Strait of Belle Isle, Newfoundland (Klein-MacPhee 2002). In the U.S., two stocks of haddock occur—one in the Gulf of Maine and one in Georges Bank (Brodziak 2005).

Larvae metamorphose into juveniles once they reach 0.8 to 1.2 in. (2 to 3 cm) (Fahay 1983). For the first 3 to 5 months, small juveniles live and feed in the upper part of the water column. Juveniles visit the seafloor in search of prey and remain on the ocean bottom once suitable habitat is located (Brodziak 2005; Klein-MacPhee 2002). Preferred benthic habitat includes include gravel, pebbles, clay, and smooth hard sand (Klein-MacPhee 2002), which is more abundant in Georges Bank than in the Gulf of Maine (Broziak 2005).

While inhabiting the upper part of the water column, small juveniles feed on phytoplankton, small crustaceans (primarily copepods and euphausiids), and invertebrate eggs (Brodziak 2005; Kane 1984). Benthic prey for larger juveniles include polychaetes, echinoderms, small decapods, and small fishes (Bowman et al. 1987; Broziak 2005).

Status of the Fishery. By the early 1990s, haddock experienced several decades of declining spawning biomass and recruitment (Brodziak 2005). Some considered the stock to be near collapse (Brodziak 2005). Since 1994, fishery management measures have helped to reduce fishing mortality (Brodziak 2005). NEFMC currently manages haddock under the northeast multispecies FMP. In 2009, NEFMC considered haddock overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for haddock eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles. Entrainment of haddock eggs varied from 0 in several years to 7.4 million in 1992 (NAI 2010). Annual average entrainment of haddock eggs was 0.4 million per year from 1990 through 2009 (Table D-1-4). Entrainment of 100,000 haddock larvae occurred in 1992 and 2005. NAI (2010) did not observe entrainment of haddock larvae in any other year from 1990 through 2009 (Table D-1-5). Haddock eggs and larvae comprised less than 1 percent of the total fish eggs and larvae entrained at Seabrook from 1990 through 2009.

Impingement of haddock varied from 0 in several years to 397 in 1996 (NAI 2010). Annual average impingement was 28 fish per year from 1994 through 2009 (Table D-1-6). Haddock comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for haddock compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for haddock during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to juvenile haddock. Young juvenile haddock remain pelagic for 3 to 5 months, at which point they travel to the seafloor in search of food and remain within this benthic habitat. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for juvenile haddock during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Juvenile haddock feed on a variety of organisms, including phytoplankton, copepods, euphausiids, invertebrate eggs, polychaetes, echinoderms, small decapods, and small fishes (Bowman et al. 1987; Broziak 2005; Kane 1984). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of phytoplankton, zooplankton (including copepods), invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for juvenile haddock during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Juvenile haddock do not use kelp habitats (Broziak 2005). Therefore, loss of kelp due to Seabrook operations are not likely to adversely affect EFH for juvenile haddock.

Combined Impacts (Monitoring Data). Seabrook monitoring data does not provide data specific to the abundance of juvenile haddock prior to and during operations (NAI 2010).

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect juvenile haddock or its habitat for the following reasons:

- Impingement and entrainment are relatively low for haddock.
- The thermal plume rises quickly to surface waters

- Forage species are not likely to be adversely affected by Seabrook operations.
- Preferred habitat does not include kelp or shellfish beds.

*D-1.3.3.9 Monkfish/Goosefish (*Lophius americanus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult goosefish EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed goosefish eggs in less than 1 percent of ichthyoplankton tows, goosefish larvae in 1 to 10 percent of ichthyoplankton tows, juveniles and adults in 1 to 10 percent of trawling samples, and juveniles and adults in less than 1 percent of gill net samples (Table D-1-2).

Species Description. Goosefish are large, slow-growing benthic fish (Steimle et al. 1999a). In the Gulf of Maine, goosefish larger than 7.9 in. (20 cm) move offshore in the winter and spring to avoid cold coastal conditions, whereas smaller goosefish migrate offshore in the fall (Hartley 1995, cited in Steimle et al. 1999a).

Adults mature at approximately 4 years for males and 5 years for females (Almeida et al. 1995). Spawning occurs from May through June in the Gulf of Maine (Hartley 1995, cited in Steimle et al. 1999a). Females shed relatively large eggs (0.6 to 0.7 in. (1.6 to 1.8 mm)) within buoyant, ribbon-like, non-adhesive, mucoid veils or rafts (Martin and Drewry 1978, cited in Steimle et al. 1999a). Egg veils float on the surface (Steimle et al. 1999a). Larvae are also pelagic. Juveniles settle to the bottom of the ocean and remain demersal as adults. Young juveniles often hide from predators within algae covered rocks. Adults prefer open sandy bottoms where they can partially bury themselves and then ambush prey (Steimle et al. 1999a).

Prey varies depending on life stage. Larval prey includes zooplankton, such as copepods, crustacean larvae, and chaetognaths (Bigelow and Schroeder 1953). Small juveniles eat pelagic fish but switch to invertebrates, especially crustaceans, once settling on the seafloor (Steimle et al. 1999a). Larger juveniles and adults consume more fish than invertebrates (Armstrong et al. 1996). NEFSC analyzed the stomach contents of goosefish and primary prey included crustaceans, squid, and fish. Common fish prey include spiny dogfish (*Squalus acanthias*), skates (*Raja* spp.), eels, sand lance, herring, Atlantic menhaden (*Brevoortia tyrannus*), smelt (Osmeridae), mackerel (*Scomber* spp.), weakfish (*Cynoscion regalis*), cunner, tautog (*Tautoga onitis*), black sea bass (*Centropristis striata*), butterfish, pufferfish, sculpins, sea raven (*Hemitripterus americanus*), searobins (*Prionotus* spp.), silver hake (*Merluccius bilinearis*), Atlantic tomcod (*Microgadus tomcod*), cod, haddock, hake (*Urophycis* spp.), witch and other flounders, and other goosefish (Bigelow and Schroeder 1953; Steimle et al. 1999a).

Status of the Fishery. In U.S. waters, NEFMC manages goosefish under the northeast multispecies FMP. In 2009, NMFS (2010b) reported that goosefish was not overfished.

Entrainment and Impingement. Entrainment of goosefish eggs varied from 0 in most years to 0.9 million in 1998 and 2000 (NAI 2010). Annual average entrainment of goosefish eggs was 0.1 million per year from 1990 through 2009 (Table D-1-4). Entrainment of goosefish larvae varied from 0 in most years to 2 million in 2000 (NAI 2010). Annual average entrainment of goosefish larvae was 0.1 million per year from 1990 through 2009 (Table D-1-5). Goosefish eggs and larvae comprised less than 1 percent of the total fish eggs and larvae entrained at Seabrook from 1990 through 2009.

Impingement of goosefish varied from 0 in several years to 59 in 2001 (NAI 2010). Annual average impingement was 10 fish per year from 1994 through 2009 (Table D-1-6). Goosefish comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for goosefish compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for goosefish during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to juvenile or adult goosefish. Seabrook's thermal discharge may slightly reduce available habitat to goosefish eggs and larvae.

Goosefish eggs and larvae are pelagic (Steimle et al. 1999a). Scott and Scott (1988, cited in Steimle et al. 1999a) reported 63 to 64° F (17 to 18° C) as the upper temperature limit for normal egg hatching. NEFSC MARMAP ichthyoplankton surveys collected most larvae from 52 to 59° F (11 to 15° C), but as high as 68 ° F (20° C) (Steimle et al. 1999a). Surface waters near the thermal plume typically range as high as 65.8° F (18.8° C) (NAI 2001). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface could exceed the typical range of temperatures that goosefish eggs and larvae inhabit. The habitat affected at the surface would likely be 32 ac (12.9 ha) or less (Padmanabhan and Hecker 1991).

Adult and juvenile goosefish are primarily benthic, meaning that they spend most of the time residing near the seafloor (Steimle et al. 1999a). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991).

Because the thermal plume could exceed the typical range of temperatures that larvae inhabit, the NRC staff concludes that the heated thermal effluent may have minimal adverse effects on Atlantic cod larvae. Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for goosefish during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Goosefish feed on a variety of organisms, including zooplankton, invertebrates, and several fish species (Bigelow and Schroeder 1953; Steimle et al. 1999a). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of zooplankton, invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for goosefish during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Newly settled juveniles may hide within algae covered rocks (Steimle et al. 1999a). Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began (NAI 2010). Therefore, Seabrook operations may have minimal adverse effects on juvenile goosefish habitat. Effects would likely be minimal because juvenile goosefish would likely inhabit algae (other than kelp) that have not declined near Seabrook (NAI 2001).

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the density or abundance of goosefish eggs, larvae, juveniles, or adults prior to and during operations (NAI 2010).

Conclusion. Because the thermal plume could exceed the typical range of temperatures that eggs and larvae inhabit, and because juveniles may use algal habitats that have declined near Seabrook since operations began, the NRC staff concludes that Seabrook may have minimal adverse effects on EFH for goosefish eggs, larvae, and juveniles near Seabrook. Based on the above analysis, Seabrook is not likely to affect goosefish adults or its habitat because entrainment and impingement are relatively low compared to other species at Seabrook, the thermal plume rises quickly to surface waters, and forage species are not likely to be adversely affected.

*D-1.3.3.10 Ocean Pout (*Macrozoarces americanus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult ocean pout EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed ocean pout larvae in 1 to 10 percent of ichthyoplankton tows, juveniles and adults in greater than 10 percent of trawling samples, and juveniles and adults in less than 1 percent of gill net samples (Table D-1-2).

Species Description. Ocean pout inhabit the Atlantic continental shelf of North America and are common off the coast of southern New England (Chang 1990). Ocean pout are benthic and use both open and rough habitats (Steimle et al. 1999b).

In the fall, ocean pout spawn in rock crevices, man-made artifacts, or other protected areas where they lay eggs in nests (Steimle et al. 1999b). Eggs remain demersal, and nests are guarded by one or both parents (Bigelow and Schroeder 1953). Once hatched, larvae generally remain near or at the bottom of the seafloor (Bigelow and Schroeder 1953). Juveniles and adults are also demersal. Bigelow and Schroeder (1953) reported that juveniles occur in shallow coastal waters around rocks and attached algae and in rivers with saline bottom waters in the Gulf of Maine. Juveniles may also use scallop or quahog shells for cover. Adults use a variety of habitats including rocky crevices, soft bottom habitats, gravel covered areas, and shellfish beds (Steimle et al. 1999b).

Ocean pout prey on benthic organisms in soft sandy bottom habitats either by sorting mouthfuls of sediments for infaunal species (MacDonald 1983) or by ambushing prey (Auster et al. 1995). Sedberry (1983, cited in Steimle et al. 1999b) found that juveniles feed on gammarid amphipods and polychaetes. Adults prey on a variety of benthic invertebrates, such as polychaetes, mollusks, crustaceans, and echinoderms (see review in Steimle et al. 1999b). Langton and Watling (1990 in Steimle et al. 1999b) reported that ocean pout primarily eat bivalve mollusks off the coast of southern Maine. Ocean pout and American plaice may compete for prey in the Gulf of Maine (MacDonald and Green 1986). Predators of juvenile ocean pout include squid, spiny dogfish, sea raven, cod, barndoor skate (*Raja laevis*), harbor seals, and cormorants (Steimle et al. 1999).

Status of the Fishery. NEFMC currently manages ocean pout as two stocks, one in northern Gulf of Maine and one south of this area (Wigley 1998). In 2009, NEFMC reported that ocean pout was not overfished (NMFS 2010b).

Entrainment and Impingement. NAI (2010) did not observe entrainment of ocean pout eggs from 1990 through 2009 (Table D-1-4). Seabrook entrained less than 10,000 ocean pout larvae in 2003 (NAI 2010). NAI (2010) did not observe entrainment of ocean pout larvae during any other year from 1990 through 2009 (Table D-1-5).

Impingement of ocean pout varied from 0 in several years to 21 in 2001 (NAI 2010). Annual average impingement was four fish per year from 1994 through 2009 (Table D-1-6). Ocean pout comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement were relatively low for ocean pout compared to other species at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for ocean pout during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Thermal Effects</u>. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to eggs, larvae, juvenile, or adult ocean pout. Ocean pout are primarily benthic (Steimle et al. 1999b), meaning that they spend most of the time residing near the seafloor. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for all life stages of ocean pout during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Loss of Forage Species</u>. Ocean pout feed on a variety of invertebrates, including gammarid amphipods, polychaetes, mollusks, echinoderms, and other crustaceans (Langton and Watling 1990, cited in Steimle et al. 1999b; Steimle et al. 1999b). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of zooplankton and benthic invertebrates (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for ocean pout during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Loss of Habitat-forming Species</u>. Juveniles may use habitats with algae, and both juveniles and adults may use shellfish beds (Bigelow and Schroeder 1953; Steimle et al. 1999b). Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began, but Seabrook observed similar trends in the density of benthic invertebrates at the nearfield and farfield sites prior to and during operations (NAI 2010). Because the density of kelp is lower since operations began at Seabrook, but juvenile ocean pout use complex habitats other than kelp, the NRC staff concludes that Seabrook operations may have minimal adverse effects on juvenile ocean pout and its habitat. Because Seabrook operations have not adversely affected the density or species diversity of benthic invertebrates, including shellfish beds, Seabrook operations are not likely to adversely affect adult ocean pout habitat.

<u>Combined Impacts (Monitoring Data)</u>. NextEra monitored the abundance of ocean pout eggs, larvae, juveniles, and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Icthoplankton trawls did not capture ocean pout eggs and captured larvae in less than 10 percent of all samples (Table D-1-2). Monitoring data indicate that the abundance of juveniles and adult increased or remained the same at both nearfield and farfield sampling sites (Table D-1-9). Because NAI (2010) found similar trends at both the nearfield and farfield sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for ocean pout.

<u>Conclusion</u>. Because juveniles may use algal habitats and other complex habitats, and because the density of several kelp species has declined near Seabrook since operations began, NRC staff concludes that Seabrook may have minimal adverse effects on juvenile ocean pout and its habitat near Seabrook. Based on the above analysis, Seabrook is not likely to affect EFH for ocean pout eggs, larvae, or adults for the following reasons:

- Entrainment and impingement are relatively low compared to other species at Seabrook.
- The thermal plume rises quickly to surface waters.
- Forage species and shellfish beds are not likely to be adversely affected by Seabrook operations.

- Monitoring data indicate that the abundance trends for ocean pout were similar at nearfield and farfield sties.

*D-1.3.3.11 Pollock (*Pollachius virens*) (Juvenile)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile pollock EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed pollock in greater than 10 percent of trawling samples, in greater than 10 percent of gill net samples, and in 1 to 10 percent of seine pull samples (Table D-1-2) (NAI 2010).

Species Description. Pollock are gadoids that occur on both sides of the North Atlantic (Cargnelli et al. 1999). Within the western Atlantic, pollock are relatively common within the Gulf of Maine (Cargnelli et al. 1999).

Juveniles migrate to and from offshore waters to nearshore habitats, such as the rocky subtidal and intertidal, until they remain offshore as adults (Cargnelli et al. 1999). Juveniles use a wide variety of habitats, including sand, mud, or rocky bottom and vegetation (Hardy 1978, cited in Cargnelli et al. 1999). NEFSC trawl surveys captured juveniles at temperatures ranging from 34 to 64° F (1 to 18° C).

Juveniles consume crustaceans, such as euphausiids and mollusks, and fish (Bowman and Michaels 1984). Ojeda and Dearborn (1991) determined that fish, such as young Atlantic herring, dominated the diet of subtidal juveniles in the Gulf of Maine.

Status of the Fishery. NEFMC manages pollock as a single unit under the northeast multispecies FMP. In 2009, NEFMC determined that pollock was not overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for pollock eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles. Entrainment of pollock eggs varied from 0 in 1990 to 8.5 million in 2007 (NAI 2010). Annual average entrainment of pollock eggs was 1.4 million per year from 1990 through 2009 (Table D-1-4). Entrainment of pollock larvae varied from 0 in most years to 0.8 million in 2007 (NAI 2010). Annual average entrainment of pollock larvae was 0.2 million per year from 1990 through 2009 (Table D-1-5). Pollock eggs and larvae comprised less than 1 percent of the total fish eggs and larvae entrained at Seabrook from 1990 through 2009.

Impingement of pollock varied from 72 in 2006 to 11,392 in 1999 (NAI 2010). Annual average impingement was 1,273 fish per year from 1994 through 2009 (Table D-1-6). Pollock was the sixth most commonly impinged fish species and comprised 6.1 percent of all impinged fish at Seabrook from 1994 through 2009.

Entrainment of pollock is small compared to other species entrained at Seabrook. However, pollock is the sixth most impinged fish species, comprising 6.1 percent of the total fish impinged at Seabrook. Therefore, the NRC staff concludes that impingement may have minimal adverse effects on EFH for pollock during the remainder of the facility’s operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of water (or habitat) captures in the Seabrook cooling system would be a very small proportion of available habitat for pollock juveniles and adults.

Thermal Effects. The NRC staff does not expect Seabrook’s thermal discharges to reduce available habitat to juvenile pollock. Juvenile pollock use primarily benthic habitats in the nearshore, such as rocky subtidal or intertidal area, although some may also travel throughout the water column (Cargnelli et al. 1999). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). From May through June and October through December, when pollock density was highest in Seabrook monitoring studies, the surface temperature reached 57.7° F (14.3° C) near Seabrook

(NAI 2010). NEFSC trawl surveys captured juveniles at temperatures ranging from 34 to 64° F (1 to 18° C). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface would be within the typical range of temperatures that juvenile pollock inhabit. The NRC staff concludes that the increased temperatures at Seabrook are not likely to adversely affect EFH for juvenile pollock during the remainder of the facility's operating license or during the proposed license renewal term. This conclusion is based on the findings that the buoyant thermal plume at the discharge points quickly rises toward the surface, and the temperature range within the thermal plume at the surface would be within the typical range for juvenile pollock.

Loss of Forage Species. Juveniles consume crustaceans, such as euphausiids and mollusks, and fish, such as Atlantic herring (Bowman and Michaels 1984; Ojeda and Dearborn 1991). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance and density of zooplankton, benthic invertebrates, and most fish species (NAI 2010). Entrainment and impingement were relatively low for Atlantic herring, primary fish prey for juvenile pollock, compared to other species at Seabrook. Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect pollock during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Juveniles use a wide variety of habitats, including sand, mud, or rocky bottom and vegetation (Hardy 1978, cited in Cargnelli et al. 1999). Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began, but NextEra observed similar trends for the density of benthic invertebrates at the nearfield and farfield sampling sites prior to and during operations (NAI 2010). Because the density of kelp is lower since operations began at Seabrook, but juvenile pollock use complex habitats other than kelp, the NRC staff concludes that Seabrook operations may have minimal adverse effects on juvenile pollock habitat.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of juvenile pollock prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away and within Hampton-Seabrook Estuary (NAI 2010). Monitoring data indicate that the abundance of juvenile pollock decreased or remained the same at both nearfield and farfield sampling sites (Tables D-1-10 and D-1-11). Because NAI (2010) found similar trends at both the nearfield and farfield sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for juvenile pollock.

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook may have minimal adverse effects on EFH for juvenile pollock because juveniles may use algal habitats that have declined near Seabrook since operations began, and pollock is the sixth most impinged fish species, comprising 6.1 percent of the total fish impinged at Seabrook. Impacts would likely be minimal for the following reasons:

- Pollock are not commonly entrained in the Seabrook cooling system.
- The thermal plume rises quickly to the surface.
- The temperature range within the thermal plume at the surface would be within the typical range for juvenile pollock.
- Forage species are not likely adversely affected by Seabrook operations.
- Monitoring data show similar trends at nearfield and farfield stations prior to and during operations.

*D-1.3.3.12 Red Hake (*Urophycis chuss*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult red hake EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed *Urophycis* spp. (mostly red and white (*U. tenuis*) hake and to a lesser extent spotted hake (*U. regia*)) egg and larvae in greater than 10 percent of ichthyoplankton tows, juveniles and adults in greater than 10 percent of trawling samples, in 1 to 10 percent of gill net samples, and in more than 10 percent of seine pull samples (Table D-1-2).

Species Description. Red hake are demersal fish that occur along the U.S. and Canadian costs from North Carolina to Southern Newfoundland (Sosebee 1998). Red hake migrate seasonally to various depths to inhabit waters with relatively consistent temperatures—they migrate to waters deeper than 328 ft (100 m) in the fall and waters less than 328 ft (100 m) in warmer months (Steimle et al. 1999c).

Southern Gulf of Maine is not a common spawning ground for red hake (Steimle et al. 1999c). Eggs are buoyant and float near the surface (Steimle et al. 1999c). Larvae are also pelagic and inhabit the upper water column. NEFSC MARMAP ichthyoplankton surveys collected larvae at temperatures ranging from 46 to 73° F (8 to 23° C) (Steimle et al. 1999c). Surveys indicate that larvae are more abundant in the Middle Atlantic Bight than the Gulf of Maine (Steimle et al. 1999c). Juveniles remain pelagic for approximately 2 months before they settle to the sea floor. Bottom trawl surveys captured juveniles in waters up to 72° F (22° C) (Steimle et al. 1999c). Benthic habitat structure for shelter—such as sea scallop shells, Atlantic surf clams, seabed depressions, or other structure—is important habitat for juveniles (Steiner et al. 1982). Adult red hake commonly inhabit areas with soft sediments bottoms that contain shellfish beds or depressions as well as natural and artificial reefs (Steimle et al. 1999c).

Prey varies by life stage. Larvae consume mainly copepods and other microcrustaceans (Steimle et al. 1999c). Juvenile red hake consume small benthic and pelagic crustaceans, such as larval and small decapod shrimp and crabs, mysids, euphausiids, and amphipods (Steimle et al. 1999c). Similar to juveniles, adults consume crustaceans but also prey on a variety of demersal and pelagic fish and squid.

Status of the Fishery. NEFMC manages the red hake fishery under the northeast multispecies FMP. In 2009, NEFMC did not consider the red hake fishery overfished (NMFS 2010b).

Entrainment and Impingement. Entrainment of red, white, and spotted hake at Seabrook was recorded under a single category for *Urophycis* spp. (NAI 2010). Entrainment of hake eggs varied from 0.6 million in 1994 to 213.2 million in 1996 (NextEra 2010a). Annual average entrainment of hake eggs was 45.7 million per year from 1990 through 2009 (Table D-1-4). Hake was the fourth most commonly entrained taxa, comprising 5.1 percent of all entrained fish eggs at Seabrook from 1990 through 2009.

Entrainment of hake larvae varied from 0 in most years to 29.8 million in 2000 (NAI 2010). Annual average entrainment of hake larvae was 2.8 million per year from 1990 through 2009 (Table D-1-5). Hake larvae comprised 1 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of red hake varied from 1 in 1994 to 1,478 in 1996 (NAI 2010). Annual average impingement was 509 fish per year from 1994 through 2009 (Table D-1-6). For hakes, which included red hake, white hake, and spotted hake, impingement varied from 4 in 1998 to 3,216 in 2008 (NAI 2010). Annual average impingement was 866 fish per year from 1994 through 2009 (Table D-1-6). The red hake and hake categories comprised 6.5 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment and impingement of hake were relatively common at Seabrook, the NRC staff concludes that entrainment and impingement may have minimal adverse effects on EFH for red hake during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of water (or habitat) captured in the Seabrook cooling system would be a very small proportion of available habitat for all life stages of red hake.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to red hake. Larvae and young juveniles inhabit pelagic waters up to 72 to 73° F (22 to 23° C) (Steimle et al. 1999c). Surface waters near the thermal plume typically range as high as 65.8° F (18.8° C) (NAI 2001). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface would be within the typical range of temperatures that larvae and young juveniles inhabit. Older juvenile and adult red hake are benthic (Steimle et al. 1999c). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). The NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for red hake during the remainder of the facility's operating license or during the proposed license renewal term. This conclusion is based on the fact that the buoyant thermal plume at the discharge points quickly rises toward the surface, and the temperature range within the thermal plume at the surface would be within the typical range for larvae and young juvenile red hake.

Loss of Forage Species. Red hake consume a variety of prey items, including copepods, shrimp, crabs, euphausiids, amphipods, and other crustaceans, and a variety of demersal and pelagic fish and squid (Steimle et al. 1999c). NextEra's monitoring studies show relatively similar trends in abundance prior to and during operations at nearfield and farfield sampling sites for zooplankton, benthic invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for red hake during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Juvenile and adult red hake commonly use shellfish bed for shelter, as well as other natural and artificial structures. Seabrook observed similar trends in the density of benthic invertebrates at the nearfield and farfield sites prior to and during operations (NAI 2010). Therefore, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook is not likely to adversely affect EFH for red hake during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of hake eggs, juveniles, and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). This category included *Urophycis* spp. (mostly red and white hake) and to a lesser extent spotted hake (NAI 2010). Monitoring data indicate that the abundance of hake eggs, juveniles, and adults decreased at both nearfield and farfield sampling sites (Tables D-1-8 and D-1-9). Because NAI (2010) found similar trends at both the nearfield and farfield sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for hake.

Conclusion. Based on the above analysis, the NRC staff concludes that entrainment and impingement may have minimal adverse effects on EFH for red hake eggs, larvae, juvenile, and adults during the remainder of the facility's operating license or during the proposed license renewal term because entrainment and impingement of hake were relatively common at Seabrook. Impacts would likely be minimal for the following reasons:

- Thermal plume rises quickly to surface waters and is within the typical range of surface temperatures for larvae and young juveniles.

- Forage species and shellfish beds are not likely to be adversely affected.
- Monitoring data show similar trends in the abundance of red hake at nearfield and farfield sties prior to and during operations.

*D-1.3.3.13 Scup (*Stenotomus chrysops*) (Juvenile and Adult)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile and adult scup EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed scup in 1 to 10 percent of trawling samples and less than 1 percent of gill net samples (Table D-1-2).

Species Description. Scup are demersal fish that primarily occur primarily along the U.S. coast from Massachusetts to South Carolina, and have been observed as far north as the Bay of Fundy (Steimle et al. 1999d). Scup migrate south of New Jersey during the winter.

During the summer and early fall, juveniles and adults inhabit larger estuaries and coastal areas. Baird (1873, cited in Steimle et al. 1999d) reported habitat for juveniles to include sand, silty-sand, shell, mud, mussel beds, and eelgrass (*Zosteria marina*). Adults exhibit schooling behavior and also use a variety of habitats, including open sandy bottom and structured habitats such as mussel beds, reefs, or rough bottom (Steimle et al. 1999d).

Juveniles prey on small crustaceans, such as amphipods, polychaetes, and copepods (Steimle et al. 1999d). Adults consume a variety of prey, including small zooplankton, polychaetes, mollusks, other crustaceans, small squid, vegetable detritus, insect larvae, hydroids, sand dollars, and small fish (Bigelow and Schroeder 1953; Steimle et al. 1999d). Predators of scup include a variety of fish and sharks, such as bluefish (*Pomatomus saltatrix*), Atlantic halibut, cod, striped bass (*Morone saxitilus*), weakfish, goosefish, silver hake, and other coastal fish predators (see review in Steimle et al. 1999d).

Status of the Fishery. MAFMC manages the scup fishery under the summer flounder, scup, and black sea bass FMP. In 2009, MAFMC did not consider the scup fishery overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for scup eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles and adults. NAI (2010) did not observe scup eggs or larvae in entrainment studies from 1990 through 2009. Impingement of scup varied from 0 in multiple years to 21 in 2005 (NAI 2010). Annual average impingement was seven fish per year from 1994 through 2009 (Table D-1-6). Scup comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because NAI (2010) did not observe scup entrainment, and because impingement is small compared to other species entrained at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for scup during the remainder of the facility’s operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook’s thermal discharges to reduce available habitat to juvenile or adult scup. Juvenile and adult scup are primarily benthic (Steimle et al. 1999d). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for scup during the remainder of the facility’s operating license or during the proposed license renewal term.

Loss of Forage Species. Scup consume a variety of prey including zooplankton, amphipods, polychaetes, copepods, mollusks, other crustaceans, small squid, vegetable detritus, insect larvae, hydroids, sand dollars, and small fish (Bigelow and Schroeder 1953; Steimle et al. 1999d). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of zooplankton, benthic invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for scup during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Juvenile and adult scup use a variety of habitats, including open areas and areas with structure such as mussel beds and eelgrass (*Zosteria marina*) (Steimle et al. 1999d). Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began, but Seabrook observed similar trends in the density of benthic invertebrates at the nearfield and farfield sites prior to and during operations (NAI 2010). Because scup inhabit a wide variety of habitats and kelp are not a primary or preferred habitat, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook is not likely to adversely affect EFH for scup during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the abundance of juvenile or adult scup prior to and during operations (NAI 2010).

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations are not likely to adversely affect EFH for juvenile or adult scup for the following reasons:

- Impingement and entrainment are relatively low for scup.
- The thermal plume quickly rises to the surface.
- Forage species and shellfish beds are not likely to be adversely affected by Seabrook operations.
- Scup use a wide variety of habitats other than kelp.

*D-1.3.3.14 Summer Flounder (*Paralicthys dentatus*) (Adult)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated adult summer flounder EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed summer flounder in less than 1 percent of trawling samples (Table D-1-2).

Species Description. Summer flounder are benthic fish that occurs from Nova Scotia to Florida (Packer et al. 1999). Adult summer flounder migrate seasonally, whereby summer flounder normally inhabit shallow coastal and estuarine waters during summer and remain offshore during the fall and winter (Lux and Nichy 1981, cited in Packer et al. 1999; Packer et al. 1999).

Adults prefer sandy habitats. Lascara (1981, cited in Packer et al. 1999) showed that adults remain along the vegetative perimeter of eelgrass patches and capture prey that move from within the grass. Adult summer flounder are opportunistic feeders and prey upon a variety of fish and crustaceans (Bigelow and Schroeder 1953; Packer et al. 1999). Common prey items include windowpane, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, American sand lance, bluefish, weakfish, mummichog, rock crabs, squids, shrimps, small bivalve and gastropod mollusks, small crustaceans, marine worms, and sand dollars (Packer et al. 1999). Predators of summer flounder include large sharks, rays, and goosefish.

Status of the Fishery. MAFMC manages the summer flounder fishery under the summer flounder, scup, and black sea bass FMP. In 2009, MAFMC did not consider the summer flounder fishery overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for summer flounder eggs and larvae, entrainment and impingement can adversely affect recruitment of adults. NAI (2010) did not observe summer flounder eggs in entrainment studies from 1990 through 2009. NAI (2010) observed entrainment of less than 100,000 summer flounder larvae during 3 years from 1990 through 2009 (Table D-1-5). NAI (2010) observed three impinged fish in 1994 and four impinged fish in 2006 (Table D-1-6).

Because entrainment and impingement of summer flounder were relatively rare at Seabrook, the NRC staff concludes that entrainment and impingement are not likely to adversely affect EFH for summer flounder during the remainder of the facility's operating license or during the proposed license renewal term.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to adult summer flounder. Summer flounder are primarily benthic (Packer et al. 1999). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for summer flounder during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Adult summer flounder are opportunistic feeders and prey upon a variety of fish and crustaceans (Bigelow and Schroeder 1953; Packer et al. 1999). NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of benthic invertebrates and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect summer flounder EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Adult summer flounder use open sandy areas and patches of eelgrass for feeding (Packer et al. 1999). Near the intake and discharge structures, it is reasonable to assume that patches of kelp may play a similar ecological role as eelgrass for summer flounder to ambush predators. Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations because operations began (NAI 2010). Because summer flounder use patches of vegetation to ambush predators, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook may have minimal adverse effects on EFH for adult summer flounder during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since adult summer flounder inhabit a variety of habitats and vegetation other than kelp.

Combined Impacts (Monitoring Data). Seabrook monitoring data do not provide data specific to the abundance of adult summer flounder prior to and during operations (NAI 2010).

Conclusion. Because summer flounder may use algal habitats that have declined near Seabrook since operations began, the NRC staff concludes that Seabrook may have minimal adverse effects on EFH for summer flounder near Seabrook. Impacts would likely be minimal because impingement and entrainment are relatively rare for summer flounder, the thermal plume quickly rises to the surface, and forage species and shellfish beds are not likely to be adversely affected by Seabrook operations.

*D-1.3.3.15 Whiting/Silver Hake (*Merluccius bilinearis*) (All life stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult silver hake EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed silver hake egg and larvae in greater than 10 percent of ichthyoplankton tows, juveniles and adults in greater than 10 percent of trawling samples, in greater than 10 percent of gill net samples, and in less than 1 percent of seine pull samples (Table D-1-2).

Species Description. Silver hake are schooling gadids (Lock and Packer 2004). Two stocks occur in the western Atlantic Ocean—one stock ranges from the Gulf of Maine to northern Georges Bank and the other stock ranges from southern Georges Bank to Cape Hatteras.

Coastal Gulf of Maine is a major spawning area for silver hake. Brodziak (2001) reported peak spawning from July through August in the northern stock of silver hake. Eggs and newly hatched larvae are pelagic (Lock and Packer 2004). After 3 to 5 months, larvae descend towards benthic habitats (Jeffrey and Taggart 2000). NEFSC MARMAP ichthyoplankton surveys captured eggs at temperatures ranging from 41 to 73° F (5 to 23 ° C) and larvae from 41 to 66° F (5 to 19° C) (Lock and Packer 2004).

Juvenile and adult silver hake make seasonal migrations, moving offshore as water temperatures decline in the fall and returning to shallow waters in spring and summer to spawn. Juvenile and adult silver hake are primarily benthic but will move up into the water column for feeding (Koeller et al. 1989; Lock and Packer 2004). Lock and Packer (2004) consider silver hake use and preference of various bottom habitats a future research need. NEFSC bottom trawl surveys captured juveniles at temperatures ranging from 36 to 70° F (2 to 21° C) and adults from 36 to 63° F (2 to 17° C) (Lock and Packer 2004).

Silver hake are an important predator species due to their dominant biomass and high prey consumption (Bowman 1984; Garrison and Link 2000). Silver hake diet varies with life stage, size, sex, season, migration, spawning, and age. Larvae prey on plankton such as copepod larvae and younger copepodites (Lock and Packer 2004). Juveniles generally consume euphausiids, shrimp, amphipods, and decapods (Bowman 1984). Adults and older juveniles mainly prey on schooling fish, such as young herring, mackerel, menhaden, alewives, sand lance, or silversides, although crustaceans and squids are also consumed (Bowman 1984; Garrison and Link 2000; Lock and Packer 2004). Predators include offshore, silver, white, red, and spotted hakes and to a lesser extent demersal gadids, pelagic fish species, and squids (Lock and Packer 2004).

Status of the Fishery. NEFMC manages the silver hake fishery. In 2009, NEFMC did not consider the silver hake fishery overfished (NMFS 2010b).

Entrainment and Impingement. Entrainment of silver hake eggs varied from 0.6 million in 1991 to 341.4 million in 2002 (NAI 2010). Annual average entrainment of silver hake eggs was 81.1 million per year from 1990 through 2009 (Table D-1-4). Silver hake was the third most commonly entrained egg species, comprising 9 percent of all entrained fish eggs at Seabrook from 1990 through 2009.

Entrainment of silver hake larvae varied from 0 in several years to 69 million in 1997 (NAI 2010). Annual average entrainment of silver hake larvae was 8.1 million per year from 1990 through 2009 (Table D-1-5). Silver hake larvae was the ninth most commonly entrained larval species, comprising 3 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of silver hake varied from 0 in 1994 to 1,177 in 2002 (NAI 2010). Annual average impingement was 167 fish per year from 1994 through 2009 (Table D-1-6). Silver hake comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment of silver hake was relatively common at Seabrook, the NRC staff concludes that entrainment may have minimal adverse effects on EFH for silver hake during the remainder of the facility's operating license or during the proposed license renewal term.

Effects would likely be minimal since the amount of water (or habitat) entrained in the Seabrook cooling system would be a very small proportion of available habitat for silver hake eggs and larvae.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to silver hake. NEFSC MARMAP ichthyoplankton surveys captured eggs at temperatures ranging from 41 to 73° F (5 to 23° C) and larvae from 41 to 66° F (5 to 19° C) (Lock and Packer 2004). Juveniles and adults are primarily benthic but may move into the water column for feeding (Lock and Packer 2004). NEFSC bottom trawl surveys captured juveniles at temperatures ranging from 36 to 70° F (2 to 21° C) and adults from 36 to 63° F (2 to 17° C) (Lock and Packer 2004). Surface waters near the thermal plume typically range as high as 65.8° F (18.8° C) (NAI 2001). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface would be within the typical range of temperatures that eggs and juveniles inhabit. However, the thermal plume may exceed the typical range of temperatures that larvae and adults inhabit. A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). The NRC staff concludes that the heated thermal effluent from Seabrook is not likely to adversely affect EFH for eggs and juveniles during the remainder of the facility's operating license or during the proposed license renewal term. This conclusion is based on the fact that the buoyant thermal plume at the discharge points quickly rises toward the surface, and the temperature range within the thermal plume at the surface would be within the typical range for eggs and juvenile silver hake. Because the thermal plume could exceed the typical range of temperatures that larvae and adults inhabit, the NRC staff concludes that the heated thermal effluent may adversely affect EFH for silver hake larvae and adults.

Loss of Forage Species. Silver hake consume a variety of prey, including copepod larvae, copepodites, euphausiids, shrimp, amphipods, decapods, and other crustaceans and schooling fish (e.g., young herring, mackerel, menhaden, alewives, sand lance, and silversides) and squids (Bowman 1984; Garrison and Link 2000; Lock and Packer 2004). NextEra's monitoring studies show relatively similar trends in abundance prior to and during operations at nearfield and farfield sampling sites for zooplankton, benthic invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect silver hake EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Lock and Packer (2004) consider silver hake use and preference of various bottom habitats a future research need. A recent literature search by NRC staff did not indicate that silver hake prefer or heavily rely on shellfish beds or algae covered areas.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of silver hake eggs, larvae juveniles, and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Monitoring data indicate that the abundance of silver hake eggs and larvae increased at both nearfield and farfield sampling sites (Table D-1-8). Gill net surveys indicate that abundance of silver hake within the water column decreased at both nearfield and farfield sites (Table D-1-10). Trawling surveys indicate that silver hake abundance near the sea floor decreased at the nearfield site but increased at the farfield sites (Table D-1-9). NAI (2010) did not report the statistical significance of this relationship. Because adult and juvenile silver hake decreased at nearfield trawling sites but increased at farfield trawling sites, these monitoring results suggest that Seabrook operation may adversely affect bottom habitat for adult and juvenile silver hake.

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations may adversely affect EFH for silver hake eggs, larvae, juveniles, and adults for the following reasons:

- Entrainment of silver hake eggs was relatively common at Seabrook.
- The thermal plume could exceed the typical range of temperatures that larvae and adults inhabit.
- Adult and juvenile silver hake decreased at nearfield trawling sites but increased at farfield trawling sites in NextEra monitoring studies.

*D-1.3.3.16 Windowpane Flounder (*Scopthalmus aquosus*) (Juveniles and Adults)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile and adult windowpane flounder EFH near Seabrook (NMFS 2011b). NAI (2010) observed windowpane flounder in greater than 10 percent of trawling samples, less than 1 percent of gill net samples, and 1 to 10 percent of seine pull samples (Table D-1-2).

Species Description. Windowpane flounder inhabit estuaries, coastal waters, and oceans over the continental shelf along the Atlantic coast from the Gulf of Saint Lawrence to Florida. This species is most abundant from Georges Bank to Chesapeake Bay (Chang et al. 1999). North of Cape Cod Bay, windowpane flounder inhabit nearshore waters, and distribution patterns within estuaries is not well documented (Chang et al. 1999).

Windowpane flounder spawn in estuaries. Juveniles migrate from estuaries to coastal waters during autumn, and they overwinter offshore in deeper waters. Adults remain offshore throughout the year but inhabit nearshore waters in spring and autumn (Chang et al. 1999). Langton et al. (1994) reported that adult windowpane occur primarily on sandy or muddy substrates in the Gulf of Maine.

Juvenile and adult windowpane flounder have similar food sources, including small crustaceans (especially shrimp) and fish larvae of hakes and tomcod. Predators include spiny dogfish, thorny skate (*Amblyraja radiata*), goosefish, Atlantic cod, black sea bass (*Centropristis striata*), weakfish (*Cynoscion regalis*), and summer flounder (Chang et al. 1999).

Status of the Fishery. The NEFMC manages windowpane flounder under the northeast multispecies FMP. Windowpane flounder have never been widely directly targeted as a commercial species but have been harvested in mixed-species fisheries since the 1900s. In the 1950s, landings were estimated to be as high as 2.04 million lb (924 MT) per year (Hendrickson 2006). Landings ranged from 1.1 to 2.0 million lb (500 to 900 MT) per year from 1975 through 1981, increased to a record high of 4.6 million lb (2,100 MT) in 1985, and they have since steadily declined (Hendrickson 2006). The windowpane stock structure has never been formally quantified, and windowpane bycatch and discards from other fisheries are unknown and may account for a significant portion of annual windowpane catch. Currently, NEFMC consider the New England and Mid-Atlantic stock overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for windowpane eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles and adults. Entrainment of windowpane eggs varied from 0.1 million in 1994 to 61.8 million in 2009 (NAI 2010). Annual average entrainment of windowpane eggs was 31.7 million per year from 1990 through 2009 (Table D-1-4). Windowpane was the eighth most commonly entrained egg species, comprising 3.5 percent of all entrained fish eggs at Seabrook.

Entrainment of windowpane larvae varied from 0.05 in 1991 to 6.5 million in 2002 (NAI 2010). Annual average entrainment of windowpane larvae was 2.3 million per year from 1990 through

2009 (Table D-1-5). Windowpane larvae comprised less than 1 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of windowpane varied from 161 in 2001 to 4,749 in 2003 (NAI 2010). Annual average impingement was 1,297 fish per year from 1994 through 2009 (Table D-1-6). Windowpane was the fifth most commonly impinged fish species, comprising 6.2 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment of windowpane eggs and impingement of juveniles and adults was relatively common at Seabrook, the NRC staff concludes that entrainment and impingement may have minimal adverse effects on EFH for windowpane during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of water (or habitat) captured in the Seabrook cooling system would be a very small proportion of available habitat for all stages of windowpane.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to juvenile or adult windowpane. Juvenile and adult windowpane are primarily benthic (Chang et al. 1999). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for juvenile or adult windowpane during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Juvenile and adult windowpane flounder prey on small crustaceans (especially shrimp) and fish larvae of hakes and tomcod. NextEra's monitoring studies show relatively similar trends in abundance prior to and during operations at nearfield and farfield sampling sites for zooplankton and invertebrates (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for windowpane flounder during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Juvenile and adult windowpane flounder do not appear to use shellfish bed or algae for habitat. Therefore, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook is not likely to adversely affect windowpane EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of windowpane juveniles and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Trawling surveys indicate that windowpane flounder decreased at the nearfield site but increased at the farfield sites (Table D-1-9). However, the confidence intervals overlapped, suggesting that this relationship would not be statistically significant. NAI (2010) did not report whether or not the relationship was statistically significant. These monitoring results suggest that Seabrook operation is not likely to adversely affect EFH of adult and juvenile windowpane.

Conclusion. Because entrainment of windowpane eggs and impingement of juveniles and adults were relatively common at Seabrook, the NRC staff concludes that Seabrook operation may have minimal adverse effects on EFH for windowpane during the remainder of the facility's operating license or during the proposed license renewal term. Impact would be minimal because the thermal plume quickly rises to the surface, forage species and shellfish beds are not likely to be adversely affected by Seabrook operations, and monitoring data shows similar trends at nearfield and farfield sites.

*D-1.3.3.17 Winter Flounder (*Pleuronectes americanus*) (All Life Stages)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated eggs, larvae, juvenile, and adult winter flounder EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed winter flounder larvae in greater than 10 percent of ichthyoplankton tows, juveniles and adults in greater than 10 percent of trawling samples, in 1 to 10 percent of gill net samples, and in more than 10 percent of seine pull samples (Table D-1-2).

Species Description. There are three stocks of winter flounder in the Atlantic—the Gulf of Maine, southern New England and the Middle Atlantic, and Georges Bank (Pereira et al. 1999). In New England, winter flounder are common in inshore and nearshore waters (Pereira et al. 1999). Adult winter flounder are a small-mouthed, right-eyed flounder that grow to 23 in. (58 cm) in total length and live up to 15 years (Pereira et al. 1999).

Adult winter flounder migrate inshore to bays and estuaries in the fall and early winter to spawn and may remain inshore year-round in areas where temperatures are 59° F (15° C) or lower and enough food is available (Pereira et al. 1999). Studies vary widely on the age of maturity of winter flounder. Generally, sexual maturity is dependent on size rather than age, and southern individuals reach spawning size more rapidly than northern fish. North of Cape Cod, O'Brien et al. (1993) determined that the median age of maturity was 11.7 in. (29.7 cm) for females and 10.9 in. (27.6 cm) for males. In the Hampton-Seabrook area, winter flounder spawn in coastal waters from February through April. Females spawn at depths of 7 to 60 ft (2 to 79 m) over sandy substrates in inshore coves and inlets at salinities of 31 to 32.5 parts per thousand (ppt) (Buckley 1989; Pereira et al. 1999). Eggs are demersal, stick to the substrate (such as gravel or algal fronds), and are most often found at salinities between 10 and 30 ppt (Buckley 1989; Crawford and Cary 1985). Larvae initially are planktonic but become increasingly benthic as they develop (Pereira et al. 1999). Juveniles and adults are completely benthic. Able et al. (1989, cited in Pereira et al. 1999) reported that juveniles use macroalgae. Juveniles move seaward as they grow, remaining in estuaries for the first year (Buckley 1989; Grimes et al. 1989). Adult winter flounder tolerate salinities of 5 to 35 ppt and prefer waters temperatures of 32 to 77° F (0 to 25° C).

Winter flounder larvae feed on small invertebrates, invertebrate eggs, and phytoplankton (Buckley 1989; Pereira et al. 1999). Adults feed on benthic invertebrates such as polychaetes, cnidarians, mollusks, and hydrozoans. Adults and juveniles are an important food source for predatory fish such as the striped bass (*Morone saxatilis*), bluefish, goosefish, spiny dogfish, and other flounders, and birds such as the great cormorant (*Phalacrocorax carbo*), great blue heron (*Ardea herodias*), and osprey (*Pandion haliaetus*) (Buckley 1989).

Status of the Fishery. Winter flounder are highly abundant in estuarine and coastal waters and, therefore, are one of the most important species for commercial and recreational fisheries on the Atlantic coast (Buckley 1989). Winter flounder are, generally, commercially harvested using otter trawl, but the species is also a popular recreational fish. Commercial landings of winter flounder peaked in the 1980s throughout its range and declined through the early 2000s (Brown and Gabriel 1998; Pereira et al. 1999). Commercial landings reached a record low in 2005 at 2.98 million lb (1,350 MT) but have increased slightly since, with landings at 3.58 million lb (1,622 MT) in 2007 (NEFSC 2008).

The NEFMC manages the winter flounder in Federal waters under the northeast multispecies FMP. As of 2009, the NEFMC reported that the Gulf of Maine winter flounder stock is overfished (NOAA 2010).

Entrainment and Impingement. Entrainment of winter flounder eggs varied from 0 in most years to 1.05 million in 2008 (NAI 2010). Annual average entrainment of winter flounder eggs was

96,500 per year from 1990 through 2009 (Table D-1-4). Winter flounder eggs comprised less than 1 percent of the total fish eggs entrained at Seabrook from 1990 through 2009.

Entrainment of winter flounder larvae varied from 0 in 1994 to 34.8 million in 2004 (NAI 2010). Annual average entrainment of winter flounder larvae was 9.2 million per year from 1990 through 2009 (Table D-1-5). Winter flounder larvae was the eighth most commonly entrained species, comprising 3.4 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of winter flounder varied from 102 in 2000 to 10,491 in 2003 (NAI 2010). Annual average impingement was 2,082 fish per year from 1994 through 2009 (Table D-1-6). Winter flounder was the third most commonly impinged fish species, comprising 10 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment of winter flounder larvae and impingement of juveniles and adults were relatively common at Seabrook, the NRC staff concludes that entrainment and impingement may have minimal adverse effects on EFH for winter flounder during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of water (or habitat) captured in the Seabrook cooling system would be a very small proportion of available habitat for all stages of winter flounder.

Thermal Effects. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to eggs, larvae, juvenile, or adult winter flounder. Winter flounder are primarily benthic (Pereira et al. 1999.) A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for winter flounder during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Forage Species. Winter flounder feed on phytoplankton, small invertebrates, invertebrate eggs, and benthic invertebrates such as polychaetes, cnidarians, mollusks, and hydrozoans. NextEra's monitoring studies show relatively similar trends prior to and during operations at nearfield and farfield sampling sites for the abundance, density, and species composition of zooplankton and invertebrates (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect winter flounder EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Loss of Habitat-forming Species. Window flounder eggs may be deposited on macroalgae (Crawford and Carey 1985), but spawning occurs in estuaries and NAI (2010) did not observe winter flounder eggs in monitoring studies near Seabrook, likely due to its offshore location. Able et al. (1989 in Pereira et al. 1999) reported that juveniles use macroalgae habitat, along with other types of habitats. Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling stations since operations began (NAI 2010). Because juvenile winter flounder may utilize macroalgae habitat, along with other types of aquatic vegetation, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook may have minimal adverse effects on juvenile winter flounder EFH during the remainder of the facility's operating license or during the proposed license renewal term.

Combined Impacts (Monitoring Data). NextEra monitored the abundance of winter flounder larvae, juveniles, and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Monitoring data indicate that the abundance of larvae decreased at both nearfield and farfield sampling sites

(Table D-1-8). Trawling data for juveniles and adults indicated different trends at the nearfield and farfield sites (NAI 2010). At the nearfield site, the abundance of winter flounder significantly decreased over time from a mean CPUE of 5.5 prior to operations to 2.3 during operations (Table D-1-9). However, at both farfield sampling sites, the mean CPUE increased from 2.8 and 1.4 prior to operations, respectively, to 4.0 and 3.6 during operations. This increase was statistically significant at one of the farfield sites. Based on monitoring data, NRC concludes that Seabrook operation has adversely affected EFH for winter flounder because the abundance of winter flounder has decreased to a greater and observable extent near Seabrook's intake and discharge structures compared to 3 to 4 mi (5 to 8 km) away.

Conclusion. Based on the above analysis, the NRC staff concludes that Seabrook operations may adversely affect EFH for winter flounder larvae, juveniles, and adults for the following reasons:

- Entrainment of winter flounder larvae and impingement of juveniles and adults were relatively common at Seabrook.
- Juveniles may use algal habitats that have declined near Seabrook since operations began.
- Ault and juvenile winter flounder abundance decreased at nearfield trawling sites but increased at farfield trawling sites in NextEra monitoring studies.

*D-1.3.3.18 Yellowtail Flounder (*Pleuronectes ferruginea*) (Juveniles and Adults)*

Designated EFH in the Vicinity of Seabrook. The NMFS has designated juvenile and adult yellowtail flounder EFH in the vicinity of Seabrook (NMFS 2011b). NAI (2010) observed yellowtail flounder in greater than 10 percent of trawling samples, in less than 1 percent of gill net samples, and in less than 1 percent of seine pull samples (Table D-1-2).

Species Description. Yellowtail flounder occur along the U.S. and Canadian coasts from the Gulf of St. Lawrence, Labrador, and Newfoundland to the Chesapeake Bay (Bigelow and Schroeder 1953; Johnson et al. 1999). Juveniles and adults are asymmetrical benthic flatfish (Johnson et al. 1999). Preferred habitat includes areas covered in sand or sand-mud sediments where demersal prey inhabits (Bowering and Brodie 1991; Johnson et al. 1999).

Juvenile yellowtail flounder consume primarily polychaetes while adult yellowtail flounder consume primarily crustaceans, such as amphipods and sand dollars (*Echinarachius parma*) (Johnson et al. 1999). Predators include spiny dogfish, winter skate, Atlantic cod, Atlantic halibut, fourspot flounder, goosefish, little skate, smooth skate, silver hake, bluefish, and sea raven (Johnson et al. 1999).

Status of the Fishery. Yellowtail first became commercial desirable in the 1930s and is currently a highly targeted fish (Johnson et al. 1999). In 2009, NEFMC considered yellowtail overfished (NMFS 2010b).

Entrainment and Impingement. Although NMFS has not designated EFH for yellowtail flounder eggs and larvae, entrainment and impingement can adversely affect recruitment of juveniles and adults. Entrainment of yellowtail flounder eggs varied from 0 in multiple years to 569.2 million in 1991 (NextEra 2010a). Annual average entrainment of yellowtail flounder eggs was 42.8 million per year from 1990 through 2009 (Table D-1-4). Yellowtail flounder eggs was the sixth most commonly entrained fish egg species, comprising 4.8 percent of the total fish eggs entrained at Seabrook from 1990 through 2009.

Entrainment of yellowtail flounder larvae varied from 0 in 1994 to 2.7 million in 2007 (NAI 2010). Annual average entrainment of winter flounder larvae was 0.4 million per year from 1990 through 2009 (Table D-1-5). Yellowtail flounder larvae comprised less than 1 percent of the total fish larvae entrained at Seabrook from 1990 through 2009.

Impingement of yellowtail flounder varied from 0 in several years to 1,149 in 1995 (NAI 2010). Annual average impingement was 83 fish per year from 1994 through 2009 (Table D-1-6). Yellowtail flounder comprised less than 1 percent of all impinged fish at Seabrook from 1994 through 2009.

Because entrainment of yellowtail flounder eggs was relatively common at Seabrook, the NRC staff concludes that entrainment may have minimal adverse effects on EFH for yellowtail flounder during the remainder of the facility's operating license or during the proposed license renewal term. Effects would likely be minimal since the amount of weather (or habitat) entrained in the Seabrook cooling system would be a very small proportion of available habitat for yellowtail flounder eggs.

<u>Thermal Effects</u>. The NRC staff does not expect Seabrook's thermal discharges to reduce available habitat to juvenile or adult yellowtail flounder. Juvenile and adult yellowtail flounder are benthic flatfish (Johnson et al. 1999). A relatively small area near the discharge structure in deep water experiences increased temperatures (NAI 2001; Padmanabhan and Hecker 1991). Because the buoyant thermal plume at the discharge points quickly rises toward the surface, the NRC staff concludes that the heated effluent from Seabrook is not likely to adversely affect EFH for yellowtail flounder during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Loss of Forage Species</u>. Juvenile yellowtail flounder consume primarily polychaetes while adult yellowtail flounder consume primarily crustaceans, such as amphipods and sand dollars (Johnson et al. 1999). NextEra's monitoring studies show relatively similar trends in abundance prior to and during operations at nearfield and farfield sampling sites for invertebrates (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect yellowtail flounder EFH during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Loss of Habitat-forming Species</u>. Juvenile and adult yellowtail flounder do not commonly use kelp or shellfish beds. Therefore, the NRC staff concludes that the potential loss of habitat-forming species at Seabrook is not likely to adversely affect yellowtail flounder EFH during the remainder of the facility's operating license or during the proposed license renewal term.

<u>Combined Impacts (Monitoring Data)</u>. NextEra monitored the abundance of yellowtail flounder juveniles and adults prior to and during operations at sampling sites near the intake and discharge structures and at sites 3 to 4 mi (5 to 8 km) away (NAI 2010). Monitoring data indicate that the abundance of juveniles and adults decreased at both nearfield and farfield sampling sites (Table D-1-9). Because NAI (2010) found similar trends at both the nearfield and farfield sites, these monitoring results suggest that Seabrook operations have not adversely affected EFH for juvenile or adult yellowtail.

<u>Conclusion</u>. Because entrainment of yellowtail flounder eggs was relatively common at Seabrook, Seabrook operation may have minimal adverse effects on EFH for juvenile and adult yellowtail flounder during the remainder of the facility's operating license or during the proposed license renewal term. Impacts would be minimal for the following reasons:

- Impingement and entrainment are relatively low for yellowtail flounder.
- The thermal plume quickly rises to the surface.

- Forage species and shellfish beds are not likely to be adversely affected by Seabrook operations.
- Monitoring data show similar trends at nearfield and farfield sites.

D-1.3.3.19 Essential Fish Habitat Species Not Likely to Regularly Occur Near Seabrook

The NMFS has designated EFH for eggs, larvae, juvenile and adult Atlantic halibut; adult bluefin tuna; larvae, juvenile, and adult redfish; and juvenile and adult longfin inshore squid and northern shortfin squid in the vicinity of Seabrook (NMFS 2011b). NAI (2010) never, rarely, or occasionally observed Atlantic halibut, bluefin tuna, redfish, northern shortfin squid, and longfin inshore squid during monitoring, entrainment, and impingement studies from the 1970s through 2009. For example, NAI (2010) rarely identified Atlantic halibut in trawling surveys and did not report Atlantic halibut in any other monitoring surveys or any impingement or entrainment studies. NAI (2010) occasionally identified redfish in trawling surveys and did not report redfish in other monitoring surveys or any impingement or entrainment studies. Bluefin tuna were not reported in any monitoring, entrainment, or impingement studies. Seabrook did not explicitly include longfin inshore squid and northern shortfin squid in its entrainment and impingement studies. However, field technicians did not recall any time that squid have been impinged at Seabrook (NRC 2011). Longfin inshore squid lay eggs on the seafloor and larvae are often found near the surface, whereas the intake structure is located in deeper water (Jacobson 1995). Northern shortfin squid eggs and larvae are pelagic, but primarily occur within the Gulf Stream (Hendrickson and Holmes 2004).

Bluefin tuna, longfin inshore squid, and northern shortfin squid are pelagic and, therefore, could encounter the thermal plume when passing by Seabrook. Surface waters near the thermal plume typically range as high as 65.8° F (18.8° C) (NAI 2001). NEFSC trawl data indicate that northern shortfin squid inhabit waters up to as 66° F (19° C), and longfin inshore squid inhabit waters up to as 79° F (26° C) (NAI 2001). With a temperature rise of 3 to 5° F (1.7 to 2.8° C), the thermal plume near the surface could exceed the typical temperature range for northern shortfin squid but would be within the typical temperature range for longfin inshore squid. Bluefin tuna have never been captured in any of NextEra's monitoring study; therefore, the relatively small size of the thermal plume is not likely to adversely affect large amounts of EFH for bluefin tuna if any happen to pass by Seabrook. The thermal plume is not likely to adversely affect EFH for Atlantic halibut or redfish because both of these species are pelagic and the thermal plume rises quickly to the surface.

Bluefin tuna, longfin inshore squid, and northern shortfin squid are pelagic and, therefore, not likely to regularly inhabit benthic habitats such as kelp forest or shellfish beds. Redfish and Atlantic halibut may use kelp near Seabrook, along with other habitats that provide structure. Seabrook monitoring data indicate that the density of several species of kelp has decreased at nearfield sampling sites since operations began (NAI 2010). Because the density of kelp is lower since operations began at Seabrook, but Atlantic halibut and redfish rarely or occasionally use habitat near Seabrook, the NRC staff concludes that Seabrook operations may have minimal adverse effects on Atlantic halibut and redfish.

Forage species for Atlantic halibut, bluefin tuna, redfish, longfin inshore squid, and northern shortfin squid are not likely to be adversely affected near Seabrook. Typical prey includes copepods, euphausiids, crabs, polychaetes, shrimp, and fish. NextEra's monitoring studies show relatively similar trends in abundance prior to and during operations at nearfield and farfield sampling sites for zooplankton, benthic invertebrates, and most fish species (NAI 2010). Therefore, the NRC staff concludes that the potential loss of forage species at Seabrook is not likely to adversely affect EFH for Atlantic halibut, bluefin tuna, redfish, longfin inshore squid, or northern shortfin squid during the remainder of the facility's operating license or during the proposed license renewal term.

Based on the above analysis, the NRC staff concludes that Seabrook operations may have minimal adverse effects on EFH for northern shortfin squid because the thermal plume near the surface could exceed the typical temperature range for northern shortfin squid. Seabrook operations may have minimal adverse effects on EFH for redfish and Atlantic halibut because both species may use kelp beds near Seabrook. Seabrook operations are not likely to affect EFH for longfin inshore squid or bluefin tuna.

D-1.4 Cumulative Effects to Essential Fish Habitat

This section addresses the direct and indirect effects of license renewal on EFH when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. The geographic area considered in the cumulative aquatic resources analysis includes the vicinity of Seabrook, the offshore intake and discharge structures, the Hampton-Seabrook Estuary, and the rivers that drain into the Hampton-Seabrook Estuary.

Section 2.2.6.2 of the SEIS summarizes the condition of the Gulf of Maine and the Hampton-Seabrook Estuary and the history and factors that led to its current condition. The direct and indirect impacts from fishing are some of the most influential human activities on the Gulf of Maine ecosystem (Sosebee et al. 2006). Fishing has caused wide-scale changes in fish populations and food web dynamics within the Gulf of Maine (Sosebee et al. 2006; Steneck et al. 1994). In the Hampton-Seabrook Estuary, wetland habitat and water flow has been affected by human uses such as those listed below (Eberhardt and Burdick 2009):

- harvesting salt marsh hay (*Spartina patens*) as feed for livestock in the 1700 and 1800s;
- digging ditches in an attempt to control mosquito populations in the early 1900s; and
- building roads, jetties, commercial buildings, and residential areas in the 1900s and 2000s.

The increased urbanization in the past 100 years has caused increased runoff and levels of pollutants within the Hampton-Seabrook Estuary (NHDES 2004). In the rivers connected to Hampton-Seabrook Estuary, dams block fish migrations and have resulted in the precipitous decline of anadromous fish that move to freshwater to spawn and to marine waters to grow and feed (Eberhardt and Burdick 2009).

Many natural and anthropogenic activities can influence the current and future EFH in the area surrounding Seabrook. Potential biological stressors include continued entrainment, impingement, and potential heat shock from Seabrook (if the license renewal is granted), and fishing mortality, climate change, energy development, and urbanization, as described below.

Fishing. Fishing has been a major influence on the population levels of commercially sought fish species in the Gulf of Maine (Sosebee et al. 2006). The Hampton-Seabrook Estuary and the Gulf of Maine support significant commercial and recreational fisheries for many of the fish and invertebrate species also affected by Seabrook operations. EPA (2002b) determined that 69 percent of all entrained and impinged fish species at Seabrook are commercially or recreationally fished. From 1990 through 2000, Atlantic cod comprised 33 percent of the catch in New Hampshire and 25 percent of the revenue. Other commercially important and EFH species in New Hampshire include spiny dogfish shark, pollock, Atlantic herring, bluefin tuna, American plaice, white hake, yellowtail flounder, and shrimp. Recreationally fished species include American lobster, striped bass, summer flounder, Atlantic cod, scup, and bluefish (EPA 2002b). Federal, regional, and State agencies manage many of these fisheries, although the biomass of many fish stocks have not rebounded to pre-1960s levels (Sosebee 2006). Indirect impacts from fishing include habitat alteration as well as indirect effects that propagate throughout the food web.

For these reasons, the NRC staff concludes that fishing pressure has the potential to continue to influence the aquatic ecosystem, especially food webs, and may continue to contribute to cumulative impacts on EFH.

Climate Change. The potential cumulative effects of climate change on the Gulf of Maine and Hampton-Seabrook Estuary could result in a variety of changes that would affect EFH. The environmental factors of significance identified by the U.S. Global Change Research Program (USGCRP) (2009) include temperature increases and sea level rise. Warming sea temperatures may influence the abundance and distribution of species, as well as earlier spawning times. For example, USGCRP (2009) projects that lobster populations will continue to shift northward in response to warming sea temperatures. Atlantic cod, which were subject to intense fishing pressure and other biological stressors, are likely to be adversely affected by the warmer temperatures because this species inhabits cold waters (USGCRP 2009). USGCRP (2009) projects that the Georges Bank Atlantic cod fishery will likely diminish by 2100. NMFS (2009) analyzed fish abundance data from 1968 through 2007 and determined that the range of several species of fish is moving northward or deeper, likely in response to warming sea temperatures.

Warmer temperatures can also lead to earlier spawning because spawning time is often correlated with a distinct temperature ranges. Seabrook monitoring studies showed a shift in blue mussel spawning times (NAI 2010). From 1996 through 2002, and select years from 2002 through 2009, the greatest blue mussel larval density occurred in mid-April, whereas the greatest blue mussel larval density occurred in late April in the 1970s, 1980s, and early 1990s.

Sea level rise could result in dramatic effects to nearshore communities and EFH, including the reduction or redistribution of kelp, eelgrass, and wetland communities. Aquatic vegetation is particularly susceptible to sea level rise because it is immobile and cannot move to shallower areas. In addition, most species grow within a relatively small range of water depth in order to receive sufficient light to photosynthesize.

The ocean absorbs nearly one-third of the carbon dioxide (CO_2) released into the atmosphere (NMFS 2011d). As atmospheric CO_2 increases, there is a concurrent increase in CO_2 levels in the ocean (NMFS 2011d). Ocean acidification is the process by which CO_2 is absorbed by the ocean, forming carbonic and carbolic acids that increase the acidity of ocean water. More acidic water can lead to a decrease in calcification (or a softening) of shells for bivalves (e.g., Atlantic sea scallops and Atlantic surf clams), decreases in growth, and increases in mortality in marine species (Nye 2010).

The extent and magnitude of climate change impacts to the aquatic resources of the Gulf of Maine and the Hampton-Seabrook Estuary are an important component of the cumulative assessment analyses and could be substantial.

Energy Development. As part of a technical workshop held by NOAA, Johnson et al. (2008) categorized the largest non-fishing impacts to coastal fishery habitats. Johnson et al. (2008) determined that the largest known and potential future impacts to marine habitats are primarily from the development of energy infrastructure, including petroleum exploration, production, and transportation; liquefied natural gas development; offshore wind development; and cables and pipelines in aquatic ecosystems.

Petroleum explorations and offshore wind development can result in habitat conversion and a loss of benthic habitat as developers dig, blast, or fill biologically productive areas. Petroleum and liquefied natural gas development can adversely affect water quality if there are oil spills or discharges of other contaminants during exploration- or transportation-related activities. Underwater cables and pipelines may block fish and other aquatic organisms from migrating to various habitats (Johnson et al. 2008). Thus, energy development may contribute to future cumulative impacts in a variety of ways.

Urbanization. The area surrounding the Hampton-Seabrook Estuary experienced increased residential and commercial development in the 1900s, as the seaside town became a popular tourist destination (Eberhardt and Burdick 2009). At the beginning of the 21st century, moderate commercial and residential development surrounded the Hampton-Seabrook Estuary (NHNHB 2009). The town of Hampton's Master Plan calls for continued growth in the area to sustain its attractiveness for tourists (Hampton 2001).

Increased urbanization has led, and will likely continue to lead, to additional stressors on the Hampton-Seabrook Estuary. Runoff from developed and agricultural areas has increased the concentration of nutrients, bacteria, and other pollutants to the estuary. Sections of the Hampton-Seabrook Estuary are listed on New Hampshire's 303(d) list as being impaired due to high concentrations of bacteria (NHDES 2004). NHDES (2004) also lists the estuary as impaired for fish and shellfish consumption due to polychlorinated biphenyl, dioxin, and mercury concentrations in fish tissue and lobster tomalley. Other activities that may affect marine aquatic resources in Hampton-Seabrook Estuary include periodic maintenance dredging, continued urbanization and development, and construction of new overwater or near-water structures (e.g., docks), and shoreline stabilization measures (e.g., sheet pile walls, rip-rap, or other hard structures).

Future threats to salt marshes in the Hampton-Seabrook Estuary include developmental activities that further hydrological alterations from filling wetlands or other physical changes that alter the flow of tidal waters (Johnson et al. 2008; NHNHB 2009). Increased nutrients and pollutants in storm runoff are also current threats to the health of this ecosystem (NHNHB 2009). The NRC staff concludes that the direct and indirect impacts from future urbanization are likely to contribute to cumulative impacts in the Hampton-Seabrook Estuary.

Conclusion. The direct impacts to fish populations, from fishing pressure and alterations of aquatic habitat within the Hampton-Seabrook watershed from past activities, have had a significant effect on aquatic resources in the geographic area near Seabrook. These aquatic ecosystems have been adversely affected, as evidenced by the low population numbers for several commercially sought fisheries, the change in food web dynamics, habitat alterations, and the blockage of fish passage within the Hampton-Seabrook watershed. The cumulative stress from the activities described above, spread across the geographic area of interest, depends on many factors that NRC staff cannot quantify but are likely to adversely affect EFH when all stresses on the aquatic communities are assessed cumulatively. Therefore, the NRC staff concludes that the cumulative impacts from the proposed license renewal and other past, present, and reasonably foreseeable projects may adversely affect the EFH of most species, especially Atlantic cod due to climate change.

D-1.5 Essential Fish Habitat Conservation Measures

NextEra prepared a proposal for information collection (PIC) as a first step to comply with EPA's 2004 proposed Phase II rule of Section 316(b) of CWA (NAI and ARCADIS 2008). In this document, NextEra identified three types of mitigation that are now in place and reduce entrainment and impingement (NAI and ARCADIS 2008). First, the location of the intake structures is offshore in an area of reduced biological activity as compared to an inshore location. Second, the design of the intake structures includes velocity caps, which fish tend to avoid due to the changes in horizontal flow of water created by the velocity cap. Third, less water is pumped from the Gulf of Maine to Seabrook due to the offshore location, which provides cooler water than an inshore location (NAI and ARCADIS 2008).

NextEra identified other intake technologies that might mitigate adverse intake effects, such as physical barriers, collection systems, diversion systems, and behavioral deterrent systems. Velocity caps that are installed on Seabrook's intake structures are considered behavioral deterrents. In addition, NextEra installed a seal deterrent system by adding vertical bars on intake structures to prevent seals from being trapped and drowning (NextEra 2010a). NextEra did not consider any additional physical barriers, collection, or diversion systems to be practical for Seabrook due to the additional costs associated with designing and constructing these technologies in an open water environment as compared to an inshore environment.

D-1.6 Conclusion

Table D-1-13 summarizes NRC conclusions on the effect of Seabrook operation on habitat for the 23 EFH species that may occur within the vicinity of Seabrook.

Table D-1-13. Summary of NRC Conclusions Regarding the Effect on Habitat by Species and Life Stages

Species	Eggs	Larvae	Juveniles	Adults	Rational for adverse impact
American plaice			NL[(a)]	NL	
Atlantic butterfish	NL	NL	NL	NL	
Atlantic cod	NL	MIN[(b)]	MIN	MIN	Some of the primary and preferred forage fish, such as Atlantic herring and American sand lance, are regularly entrained and impinged at Seabrook; the thermal plume near the surface could slightly exceed the typical range of temperatures that Atlantic cod inhabit; juvenile cod likely use kelp beds near Seabrook.
Atlantic halibut	NL	NL	MIN	MIN	Atlantic halibut may use algal habitats that have declined near Seabrook since operations began.
Atlantic herring			MIN	MIN	The thermal plume near the surface could slightly exceed the typical range of temperatures that Atlantic herring juveniles and adults inhabit.
Atlantic mackerel	MIN	NL	NL	MIN	Atlantic mackerel is the second most entrained egg species, comprising 21.3 percent of the total fish eggs entrained at Seabrook. The thermal plume near the surface could exceed the typical temperature range that adult Atlantic mackerel inhabit.
Atlantic sea scallop	NL	NL	MIN	NL	Newly settled Atlantic sea scallops may use algal habitats that have declined near Seabrook since operations began.
Atlantic surf clam			NL	NL	
Bluefin tuna				NL	
Haddock			NL		
Longfin inshore squid			NL	NL	
Monkfish/ Goosefish	MIN	MIN	MIN	NL	The thermal plume near the surface could slightly exceed the typical range of temperatures that goosefish eggs and larvae inhabit; juveniles may use algal habitats that have declined near Seabrook since operations began.
Northern shortfin squid			MIN	MIN	The thermal plume near the surface could exceed the typical temperature range for northern shortfin squid.
Ocean pout	NL	NL	MIN	NL	Juveniles may use algal habitats that have declined near Seabrook since operations began.

Species	Eggs	Larvae	Juveniles	Adults	Rational for adverse impact
Pollock			MIN		Pollock is the sixth most impinged fish species, comprising 6.1 percent of the total fish impinged at Seabrook. Juveniles may use algal habitats that have declined near Seabrook since operations began.
Redfish		NL	MIN	MIN	Redfish may use algal habitats that have declined near Seabrook since operations began.
Red hake	MIN	MIN	MIN	MIN	The hake (which includes red, white, and spotted hake) comprised 6.2 percent of all entrained fish eggs and 6.5 percent of all impinged fish at Seabrook.
Scup			NL	NL	
Summer flounder				MIN	Summer flounder may use algal habitats that have declined near Seabrook since operations began.
Whiting/Silver hake	ADV [c]	ADV	ADV	ADV	Silver hake was the third most commonly entrained egg species, comprising 9 percent of all entrained fish eggs at Seabrook. The thermal plume could exceed the typical range of temperatures that larvae and adults inhabit, and adult and juveniles decreased at nearfield trawling sites but increased at farfield trawling sites in NextEra monitoring studies.
Windowpane flounder			MIN	MIN	Windowpane comprised 3.5 percent of all entrained eggs and 6.2 percent of all impinged fish at Seabrook
Winter flounder	NL	ADV	ADV	ADV	Winter flounder was the third most commonly impinged fish species, comprising 10 percent of all impinged fish. Winter flounder larvae was the eighth most commonly entrained species, comprising 3.4 percent of the total fish larvae entrained. Winter flounder may use algal habitats that have declined near Seabrook since operations began. Adult and juvenile winter flounder abundance decreased at nearfield trawling sites but increased at farfield trawling sites in NextEra monitoring studies.
Yellowtail flounder			MIN	MIN	Yellowtail flounder eggs was the sixth most commonly entrained fish egg species, comprising 4.8 percent of the total fish eggs entrained at Seabrook.

[a] NL= Seabrook operation is not likely to affect EFH.

[b] MIN= Seabrook operation may have minimal adverse effects on EFH.

[c] ADV= Seabrook operation may adversely affect EFH.

D-1.7 References

Able, K.W., K.A. Wilson and K.L. Heck, Jr., 1989, "Fishes of the Vegetated Habitats in New Jersey Estuaries: Composition, Distribution and Abundance, Based on Quantitative Sampling," Center for Coastal and Environmental Studies, Rutgers University, New Brunswick, NJ, Publication No. 1041, 39 p. in Pereira et al., 1999

Almeida, F.P., D.L. Hartley and J. Burnett, 1995, "Length–weight Relationships and Sexual Maturity of Goosefish off the Northeast Coast of the United States," *North American Journal of Fisheries Management*, 15: 14–25.

ARCADIS et al., 2008, "Cooling Water Intake Structure Information Document," Prepared for Florida Power and Light (FPL) Energy Seabrook, LLC (FPLE), Appendix A, July 2008.

Armstrong, M. P., J. A. Musick and J. A. Colvocoresses, 1996, "Food and Ontogenetic Shifts in Feeding of the Goosefish, *Lophius americanus," Journal of Northwest Atlantic Fishery Science*, 18: 99–103.

Auster, P.J., R.J. Malatesta and S.C. LaRosa, 1995, "Patterns of Microhabitat Utilization by Mobile Megafauna on the Southern New England (USA) Continental Shelf and Slope," *Mar. Ecol. Prog. Ser.*, 127: 77–85.

Baird, S.F., 1873, "Natural History of Some of the More Important Food-Fishes of the South Shore of New England," *Report on the Condition of the Sea Fisheries of the South Coast of New England in 1871 and 1872*, Rep. Commissioner U.S. Comm. Fish. Fisheries, Pt. I, p. 228–235, in Steimle et al., 1999d.

Berrien, P., 1982, "Atlantic mackerel, *Scomber scombrus*," *MESA New York Bight Atlas Monograph 15*, Sea Grant Institute, Albany, NY, p. 99–102, in Studholme et al., 1999.

Bigelow, H.B. and W.C. Schroeder, 1953, "Fishes of the Gulf of Maine," *FWS Bulletin 53*, 577 p.

Bigelow, H.B. and W.C. Schroeder, 2002, "Butterfish, *Porontus triacanthus* (Peck) 1800: in Fishes of the Gulf of Maine," *Fishery Bulletin of the Fish and Wildlife Service*, No. 74, Vol. 53, Revision 1.1, originally published in 1953, Available URL: http://www.gma.org/fogm/Poronotus_triacanthus.htm (accessed December 14, 2010).

Bowering, W.R. and W.B. Brodie, 1991, "Distribution of Commercial Flatfishes in the Newfoundland-Labrador Region of the Canadian Northwest Atlantic and Changes in Certain Biological Parameters since Exploitation," *Neth. J. Sea Res*., 27: 407–422.

Bowman, R.E., 1975, "Food habits of Atlantic cod, haddock, and silver hake in the northwest Atlantic, 1969-1972," *U.S. Natl. Mar. Fish. Serv., Northeast Fish. Cent. Lab. Ref*., 75-1; 53 p. in Lough, 2004.

Bowman, R.E., 1984, "Food of Silver Hake, *Merluccius bilinearis," Fish. Bull. (U.S.)*, 82: 21–35.

Bowman, R.E. and W.L. Michaels, 1984, "Food of Seventeen Species of Northwest Atlantic Fish," *NOAA Tech. Mem. NMFS-F/NEC-28*, 183 p.

Bowman, R.E., et al., 1987, "Food and Distribution of Juveniles of Seventeen Northwest Atlantic Fish Species, 1973–1976," *NOAA Tech. Mem. NMFS-F/NEC-45*, 57 p.

Brodziak, J., 2001, "Silver Hake," Available URL: http://www.nefsc.nmfs.gov/sos/spsyn/pg/silverhake/silverhake.pdf (accessed October 15, 2001), in Lock and Packer, 2004.

Brodziak, J., 2005, “Essential Fish Habitat Source Document: Haddock, *Melanogrammus aeglefinus*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 2nd Edition, 196; 64 p.

Brown, R. and W. Gabriel, 1998, “Winter Flounder,” *Status of the Fishery Resources off the Northeastern United States for 1998*, *NOAA Tech. Mem. NMFS-NE-115,* p. 81-84.

Buckley, J., 1989, “Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic)—Winter Flounder,” U*.S. Fish and Wildlife Service Biological Report, 82(11.87)*, U.S. Army Corps of Engineers, TR EL 82 4. Available URL: http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-087.pdf (accessed September 7, 2010).

Cargnelli, L.M., et al., 1999, “Essential Fish Habitat Source Document: Pollock, Pollachius Virens, Life History and Habitat Characteristics,” *NOAA Tech Memo, 131*; 30 p.

Cargnelli, L.M., et al., 1999a, “Essential Fish Habitat Source Document: Atlantic Surfclam, Spisula solidissima, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE,* 142; 13 p.

Chang, S., 1990, “Seasonal Distribution Patterns of Commercial Landings of 45 Species off the Northeast United States during 1977–88,” *NOAA Tech. Mem. NMFS-F/NEC-78*, 130 p.

Chang, S., 1999, “Essential Fish Habitat Source Document: Windowpane, Scophthalmus aquosus, Life History and Habitat Characteristics,” *NOAA Technical Memorandum NMFS-NE-137*, Available URL: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm137/tm137.pdf (accessed December 7, 2010).

Cross, J.N., et al., 1999, “Essential Fish Habitat Source Document: Butterfish, Peprilus triacanthus, Life History and Habitat Characteristics,” *NOAA Technical Memorandum NMFS-NE-145*, Available URL: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm145/tm145.pdf (accessed December 7, 2010).

Crawford, R.E. and C.G. Carey, 1985, “Retention of Winter Flounder Larvae within a Rhode Island Salt Pond,” *Estuaries*, 8: 217–227.

Dow, R.L. and F.T. Baird, Jr., 1960, “Scallop Resources of the United States Passamaquoddy Area,” U*.S. Fish. Wildl. Serv. Spec. Sci. Rep*., Fish. No. 367., 9 p. in Hart and Chute, 2004.

Edwards, R.L. and R.E. Bowman, 1979, “Food Consumed by Continental Shelf Fishes,” *Predator-prey Systems in Fish Communities and their Role in Fisheries Management*, Sport Fishing Institute, Washington, D.C., pp. 387–406, in Lough, 2004.

Fahay, M.P., 1983, “Guide to the Early Stages of Marine Fishes Occurring in the Western North Atlantic Ocean, Cape Hatteras to the Southern Scotian Shelf,” *J. Northwest Atl. Sci*., 4: 1–423.

Fisheries and Oceans Canada (DFO), 1989, *Communications Directorate*, Ottawa, Ontario, Available URL: http://www.mi.mun.ca/mi%2Dnet/fishdeve/plaice.htm (accessed February 25, 2004), in Johnson, 2004.

FPLE, 2008, “Seabrook Station Updated Final Safety Analysis Report,” Revision 12, August 1, 2008.

Gallego, A. and M.R. Heath, 1994, “The Development of Schooling Behaviour in Atlantic Herring, *Clupea harengus,” J. Fish. Biol*., 45: 569–588.

Garrison, L.P. and J.S. Link, 2000, “Diets of Five Hake Species in the Northeast United States Continental Shelf Ecosystem,” *Mar. Ecol. Prog. Ser*., 204: 243–255.

Hardy, J.D., Jr., 1978, “Development of Fishes of the Mid-Atlantic Bight: An Atlas of Egg, Larval and Juvenile Stages, Vol. 2 Anguillidae through Syngnathidae,” *U.S. Fish Wildl. Serv. Biol. Serv. Prog.*, FWS/OBS-78/12, 458 p. in Cargnelli, et al., 1999.

Hart D.R. and A.S. Chute, 2004, “Essential Fish Habitat Source Document: Sea Scallop, *Placopecten magellanicus*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 2nd Edition, 189; 21 p.

Hartley, D.L., 1995, “The Population Biology of the Goosefish, *Lophius americanus*, in the Gulf of Maine,” M.S. Thesis, University of Massachusetts, Amherst, MA, 142 p., in Steimle et al., 1999a.

Hendrickson, L., 2006. “Status of Fishery Resources off the Northeastern U.S.: Windowpane Flounder (*Scophthalmus aquosus*),” December 2006. Available URL: http://www.nefsc.noaa.gov/sos/spsyn/fldrs/window/ (accessed December 10, 2010).

Hendrickson LC, Holmes EM, 2004, “Essential Fish Habitat Source Document: Northern shortfin squid, *Illex illecebrosus*, Life History and Habitat Characteristics (2nd edition),” *NOAA Tech Memo NMFS NE* 191; 36 p.

Jacobson LD, 2005, “Essential Fish Habitat Source Document: Longfin inshore squid, *Loligo pealeii*, Life History and Habitat Characteristics (2nd edition),” *NOAA Tech Memo NMFS NE* 193; 42 p.

Jeffrey, J.A. and C.T. Taggart, 2000, “Growth Variation and Water Mass Associations of Larval Silver Hake (*Merluccius bilinearis*) on the Scotian Shelf,” *Can. J. Fish. Aquat. Sci*., 57:1728−1738.

Johnson, D.L., 2005, “Essential Fish Habitat Source Document: American plaice, *Hippoglossoides platessoides*, Life History And Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 2nd Edition, 187; 72 p.

Johnson D.L., et al., 1999, “Essential Fish Habitat Source Document: Yellowtail flounder, *Limanda ferruginea*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 140; 29 p.

Johnson, M.R., et al., 2008, “Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States,” *NOAA Technical Memorandum NMFS-NE-209,* NMFS, Northeast Regional Office, Gloucester, MA.

Kane, J., 1984, “The Feeding Habits of Co-occurring Cod and Haddock Larvae from Georges Bank,” *Mar. Ecol. Prog. Ser*., 16: 9–20.

Keats, D.W., 1991, “American Plaice, *Hippoglossoides platessoides* (Fabricius), Predation on Green Sea Urchins, *Strongylocentrotus droebachiensis* (O.F. Muller) in eastern Newfoundland,” *J. Fish Biol*., 38: 67–72.

Klein-MacPhee, G., 2002, “Haddock/*Melanogrammus aeglefinus* Linnaeus 1758,” *Bigelow and Schroeder’s fishes of the Gulf of Maine*, Smithsonian Institution Press, Washington D.C., 3rd Edition, pp. 235–242.

Koeller, P.A., L. Coates-Markle, and J.D. Neilson, 1989, “Feeding Ecology of Juvenile (Age-0) Silver Hake (*Merluccius bilinearis*) on the Scotian Shelf,” *Can. J. Fish. Aquat. Sci*., 46: 1762−1768.

Langton, R.W., J.B. Pearce, and J.A. Gibson, eds., 1994, “Selected Living Resources, Habitat Conditions, and Human Perturbations of the Gulf of Maine: Environmental and Ecological Considerations for Fishery Management,” *NOAA Tech. Mem*., NMFS-NE-106, 70 p.

Langton, R.W., W.E. Robinson, and D. Schick, 1987, “Fecundity and Reproductive Effort of Sea Scallops *Placopecten magellanicus* from the Gulf of Maine,” *Mar. Ecol. Prog. Ser*., 37: 19–25.

Langton, R.W. and L. Watling, 1990, “The Fish-Benthos Connection: A Definition of Prey Groups in the Gulf of Maine,” *Trophic Relationships in the Marine Environment: Proceedings 24th European Marine Biology Symposium,* Aberdeen University Press, Aberdeen, Scotland, pp. 424–438, in Steimle et al., 1999b.

Larsen, P.F. and R.M. Lee, 1978, “Observations on the Abundance, Distribution and Growth of Post-Larval Sea Scallops, *Placopecten magellanicus*, on Georges Bank,” *Nautilus*, 92: 112−116.

Lascara, J., 1981, “Fish Predator-prey Interactions in Areas of Eelgrass (*Zostera marina*),” M.S. thesis, Coll. William and Mary, Williamsburg, VA. 81 p., in Packer et al. 1999.

Link, J.S. and L.P. Garrison, 2002, “Trophic Ecology of Atlantic cod *Gadus morhua* on the Northeast US Continental Shelf,” *Mar. Ecol. Prog. Ser*., 227: 109–123.

Lock M.C. and P.B. Packer, 2004, “Essential Fish Habitat Source Document: Silver Hake, *Merluccius bilinearis*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 2nd Edition, 186; 68 p.

Lough, R.G., 2004, “Essential Fish Habitat Source Documents: Atlantic Cod, *Gadus morhua*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 2nd Edition, 190; 94 p.

Lux, F.E. and F.E. Nichy, 1981, “Movements of Tagged Summer Flounder, *Paralichthys dentatus*, off Southern New England,” *NOAA Tech. Rep. NMFS SSRF-752*, 16 p., in Packer et al., 1999.

MacDonald, J.S., 1983., “Laboratory Observations of Feeding Behavior of the Ocean Pout (*Macrozoarces americanus*) and Winter Flounder (*Pseudopleuronectes americanus*) with Reference to Niche Overlap of Natural Populations,” *Can. J. Zool*., 61: 539–546.

MacDonald, J.S. and R.H. Green, 1986, “Food Resource Utilization by Five Species of Benthic Feeding Fish in Passamaquoddy Bay, New Brunswick,” *Can. J. Fish. Aquat. Sci*., 43: 1534−1546.

Martin, F.D. and G.E. Drewry, 1978, “Development of Fishes of the Mid-Atlantic Bight: An Atlas of Egg, Larval and Juvenile Stages, Vol. 6: Stromateidae through Ogcocephalidae,” *U.S. Fish Wildl. Serv. Biol. Serv. Prog*., FWS/OBS 78/12, 416 p. in Steimle, et al., 1999a.

Maurer, R. and R.E. Bowman, 1975, “Food Habits of Marine Fishes of the Northwest Atlantic—Data Report,” *U.S. Natl. Mar. Fish. Serv. Northeast Fish. Cent. Woods Hole Lab. Ref. Doc*., 75-3, 90 p. in Stevenson and Scott, 2005.

Mayo, R., 1995, “Atlantic Cod,” *Status of the Fishery Resources off the Northeastern United States for 1994, NOAA Tech. Mem. NMFS-NE*, 108: 44–47.

Merrill, A.S. and Ropes, J.W., 1969, “The General Distribution of the Surf clam and Ocean quahog,” *Proc. Nat. Shellfish, Assoc.* 59: 40-45, in Cargnelli et al., 1999a.

Munroe, T.A., 2002, “Atlantic herring/*Clupea harengus* Linnaeus 1758,” *Bigelow and Schroeder’s Fishes of the Gulf of Maine*, Smithsonian Institution Press, Washington D.C., 3rd Edition, pp. 141–156.

National Marine Fisheries Service (NMFS), July 30, 2002, "Small Takes of Marine Mammals Incidental to Specified Activities; Taking of Marine Mammals Incidental to Power Plant Operations," *Federal Register*, Vol. 67, No., 146, pp. 49292–49293.

NMFS, 2009, "Ecosystem Assessment Report for the Northeast U.S. Continental Shelf Large Marine Ecosystem," Northeast Fisheries Science Center Reference Document 09 11, Northeast Fisheries Science Center, Ecosystem Assessment Program.

NMFS, 2010a, Letter from P. Kurkul, Regional Administrator, to B. Pham, Branch Chief, NRC. Subject: Renewal Application for Seabrook Station, Seabrook, NH, Agencywide Documents Access and Management System (ADAMS) Accession No. ML102240108.

NMFS, 2010b, "2009 Status of U.S. Fisheries: Message from Eric Schwaab NOAA's Assistant Administrator for Fisheries, Status Determination by Region, Changes in Stock Status for 2009," Office of Sustainable Fisheries.

NMFS, 2011a, *Guide to Essential Fish Habitat Designations in the Northeastern Unites States,* Available URL: http://www.nero.noaa.gov/hcd/webintro.html (accessed March 8, 2011).

NMFS, 2011b, *Summary of Essential Fish Habitat (EFH) Designation,* Available URL: http://www.nero.noaa.gov/hcd/STATES4/Gulf_of_Marine_3_western_part/42507040.html (accessed March 8, 2011).

NMFS, 2011c, *Guide to Essential Fish Habitat Descriptions,* Available URL: http://www.nero.noaa.gov/hcd/list.htm (accessed March 22, 2011).

NMFS, 2011d, *Ocean Acidification: The Other Carbon Dioxide Problem,* Available URL: http://www.pmel.noaa.gov/co2/story/Ocean+Acidification (accessed February 22, 2011).

National Oceanic and Atmospheric Administration (NOAA), 2009, "NOAA Fisheries Weekly Quota Management Report for Butterfish, Week Ending December 26, 2009." Available URL: http://www.nero.noaa.gov/ro/fso/reports/reports_frame.htm (accessed December 9, 2010).

NOAA, 2010, "Butterfish Coastwide Weekly Landings Report." Available URL: http://www.nero.noaa.gov/ro/fso/reports/reports_frame.htm (accessed December 9, 2010).

NextEra, 2010 "Applicant's Environmental Report—Operating License Renewal Stage," Appendix E, Docket No. 050-443, ADAMS Accession Nos. ML101590092 and ML101590089.

NextEra Energy Seabrook, LLC (NextEra), 2010a, letter to U.S. NRC Document Control Desk, "Seabrook Station Response to Request for NextEra Energy Seabrook License Renewal Environmental Report," SBK-L-10185, Docket No. 50-443, ADAMS Accession No. ML103350639.

Normandeau Associates Inc. (NAI), 1998, "Seabrook Station 1996 Environmental Monitoring in the Hampton-Seabrook Area: A Characterization of Environmental Conditions," Prepared for Northeast Utilities Service Company.

NAI, 2001, "Seabrook Station Essential Fish Habitat Assessment," R-18900.009, Prepared for North Atlantic Energy Service Corporation.

NAI, 2010, "Seabrook Station 2009 Environmental Monitoring in the Hampton-Seabrook Area: A Characterization of Environmental Conditions," Prepared for NextEra.

NAI and ARCADIS (NAI and ARCADIS), 2008, "Seabrook Nuclear Power Station EPA 316(b) Phase II Rule Project, Revised Proposal for Information Collection," Prepared for FPLE, Section 7.0, June 2008.

New Hampshire Department of Environmental Services (NHDES), 2004, “Total Maximum Daily Load (TMDL) Study for Bacteria in Hampton/Seabrook Harbor,” State of New Hampshire, Department of Environmental Services, Water Division, Watershed Management Bureau, May 2004.

New Hampshire Natural Heritage Bureau (NHNHB), 2009, Memo from M. Coppola to S. Barnum, Normandeau Associates. Subject: Database Search for Rare Species and Exemplary Natural Communities Along Seabrook Station Transmission Corridors, NHB File ID: NHB09-0508, March 18, 2009, ADAMS Accession No. ML101590089.

Nye, J., 2010, “Climate Change and Its Effect on Ecosystems, Habitats, and Biota: State of the Gulf of Maine Report,” Gulf of Maine Council on the Marine Environment and NOAA, June 2010.

O’Brien, L., J. Burnett, and R.K. Mayo, 1993, “Maturation of Nineteen Species of Finfish off the Northeast Coast of the United States, 1985–1990,” *NOAA Tech. Rep. NMFS*, 113; 66 p.

Ojeda, F.P. and J.B. Dearborn, 1989, “Community Structure of Macroinvertebrates Inhabiting the Rocky Subtidal Zone in the Gulf of Maine: Seasonal and Bathymetric Distribution,” *Marine Ecology Progress Series*, 57: 147–161.

Ojeda, F.P. and J.H. Dearborn, 1991, “Feeding Ecology of Benthic Mobile Predators: Experimental Analyses of their Influence in Rocky Subtidal Communities of the Gulf of Maine,” *J. Exp. Mar. Biol. Ecol*., 149: 13–44.

Overholtz, W., 2006, “Status of Fishery Resources off the Northeastern U.S.: Butterfish (*Peprilus triacanthus*),” Available URL: http://www.nefsc.noaa.gov/sos/spsyn/op/butter/#tab241 (accessed December 9, 2010).

Overholtz, W.J. and E.D. Anderson, 1976, “Relationship Between Mackerel Catches, Water Temperature, and Vessel Velocity during USA Spring Bottom Trawl Surveys in SA 5–6,” *Int. Comm. Northwest Atl. Fish. (ICNAF) Res.*, Doc. 76/XIII/170; 7 p., in Studholme et al., 1999.

Packer D.B., et al., 1999, “Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics,” *NOAA Tech Memo NMFS NE*, 151; 88 p.

Padmanabhan M. and G.E. Hecker, 1991, *Comparative Evaluation of Hydraulic Model and Field Thermal Plume Data, Seabrook Nuclear Power Station*, Alden Research Laboratory, Inc.

Pereira, J.J., et al., 1999, “Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics*,” NOAA Technical Memorandum NMFS-NE-138*, Available URL: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm138/tm138.pdf (accessed December 7, 2010).

Peterson, W.T. and S.J. Ausubel, 1984, “Diets and Selective Feeding by Larvae of Atlantic mackerel Scomber scombrus on Zooplankton,” *Mar. Ecol. Prog. Ser., 17*: 65–75.

Scott, W.B. and M.G. Scott, 1988, “Atlantic Fishes of Canada,” *Can. Bull. Fish. Aquat. Sci. 219*, 731p., in Steimle et al., 1999a.

Sedberry, G.R., 1983, “Food Habits and Trophic Relationships of a Community of Fishes on the Outer Continental Shelf,” *NOAA Tech. Rep. NMFS SSRF*, 773; 56 p. in Steimle et al., 1999b.

Sette, O.E., 1943, “Biology of Atlantic Mackerel (*Scomber scombrus*) of North America. Part I: Early Life History Including Growth, Drift, and Mortality of the Egg and Larval Populations,” *U.S. Fish Wildl. Serv. Fish. Bull.*, 50: 149–237, in Studhome et al., 1999.

Sette, O.E., 1950, "Biology of Atlantic Mackerel (*Scomber scombrus*) of North America. Part II. Migrations and Habits," *U.S. Fish Wildl. Serv. Fish. Bull*., 51: 251–358 in Studholme et al., 1999.

Sherman, K. and H.C. Perkins, 1971, "Seasonal Variation in the Food of Juvenile Herring in Coastal Waters of Maine," Trans. Am. Fish. Soc., 100: 121–124.

Shumway, S.E., R. Selvin, and D.F. Schick, 1987, "Food Resources Related to Habitat in the Scallop *Placopecten magellanicus* (Gmelin, 1791): A Qualitative Study," J. Shellfish Res., 6: 89−95.

Sosebee, K., 1998, "Red hake," *Status of the Fishery Resources off the Northeastern United States for 1998, NOAA Tech. Mem. NMFS-NE*, 115: 64–66.

Sosebee, K. M. Traver and R. Mayo. 2006, "Aggregate Resource and Landings Trends," Available URL: http://www.nefsc.noaa.gov/sos/agtt/archives/AggregateResources_2006.pdf (accessed January 25, 2011).

Steimle F.W., et al., 1999a, "Essential Fish Habitat Source Document: Goosefish, Lophius americanus, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE,* 127; 31 p.

Steimle, F.W., et al., 1999b, "Essential Fish Habitat Source Document: Ocean Pout, Macrozoarces Americanus, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 129; 26 p.

Steimle, F.W., et al., 1999c, "Essential Fish Habitat Source Document: Red Hake, Urophycis Chuss, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 133; 34 p.

Steimle F.W., et al., 1999d, "Essential Fish Habitat Source Document: Scup, Stenotomus Chrysops, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 149; 39 p.

Steimle F.W., W.W. Morse, and D.L. Johnson, 1999a, "Essential Fish Habitat Source Document: Goosefish, Lophius Americanus, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 127; 31 p.

Steiner, W.W., J.J. Luczkovich, and B.L. Olla, 1982, "Activity, Shelter Usage, Growth and Recruitment of Juvenile Red Hake, *Urophycis chuss,"* Mar. Ecol. Prog. Ser., 7: 125–135.

Stevenson, D.K and M.L. Scott, 2005, "Essential Fish Habitat Source Document: Atlantic Herring, *Clupea harengus*, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 2nd Edition, 192; 84 p.

Studholme, A.L., et al., 1999, "Essential Fish Habitat Source Document: Atlantic Mackerel, Scomber Scombrus, Life History and Habitat Characteristics," *NOAA Tech Memo NMFS NE*, 141; 35 p.

Sullivan, L.F., 1981, "American plaice, *Hippoglossoides platessoides* in the Gulf of Maine: I. The Fishery, II. Age and Growth, III. Spawning and Larval Distribution," M.S. Thesis, University of Rhode Island, Kingston, RI, 132 p. in Johnson 2004.

Thompson, C., 2010, "The Gulf of Maine in Context, State of the Gulf of Maine Report," Gulf of Maine Council on the Marine Environment, Fisheries, and Oceans, Canada, June 2010.

The Town of Hampton (Hampton), 2001, "Hampton Beach Area Master Plan," The Town of Hampton, NH, NH Department of Resources and Economic Development, Division of Parks and Recreation, November 7, 2001, Available URL: http://www.hampton.lib.nh.us/hampton/town/masterplan/index.htm (accessed September 30, 2010).

United States Code (U.S.C.), “Definitions,” Part 1802, Title 10, “Conservation,” Chapter 38, “Fishery Conversation and Management.”

U.S. Code of Federal Regulations (CFR), “Magnuson–Stevens Act Provisions,” Part 600, Title 50, “Wildlife and Fisheries.”

U.S. Environmental Protection Agency (EPA), 2002, “Authorization to Discharge Under the National Pollutant Discharge Elimination System (NPDES) Permit No. NH0020338, transferred to FPL Energy Seabrook, LLC.,” December 24, 2002.

EPA, 2002b, “Case Study Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule, EPA 821 R 02 002,” Office of Water, Washington, DC.

EPA, 2010, “Enforcement & Compliance History Online (ECHO),” Detailed Facility Report, 2010, Available URL: http://www.epa-echo.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=110001123061 (accessed October 1, 2010).

U.S. Global Change Research Program (USGCRP), 2009, *Global Climate Change Impacts in the United States*, Cambridge University Press, Cambridge, MA, Available URL: http://downloads.globalchange.gov/usimpacts/pdfs/climate impacts report.pdf (accessed January 20, 2011).

U.S. Nuclear Regulatory Commission (NRC), 1996, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Washington, D.C., Volumes 1 and 2, ADAMS Accession Nos. ML040690705 and ML040690738.

NRC, 2010, Letter from B. Pham, Branch Chief, to P. Kurkul, Regional Administrator, NMFS, Subject: Request for List of Protected Species and Essential Fish Habitat Within the Area Under Evaluation for the Seabrook Station License Renewal Application Review, ADAMS Accession No. ML101760221.

NRC, 2011, Summary of telephone conference calls held on February 3, 2011, between the NRC and NextEra to Clarify information pertaining to the review of the Seabrook Station license renewal application (TAC No. ME3959), ADAMS Accession No. ML110560362.

Wigley, S., 1998, “Ocean Pout,” *Status of the Fishery Resources off the Northeastern United States for 1998, NOAA Tech. Mem. NMFS-NE-115*, pp. 94–95.

Witman, J.D. and K.P. Sebens, 1992, “Regional Variation in Fish Predation Intensity: A Historical Perspective in the Gulf of Maine,” *Oecologia*, 90: 305–315.

Witman, J.D. and P.K. Dayton, 2001, “Chapter 13: Rocky Subtidal Communities,” *Marine Community Ecology*, Sinauer Associates, Inc., Sunderland, MA, 2001.

APPENDIX E
CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of its environmental review for Seabrook Station (Seabrook). All documents, with the exception of those containing proprietary information, are available electronically from the NRC's Public Electronic Reading Room, found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents. The ADAMS accession number for each document is included below.

E.1 Environmental Review Correspondence

March 3, 2010	Letter from Ms. Brona Simon, State Historic Preservation Officer, Commonwealth of Massachusetts, Massachusetts Historical Commission, indicating that the Massachusetts Historical Commission had completed its review of the proposed Seabrook license renewal and had no concerns (ADAMS Accession No. ML100880129)
May 25, 2010	Letter from NextEra Energy Seabrook, LLC (NextEra) forwarding the application for renewal of the operating license for Seabrook, requesting an extension of the operating license for an additional 20 years (ADAMS Accession No. ML101590099)
May 25, 2010	Applicant's Environmental Report (ER), cover through page B-90 (ADAMS Accession No. ML101590092)
May 25, 2010	Applicant's ER page C-1 through page F.A-5 (ADAMS Accession No. ML101590089)
May 28, 2010	Letter from NextEra to the State of New Hampshire Department of Environmental Services, "Seabrook, Federal Coastal Zone Consistency Certification for License Renewal" (ADAMS Accession No. ML101550353)
May 31, 2010	Report submitted by Mr. Brian Valimont, New England Archaeology Co, LLC, "Enclosure, Cultural Resources Management Plan Seabrook Nuclear Power Plant Seabrook and Hampton Falls, New Hampshire" (ADAMS Accession No. ML103280393)
June 1, 2010	Letter to Ms. Ann Robinson, Town of Seabrook, NH, "Maintenance of Reference Materials at the Seabrook Library in Regards to the Review of the Seabrook Station License Renewal Application" (ADAMS Accession No. ML101180134)
June 1, 2010	Letter to Ms. Patricia DeTullio, Town of Amesbury, MA, "Maintenance of Reference Materials at the Amesbury Public Library in Regards to the Review of the Seabrook Station License Renewal Application" (ADAMS Accession No. ML101260102)
June 10, 2010	Letter from NRC to NextEra, "Receipt and Availability of the License Renewal Application for the Seabrook Station Nuclear Power Plant" (ADAMS Accession No. ML101320273)
June 10, 2010	*Federal Register* Notice, "Notice of Receipt and Availability for Seabrook Station License Renewal Application" (ADAMS Accession No. ML101330049)
July 13, 2010	Letter from NRC to NextEra, "Notice of Intent to Prepare an Environmental Impact Statement and Conduct the Scoping Process for License Renewal for Seabrook Station" (ADAMS Accession No. ML101680410)
July 13, 2010	*Federal Register* Notice, "Notice of Intent to Prepare an Environmental Impact Statement and Conduct the Scoping Process for License Renewal for Seabrook Station" (ADAMS Accession No. ML101680427)
July 13, 2010	Letter from NRC to NextEra, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from NextEra Energy Seabrook, LLC, for Renewal of the Operating License for Seabrook Station, Unit 1" (ADAMS Accession No. ML101690417)

July 13, 2010	*Federal Register* Notice, "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License No. NPF-086 for an Additional 20-year Period" (ADAMS Accession No. ML101690449)
July 16, 2010	Letter from NRC to Mr. Reid Nelson, Director, Office of Federal Agency Programs, Advisory Council On Historic Preservation, regarding the Seabrook License Renewal (ADAMS Accession No. ML101760128)
July 16, 2010	Letter from NRC to Ms. Patricia Kurkul, Regional Administrator, Northeast Region, National Marine Fisheries Service (NMFS), "Request for List of Protected Species and Essential Fish Habitat Within the Area Under Evaluation for the Seabrook Station License Renewal Application Review" (ADAMS Accession No. ML101760221)
July 16, 2010	Letter from NRC to Ms. Elizabeth Muzzey, State Historic Preservation Officer, State of New Hampshire, Division of Historical Resources, "Seabrook Station License Renewal Application Review" (ADAMS Accession No. ML101790273)
July 16, 2010	Letter from NRC to Mr. Marvin Moriarty, U.S. Fish and Wildlife Service (FWS), "Request for List of Protected Species Within the Area Under Evaluation for the Seabrook Station License Renewal Application Review" (ADAMS Accession No. ML101790278)
July 16, 2010	Summary of telephone conference call held between NRC and NextEra concerning the review of acceptability of docketing of the Seabrook license renewal application (LRA) (ADAMS Accession No. ML101800207)
July 16, 2010	Letter from NRC to Mr. Thomas Burack, Commissioner, State of New Hampshire, Department of Environmental Services, "Seabrook Station License Renewal Application Review" (ADAMS Accession No. ML101900093)
July 20, 2010	*Federal Register* Notice, "Forthcoming Meeting to Discuss the License Renewal Process and Environmental Scoping for Seabrook Station License Renewal Application Review" (ADAMS Accession No. ML101900013)
July 20, 2010	NRC press release announcing an opportunity for a hearing on the application to renew the operating license for Seabrook (ADAMS Accession No. ML102010170)
July 27, 2010	Letter from Edna Feighner, State of New Hampshire, Division of Historical Resources, regarding the Seabrook license renewal (ADAMS Accession No. ML102160299)
August 4, 2010	NRC Press Release announcing the public meetings to discuss the process for the review of the Seabrook LRA and to seek input on the environmental review (ADAMS Accession No. ML102160633)
August 5, 2010	Letter from Ms. Patricia Kurkul, Regional Administrator, Northeast Region, NMFS, "Scoping Letter Response From NMFS Regarding the Seabrook License Renewal Application" (ADAMS Accession No. ML102240108)
August 12, 2010	E-mail from NRC to Ms. Emily Holt, Commonwealth of Massachusetts, Division of Fisheries and Wildlife (DFW), "E-mail to [Massachusetts] DFW re State-Listed Rare Species Near Seabrook Station" (ADAMS Accession No. ML102240484)
August 18, 2010	E-mail from Ms. Emily Holt, Commonwealth of Massachusetts, Division of Fisheries and Wildlife, "E-mail from MA DFW re State-Listed Species Near Seabrook Station" (ADAMS Accession No. ML102360545)
August 19, 2010	Letter from Ms. Maggie Hassan, Senator, State of New Hampshire, regarding the Seabrook license renewal (ADAMS Accession No. ML102420037)
August 19, 2010	Transcript of the Seabrook license renewal public meeting—afternoon session, August 19, 2010 (ADAMS Accession No. ML102520183)
August 19, 2010	Transcript of the Seabrook license renewal public meeting—evening session, August 19, 2010 (ADAMS Accession No. ML102520207)
August 23, 2010	Letter from Mr. William Harris regarding the Seabrook license renewal (ADAMS Accession No. ML102500271)
August 25, 2010	Letter from Mr. William Harris regarding the Seabrook license renewal (ADAMS Accession No. ML102420043)

August 26, 2010	Letter from NRC to Ms. Melissa Coppola, State of New Hampshire, New Hampshire Natural Heritage Bureau, “Seabrook Station License Renewal Application Review” (ADAMS Accession No. ML102290417)
September 1, 2010	Letter from Mr. Geordie Vining regarding the Seabrook license renewal (ADAMS Accession No. ML102450525)
September 1, 2010	Letter from Mr. Thomas Chapman, FWS, “Scoping Letter from FWS Regarding the Seabrook [license renewal application] LRA [supplemental environmental impact statement] SEIS” (ADAMS Accession No. ML102630180)
September 7, 2010	Letter from NRC to NextEra, “Environmental Site Audit Regarding Seabrook Station License Renewal Application” (ADAMS Accession No. ML102390177)
September 7, 2010	Memoranda from Ms. Melissa Coppola, State of New Hampshire, New Hampshire Natural Heritage Bureau, “NH NHB State-Listed Species and Communities [in support of] Seabrook LRA SEIS” (ADAMS Accession No. ML102520087)
September 13, 2010	Memoranda from Ms. Melissa Coppola, State of New Hampshire, New Hampshire Natural Heritage Bureau, “NH NHB State-Listed Species in T-Lines[in support of] Seabrook LRA SEIS” (ADAMS Accession No. ML102600341)
September 20, 2010	Summary of Seabrook License Renewal Overview and Environmental Scoping Meetings held on August 19, 2010 (ADAMS Accession No. ML102520222)
September 20, 2010	Letter from Ms. Joyce Kemp regarding the Seabrook license renewal (ADAMS Accession No. ML102640371)
September 20, 2010	Letter from Mr. Joseph Fahey, Director, Office of Community and Economic Development, Town of Amesbury, Massachusetts, regarding the Seabrook license renewal (ADAMS Accession No. ML102650486)
September 20, 2010	Letter from Mr. Andrew Port, Director of Planning and Development, City of Newburyport, MA, regarding the Seabrook license renewal (ADAMS Accession No. ML102660331)
September 21, 2010	Letter from Mr. Doug Bogen, Executive Director, Seacoast Anti-Pollution League, regarding the Seabrook license renewal (ADAMS Accession No. ML102670048)
October 15, 2010	Letter from NRC to Mr. Franklin Keel, Director, Eastern Regional Office, Bureau of Indian Affairs, the Abenaki Nation of New Hampshire, Cowasuck Band of Pennacook-Abenaki People, Abenaki Nation of Missisquoi, and Wampanoag Tribe of Gay Head-Aquinnah, “Request for Scoping Comments Concerning the Seabrook Station License Renewal Application Review” (ADAMS Accession No. ML102730657)
October 29, 2010	Letter from NRC to NextEra, “Request for Additional Information for the Review of the Seabrook Station License Renewal Application Environmental Review (TAC No. ME3959)” (ADAMS Accession No. ML102861217)
November 4, 2010	Letter from Mr. Christian Williams, State of New Hampshire, Department of Environmental Services, to NextEra, regarding the Seabrook Coastal Zone Management Act Certification (ADAMS Accession No. ML103080880)
November 8, 2010	Letter from NRC to NextEra, “Environmental Project Manager Change for the License Renewal of Seabrook Station, Unit 1 (TAC ME3959)” (ADAMS Accession No. ML103070056)
November 10, 2010	Summary of the site audit related to the review of the Seabrook LRA, October 5-7, 2010 (ADAMS Accession No. ML102950271)
November 16, 2010	Letter from NRC to NextEra, “Request for Additional Information for the Review of the Seabrook Station License Renewal Application-[Severe Accident Mitigation Alternative] SAMA Review (TAC ME3959)” (ADAMS Accession No. ML103090215)
November 23, 2010	Letter from NextEra, “Seabrook Station—Response to Request for Additional Information—NextEra Energy Seabrook License Renewal Environmental Report” (ADAMS Accession No. ML103350639)

November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 5, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103360298)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 7, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103360300)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 4, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103360306)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 2, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit, Continued" (ADAMS Accession No. ML103360311)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 6, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103360326)
November 23, 2010	Letter from NextEra "Attachment 2, Vol. 3, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103370092)
November 23, 2010	Letter from NextEra, "Attachment 3 to SBK-L-10185, Seabrook Station Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Environmental Report" (ADAMS Accession No. ML103370167)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 2, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML103370169)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 1, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML110100311)
November 23, 2010	Letter from NextEra, "Attachment 2, Vol. 1, to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report, References Requested for Docketing at the Seabrook Station Environmental Site Audit" (ADAMS Accession No. ML110100312)
November 23, 2010	Letter from NextEra, "Attachment 1 to SBK-L-10185, Seabrook Station Response to Request for Additional Information NextEra Energy Seabrook License Renewal Environmental Report" (ADAMS Accession No. ML110100315)
December 3, 2010	Summary of the telephone conference between NRC and NextEra concerning the draft request for information pertaining to the Seabrook SAMAs review, November 8 and 10, 2010 (ADAMS Accession No. ML103260521)
December 21, 2010	Summary of the telephone conference call between NRC and NextEra concerning the draft request for additional information pertaining to the Seabrook LRA, October 21, 2010 (ADAMS Accession No. ML102980693)
January 3, 2011	Summary of the telephone conference call between NRC and NextEra concerning the draft request for additional information pertaining to the Seabrook LRA, December 21, 2010 (ADAMS Accession No. ML103570401)
January 13, 2011	Letter from NextEra, "Seabrook—Response to Request for Additional Information, NextEra Energy License Renewal Application" (ADAMS Accession No. ML110140810)

February 18, 2011	Letter from NextEra, “Seabrook Station Environmental Permit Renewals, NextEra Energy Seabrook License Renewal Environmental Report” (ADAMS Accession No. ML110550161)
February 28, 2011	Summary of telephone conference calls held between NRC and NextEra concerning the responses to the SAMA RAIs, February 15, 2011 (ADAMS Accession No. ML110490165)
March 1, 2011	Summary of telephone conference call held between NRC and NextEra concerning the essential fish habitat in the vicinity of Seabrook, February 3, 2011 (ADAMS Accession No. ML1105603625)
March 1, 2011	Letter from NRC to NextEra, “Issuance of Environmental Scoping Summary Report Associated with the Staff’s Review of the Application by NextEra Energy Seabrook, LLC for Renewal of the Operating License for Seabrook Station (TAC Number ME3959)” (ADAMS Accession No. ML110100113)
March 4, 2011	Letter from NRC to NextEra, “Schedule Revision and Request for Additional Information for the Review of the Seabrook Station License Renewal Application Environmental Review (TAC ME3959)” (ADAMS Accession No. ML110590638)
March 16, 2011	Letter from NextEra to NRC, “Seabrook Station—Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Environmental Report” (ADAMS Accession No. ML110820121)
April 8, 2011	Summary of telephone conference call held between NRC and NextEra to clarify responses to RAIs, March 21, 2011 (ADAMS Accession No. ML110811326)
April 18, 2011	Letter from NextEra, “Seabrook—Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application” (ADAMS Accession No. ML11122A075)
May 12, 2011	Letter from NRC to NextEra, “Schedule Revision for the Environmental Review of the Seabrook Station License Renewal Application (TAC Number ME3959)” (ADAMS Accession No. ML110890319)
June 10, 2011	Letter from NextEra, “Seabrook—Supplement to Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application” (ADAMS Accession No. ML11166A255)
July 26, 2011	Letter from NextEra, “Seabrook Station—Environmental Permit Renewals NextEra Energy Seabrook License Renewal Environmental Report” (ADAMS Accession No. ML11210B392)
July 31, 2011	NUREG-1437 Supplement 46 (1 of 2), *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Seabrook Station* (ADAMS Accession No. ML11213A024)
July 31, 2011	NUREG-1437 Supplement 46 (2 of 2), *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Seabrook Station* (ADAMS Accession No. ML11213A203)
August 1, 2011	*Federal Register* Notice, “Notice Of Availability Of Draft Supplement 46 to the GEIS for License Renewal of Nuclear Plants and Public Meetings for the License Renewal of Seabrook Station, Unit 1 Docket No. 50 443 [NRC-2010-0206]” (ADAMS Accession No. ML11131A005)
August 1, 2011	Letter from NRC to NextEra, “Notice of Availability of the Draft Plant-Specific Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station (TAC ME3959)” (ADAMS Accession No. ML11129A011)
August 1, 2011	Letter from NRC to Ms. Elizabeth Muzzey, State Historic Preservation Officer, State of New Hampshire, Division of Historical Resources, and Ms. Brona Simon, Executive Director and State Historic Preservation Officer, Massachusetts Historical Commission, “Seabrook Station License Renewal Application Review” (ADAMS Accession No. ML11131A118)
August 2, 2011	Letter from NRC to U.S. Environmental Protection Agency (EPA), “Notice of Availability of the Draft Plant-Specific Supplement 46 to the GEIS for License Renewal of Nuclear Plants Regarding Seabrook Station” (ADAMS Accession No. ML11137A158)
August 2, 2011	Letter from NRC to Mr. Thomas Chapman, Supervisor, FWS, New England Field Office, “Notice of Availability of the Draft Plant-Specific Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station” (ADAMS Accession No. ML1131A004)

August 2, 2011	Letter from NRC to Mr. Peter Colosi, Assistant Regional Administrator for Habitat Conservation, Northeast Region, NMFS, “Essential Fish Habitat Assessment for License Renewal of Seabrook Station (TAC No. ME3959)” (ADAMS Accession No. ML11126A365)
August 2, 2011	NRC press release announcing the public meetings to seek input on draft SEIS for the Seabrook LRA (ADAMS Accession No. ML11214A080)
August 3, 2011	Notice of meeting with the public to discuss the draft SEIS for the license renewal of Seabrook Station (ADAMS Accession No. ML11153A164)
August 17, 2011	Comment of Ms. Edna Feighner on behalf of New Hampshire Division of Historical Resources on draft SEIS for the Seabrook Station license renewal (ADAMS Accession No. ML11242A111)
August 25, 2011	Letter from NRC to Mr. Franklin Keel, Director, Eastern Regional Office, Bureau of Indian Affairs, the Abenaki Nation of New Hampshire, Cowasuck Band of Pennacook-Abenaki People, Abenaki Nation of Missisquoi, and Wampanoag Tribe of Gay Head-Aquinnah, “Notice of Availability of the Draft Plant-Specific Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station” (ADAMS Accession No. ML11221A392)
September 1, 2011	Comment of Ms. Brona Simon of State of Massachusetts, Historical Commission on Seabrook Station license renewal application (ADAMS Accession No. ML11257A088)
September 13, 2011	Comment of Ms. Josephine Donovan on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11259A162)
September 15, 2011	Meeting Slides, “Preliminary Site-Specific Results of the License Renewal Environmental Review For Seabrook Station” (ADAMS Accession No. ML11259A002)
September 15, 2011	Transcript of Seabrook Station license renewal public meeting—afternoon session, September 15, 2011 (ADAMS Accession No. ML11273A139)
September 15, 2011	Transcript of Seabrook Station license renewal public meeting—evening session, September 15, 2011 (ADAMS Accession No. ML11273A140)
September 15, 2011	Comment of Mr. William Harris on environmental risk management and mitigation issues that are essential for NRC to analyze in the final SEIS for relicensing of Seabrook Station, Unit 1 (ADAMS Accession No. ML11279A119)
September 15, 2011	Letter from Mr. William Graham and Mr. Peter Pry, “Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack” (submitted as an attachment to September 15 comment of Mr. William Harris) (ADAMS Accession No. ML11279A118)
September 20, 2011	Comment of Ms. Sandra Koski on draft Supplement 46 to the generic environmental impact statement for license renewal of nuclear plants and public meetings for the license renewal of Seabrook, Unit 1 (ADAMS Accession No. ML11265A220)
September 22, 2011	Comment of Mr. Max Abramson, on draft SEIS division of license renewal (ADAMS Accession No. ML11266A153)
October 3, 2011	Comment of Doodle Dude on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11279A117)
October 12, 2011	Comment of Ms. Mary Broderick on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11287A038)
October 20, 2011	Comment of Mr. Donald Tilbury, opposing the extension of Seabrook operating license (ADAMS Accession No. ML11305A011)
October 20, 2011	Comment of Filson and Shirley Glanz opposing the relicensing of the Seabrook nuclear plant (ADAMS Accession No. ML11308A031)
October 23, 2011	Comment of Mr. Randall Kezar on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11300A009)
October 23, 2011	Comment of Mr. Randall Kezar on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11300A010)
October 24, 2011	Comment of Ms. Phyllis Killam Abell opposing relicensing of Seabrook nuclear reactor (ADAMS Accession No. ML11307A392)

October 24, 2011	Comment of Mr. Douglas Grout on behalf of New Hampshire Fish and Game Department (NHFGD), Marine Fisheries Division, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11301A073)
October 25, 2011	Comment of Mr. Timothy Drew, on behalf of New Hampshire Department of Environmental Services, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11301A074)
October 25, 2011	Comment of Mr. Andrew Raddant, on Behalf of U.S. Department of Interior, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11301A099)
October 25, 2011	Comment of Mr. Robin Willits on draft SEIS of Seabrook Nuclear Power Plant in New Hampshire (ADAMS Accession No. ML11304A053)
October 25, 2011	Comment of Ms. Ilse Andrews, on Behalf of Seacoast Anti-Pollution League on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11301A075)
October 26, 2011	Comment of Mr. Steven Athearn on draft SEIS for license renewal of Seabrook Station, Unit 1 (ADAMS Accession No. ML11304A054)
October 26, 2011	Summary of public meetings conducted to discuss the draft SEIS related to the review of the Seabrook Station license renewal application (ADAMS Accession No. ML11277A046)
October 26, 2011	Comment of Mr. Peter Colosi, on Behalf of NMFS, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11304A057)
October 26, 2011	Comment of Mr. Kelvin Allen Brooks on behalf of New Hampshire Department of Justice, Office of the Attorney General, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11304A058)
October 26, 2011	Comment of Mr. Timothy Timmerman, on Behalf of Mr. H. Curtis Spalding, on Behalf of EPA, on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML11304A059)
October 26, 2011	Comment of Ms. Mary Lampert, Mr. Raymond Shadis, and Mr. David Agnew, on Seabrook NUREG-1437, Supplement 46, Section 5.0 (ADAMS Accession No. ML11304A243)
October 26, 2011	Comments of Mr. William Harris and Mr. Thomas Popik, on Behalf of Foundation for Resilient Societies, on Seabrook Station license renewal for March 2030–March 2050 (ADAMS Accession No. ML11304A055)
October 26, 2011	Comment of Mr. Doug Bogen, on behalf of Seacoast Anti-Pollution League, on Draft SEIS for license renewal of Seabrook Station, Unit 1 (ADAMS Accession No. ML11304A056)
October 26, 2011	Comment of Mr. Richard Knight opposing the extension of Seabrook operating license for another 20 years (ADAMS Accession No. ML11304A052)
October 27, 2011	Letter from NextEra, “Seabrook Station—NextEra Energy Seabrook Comments on NUREG-1437 Supplement 46 Seabrook Station Draft [SEIS]” (ADAMS Accession No. ML11307A235)
November 17, 2011	Letter from NRC to Mr. Peter Colosi, Assistant Regional Administrator for Protected Resources, NMFS, “Response to Essential Fish Habitat Conservation for Seabrook Station, Unit 1, License Renewal Review” (ADAMS Accession No. ML11322A094)
December 29, 2011	Letter from NRC to Ms. Patricia Kurkul, Regional Administrator, Northeast Region, NMFS, “Request for Concurrence on the Effects of the Proposed Seabrook Station License Renewal on Threatened and Endangered Species (TAC No. ME3959)” (ADAMS Accession No. ML11343A025)
February 28, 2012	Comment of Ms. Mary Broderick on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML12059A073)
February 28, 2012	Comment of Mr. Donald Tilbury on draft Supplement 46 to the generic environmental impact statement for license renewal (ADAMS Accession No. ML12059A074)
March 12, 2012	Comment of Mr. Donald Tilbury opposing the relicensing of Seabrook (ADAMS Accession No. ML12083A056)

March 19, 2012	Letter from NextEra, "Seabrook Station—Supplement 2 to Severe Accident Mitigation Alternatives Analysis" (ADAMS Accession No. ML12080A137)
March 20, 2012	Summary of the telephone conference call between NRC and NextEra concerning the draft request for additional information pertaining to the Seabrook LRA, March 1, 2012 (ADAMS Accession No. ML12066A139)
March 21, 2012	Comment of Ms. Susan Kepner opposing NextEra for licensing from 2030–2050 of Seabrook (ADAMS Accession No. ML12094A095)
March 22, 2012	Letter from NRC to NextEra, "Schedule Revision for the Environmental Review of the Seabrook Station License Renewal Application (TAC No. ME3959)" (ADAMS Accession No. ML12074A096)
May 31, 2012	Letter from NRC to NextEra, "Notice of Intent to Prepare a Supplement to Draft Supplement 46 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station" (ADAMS Accession No. ML12109A427)
May 31, 2012	*Federal Register* Notice, "License Renewal Application for Seabrook Station, Unit 1; NextEra Energy Seabrook, LLC" (ADAMS Accession No. ML12109A402)
July 16, 2012	Letter from NRC to NextEra, "Request for Additional Information for the Review of the Seabrook Station License Renewal Application Environmental Review—SAMA Review (TAC No. ME3959)" (ADAMS Accession No. ML12180A355)
July 31, 2012	Summary of the telephone conference call between NRC and NextEra concerning the draft request for information pertaining to the Seabrook LRA SAMAs review, July 3, 2012 (ADAMS Accession No. ML12195A111)
September 13, 2012	Letter from NextEra, "Seabrook Station—Supplement 3 to Severe Accident Mitigation Alternatives Analysis, Response to RAI Request dated July 16, 2012" (ADAMS Accession No. ML12262A513)
October 10, 2012	Letter from NMFS to NRC, "Re: Seabrook Station Relicensing" (ADAMS Accession No. ML1228A250)
November 1, 2012	Summary of the telephone conference call between NRC and NextEra clarifying the responses to the requests for information pertaining to the Seabrook LRA SAMAs review, October 3, 2012 (ADAMS Accession No. ML12278A250)
November 19, 2012	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A268)
November 19, 2012	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A266)
December 13, 2012	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A256)
December 13, 2012	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A246)
December 19, 2012	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A244)
January 15, 2013	Environmental PM change for the license renewal of Seabrook Station, Unit 1 (TAC No. ME3959) (ADAMS Accession No. ML12352A141)
January 16, 2013	Schedule revision for the environmental review of the Seabrook Station license renewal application (TAC ME3959) (ADAMS Accession No. ML12352A075)
January 23, 2013	Seabrook license renewal—Seabrook Site VP (ADAMS Accession No. ML13087A189)
March 7, 2013	Seabrook license renewal—Re: Greetings (ADAMS Accession No. ML13087A033)
April 26, 2013	Notice of availability of the supplement to the draft plant-specific Supplement 46 to the generic environmental impact statement for license renewal of nuclear plants regarding Seabrook Station, Unit 1(TAC No. ME3959) (ADAMS Accession No. ML13116A189)
April 26, 2013	Notice of availability of the supplement to the draft plant-specific Supplement 46 to the generic environmental impact statement for license renewal of nuclear plants regarding Seabrook Station, Unit 1(TAC No. ME3959) (ADAMS Accession No. ML13115A642)
May 8, 2013	Press Release-I-13-023: NRC Issues Draft Supplement to Draft Environmental Impact Report on Seabrook Nuclear Power Plant License Renewal Application (ADAMS Accession No. ML13129A373)

June 27, 2013	Comment (137) of Timothy W. Drew, on behalf of State of New Hampshire Department of Environmental Services (NHDES), on SEIS (ADAMS Accession No. ML13207A106)
June 27, 2013	Comment (2) of Timothy Timmermann on behalf of EPA on GEIS for License Renewal of Nuclear Plants, Supplement 46 Regarding Seabrook (ADAMS Accession No. ML13189A128)
July 5, 2013	NHDES comments on supplement to draft SEIS (ADAMS Accession No. ML13179A066)
Dec 16, 2013	Seabrook change of schedule letter for environmental and safety review of Seabrook LRA (ADAMS Accession No. ML13298A091)
Dec 27, 2013	Seabrook conference call re: SAMA RAI (ADAMS Accession No. ML13352A511)
Dec 27, 2013	Seabrook SAMA RAI (ADAMS Accession No. ML13353A536)

APPENDIX F
U.S. NUCLEAR REGULATORY COMMISSION STAFF EVALUATION OF SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR SEABROOK STATION UNIT 1 IN SUPPORT OF LICENSE RENEWAL APPLICATION REVIEW

U.S. NUCLEAR REGULATORY COMMISSION STAFF EVALUATION OF SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR SEABROOK STATION UNIT 1 IN SUPPORT OF LICENSE RENEWAL APPLICATION REVIEW

F.1 Introduction

NextEra Energy Seabrook, LLC (NextEra), submitted an assessment of severe accident mitigation alternatives (SAMAs) for the Seabrook Station (Seabrook), Unit 1, as part of its Environmental Report (ER) (NextEra 2010). This assessment was based on the most recent Seabrook probabilistic risk assessment (PRA) available at that time, a plant-specific offsite consequence analysis performed using the Methods for Estimation of Leakages and Consequences of Releases (MELCOR) Accident Consequence Code System 2 (MACCS2) computer code (NRC 1998a), and insights from the Seabrook individual plant examination (IPE) (New Hampshire Yankee (NHY) 1991) and individual plant examination of external events (IPEEE) (North Atlantic Energy Service Corp. (NAESC) 1992). In identifying and evaluating potential SAMAs, NextEra considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and large early release frequency (LERF) at Seabrook, as well as a generic list of SAMA candidates for pressurized-water reactor (PWR) plants identified from other industry studies. In the initial ER, NextEra identified 191 potential SAMA candidates. This list was reduced to 74 SAMA candidates by eliminating SAMAs for the following reasons:

- Seabrook has a different design.
- The SAMA has already been implemented at Seabrook.
- The intent of the SAMA has already been met at Seabrook.
- The SAMA has been combined with another SAMA candidate that is similar in nature.
- Estimated implementation costs would exceed the dollar value associated with eliminating all severe accident risk at Seabrook.
- The SAMA would be of very low benefit as it is related to a non-risk significant system.

NextEra assessed the costs and benefits associated with each of these 74 potential SAMAs and concluded in the ER that several of the candidate SAMAs evaluated are potentially cost beneficial.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued requests for additional information (RAIs) to NextEra by letters dated November 16, 2010 (NRC 2010a), and March 4, 2011 (NRC 2011b). Key questions in these RAIs concerned the following:

- additional details regarding the plant-specific PRA model and changes to internal and external event CDF and LERF since the IPE,

- the process used to map Level 1 PRA results into the Level 2 analysis and group containment event tree (CET) end states into release categories,[1]
- the process for selecting the representative Modular Accident Analysis Program (MAAP) case for each release category (RC) and the release characteristics of each representative case,
- changes to the fire and seismic PRA models since the IPEEE,
- the impact of updated seismic hazard curves,
- the sensitivity of the SAMA results to assumptions used in the Level 3 analysis,
- the use of Level 2 importance analysis and industry SAMA analyses in identifying plant-specific SAMAs, and
- further information on the cost-benefit analysis of several specific candidate SAMAs and low-cost alternatives.

NextEra submitted additional information to the NRC by letters dated January 13, 2011 (NextEra 2011a), and April 18, 2011 (NextEra 2011b). NextEra provided additional information in a telephone conference call with the NRC staff on February 15, 2011 (NRC 2011a). In response to the RAIs, NextEra provided the following:

- the internal and external event contribution to CDF and LERF for each version of the Seabrook PRA model and model changes that most impacted CDF and LERF,
- a description of the CET and the process for determining the frequency of each RC,
- a description of the process for selecting representative MAAP cases for each RC and the characteristics of each plume in each RC,
- changes to the fire and seismic PRA models since the IPEEE,
- a sensitivity analysis of the impact on the SAMA analysis from updated seismic hazard curves,
- the results of the sensitivity analyses performed on the assumptions used in the Level 3 analysis,
- listings of the important basic events for the most risk-significant release categories,
- evaluation of additional SAMA candidates based on basic events important to CDF and release frequency,

[1] The NRC uses PRA to estimate risk by computing real numbers to determine what can go wrong, how likely is it, and what are its consequences. Thus, PRA provides insights into the strengths and weaknesses of the design and operation of a nuclear power plant. For the type of nuclear plant currently operating in the U.S., a PRA can estimate three levels of risk. A Level 1 PRA estimates the frequency of accidents that cause damage to the nuclear reactor core. This is commonly called CDF. A Level 2 PRA, which starts with the Level 1 core damage accidents, estimates the frequency of accidents that release radioactivity from the nuclear power plant. A Level 3 PRA, which starts with the Level 2 radioactivity release accidents, estimates the consequences in terms of injury to the public and damage to the environment. (http://www.nrc.gov/about-nrc/regulatory/risk-informed/pra.html)

- a review of the applicability of industry cost-effective SAMA candidates to Seabrook, and
- additional information regarding several specific SAMAs.

NextEra's responses addressed the NRC staff's concerns and resulted in the identification of additional potentially cost-beneficial SAMAs.

Subsequent to the RAI responses, NextEra submitted a supplement to the ER that incorporates updates made to the PRA model (NextEra 2012a). NextEra identified additional SAMA candidates, assessed the costs and benefits of these SAMAs, and reassessed the costs and benefits of the previously-identified SAMA candidates, which resulted in additional potentially cost-beneficial SAMAs.

The NRC staff reviewed this supplement and issued RAIs to NextEra by letter dated July 16, 2012 (NRC 2012a). Key questions in these RAIs concerned the following:

- additional initiating event contributors to total CDF,
- additional basic events presented in the CDF and RC importance lists,
- justification for the implementation cost estimates for certain SAMAs, and
- clarification of apparent inconsistencies in the risk reduction and cost-benefit evaluation of certain SAMAs.

NextEra submitted additional information to the NRC by letter dated September 13, 2012 (NextEra 2012b). NextEra also provided additional information in a telephone conference call with the NRC staff on October 3, 2012 (NRC 2012b). In response to the RAIs, NextEra provided the following:

- initiating events that contribute one percent and greater to CDF,
- additional risk-significant RC basic events and evaluation of SAMA candidates for each,
- justification for the increase in the implementation costs for selected SAMAs since the ER and original RAI responses were submitted to the NRC, and
- additional information regarding the cost-benefit evaluation of certain SAMAs.

NextEra's responses addressed the NRC staff's concerns.

The NRC staff notes that many of the original RAIs asked regarding the SAMA analysis in the ER, and associated RAI responses, were superseded by the updated information provided in the 2012 SAMA supplement (NextEra 2012a). For this reason, many of the RAI responses on the original ER submittal are not specifically discussed in this review since they were determined to not be needed to support the conclusions presented in Section F.7.

NextEra provided a sensitivity analysis of the MACCS2 meteorological model using the U.S. Environmental Protection Agency (EPA)'s CALMET wind field model (Hanna 2013; URS 2013). NextEra's analysis indicated that the use of the more complex CALMET model could potentially increase the calculated benefit of a SAMA by about 32 percent. However, NextEra's analysis did not directly assess the impact from a more complex meteorological model, uncertainty, and conservative assumptions in NextEra's model, but rather performed a sensitivity study to roughly assess the differences between MACCS2 and CALMET. The NRC staff's review included an evaluation of NextEra's use of the CALMET wind field model as well as an evaluation of the conservatisms in NextEra's SAMA analysis. This is discussed further in the Section F.2.1.

An assessment of SAMAs for Seabrook is presented below.

F.2 Estimate of Risk for Seabrook

NextEra's estimates of offsite risk at Seabrook are summarized in Section F.2.1. The summary is followed by the NRC staff's review of NextEra's risk estimates in Section F.2.2.

F.2.1 NextEra's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis—(1) the Seabrook Level 1 and 2 PRA model, which is an updated version of the IPE (NHY 1991), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent Seabrook Level 1 and Level 2 PRA models available, model SSPSS-2006 for the ER (NextEra 2010) updated by model SSPSS-2011 in the 2012 SAMA supplement (NextEra 2012a). The scope of this Seabrook PRA includes both internal and external events.

The Seabrook CDF is approximately 1.2×10^{-5} per year for both internal and external events, as determined from quantification of the Level 1 PRA model. A truncation level of 1×10^{-14} per year was used when quantifying event trees, and a truncation value of 1×10^{-12} per year was used when quantifying fault trees, except for the service water system (SWS) (NextEra 2011a). The SWS was divided into two trains, which were each solved at a truncation level of 1×10^{-8} per year. The CDF is based on the risk assessment for internally initiated events, which include internal flooding, and external events, which include fire and seismic events. The internal events CDF is approximately 7.8×10^{-6} per year (internal events modeling includes external flooding), and the external events CDF (fire and seismic events) is approximately 4.5×10^{-6} per year (NextEra 2012a).

The breakdown of CDF by initiating event is provided in Table F-1 and includes internal, fire, and seismic initiating events. As shown in Table F-1, the largest single contributor to the total CDF is loss of offsite power (LOOP) due to weather. NextEra clarified in response to an NRC staff RAI (NextEra 2012a) that station blackout (SBO) contributes approximately 3.3×10^{-6} per year, or 27 percent, and anticipated transients without scram (ATWS) contribute approximately 4.7×10^{-7} per year, or 4 percent, to the total internal and external events CDF.

The Level 2 Seabrook PRA model that forms the basis for the SAMA evaluation is an updated version of the Level 2 IPE model (NHY 1991) and IPEEE model (NAESC 1992). The current Level 2 model uses a single CET that is used to address internal, fire, and seismic events. The CET addresses both phenomenological and systemic events. The Level 1 core damage sequences are linked directly with the CET, so all Level 1 sequences are evaluated by the CET (NRC 2011a). The CET probabilistically evaluates the progression of the damaged core with respect to release to the environment. CET nodes are evaluated using supporting fault trees and logic rules. The CET end states are then examined for considerations of timing and magnitude of release and assigned to release categories.

Table F–1. Seabrook CDF for Internal and External Events

Internal initiating event	**CDF (per year)**	**% contribution to total CDF [a]**
LOOP due to weather[e]	6.8×10^{-7}	6
Flood in relay room from high-energy line break (HELB)[e]	5.9×10^{-7}	5
Steam generator tube rupture (SGTR)	5.7×10^{-7}	5
Reactor trip—condenser available	5.4×10^{-7}	4
Medium loss-of-coolant accident (LOCA)	5.3×10^{-7}	4
LOOP due to grid-related events		4
Flood in yard due to service water (SW) common return rupture[e]	4.1×10^{-7}	3
Loss of essential alternating current (AC) power 4 kV bus	3.2×10^{-7}	3
Loss of primary component cooling water system (PCCW) B train	3.0×10^{-7}	3
Loss of PCCW system A train	2.3×10^{-7}	2
Major flood, rupture of SW Train A in PAB[e]	2.2×10^{-7}	2
LOOP due to switchyard	2.1×10^{-7}	2
Large flood, rupture SW Train A piping in primary auxiliary building (PAB)[e]	2.0×10^{-7}	2
Large flood, rupture SW Train B piping in PAB[e]	2.0×10^{-7}	2
Major flood, rupture of SW Train B in PAB[e]	2.0×10^{-7}	2
Major flood, rupture of fire protection piping in turbine building impacting offsite power[e]	1.8×10^{-7}	2
Loss of Train B Essential AC Power (4 kV Bus E6)	1.6×10^{-7}	1
Large flood, rupture of SW common return piping in PAB[e]	1.4×10^{-7}	1
Large LOCA	3.4×10^{-7}	2
Other internal events[b]	1.6×10^{-6}	13
Total internal events CDF[e]	$\mathbf{7.8\times10^{-6}}$	**64**
Fire initiating event		
Fire in control room—power-operated relief valve (PORV) LOCA	3.6×10^{-7}	3
Fire in switchgear (SWGR) room B—loss of Bus E6	3.5×10^{-7}	3
Fire SWGR room A—loss of Bus E5	3.1×10^{-7}	2
Fire control room—AC power loss	1.8×10^{-7}	1
Other fire events[c]	3.8×10^{-7}	2
Total fire events CDF	$\mathbf{1.4\times10^{-6}}$	**11**
Seismic initiating event		
Seismic 0.7 g transient event	9.3×10^{-7}	8
Seismic 1.0 g transient event	8.9×10^{-7}	7
Seismic 1.4 g transient event	3.6×10^{-7}	3
Other seismic events[d]	8.8×10^{-7}	7
Total seismic events CDF	$\mathbf{3.1\times10^{-6}}$	**25**

Internal initiating event	CDF (per year)	% contribution to total CDF [(a)]
Total CDF (internal and external events)	**1.2×10^{-5}**	**100**

(a) Individual percent contributions may not sum exactly to subtotals due to round off.

(b) Obtained by subtracting the sum of the internal initiating event contributors to internal event CDF from the total internal events CDF.

(c) Obtained by subtracting the sum of the fire initiating event contributors to fire event CDF from the total fire events CDF.

(d) Obtained by subtracting the sum of the seismic initiating event contributors to seismic event CDF from the total seismic events CDF.

(e) NextEra explained in response to an RAI the difference in the frequencies reported for many initiating events for the 2006 and 2011 PRA models. The total internal events CDF in the 2011 model decreased slightly as a result of model enhancements, the internal flooding CDF increased as results of a more detailed flooding analysis, and the severe weather CDF decreased primarily due to the incorporation of more recent data (NextEra 2012b).

Per the 2012 SAMA supplement (NextEra 2012a), the quantified CET sequences are binned into a set of 21 release categories, which are subsequently grouped into 13 source term categories that provide the input to the Level 3 consequence analysis (NextEra 2012a). The frequency of each source term category was obtained by summing the frequency of the individual accident progression CET endpoints, or release categories, assigned to each source term category. Source terms were developed using the results of MAAP Version 4.0.7 computer code calculations (NextEra 2012a).

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution within an 80-km (50-mi) radius for the year 2050, emergency response evacuation planning, and economic parameters. The core radionuclide inventory corresponds to the end-of-cycle values for Seabrook operating at 3,659 MWt, which is slightly above the current licensed power level of 3,648 MWt. The magnitude of the onsite impacts (in terms of cleanup and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC 1997a).

In the 2012 SAMA supplement (NextEra 2012a), NextEra estimated the dose to the population within 80 km (50 mi) of the Seabrook site to be approximately 0.378 person-Sievert (Sv) (37.8 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table F-2. The large late releases are the dominant contributors to population dose risk at Seabrook.

Table F–2. Breakdown of Population Dose by Containment Release Mode

Containment release mode	Population dose (person-rem[a] per year)	% contribution
Small early releases	1.7	5
Large early releases	1.7	4
Large late releases[b]	34.4	91
Intact containment	negligible	negligible
Total	**37.8**	**100**

[a] One person-rem = 0.01 person-Sv

[b] Includes small early containment penetration failure to isolate and large late containment basemat failure (SELL).

F.2.2 Review of NextEra's Risk Estimates

NextEra's determination of offsite risk at Seabrook is based on the following major elements of analysis:

- the Level 1 and 2 risk models that form the bases for the 1991 IPE submittal (NHY 1991) and the external event analyses of the 1992 IPEEE submittal (NAESC 1992);
- the major modifications to the IPE and IPEEE models that have been incorporated in the Seabrook PRA, including a complete revision of the Level 2 risk model; and
- the MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PRA model into offsite consequence measures (essentially this equates to a Level 3 PRA).

Each of these analyses was reviewed to determine the acceptability of the Seabrook risk estimates for the SAMA analysis, as summarized below.

The first Seabrook PRA was completed in December 1983, its purpose being to provide a baseline risk assessment and an integrated plant and site model for use as a risk management tool. This model was subsequently updated in 1986, 1989, and 1990, with the last update used to support the IPE.

The NRC staff's review of the Seabrook IPE is described in an NRC report dated March 1, 1992 (NRC 1992). Based on a review of the original IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of generic letter (GL) 88-20 (NRC 1988). That is, the applicant demonstrated an overall appreciation of severe accidents, had an understanding of the most likely severe accident sequences that could occur at Seabrook, and had gained a quantitative understanding of core damage and fission product release. Although no severe accident vulnerabilities were identified in the Seabrook IPE, 14 potential plant improvements were identified. Four of the improvements have been implemented. Each of the 10 improvements not implemented is addressed by a SAMA in the current evaluation and is discussed further in Section F.3.2.

The internal events CDF value from the 1991 Seabrook IPE (6.1×10^{-5} per year) is near the average of the range of the CDF values reported in the IPEs for Westinghouse four-loop plants. Figure 11.6 of NUREG-1560 shows that the IPE-based internal events CDF for these plants range from about 3×10^{-6} per year to 2×10^{-4} per year, with an average CDF for the group of 6×10^{-5} per year (NRC 1997b). It is recognized that plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. Based on CDF values reported in the SAMA analyses for license renewal applications (LRAs), the internal events CDF result for Seabrook used for the SAMA analysis (7.8×10^{-6} per year, including internal and external flooding) is somewhat lower than that for most other plants of similar vintage and characteristics.

There have been 11 revisions to the IPE model since the 1991 IPE submittal, and 4 revisions to the PRA model, as discussed previously, from the original 1983 PRA model to the 1990 update used to support the IPE submittal. The SSPSS-2006 model was used for the SAMA analysis presented in the ER (NextEra 2010) but was updated by the SSPSS-2011 model used in the 2012 SAMA supplement (NextEra 2012a). A listing of the major changes in each revision of the PRA, and the associated change in internal and external event CDF, was provided in the ER (NextEra 2010) in response to an NRC staff RAI (NextEra 2011a), in the 2012 SAMA supplement (NextEra 2012a), and is summarized in Table F-3. A comparison of the internal events CDF between the 1991 IPE and the 2011 PRA model used for the 2012 SAMA supplement indicates a decrease of approximately 87 percent (from 6.1×10^{-5} per year to 7.8×10^{-6} per year). This decrease results from the significant changes shown, while the external events CDF has increased by approximately 25 percent since the 1993 IPEEE (from 3.6×10^{-5} per year to 4.5×10^{-5} per year).

Table F–3. Seabrook PRA Historical Summary

PRA version	Summary of significant changes from prior model[(a)]	Total CDF (per year)	Internal events CDF (per year)[(b)]	External events CDF (per year)[(b)]
SSPSA-PLG-0300 (1983)	Original model—includes internal, fire, and seismic events	2.3×10^{-4}	$1.8x10^{-4}$	$4.6x10^{-5}$
SSPSS-1986	Updated allowed outage times to reflect current technical specifications Revised models of the inservice test pump test frequency; turbine driven emergency feedwater (TDEFW) pump atmospheric relief valves; boron injection tank, pump, and lines; enclosure building air handling system; reactor trip breakers; & reactor coolant pump (RCP) thermal barrier core spray (CS) Improved quantification traceability & documentation Updated seismic fragilities Expanded common cause treatment	2.9×10^{-4}	Not provided	Not provided
SSPSS-1989	Updated initiating event frequencies Updated common cause & maintenance distributions Revised electric power recovery model using current data Added recovery actions into event model	1.4×10^{-4}	$9.5x10^{-5}$	$4.5x10^{-5}$
SSPSS-1990	IPE submittal Added modeling of ATWS mitigation system Updated electric power recovery model Updated RCP seal LOCA analysis Added new recovery actions Revised CET to explicitly model induced SGTR & direct containment heating	1.1×10^{-4}	6.1×10^{-5}	5.0×10^{-5}
SSPSS-1993	IPEEE submittal Added plant-specific data for main safety pumps & diesel generators (DGs) Improved fire event modeling, including modeling operator actions & addition of new fire hazard initiating events Revised startup feed pump (SUFP) model to conservatively require manual startup Improved modeling of high-pressure injection (HPI) and event tree logic	8.0×10^{-5}	4.4×10^{-5}	3.6×10^{-5}

PRA version	Summary of significant changes from prior model[a]	Total CDF (per year)	Internal events CDF (per year)[b]	External events CDF (per year)[b]
SSPSS-1996	Improved common cause modeling of primary component cooling (PCC) with opposite PCC train failure Updated ATWS model to account for change from an 18-month to 24-month fuel cycle Increased use of plant-specific data Changed definition of LERF to include steam leak from SGTR Increased failure likelihood for small containment penetrations in seismic sequences Added credit for manual operator action to close RCP seal return line motor-operated valve (MOV)	$4.3{\times}10^{-5}$	$2.1{\times}10^{-5}$	$2.2{\times}10^{-5}$
SSPSS-1999	Updated LOCA initiator frequencies Updated ATWS model to account for change from a 24-month to an 18-month fuel cycle & to use more current failure rates Updated event tree to explicitly incorporate RCP seal LOCA model & related power recovery models Changed emergency diesel generator (EDG) mission time from 6 hours to 24 hours for weather-related LOOP & similar initiators Moved LOOP & internal flooding models from external to internal events model Modified common cause factors & mission times for PCC system & SWS Updated human error probability (HEP) event tree rules & quantification	$4.6{\times}10^{-5}$	$2.7{\times}10^{-5}$	$1.9{\times}10^{-5}$
SSPSS-2000	Transitioned PRA software from DOS-based RISKMAN 9.2 to Windows-based RISKMAN 3.0	$4.6{\times}10^{-5}$	$2.7{\times}10^{-5}$	$1.9{\times}10^{-5}$
SSPSS-2001	Changed system initiator models	$4.8{\times}10^{-5}$	$2.8{\times}10^{-5}$	$2.0{\times}10^{-5}$
SSPSS-2002	Integrated shutdown & low power risk models into all-modes model	$4.8{\times}10^{-5}$	$2.5{\times}10^{-5}$	$2.0{\times}10^{-5}$
SSPSS-2004	Updated the human reliability analysis (HRA) Added credit for the supplemental electric power system (SEPS) DG Updated the LERF model to include consequential SGTR	$3.0{\times}10^{-5}$	$1.7{\times}10^{-5}$	$1.3{\times}10^{-5}$
SSPSS-2005	Revised success criteria & operator timing Updated the seismic PRA Updated DG failure rate & unavailability data Updated the Level 2 analysis including modeling of severe accident management guideline (SAMG) actions	$1.4{\times}10^{-5}$	$9.5{\times}10^{-6}$	$4.5{\times}10^{-6}$
SSPSS-2006	Updated the Mode 4, 5, & 6 shutdown model Revised modeling of PCC & SWS initiators	$1.5{\times}10^{-5}$	$1.1{\times}10^{-5}$	$4.5{\times}10^{-6}$

PRA version	Summary of significant changes from prior model[(a)]	Total CDF (per year)	Internal events CDF (per year)[(b)]	External events CDF (per year)[(b)]
SSPSS-2009	Updated plant-specific data & generic data distributions Incorporated electric power convolution model Expanded the steam generator (SG) model to include condenser cooling, circulating water, & condenser steam dump Revised operator action modeling	1.2×10^{-5}	7.1×10^{-6}	4.9×10^{-6}
SSPSS-2011[(c)]	Updated the internal flood model to incorporate plant changes, EPRI data and guidance, and to meet current PRA standards for internal flooding[(d)] Revised release category and source term based on more detailed modeling using MAAP 4.0.7 Added new breakers and buses to reflect a switchyard upgrade	1.2×10^{-5}	7.8×10^{-6}	4.5×10^{-6}

(a) Summarized from information provided in the ER and in response to an NRC staff RAI (NextEra 2011a).

(b) Estimated from percent contribution to total CDF provided in response to an NRC staff RAI (NextEra 2011a).

(c) PRA model revision used in the 2012 SAMA supplement (NextEra 2012a).

(d) NextEra confirmed in response to an RAI that flow orifices installed in the plant and credited in the internal flooding model passed startup acceptance testing (NextEra 2012b).

The NRC staff considered the peer reviews performed for the Seabrook PRA and the potential impact of the review findings on the SAMA evaluation. In the ER (NextEra 2010), NextEra identifies two peer reviews that have been performed on the PRA—a 1999 Westinghouse Owner's Group (WOG) certification peer review and a 2005 focused peer review against the American Society of Mechanical Engineers (ASME) PRA standard (ASME 2003). The 2012 SAMA supplement (NextEra 2012a) identifies an additional peer review—a 2009 peer review of the internal flood model against the ASME PRA standard (ASME 2009). There were no Category A facts and observations (F&Os) from that 2009 focused peer review, and the three Category B F&Os were addressed in the SSPSS-2011 PRA model update. In response to an NRC staff RAI, NextEra clarified the scope of these 1999 and 2005 peer reviews. The 1999 review provided a full review of the technical elements of the Level 1 and 2 LERF internal events models, including internal flooding and the 2005 peer review providing a focused scope examination of Level 1 internal events accident sequences, success criteria, post-initiating event HRA, and configuration control (NextEra 2011a). Neither the 1999 nor the 2005 peer review included examination of external flooding, fire, or seismic hazards. The 1999 certification peer review identified 30 Category A and B F&Os, and the 2005 focused peer review identified 4 Category A and B F&Os.[2] The applicant provides the resolution of each of the 34 F&Os in the ER and states that all have been dispositioned and implemented in the PRA model.

The NRC staff requested that NextEra clarify how the resolution to F&O 3 (aggressive load shedding and the available cross tie can extend battery life from 8 to 12 hours) addresses the F&O. The NRC asked NextEra to assess the ability of the operators to successfully cool the

[2] Now termed a "Finding," a Category A or B F&Os is an "observation (an issue or discrepancy) that is necessary to address to ensure: [1] the technical adequacy of the PRA ... [2] the capability/robustness of the PRA update process, or [3] the process for evaluating the necessary capability of the PRA technical elements (to support applications)." (NEI 05-04, "Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard," Revision 2, 2008)

core using the emergency feedwater (EFW) pump without underfeeding the SGs (NRC 2010a). In response to the RAI, NextEra clarified that during an extended SBO condition, the normal control instrumentation and procedures for which operators are trained and with which they are familiar would be used to maintain long-term control of SG water level (NextEra 2011a).

The NRC staff asked NextEra to summarize the scope and unresolved findings from any other reviews performed on the Seabrook PRA (NRC 2010a). In response to the RAI, NextEra explained that many other internal reviews—including vendor-assisted reviews—have been performed on specific model updates, and comments from these reviews—along with plant changes and potential model enhancements—are tracked through a model change database to assure that the comments are addressed in the periodic update process (NextEra 2011a). NextEra specifically explains in the 2012 SAMA supplement (NextEra 2012a) that the source term analysis was performed by the PRA group and reviewed by industry experts from a vendor, and the Level 3 model was prepared by experts from a vendor and independently reviewed.

The NRC staff asked NextEra to identify any changes to the plant, including physical and procedural modifications, since the SSPSS-2006 PRA model that could have a significant impact on the results of the SAMA analysis (NRC 2010a). In response to the RAI, NextEra stated that there have been no major plant changes since PRA model SSPSS-2006 was issued that could significantly impact the SAMA analysis but did identify specific plant and model changes made that resulted in the 2009 periodic update of the model, referred to as PRA model SSPSS-2009 (NextEra 2011a). NextEra explained that the model changes resulted in a total CDF decrease of about 19 percent but resulted in no significant shift in the relative importance of initiating events or components. Since then, NextEra has updated the SSPSS-2011 PRA model, which uses source estimates based on more detailed MAAP modeling and meets the internal flooding requirements in the ASME PRA standard (ASME 2009). The 2012 SAMA supplement (NextEra 2012a) is based on the SSPSS-2011 model and calculates an increase in the CDF, compared to the SSPSS-2009 model, by about 5 percent.

The NRC staff asked NextEra to describe the PRA quality control process used at Seabrook (NRC 2010a). NextEra responded that an existing administrative procedure defines the quality control process for updates to the Seabrook PRA, and the process is consistent with requirements of the ASME 2009 PRA standard (ASME 2009) and ensures that the PRA model accurately reflects the current Seabrook plant design, operation, and performance (NextEra 2011a). The quality control process includes monitoring PRA inputs for new information, recording new applicable information, assessing the significance of new information, performing PRA revisions, and controlling computer codes and models. NextEra also stated that the PRA training qualification is performed as part of the Engineering Support Personnel Training Program.

Given that the Seabrook internal events PRA model has been peer-reviewed and the peer review findings were all addressed, and that NextEra has satisfactorily addressed NRC staff questions regarding the PRA, the NRC staff concludes that the internal events Level 1 PRA model is of sufficient quality to support the SAMA evaluation.

The Seabrook PRA model is an integrated internal and external events model in that it includes seismic-initiated, fire-initiated, and external flooding-initiated events as well as internal initiating events. The external events models have been integrated with the internal events model since the initial 1983 PRA (NextEra 2011a). The external events models used in the SAMA evaluation are essentially those used in the IPEEE, with the exception of the seismic PRA model, which underwent a major update for the SSPSS-2005 model. The updated external events CDF results are described in a response to an NRC staff RAI (NextEra 2011a) and are included in Table F-3 along with the internal events results.

The Seabrook IPEEE was submitted October 2, 1992 (NAESC 1992), in response to Supplement 4 of GL 88-20 (NRC 1991). The submittal used the same PRA as was used for the IPE (i.e., SSPSS-1990) except for updates to the external events. No fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events were identified. Improvements that have already been realized as a result of the IPEEE process minimized the likelihood of there being cost-beneficial enhancements as a result of the SAMA analysis, especially with the inclusion of a multiplier to account for the additional risk of seismic events. In a letter dated May 2, 2001, the NRC staff concluded that the submittal met the intent of Supplement 4 to GL 88-20 and the applicant's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 2001).

The Seabrook IPEEE seismic analysis used a seismic PRA following NRC guidance (NRC 1991a). The seismic PRA included a seismic hazard analysis, a seismic fragility assessment, seismic quantification to yield initiating event frequencies and conditional system failure probabilities, and plant model assembly to integrate seismic initiators and seismic-initiated component failures with random hardware failures and maintenance unavailabilities.

The seismic hazard analysis estimated the annual frequency of exceeding different levels of ground motion. Seabrook seismic CDFs were determined for site-specific, Electric Power Research Institute (EPRI) (EPRI 1989) and Lawrence Livermore National Laboratory (LLNL) (NRC 1994) hazard curves. The seismic fragility assessment was performed by walkdowns that were conducted at the time of the original seismic PRA in 1982 through 1983, walkdowns performed for a revised fragility analysis in 1986, and supplemental walkdowns performed in 1991 for the IPEEE, using procedures and screening caveats in EPRI's seismic margin assessment methodology (EPRI 1988). Fragility calculations were made for about 82 components using a screening criterion of median peak ground acceleration of 2.0 g, which corresponds to a high confidence (95 percent) low probability (5 percent) of failure (HCLPF) capacity. A total of 15 components and 2 sets of relay groups were further assessed. Fragility calculations were also made for eight buildings and structures, and HCLPF values were determined. The seismic systems analysis defined the potential seismic induced structure and equipment failure scenarios that could occur after a seismic event and lead to core damage. The Seabrook IPE event tree and fault tree models were used as the starting point for the seismic analysis. Quantification of the seismic models consisted of convoluting the seismic hazard curve with the appropriate structural and equipment seismic fragility curves to obtain the frequency of the seismic damage state. The conditional probability of core damage, given each seismic damage state, was then obtained from the IPE models with appropriate changes to reflect the seismic damage state. The CDF was given based on the product of the seismic damage state probability and the conditional core damage probability.

Quantification of the seismic CDF for Seabrook was performed in nine discrete ground acceleration ranges between 0.1 g to 2.0 g. The seismic CDF resulting from the Seabrook IPEEE was calculated to be 1.2×10^{-5} per year using a site-specific seismic hazard curve, with sensitivity analyses yielding 1.3×10^{-4} per year using the LLNL seismic hazard curve and 6.1×10^{-6} per year using the EPRI seismic hazard curve. The Seabrook IPEEE did not identify any vulnerability due to seismic events but did identify two plant improvements to reduce seismic risk. Neither of the two improvements has been implemented. Each of the two improvements is addressed by a SAMA in the current evaluation and is discussed further in Section F.3.2.

Subsequent to the IPEEE, NextEra updated the seismic PRA analysis. The NRC staff asked NextEra to describe the changes to the seismic analysis incorporated in the PRA model SSPSS-2005 update and to explain the reasons for any significant changes to the seismic CDF (NRC 2011a). In response to the RAI, NextEra stated that the most significant changes to the IPEEE seismic model made in the SSPSS-2005 update of the Seabrook PRA were as follows (NextEra 2011a):

- The fragility analysis was updated to extend the fragility screening of equipment from greater than 2.0 g to the range from 2.0 g to 2.5 g and greater than 2.5 g to better capture seismic risk.
- The EPRI hazard curve was adopted and used to update the equipment fragilities. The site-specific hazard curve was replaced with the EPRI hazard curve because the EPRI uniform hazard spectrum (UHS) developed for the Seabrook site is more current and realistic than that used in the original 1983 and the IPEEE PRA. In response to a followup NRC staff RAI, NextEra further clarified that the EPRI UHS was judged to be more realistic and representative of the best estimate hazard because of overall general improvement in seismic technology from the early 1980s to 1989, when the EPRI hazard curve was developed (NextEra 2011b). The probabilistic estimates of seismic capacity of structures and components were updated to reflect component-specific fragility information and the EPRI UHS.
- Several new component fragilities were added to the seismic PRA model, including seismic fragilities for the SEPS DGs, which had been added to the plant since the IPEEE.
- Modeling and documentation of operator actions credited in the seismic PRA were improved.

NextEra stated that the most recognizable conservatism in the seismic model is the use of complete correlation of the fragility between identical components, such as both EDGs are assumed to fail at the same seismic hazard level (NextEra 2011a). NextEra further stated that extensive internal technical reviews of the seismic PRA analysis were performed for the original 1983 PRA, when the seismic analysis was revised for the IPEEE, and when the seismic analysis was revised for the SSPSS-2005 PRA model update. No significant comments were documented from these reviews, and no formal peer reviews have been conducted on the seismic PRA model (NextEra 2011a).

The NRC staff noted that, in the attachments to NRC Information Notice 2010-18, generic issue (GI) 199 (NRC 2010b), the NRC staff estimated a seismic CDF for Seabrook of between 5.9×10^{-6} per year and 2.2×10^{-5} per year using updated seismic hazard curves developed by the U.S. Geological Survey (USGS) in 2008 (USGS 2008). The NRC staff asked that NextEra provide an assessment of the impact of the updated USGS seismic hazard curves on the SAMA evaluation (NRC 2010a). In response to the RAI, NextEra provided a revised SAMA evaluation to account for the maximum GI-199 seismic CDF of 2.2×10^{-5} per year, which is discussed further below (NextEra 2011a, 2011b). The 2012 SAMA supplement (NextEra 2012a) uses a multiplier of 2.1 to account for a higher seismic hazard than assessed in the PRA.

Considering the following points, the NRC staff concludes that the seismic PRA model, in combination with the use of a seismic events multiplier, provides an acceptable basis for identifying and evaluating the benefits of SAMAs:

- The Seabrook seismic PRA model is integrated with the internal events PRA.
- The seismic PRA has been updated to include additional components and to extend the fragility-screening threshold.
- The SAMA evaluation was updated using a multiplier to account for a potentially higher seismic CDF.
- NextEra has satisfactorily addressed NRC staff RAIs regarding the seismic PRA.

The Seabrook IPEEE fire analysis, which was significantly updated from the original fire analysis completed in 1983, employed EPRI's FIVE methodology (EPRI 1992) to calculate area fire frequencies, quantitatively screen areas, and provide hazards analysis for resulting critical areas. The quantification of CDF was obtained by propagating fire-induced initiating events through the PRA used for the IPE.

The IPEEE fire areas were based on definitions of Appendix R fire areas for Seabrook. Qualitative screening was performed using a spatial database specifically developed for the IPEEE fire analysis that identified equipment important in initiating or mitigating an accident. Of the 73 fire areas, 13 were determined to contain important equipment (pumps, valves, and cabling, etc.) and were further assessed. Quantitative screening used industry fire data and the assumption that a fire in a compartment damaged all equipment and cables in the compartment. The resulting fire-initiating events are propagated through the appropriate event tree models. Using fire frequencies and conditional core damage probabilities from the internal events PRA, all but eight fire areas were screened as contributing less than $1{\times}10^{-6}$ per year to the CDF.

Based on the FIVE fire methodology analysis, the unscreened areas were assessed by considering possible targets, fire sources and combustibles, possible fire scenarios (e.g., target-in-plume), and detection and suppression systems to determine the probability of damage given a fire. Credit was explicitly taken for automatic and manual fire suppression. Calculation of automatic fire suppression unavailability was supported by fault tree modeling. Calculation of manual suppression unavailability was supported by HRA. Consideration of fires on containment performance was also addressed. Final quantification used the Seabrook IPE PRA model to determine plant responses and CDFs. The resulting fire-induced CDF was calculated to be $1.2{\times}10^{-5}$ per year. While no physical plant changes were found to be necessary as a result of the IPEEE fire analysis, fire potential plant improvements to improve fire risk were identified. Four of the plant improvements have been implemented. The one improvement not implemented is addressed by a SAMA in the current evaluation and is discussed further in Section F.3.2.

NextEra updated the fire PRA subsequent to the IPEEE. The NRC staff asked NextEra to describe the changes to the fire analysis since the IPEEE and to explain the reasons for any significant changes to the fire CDF (NRC 2011a). In response to the RAI, NextEra explained that the most recent update of the fire PRA was in support of the SSPSS-2004 PRA update, and the fire analysis methodology used is essentially the same, with some variations, as that described previously for the IPEEE fire analysis (NextEra 2011a). Specific changes made to the Seabrook fire PRA since the IPEEE are listed below:

- including current plant data and procedures;
- performing detailed walkdowns to verify locations of the major fire sources and important targets;

- updating data to the EPRI fire database that includes fire records through December 2000;
- developing updated severity factors for cabinets, pumps, control room panels, and transients;
- revisiting the quantitative screening results;
- using new data on cabinet heat release rates; and
- quantitatively evaluating the total area heat-up rate.

NextEra stated that the most significant conservatism in the fire analysis is the assumption that small fires, typical of the generic fire events database, are assumed to grow to cause the maximum damage (NextEra 2010). However, because these fire sequences have such low frequencies and large uncertainties, NextEra claimed that the impact of this conservatism on the overall fire CDF is difficult to determine (NextEra 2011a). NextEra further stated that extensive internal technical reviews of the fire PRA analysis were performed for the original 1983 PRA, when the fire analysis was revised for the IPEEE and when the fire analysis was revised for the SSPSS-2005 PRA model update. No significant comments were documented from these reviews, and no formal peer reviews have been conducted on the fire PRA model (NextEra 2011a).

In a followup RAI, the NRC staff asked NextEra to clarify if fire-induced failures of components and human actions credited with mitigating the initiator were assessed and to describe how hot short probabilities were considered in the fire analysis (NRC 2011b). In response to the RAI, NextEra clarified that, for fire initiators that are not screened and are evaluated in detail, the probability of fire damage to components due to the fire is included in the analysis and that this probability is dependent upon the presence of combustible material and the success of suppression (NextEra 2011b). NextEra stated that the probability of additional failures needed for core damage was also evaluated, including unavailability of redundant systems and components and failure of operator actions, and component failures not impacted by the fire are modeled as random. Regarding the hot short probability question, NextEra explained that a hot short probability of 0.1 was used in the screening evaluation for important valves and components. NextEra also described the results of an evaluation to assess the sensitivity of the SAMA results to using a hot short probability of 0.6. This evaluation determined that the fire event screening evaluation is insensitive to this increase in the potential for hot shorts and that, while the contribution to CDF does increase due to the higher probability, the contribution compared to the CDF contribution of similarly modeled internal events remains relatively low. Specifically, NextEra evaluated 18 fire events and determined that 3 of the events contributed in the range of 10 to 20 percent of the corresponding internal events CDF, and the remaining 15 fire events contributed less than 10 percent. Based on this result, NextEra determined that the increase in hot short potential does not have a significant effect on the SAMA analysis (NextEra 2011b).

The NRC staff noted that the fire ignition frequencies for a fire in SWGR room B—Loss of Bus E6 and SWGR room A—Loss of Bus E5, which were reported to be about 1.0×10^{-3} per year each, appeared to be low unless the fire only involved the associated buses. The NRC staff asked that NextEra justify these values (NRC 2010a). NextEra responded that the ignition frequency for SWGR room B—Loss of Bus E6 includes the cumulative fire ignition frequencies for 21 Bus E6 cabinets and 170 other electrical cabinets. SWGR room A—Loss of Bus E5 similarly includes the cumulative fire ignition frequencies for 21 Bus E5 cabinets and 86 other electrical cabinets (NextEra 2011a). NextEra explained that the cited value of 1.0×10^{-3} per year was more than just “frequency” (i.e., it included not only fire ignition frequency of 4.6×10^{-5} per year per cabinet but also a severity factor of 0.2 and a manual non-suppression probability of 0.1 for fires in the other electrical cabinets). Therefore, the calculated total fire ignition frequency for each of the two SWGR rooms is the same as that reported in the ER. The NRC staff considers NextEra's assumptions reasonable.

Considering that the Seabrook fire PRA model is integrated with the internal events PRA, that the fire PRA has been updated to include more current data, and that NextEra has satisfactorily addressed NRC staff RAIs regarding the fire PRA, the NRC staff concludes that the fire PRA model provides an acceptable basis for identifying and evaluating the benefits of SAMAs.

The Seabrook IPEEE analysis of high winds, tornadoes, external floods, and other (HFO) external events followed the screening and evaluation approaches specified in Supplement 4 to GL 88-20 (NRC 1991) and concluded that Seabrook meets the 1975 Standard Review Plan (SRP) criteria (NRC 1975). Two external event frequencies exceeded the 1.0×10^{-6} per year screening criterion (NAESC 1992). One of these events is flooding resulting from a storm surge caused by a hurricane, which is modeled in the PRA and described in the ER (NextEra 2010) as event EXFLSW in which the SW pumps are flooded. This sequence was reported in the ER to contribute just 2×10^{-8} per year to the total Seabrook CDF. The second event is an external initiating event involving a truck crash into the SF6 transmission lines. In response to an NRC staff RAI, NextEra explained that this event has been mitigated by the installation of jersey barriers and guard rails that further limit the possibility of a truck crash impacting the transmission lines and that, as a result, this initiating event has been screened from the PRA model (NextEra 2011a).

While no physical plant changes were found to be necessary as a result of the IPEEE HFO analysis, one plant improvement based on HFO analysis was recommended—modify several exterior doors so that they will be able to withstand the design pressure differential resulting from high winds. NextEra clarified in response to an NRC staff RAI that this suggested improvement has been implemented (NextEra 2011a).

The NRC staff noted that while the risk of flooding resulting from a storm surge caused by a hurricane is included in the PRA, the impact of hurricane-force winds does not appear to be addressed, and the NRC staff requested that NextEra provide an assessment of the risk of this event on the Seabrook site (NRC 2010a). In response to the RAI, NextEra explained that the high winds associated with a hurricane that might accompany a storm surge are screened from consideration because the site design basis criteria for high winds and tornadoes meets the 1975 SRP criteria (NextEra 2011a). The NRC staff considered this explanation acceptable.

The Seabrook IPEEE submittal also stated that as a result of the Seabrook IPE, cost-benefit analyses are being performed for many potential plant improvements, which may also reduce external event risk because they address functional failures. Five potential plant improvements to improve internal event risk that may also reduce external event risk were identified. Four of the plant improvements have been implemented. The one improvement not implemented is addressed by a SAMA in the current evaluation and is discussed further in Section F.3.2.

NextEra estimated the benefits for both internal and external events using the integrated Seabrook PRA model. However, as discussed previously, an NRC staff assessment of the USGS 2008 seismic hazard curves yielded an upper bound seismic CDF for Seabrook of 2.2×10^{-5} per year, which is substantially greater than the 3.1×10^{-6} per year seismic CDF used in the SAMA evaluation. The NRC staff requested that NextEra provide an assessment of the impact of this higher seismic CDF on the SAMA evaluation (NRC 2010a, 2011b). In response to the RAIs, NextEra noted that the NRC staff's estimate of the seismic CDF using the USGS 2008 seismic hazard curves did not include credit for the SEPS DGs installed at Seabrook in 2004, which have a median seismic fragility of 1.23 g (NextEra 2011b). NextEra stated that the

SEPS DGs were modeled in the Seabrook seismic PRA in 2005 and reduced the seismic CDF by approximately 26 percent by avoiding SBO sequences, and a corresponding reduction in the NRC staff estimate of the seismic CDF using the USGS 2008 seismic hazard curves to 1.6×10^{-5} per year would be expected. NextEra also provided a sensitivity analysis using a multiplier of 2.1 to account for the revised higher seismic CDF. This multiplier is based on an increased seismic CDF of 1.3×10^{-5} per year (upper bound seismic CDF of 1.6×10^{-5} per year minus seismic CDF of 3.1×10^{-6} per year used in the SAMA evaluation) and a total estimated CDF of 1.2×10^{-5} per year for PRA model SSPSS-2009 (NextEra 2011b). The NRC staff agrees that a seismic CDF of 1.6×10^{-5} per year for Seabrook is reasonable and agrees that the applicant's use of a multiplier of 2.1, which was used in the 2012 SAMA supplement (NextEra 2012a), to account for the additional risk from seismic events is reasonable for the purposes of the SAMA evaluation. This is discussed further in Section F.6.2.

The NRC staff reviewed the general process used by NextEra to translate the results of the Level 1 PRA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in response to NRC staff RAIs (NextEra, 2011a). The Level 2 model was significantly revised in the 2005 PRA update (i.e., PRA model SSPSS-2005) from that used in the IPE and reflects the Seabrook plant as designed and currently operated. In response to an NRC staff RAI (NextEra 2010), NextEra identified the following major changes to the PRA that most impacted the LERF (NextEra 2011a):

- change in definition of LERF to include steam leak from a steam generator tube rupture (SGTR),
- higher failure likelihood for small containment penetrations in seismic sequences,
- update to credit manual operator action to close the reactor coolant pump (RCP) seal return line MOV,
- expansion of the LERF model by adding a steam line break to SGTR and consideration of ATWS sequences,
- updates to the Level 2 analysis to reflect current state of knowledge including SAMGs,
- revisions to incorporate plant-specific data,
- update of data distributions, and
- revisions to operator action modeling.

No Level 2 design or plant changes were identified in the 2012 SAMA supplement (NextEra 2012a).

In response to an NRC staff RAI, NextEra explained that the quantification of the Level 1 and Level 2 models is done using a linked event tree method approach and does not employ plant damage states (PDSs) (NextEra 2011a). Therefore, all Level 1 sequences are evaluated by the CET, making it unnecessary to summarize and group similar sequences into Level 1 PDSs before they are input to the CET. The Level 2 model is a single CET and evaluates the phenomenological progression of all the Level 1 sequences including internal, fire, and seismically initiated events. In response to another NRC staff RAI, NextEra clarified that the CET has 37 branching events, which include 10 hardware-related, 13 human action-related, and 13 phenomena-related events, along with a single mapping event (NextEra 2011a). CET branch point split fraction numerical values are determined based on the type of event. The CET event success criterion is defined, and split fraction logic rules are used to apply the correct event split fraction values during CET quantification. Included in the response to the NRC staff RAI, NextEra provided a description of each of the 37 CET branching events. End states resulting from the combinations of the branches are then assigned to one of 16 release categories based on characteristics that determine the timing and magnitude of the release, whether or not the containment remains intact, and isotopic composition of the released material. In response to another NRC staff RAI, NextEra clarified that the frequency of each RC was obtained by summing the frequency of the individual accident progression CET end states binned into the RC (NextEra 2011a).

The quantified CET sequences binned into the 21 release categories are subsequently grouped into 13 source term categories that provide the input to the Level 3 consequence analysis (NextEra 2012a). In response to an NRC staff RAI, NextEra explained that the release categories were reduced to source term categories by grouping release categories that occur due to different phenomena, but the consequence is essentially the same (e.g., thermally induced SGTR and pressure-induced SGTR) (NextEra 2011a). Eight of the release categories were mapped one-to-one into a corresponding source term category. For three of the source term categories, three release categories were binned together to form the combined source term category, and for two of the source term categories, two release categories were binned together to form the combined source term category.

Source terms were developed for each of the source term categories. In the 2012 SAMA supplement, NextEra explains that the release fractions and timing for source term categories are based on the results of plant-specific calculations using the MAAP Version 4.0.7 and represent more realism and an upgrade from the source terms presented in the ER (NextEra 2010). NextEra generally selected the representative MAAP case based on that which resulted in the most realistic timing and source term release. In four of the combined source term categories, the source term for the RC having the highest (dominant) release frequency was used as the source term for the combined category. The consequences from the contributors were considered similar. In one of the four categories, the total frequency was very low (approximately 1E-9 per year). In the fifth combined source term category (i.e., SELL), one of the contributors had the most significant source term and the highest frequency so it was selected as the representative case. The source term categories and their frequencies and release characteristics are presented in tables on pages 12, 13, and 18 of the 2012 SAMA supplement (NextEra 2012a).

As indicated above, the current Seabrook Level 2 PRA model is an update of that used in the IPE. The IPE did not identify any severe accident vulnerabilities associated with containment performance. Risk-related insights and improvements discussed in the IPE submittal were discussed previously. The NRC staff review of the IPE back-end (i.e., Level 2) model concluded that it appeared to have addressed the severe accident phenomena normally associated with large dry containments, it met the IPE requirements, and there were no obvious or significant problems or errors.

The LERF model was included in the 1999 industry peer review discussed previously. Seven of the F&Os from this review addressed the LERF analysis. The applicant provides in the ER the resolution of each of the seven F&Os and states that all have been dispositioned and implemented in the PRA model. NextEra noted that the Seabrook radiological source terms were significantly revised for the SSPSS-2005 PRA model based on Level 2 analysis by Westinghouse Electric Company. In addition, NextEra noted that the source terms were further revised during the SSPSS-2011 PRA model and are reflected in the 2012 SAMA supplement (NextEra 2012a).

The NRC staff noted that the LERF reported for Seabrook is less than 1 percent of the CDF and asked NextEra to explain this apparently very low LERF (NRC 2010a). In response to the RAI, NextEra explained that Seabrook has a very large-volume and strong containment building in comparison to most other nuclear power plant containment designs (NextEra 2011a). As a result of the containment design median failure pressure of 187 pounds per square inch absolute (psia) (dry) and 210 psia (wet), there are no conceivable severe accident progression scenarios that result in catastrophic failure early in the accident sequence. The NRC staff considers NextEra's explanation reasonable.

The NRC staff requested that NextEra explain how fire-induced interfacing system loss-of-coolant accidents (ISLOCAs) and fire-induced containment impacts are addressed in the fire analysis (NRC 2010a, 2011b). In response to the RAIs, NextEra explained that containment performance was evaluated in three areas: (1) containment structure, (2) containment response to a core damage event, and (3) containment isolation failure (NextEra 2011a). Fires were determined to have no impact on containment structure integrity. Fire-initiated core damage events were determined to have the same impact on containment response as internal-initiated events; thus, they are handled through the CET. The potential for containment isolation failure was assessed by evaluating the potential for fire-induced failure of important isolation valves, as follows:

- Because the containment isolation valves (CIVs) are located both inside and outside containment, NextEra concluded that only a fire in the control room or cable spreading room could affect CIVs both inside and outside containment and that, in this event, important CIVs could be controlled locally at the valve or from the remote shutdown panel (RSP). CIVs located outside containment could be controlled both locally at the valve and from the RSP, CIVs located inside containment could be controlled from the RSP, and no credit is taken for local control of valves inside containment (NextEra 2011b).
- Because the letdown system has three normally open, air-operated valves (AOVs) in series, NextEra concluded that hot shorting in all three valves is not credible. NextEra clarified that failure to isolate the letdown system for an extended period of time is judged to not be credible for the following reasons (NextEra 2011b):
  - There are three AOVs inside containment and one AOV outside containment.
  - All four AOVs fail to the closed position upon loss of air or control power.
  - Shorts to ground in the control cables for these AOVs will also result in the AOVs failing to the closed position.
  - There are two MOVs inside containment that are available to provide isolation.
- The potential for fire-induced failures of several other potential isolation pathways was also evaluated (e.g., large residual heat removal (RHR) suction line MOVs, RCP seal return line isolation valves, and containment on-line purge valves) and determined to not be credible.

Based on the information above, NextEra concluded that the only credible impact of fires on containment performance is to fail a single train of isolation. For isolation failure of one or more valves in a single train, either redundant isolation would be available or the ability to remove power from fail closed valves to provide isolation is available (NextEra 2011a). NextEra further clarified that, since Seabrook is designed with divisional cable separation, power to the fail closed valves can be removed, if necessary, by removing its divisional power supply, thus ensuring that the valves fail closed and are prevented from being failed opened due to hot shorting (NextEra 2011b). NextEra further concluded that the frequency of fires that could cause this level of damage is sufficiently low compared to hardware failures that this scenario does not contribute significantly to containment isolation failure and that, as a result, no fire impacts on containment isolation components are included in the PRA (NextEra 2011a).

Based on the NRC staff's review of the Level 2 methodology, the NRC staff concludes that NextEra has adequately addressed NRC staff RAIs, that the LERF model was reviewed in more detail as part of the 1999 WOG certification peer review, and that all F&Os have been resolved. Therefore, the NRC staff concludes that the Level 2 PRA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

As indicated in the ER, the reactor core radionuclide inventory used in the consequence analysis corresponds to the end-of-cycle values for Seabrook operating at 3,659 MWt. This bounds the current Seabrook rated power of 3,648 MWt. The core radionuclide inventory is provided in Table F.3.4.3-1 of Appendix F of the ER (NextEra 2010). In response to an NRC staff RAI, NextEra clarified that a Seabrook-specific core inventory was calculated using ORIGEN2.1 except for Cobalt-58 and Cobalt-60 (NextEra 2011a). NextEra noted that the ORIGEN calculations did not provide isotopic inventories for Cobalt-58 and Cobalt-60. Therefore, these isotope inventories were estimated using the MACCS2 sample problem inventory corrected by the ratio of Seabrook's power level to the MACCS2 sample problem A power level (i.e., 3,659 MWt/3,412 MWt). Based on this clarification, the NRC staff concludes that the reactor core radionuclide inventory assumptions for estimating consequences are reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff reviewed the process used by NextEra to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3 PRA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses. Version 1.13.1 of the MACCS2 code was used to estimate offsite consequences (NRC 1998) based on the results of the SSPSS-2011 PRA model (NextEra 2012a). Plant-specific input to the code includes the source terms for each RC and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within an 80-km (50-mi) radius for the year 2050, emergency evacuation planning, and economic parameters including agricultural production. This information is provided in Section F3.4 of Attachment F to the ER (NextEra 2010) and was unchanged by the 2012 SAMA supplement (NextEra, 2012a).

All releases were modeled as occurring at the top height of the containment building. In the ER, sensitivity cases were run assuming ground level release, as well as releases at 25 percent, 50 percent, and 75 percent of the containment building height. In response to an NRC staff RAI, NextEra reported that decreasing the release height from the top of the reactor building to ground level decreased the population dose risk and offsite economic cost risk by up to 3 percent and 4 percent, respectively (NextEra 2011a). The thermal content of each of the releases was assumed to be the same as ambient (that is a non-buoyant plume). A sensitivity analysis was performed in the ER assuming a 1 MW and 10 MW heat release plume. In response to an NRC staff RAI, NextEra reported that increasing the release heat decreased the population dose risk by 2 percent and 12 percent, and the offsite economic cost risk decreased by 1 percent and 9 percent for the 1 MW and 10 MW heat release, respectively (NextEra 2011a). Wake effects for the containment building were included in the model. A sensitivity analysis was performed in the ER assuming the wake size was one-half and double the baseline wake size. In response to an NRC staff RAI, NextEra reported that decreasing the wake size by one-half decreased the population dose risk by 1 percent and did not change the offsite economic cost risk, while doubling the wake size increased both the population dose risk and offsite economic cost risk by 1 percent (NextEra 2011a). While these sensitivity analyses were not re-performed for the 2012 SAMA supplement, NextEra concluded that the results in the ER would be representative of the updated SAMA evaluation (NextEra 2012a). The NRC staff notes that these results are consistent with previous SAMA analyses that have shown only minor sensitivities to release height, buoyancy, and building wake effects. Based on the information provided, the NRC staff concludes that the release parameters used are acceptable for the purposes of the SAMA evaluation.

NextEra used site-specific meteorological data for the year 2005 as input to the MACCS2 code. The development of the meteorological data is discussed in Section F.3.4.5 of the ER (NextEra 2010). Data from 2004 through 2008 were also considered, but the 2005 data were chosen because the results of a MACCS2 sensitivity analysis indicated that the 2005 data produced more conservative results (i.e., the 2005 data set was found to result in the largest population dose risk and offsite economic cost risk). In response to an NRC staff RAI, NextEra reported that the results of the meteorological data sensitivity analysis, which was performed for each of the years 2004 through 2008, showed a decrease in population dose risk in the range of 5 to 13 percent and a range of 3 to 12 percent decrease in offsite economic cost risk (NextEra 2011a). NextEra repeated this sensitivity study for the 2012 SAMA supplement (NextEra 2012a), and the 2005 data set was again found to result in the largest population dose risk and offsite economic cost risk. Missing data were estimated using data substitution methods. These methods include substitution of missing data with corresponding data from another level on the meteorological tower, interpolation between data from the same level, or data from the same hour and a nearby day of a previous year. Hourly stability was classified according to the system used by the NRC (NRC 1983). The baseline analysis assumes perpetual rainfall in the 40 to 50 mi segment surrounding the site. A sensitivity analysis was performed for the 2012 SAMA supplement assuming measured rainfall rather than perpetual rainfall in the 40 to 50 mi spatial segment (NextEra 2012a). This resulted in a decrease in population dose risk of 14 percent and a decrease in offsite economic cost risk of 15 percent. The NRC staff notes that these results are consistent with previous SAMA analyses that have shown little sensitivity to year-to-year differences in meteorological data. Based on the information provided, the NRC staff concludes that the use of the 2005 meteorological data in the SAMA analysis is reasonable.

The population distribution the licensee used as input to the MACCS2 analysis was estimated for the year 2050 using year 2000 census data as accessed by SECPOP2000 (NRC 2003). The baseline population was determined for each of 160 sectors, consisting of the 16 directions for each of 10 concentric distance rings with outer radii at 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 mi surrounding the site. County population growth estimates were applied to year 2000 census data to develop year 2050 population distribution. The distribution of the population is given for the 10-mi radius from Seabrook and for the 50-mi radius from Seabrook in the ER (NextEra 2010). In response to an NRC staff RAI, NextEra clarified that the year 2000 population was exponentially extrapolated to year 2050 (NextEra 2011a). The NRC staff noted that the total population of 4,157,215, identified in Section 2.6.1 of the ER, was different than the 4,232,394 reported in ER Table F.3.4.1-1 (NRC 2010a). In response to the NRC staff RAI, this difference was attributed to the following factors (NextEra 2011a):

- the choice of distribution centroids between the two references,
- the inclusion of transient population in the population extrapolation for ER Table F.3.4.1-1 but not in ER Section 2.6.1, and

- the assumption that the population fraction is equal to the land area fraction where the 50-mi radius bisects the census block groups.

The NRC staff also requested clarification of why some sectors showed zero or (small) negative population growth (NRC 2010a). NextEra clarified that this was attributed to the geographic information system (GIS) land layers not being detailed enough to account for the existence of some small islands, and the GIS water sectors were projected as zero populations (NRC 2011a). Also, the direction distribution used in the 2050 projection was slightly off-set from the existing population, resulting in some sectors being considered all water and, thus, zero population. In fact, a portion of those sectors include the coastline; therefore, they have a population. The population projections were refined to account for the above and to include the most recent county population growth rates (the sensitivity case above). A sensitivity analysis was performed using the refined population projections and the population distribution centroid for ER Table F.3.4.1-1 (NextEra 2010). This resulted in an overall population decrease of about 4 percent, resulting in a corresponding decrease in population dose risk and economic cost risk of 5 percent and 6 percent, respectively. The NRC staff considers the methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 16 km (10 mi) from the plant. NextEra assumed that 95 percent of the population would evacuate. This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone (EPZ). The evacuated population was assumed to move at an average speed of approximately 0.4 meters per second (0.9 mph) with a delayed start time of 120 minutes after declaration of a general emergency. The evacuation speed was derived from the projected time to evacuate the entire EPZ under adverse weather conditions during the year 2000 (NextEra 2010) and then adjusted by the ratio of the year 2000 EPZ population to the projected year 2050 EPZ population. In the ER, NextEra performed sensitivity analyses in which the evacuation speed, the delayed start time or preparation time for evacuation of the EPZ, and the emergency declaration time were each individually decreased by 50 percent and doubled relative to the base case. In response to an NRC staff RAI, NextEra reported that the decrease in evacuation speed increased the population dose risk by 3 percent, and the increase in evacuation speed decreased the population dose risk by 4 percent. Additionally, the decrease in delay time decreased the population dose risk by 9 percent, the increase in delay time decreased the population dose risk by 2 percent, the decrease in emergency declaration time decreased the population dose risk by 6 percent, and the increase in emergency declaration time decreased the population dose risk by 3 percent (NextEra 2011a). For all three parameters, both the increase and decrease in the base values resulted in no change to the offsite economic cost risk. In the ER, NextEra explained that an increase in delay time or emergency declaration time could decrease population dose risk if the evacuation and plume release are simultaneous. NextEra also performed a sensitivity analysis in the 2012 SAMA supplement (NextEra 2012a) assuming that the population does not evacuate for a severe accident resulting in a small, early containment penetration failure with no source term scrubbing, representative of a seismically induced severe accident event. This resulted in an increase in population dose risk of less than 1 percent and no change in offsite economic cost risk. The NRC staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

In an NRC staff RAI, NextEra clarified that sea-breeze circulation was included in the SAMA evaluation only to the extent that this is included in the onsite meteorological data (NextEra 2011a). NextEra further explained that there are two major mechanisms associated with sea-breezes, a mixing front and thermal internal boundary layer (TIBL). A mixing front results in increased plume mixing and dispersion, resulting in a potential decrease in population dose. This was conservatively ignored in the SAMA evaluation. However, TIBL could decrease dispersion and increase population dose. Given this, NextEra performed a sensitivity study assuming 25 percent of the year with TIBL formation (data for year 2005 identified a TIBL was present 7 percent of the year). The increase in TIBL formation increased the population dose risk and offsite economic cost risk by 4 percent and 7 percent, respectively. NextEra re-performed this sensitivity study in the 2012 SAMA supplement (NextEra 2012a). The results of the evaluation indicate that the population dose and offsite economic cost risks increase by less than 1 percent each. NextEra clarified that the previous results were calculated in MACCS2 using the Monte Carlo random bin sampling technique. The revised evaluation summarized above used the MACCS2 sequential hour analysis technique, which provides a more accurate result compared to the Monte Carlo bin sampling technique. Thus, the latest results are shown to be less than previous results despite the increase in RC source terms. In both the original RAI response and the 2012 SAMA supplement, NextEra performed a sensitivity study of the TIBL lid height by changing the lid height from 110 m to 100 m. The decrease in TIBL lid height, in both sensitivity studies, resulted in an increase in population dose risk and offsite economic cost of less than 1 percent each. The NRC staff concludes that sea-breeze affects have a minor impact on the SAMA analysis results.

Much of the site-specific economic and agricultural data were provided from SECPOP2000 (NRC 2003) by specifying the data for each of the 13 counties surrounding Seabrook, to a distance of 80 km (50 mi). SECPOP2000 uses county economic and agriculture data from the 2000 National Census of Agriculture. This included the fraction of land devoted to farming, annual farm sales, the fraction of farm sales resulting from dairy production, and the value of non-farmland. In response to an NRC staff RAI, NextEra identified that the recent, three known errors in SECPOP2000 were corrected for the SAMA evaluation (NextEra 2011a).

NRC staff asked NextEra to explain its assertion in the 2012 SAMA supplement (NextEra 2012a) that sensitivities to variation in other Level 3 parameters (not explicitly re-evaluated in the 2012 SAMA supplement) are expected to be consistent with the ER sensitivity analysis results. NextEra explained (NextEra 2012b) that except for the difference in source term release, the Level 3 parameters used in the SAMA analysis supplement did not change. In addition, NextEra further noted (a) that greater meteorology specification (imposed as 40 to 50 mi (approximately 64 to 80 km) rather than following the site boundary) produces 15 percent more conservative dose and cost risks, (b) that the re-evaluated sea-breeze effect for the 2012 SAMA supplement (NextEra 2012a) showed only small change in dose and cost risk, and (c) that non-evacuation rather than delayed evacuation for extreme seismic events (RC LE4) results in only a small increase in total LE4 dose consequences.

NextEra provided a sensitivity analysis comparing the ATMOS meteorological model imbedded within MACCS2 to the EPA's CALMET wind field model (Hanna 2013; URS 2013). To accomplish this, NextEra performed an exposure index (EI) study using MACCS2 and CALMET. The EI is a metric used by the NRC in the assessment of future plant operation risk impacts from atmospheric release pathways. The EI is a function of the population distribution surrounding the plant of interest weighted by the site-specific wind direction frequencies for the 16 different principal compass directions.

NextEra performed an EI study to better understand the sensitivity of using localized wind trajectories throughout the 50-mi radius around Seabrook, as compared to a single set of annual wind trajectories based on measurements for the Seabrook site. For this analysis, the single set of wind trajectories was based on the 2005 annual wind rose for Seabrook as processed by Version 1.13.1 of the MACCS2 computer model, and the localized trajectory roses were calculated using Version 5 of the CALMET model. NextEra's analysis indicated that the use of the more complex CALMET model could potentially increase the calculated benefit of a SAMA by about 32 percent.

The NRC staff notes that CALMET does not treat radioactive decay and daughter ingrowth, calculate air concentrations accounting for dispersion, or calculate ground concentrations accounting for deposition. Radioactive decay and deposition are mechanisms that deplete the plume as it travels. Not accounting for these mechanisms results in a conservative result when using CALMET to perform an EI calculation. This is because the EI calculation is structured to treat exposure to individuals at short distances the same as exposure to individuals at long distances. This ignores the fact that the plume is depleted by the time it reaches longer distances, both because of radioactive decay of the shorter lived isotopes and because some of the contents will be deposited onto the ground. For example, using the assumptions made by NextEra, ATMOS calculates that deposition depletes the plume by 70 percent by the time it reaches a distance of 40 to 50 mi. The effect of not accounting for decay and deposition are exacerbated by the fact that the plume may follow a curved or meandering trajectory in the CALMET analysis. This results in more time for radioactive decay to occur and a longer path length for deposition to occur than if the plume had followed a straight line as it is assumed to do in the MACCS2 analysis. Finally, NextEra's EI calculation does not account for the fact that the plume is more disperse; therefore, doses are lower at longer distances than they are at shorter distances. For example, ATMOS calculates the plume is about 50 times more dilute at 45 mi than it is at 5 mi. This is important for the application of an EI calculation at Seabrook because Boston, the largest population center, is in the outer portion of the 50-mi region. Thus, putting together the two facts that (1) doses diminish with distance from the plant, both by dispersion and by depletion of the plume; and (2) the majority of the population lives towards the outer portion of the 50-mi region, the EI analysis conducted by NextEra tends to overestimate the increase in consequences using the CALMET model. The NRC staff notes that the 32 percent increase in benefits estimated using the CALMET model is likely to be significantly larger than the increase that would have been observed had it been possible to conduct a full analysis, accounting for factors such as radioactive decay and plume depletion from deposition.

The CALMET sensitivity analysis performed by NextEra could alternatively be treated as a new baseline analysis or as a sensitivity analysis. Depending on how this analysis is considered, uncertainty may also need to be accounted for in the determination of the potential benefit of a SAMA. Conservatively, the NRC staff chose to treat the CALMET analysis as a baseline analysis. After reviewing NextEra's analysis, the NRC staff determined that if the CALMET model was used as the baseline SAMA analysis and NextEra's uncertainty factor was applied, several additional SAMAs would be identified as potentially cost-beneficial including: SAMAs 13, 24, 44, 55, 56, 77, 96, 108, 109, 147, 163, 167, 168, 169, and 170.

For example, to make this determination for SAMA 77, the NRC staff first applied the EI correction factor of 1.32 to SAMA 77's total benefit of $6.41 million resulting in a benefit of $8.46 million. Since the estimated SAMA cost for SAMA 77 is $15 million, applying the EI correction factor alone would not make SAMA 77 potentially cost-beneficial because the benefit of $8.46 million is less than the estimated cost of $15 million. However, if NextEra's uncertainty factor of 2.35 is applied to the benefit with the EI correction factor, the resulting total benefit would be $19.9 million. Therefore, if the CALMET analysis is conservatively used as a baseline analysis and the uncertainty factor is applied, then SAMA 77 would be determined to be potentially cost-beneficial because $19.9 million exceeds the estimated SAMA cost of $15 million. When both the EI correction factor and uncertainty factor were applied to all of the SAMAs listed in Table 1 of NextEra's March 2012, SAMA supplement (NextEra 2012a), the NRC staff identified additional potentially cost-beneficial SAMAs, as shown in Table F-5.

The NRC staff notes that NextEra's baseline analysis contained a number of conservative assumptions relative to accepted practice in performing SAMA analyses. To assess the quantitative impact of these conservatisms, the NRC staff contracted Sandia National Laboratories (Sandia). Sandia documented their findings in a report entitled, "Review of Conservatism in the Seabrook Consequence Analysis" (Sandia 2014). As documented in the Sandia report, the leading sources of conservatism in NextEra's SAMA analysis are (1) the assumption of perpetual rainfall in the area from 40 to 50 mi from the plant, which includes the city of Boston; (2) the choice of the worst case year for meteorological data; (3) the use of a value for surface roughness, which is conservative for the area near Seabrook; and (4) the use of older and significantly higher EPA dose values for normal and hot spot relocation. The conservative assumptions made by NextEra inflated the potential benefit that could be realized by each potential cost-beneficial mitigation measure. In total, the increase in benefit resulting from the conservative assumptions used in NextEra's baseline analysis would offset any increase in benefit associated with using CALMET, identified as part of NextEra's CALMET sensitivity analysis.

The NRC staff concludes that the methodology used by NextEra to estimate the offsite consequences for Seabrook provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and offsite doses reported by NextEra.

F.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by NextEra are discussed in this section.

F.3.1 Process for Identifying Potential Plant Improvements

NextEra's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- review of the most significant basic events from the plant-specific PRA used in the 2012 SAMA supplement (NextEra 2012a),
- review of potential plant improvements identified in the Seabrook IPE and IPEEE,
- review of other industry documentation discussing potential plant improvements, and
- insights from Seabrook personnel.

Based on this process, an initial set of 191 candidate SAMAs was identified in the ER (NextEra 2010), and 4 additional SAMA candidates were identified in the 2012 SAMA supplement. A total of 195 candidate SAMAs, which are referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, NextEra performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration. The screening was performed using the following criteria:

- The SAMA is not applicable to Seabrook due to design differences (19 SAMAs screened).
- The SAMA has already been implemented at Seabrook or Seabrook meets the intent of the SAMA (87 SAMAs screened).

- The SAMA is similar to another SAMA under consideration (11 SAMAs screened).
- The SAMA has estimated implementation costs that would exceed the dollar value associated with eliminating all severe accident risk at Seabrook (no SAMA screened).
- The SAMA was determined to provide very low benefit (no SAMA screened).

In response to an NRC staff RAI (NRC 2012a), NextEra clarified that Phase I SAMAs screened on the basis of the first three criteria were not re-reviewed in the 2012 SAMA supplement since this supplement was based on modeling changes that did not change the conclusions of earlier qualitative screening of Phase 1 SAMAs (NextEra 2012b). Based on this screening, 117 SAMAs were eliminated, leaving 78 for reevaluation, including the 4 new SAMAs identified in the 2012 SAMA supplement (NextEra 2012a). These SAMAs are referred to as Phase II SAMAs and are listed in Table 1 of the 2012 SAMA supplement (NextEra 2012a). As part of Phase II, a detailed evaluation was performed for each of these 78 SAMA candidates, as discussed in Sections F.4 and F.6 below. The estimated benefits for these SAMAs include the risk reduction from both internal and external events.

As previously discussed, NextEra accounted for the potential risk reduction benefits associated with each SAMA by quantifying the benefits using the integrated internal and external events PRA model. In response to NRC staff RAIs, NextEra performed a sensitivity analysis to account for the potential additional risk reduction benefits associated with the additional risk from seismic events (NextEra 2011a), which was also performed in the 2012 SAMA supplement (NextEra 2012a), NextEra multiplied the estimated benefits for internal and external events by a factor of 2.1 for all other Phase II SAMAs for which a detailed evaluation was performed (NextEra 2012a).

F.3.2 Review of NextEra's Process

NextEra's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events but also included explicit consideration of potential SAMAs for fire and seismic events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth (RRW) perspectives at Seabrook.

NextEra's SAMA identification process began with a review of the list of potential PWR enhancements in Table 14 of NEI 05-01 (NEI 2005). As a result of this review, 153 SAMAs were identified. In response to NRC staff RAIs, NextEra clarified that 25 SAMAs were identified from previous reviews of internal and external events from the Seabrook plant-specific PRA and an additional 13 SAMAs were identified as a result of a general solicitation of Seabrook staff for possible SAMA candidates by an expert panel. As mentioned previously, four additional SAMAs were identified in the 2012 SAMA supplement, of which three SAMAs were suggested by plant personnel and one SAMA was identified in response to an NRC staff RAI (NextEra 2012a).

In the ER and subsequent RAI responses, NextEra provided tabular listings of both the Level 1 and LERF PRA internal, fire, and seismic basic events sorted according to their RRW (NextEra 2010), listings of the Level 2 non-LERF basic events that contribute 90 percent of the population dose risk, and a review all of these basic events for potential SAMAs.

These importance analyses were subsequently updated in the 2012 SAMA supplement (NextEra 2012a) based on the SSPSS-2011 PRA model. In this supplement, NextEra provided a tabular listing of the top 15 initiating events contributing to each of CDF and LERF, the top 15 basic events contributing to each of CDF and LERF, and the basic events for the Level 2 release categories that cumulatively contribute to approximately 90 percent of the total public risk (i.e., dose and economic cost risk). As a result, existing SAMAs or new SAMAs were identified for a total of 29 initiating events (one initiating event contributes to both CDF and LERF) and 43 basic events (some basic events contribute to multiple release categories). In response to an NRC staff RAI on the supplement to provide importance analysis down to a level that all potentially cost-beneficial SAMAs could be identified, NextEra provided listings of basic event contributors to non-LERF release categories LL-5 (large late containment basemat failure), SE-3 (small early containment penetration failure to isolate), and SELL (small early RCS release with large late containment failure), down to RRW values of 1.005, 1.003, and 1.003, respectively (NextEra 2012b). For release categories SE-3 and SELL, all of the basic events were already identified and evaluated in the 2012 SAMA supplement. For RC LL-5, 28 new basic events were identified, and a SAMA (either already existing or new) was correlated to each of these basic events. NextEra explained that differences in basic events and corresponding RRW values to those presented in the ER (NextEra 2010) and associated RAI responses (NextEra 2011a) were in general due to an accumulation of small changes including an updated HRA performed in 2009. In response to a separate RAI (NextEra 2012b), NextEra also provided a listing of all CDF and LERF initiating events contributing greater than 1 percent of the total CDF and 0.3 percent of the total LERF. All of the LERF initiating events were already identified and evaluated in the 2012 SAMA supplement, while 11 new CDF initiating events and a SAMA (either already existing or new) was correlated to each of these initiating events. The newly identified SAMAs, and the results of their evaluation, are discussed further in Section F.6.2.

NextEra states in the ER that no SAMAs were identified to address the operator actions in the Level 1 and LERF basic events importance lists because the current plant procedures and training meet current industry standards, and no plant-specific procedure improvements were identified that would affect the results of the HEP calculations. The NRC staff asked NextEra to consider the feasibility of non-procedural and training SAMAs for the human error basic events (NRC 2011a). In response to RAIs, NextEra identified and evaluated three operator actions included in the top 15 Level 1 basic events and to automate or install additional alarm indication for the operator action having the highest LERF-related RRW (NextEra 2011a). Subsequently in the 2012 SAMA supplement (NextEra 2012a), NextEra included an evaluation of SAMAs for 15 different operator failures covered by the importance analyses.

The NRC staff estimated that a risk reduction of 1 percent, corresponding to the least bounding cut-off of the different importance analysis listings (i.e., CDF initiating event listing) produced by NextEra, equates to a maximum baseline benefit of approximately $30,000, or approximately $64,000 after the benefits have been multiplied by a factor of 2.1 to account for the additional risk from seismic events, which is less than the minimum implementation cost of $100,000 associated with a hardware change.

Based on this, and NextEra’s statement discussed previously that procedure and training improvements have been considered but that no improvements were identified that would reduce plant risk, the NRC staff concludes that it is unlikely that additional cost-beneficial SAMAs would be found from a further review of initiating events having lower contribution to CDF.

In response to an NRC staff RAI, NextEra reviewed the cost-beneficial SAMAs from prior SAMA analyses for five Westinghouse four-loop PWR sites (NextEra 2011a). NextEra’s review determined that all but two of these cost-beneficial SAMAs were already represented by a SAMA, have intent that was already met at Seabrook, have low potential for risk reduction at

Seabrook (e.g., do not address risk-important basic events), or were not applicable to Seabrook. Two SAMAs were identified and evaluated further as a result of this review and are further discussed in Section F.6.2. The two SAMAs are “procedure change to ensure that the reactor coolant system (RCS) cold leg water seals are not cleared” and “installation of redundant parallel service water valves to the emergency diesel generators (EDGs).”

The NRC staff noted that both SAMA 173, identified from the IPEEE review, and SAMA 185 are described as “improve procedural guidance for directing depressurization of RCS,” and it asked NextEra to clarify the difference between these two SAMAs (NRC 2010a). In response to the RAI, NextEra clarified that SAMA 173 was to improve procedural guidance directing operators to depressurize the RCS before core damage, while SAMA 185 was to improve procedural guidance directing operators to depressurize the RCS after core damage. The NRC staff considers NextEra’s clarification reasonable and the screening of those Phase I SAMAs acceptable.

Although the IPE did not identify any fundamental vulnerabilities or weaknesses related to internal events, 14 potential plant improvements were identified. NextEra reviewed these potential improvements for consideration as plant-specific candidate SAMAs. In response to an NRC staff RAI, NextEra clarified that the following 13 SAMAs were identified from the review of the potential plant improvements identified in the IPE (NextEra 2011a):

- Phase II SAMA 167, “install independent seal injection pump (low volume pump) with automatic start”;
- Phase II SAMA 168, “install independent seal injection pump (low volume pump) with manual start”;
- Phase II SAMA 169, “install independent charging pump (low volume pump) with manual start”;
- Phase I SAMA 155, “install alternate emergency AC power source (e.g., swing diesel)”;
- Phase II SAMA 156, “install alternate offsite power source that bypasses switchyard, for example, use campus power source to energize Bus E5 or E6”;
- Phase II SAMA 174, “provide alternate scram button to remove power from motor generator (MG) sets to control rod (CR) drives”;
- Phase II SAMA 157, “provide independent AC source for battery chargers, for example, provide portable generator to charge station battery”;
- Phase I SAMA 158, “provide enhanced procedural direction for cross-tie of batteries within each train”;
- Phase II SAMA 159, “install additional batteries”;
- Phase II SAMA 184, “control/reduce time that the containment purge valves are in open position”;
- Phase I SAMA 185, “improve procedural guidance to directing depressurization of RCS”;
- Phase II SAMA 186, “install containment leakage monitoring system”; and
- Phase II SAMA 187, “install RHR isolation valve leakage monitoring system.”

In addition, the improvement identified in the IPE for "alternate, independent EFW pump (e.g., diesel firewater pump hard piped to discharge of startup feed pump)," is already addressed by Phase I SAMA 29, "provide capability for alternate injection via diesel-driven fire pump," and Phase II SAMA 163, "install third EFW pump (steam-driven)." Phase I SAMA 29 and Phase II SAMA 163 were previously identified from the review of the list of potential PWR enhancements in Table 14 of NEI 05-01 (NEI 2005). Phase I SAMAs 29, 155, 158, and 185 were screened in the Phase I evaluation as having already been implemented.

Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER and 2012 SAMA supplement (NextEra 2012a), together with those identified in response to NRC staff RAIs, addresses the major contributors to internal event CDF.

As described previously, NextEra's importance analysis considered both fire and seismic basic events from the internal and external event integrated Level 1 and Level 2 PRA model. The NRC staff noted that since the importance analyses did not separately consider the importance of internal, fire, and seismic events, SAMAs identified to address the important basic events may not address the more important initiator (e.g., fire), and it asked NextEra to explain how the identified SAMAs address this issue (NRC 2010a). In response to the RAI, NextEra explained that the importance analysis considers the contribution from all hazards, and the contribution from the individual hazards will be a subset of the total risk contribution (NextEra 2011a). Additionally, based on evaluations provided in response to the NRC staff RAIs discussed above, in which SAMAs were identified to address each of the important Level 1 and 2 basic events, hardware changes to address the individual hazard contributors would not, in NextEra's judgement, be cost beneficial based on a conservative minimum cost for a hardware change of $100,000 (NextEra 2011a). Based on the NRC staff conclusions above regarding NextEra's systematic process for identifying SAMAs for each important Level 1 and 2 basic event and NextEra's statement that procedure/training improvements have been considered but that no improvements were identified that would reduce plant risk, the NRC staff agrees that it is unlikely that additional cost-beneficial SAMAs would be found from a further review of basic events.

Although the IPEEE did not identify any fundamental vulnerabilities or weaknesses related to external events, two potential plant improvements were identified to improve seismic CDF, and five potential plant improvements were identified to improve fire CDF. Additionally, five potential plant improvements were identified that were being evaluated to improve internal event risk but which may also reduce external event risk because they address functional failures. In response to an NRC staff RAI, NextEra clarified that the following 12 SAMAs were identified from the review of the potential plant improvements identified in the IPEEE (NextEra 2011a):

- SAMAs to improve seismic CDF:
  - Phase II SAMA 181, "improve relay chatter fragility"; and
  - Phase II SAMA 182, "improve seismic capacity of EDGs and steam-driven EFW pump."
- SAMAs to improve fire CDF:
  - Phase II SAMA 175, "install fire detection in turbine building relay room";
  - Phase I SAMA 176, "install additional suppression at west wall of turbine building";
  - Phase I SAMA 177, "improve fire response procedure to indicate that PCCW can be impacted by PAB fire event";

- Phase I SAMA 178, "improve the response procedure to indicate important fire areas including control room, PCCW pump area, and cable spreading room"; and
- Phase I SAMA 180, "modify SW pump house roof to allow scuppers to function properly."

- Other SAMAs identified from the IPEEE review:
  - Phase I SAMA 160, "enhancements to address loss of SF6-type sequences";
  - Phase I SAMA 171, "install high temperature O-rings in RCPs";
  - Phase I SAMA 173, "improve procedural guidance for directing depressurization of RCS";
  - Phase II SAMA 179, "fire-induced LOCA response procedure from Alternate Shutdown Panel"; and
  - Phase I SAMA 183, "Turbine Building internal flooding improvements."

Phase I SAMAs 160, 171, 173, 176, 177, 178, 180, and 183 were screened in the Phase I evaluation as having already been implemented.

The NRC staff questioned whether SAMA 162, "increase the capacity margin of the CST" addressed basic event COTK25.RT, "CST CO-TK-25 ruptures/excessive leakage" (NRC 2010a). In response to the RAI, NextEra explained that the CST has a median seismic fragility of 1.65 g and a HCLPF of 0.65, without crediting the concrete shield structure surrounding the CST (NextEra 2011a). Therefore, NextEra identified and evaluated a SAMA to make "seismic upgrades to the CST." This is discussed further in Section F.6.2.

The NRC staff asked NextEra to clarify how additional fire barriers for fire areas were considered since SAMA 143, "upgrade fire compartment barriers," was screened in the Phase I evaluation based on the Seabrook plant design including 3-hour rated fire barriers (NRC 2010a). NextEra responded with a review of the fire risk by plant location and explained that it is not physically possible to install additional fire barriers in the control room, which contribute 52 percent of the fire CDF. Additionally, NextEra stated that additional fire barriers in the essential SWGR rooms, which contribute 41 percent of the fire CDF, would have no impact on the fire risk since these rooms are already separated (NextEra 2011a). Other lower risk fire areas were also similarly evaluated with similar conclusions. In a response to a followup NRC staff RAI, NextEra further clarified that additional fire barriers were not considered for the essential SWGR rooms because a review of fire scenarios in these rooms did not identify impacts to any redundant safety train cables (NextEra 2011b). The NRC staff concludes that the applicant's rationale for eliminating fire barrier enhancements from further consideration is reasonable.

Based on the licensee's IPEEE, the review of the results of the Seabrook PRA, which includes seismic and fire events, and the expected cost associated with further risk analysis and potential plant modifications, the NRC staff concludes that the opportunity for seismic and fire-related SAMAs has been adequately explored, and it is unlikely that there are any additional cost-beneficial seismic or fire-related SAMA candidates.

As stated earlier, other external hazards (i.e., high winds, external floods, transportation and nearby facility accidents, and chemical releases) are below the IPEEE threshold screening frequency, or met the 1975 SRP design criteria, and are not expected to represent opportunities for cost-beneficial SAMA candidates. Nevertheless, NextEra reviewed the IPEEE results and identified no additional Phase I SAMAs to reduce HFO risk (NextEra 2010).

For many of the Phase II SAMAs listed in the ER, the information provided did not sufficiently describe the proposed modification. Therefore, the NRC staff asked the applicant to provide more detailed descriptions of the modifications for several of the Phase II SAMA candidates (NRC 2010a). In response to the RAI, NextEra provided the requested information on the modifications for SAMAs 44, 59, 94, 112, 114, 163, 186, and 187 (NextEra 2011a).

The NRC staff questioned NextEra about lower cost alternatives to some of the SAMAs evaluated (NRC 2010a) to include using a portable generator to extend the coping time in loss of AC power events (to power selected instrumentation and DC power to the turbine-driven auxiliary feedwater (TDAFW) pump provide alternate DC feeds (using a portable generator) to panels supplied only by DC bus and purchasing or manufacturing a “gagging device” that could be used to close a stuck-open SG safety valve for an SGTR event prior to core damage.

In response to the RAIs, NextEra clarified that the first alternative to use a portable generator was already represented by SAMA 157, “provide independent AC power source for battery chargers; for example, provide portable generator to charge station battery” (NextEra 2011a). The second alternative was addressed in the 2012 SAMA supplement (NextEra 2012a) as SAMA 194, “purchase or manufacture of a “gagging device” that could be used to close a stuck-open steam generator safety valve.” Both of these SAMAs were assessed in the Phase II cost-benefit evaluation. The NRC staff concludes that these alternatives have been adequately addressed.

The NRC staff requested NextEra to clarify the Phase I screening criteria, which was described in the ER as including two criteria that appear to not have been used—(1) excessive implementation cost, and (2) very low benefit (NRC 2010a). NextEra responded that these criteria, while they could have been used in the Phase I evaluation, were not used in the Phase I screening evaluation in order to force evaluation of more SAMA candidates into the Phase II evaluation so that the merit of each could be judged based on associated costs and benefits (NextEra 2011a).

The NRC staff asked NextEra to provide justification for the screening of SAMA 29, “provide capability for alternate injection via diesel-driven fire pump,” in the Phase I evaluation on the basis that it has already been implemented through an existing alternate mitigation strategy (NRC 2010a). In response to the RAI, NextEra responded that Seabrook has the capability to use its diesel-driven fire pump to provide injection to the SGs through implementation of existing SAMGs (NextEra 2011a). NextEra also stated that two portable diesel-driven pumps are also available to provide injection using suction from the fire protection system, the cooling tower basin, and the Browns River. Based on this clarification, the NRC staff considers NextEra’s basis for screening SAMA 29 reasonable.

The NRC staff noted that SAMA 64, “implement procedure and hardware modification for a CCW header cross-tie,” was screened in the Phase I evaluation because a cross-tie already exists to support a maintenance activity. The NRC staff asked NextEra to clarify if the cross-tie between divisions A and B of the PCCW system is already provided for in existing plant procedures (NRC 2010a). In response to the RAI, NextEra clarified that the Seabrook operating procedures do provide explicit instructions for alignment of the PCCW division A and B cross-tie. Additionally, while the cross-tie is primarily used during maintenance activities, it could be used during an off-normal event involving a failure of heat sink in one division with failure of frontline components in the opposite division, provided that adequate time is available (NextEra 2011a). Based on this clarification, the NRC staff considers NextEra’s basis for screening SAMA 64 reasonable.

The NRC staff questioned why SAMA 79, “install bigger pilot operated relief valve so only one is required,” was screened in the Phase I evaluation based on the intent of the SAMA having already been implemented when the success criterion is two of two PORVs needed for intermediate head SI (NRC 2010a). NextEra responded that the context of SAMA 79 was to increase the capacity of the pressurizer PORVs such that opening of only one PORV would satisfy the feed and bleed success criteria for all loss of feedwater-type sequences, which is all that is needed at Seabrook if feed and bleed is provided by one of two high head charging pumps (NextEra 2010). However, since opening of two PORVs is needed if feed is provided by one of two SI pumps, NextEra provided a Phase II evaluation of this SAMA, the results of which are further discussed in Section F.6.2.

The NRC staff asked NextEra to provide justification for the screening of SAMA 82, “stage backup fans in switchgear rooms,” and SAMA 84, “switch for emergency feedwater room fan power supply to station batteries,” in the Phase I evaluation on the basis that they are not applicable to Seabrook (NRC 2010a). In response to the RAI, NextEra explained that the context of SAMA 82 was to enhance the availability and reliability of ventilation to the essential SWGR rooms in the event of a loss of SWGR room ventilation. Additionally, this SAMA is more accurately screened as its intent having been already implemented at Seabrook since procedures already exist for maintaining acceptable SWGR room temperatures when ventilation becomes unavailable, which includes opening doors and setting up portable fans (NextEra 2011a). The NRC staff considers NextEra’s basis for screening SAMA 82 reasonable.

Regarding SAMA 84, NextEra explained that the context of this SAMA was to enhance the availability and reliability of ventilation to the EFW pump house, in the event of a loss of pump house ventilation, by switching the pump house ventilation fan(s) power supply to station batteries. NextEra further stated that the initial screening of “not applicable” is incorrect (NextEra 2011a). NextEra explained that since procedures already exist for maintaining acceptable EFW pump house room temperatures when ventilation becomes unavailable, failure of the already reliable ventilation system is not a significant contributor to CDF. Nevertheless, NextEra provided a Phase II evaluation of this SAMA, the results of which are further discussed in Section F.6.2.

The NRC staff noted that SAMA 92, “use a fire water system as a backup source for the containment spray system,” was screened in the Phase I evaluation because the containment spray function is not important early, yet basic events RCPCV456A.FC and RCPCV456B.FC, “spray valves fail to open on demand,” appear on the LERF importance list (NRC 2010a). In response to the RAI, NextEra explained that these two basic events refer to modeling of the PORVs and not the containment spray valves, that descriptions of these two events in the ER inadvertently referred to the PORVs as PORV spray valves, that the PORV function is unrelated to the containment spray function, and that, therefore, no SAMA is necessary. The NRC staff considers NextEra’s basis for screening SAMA 92 reasonable.

The NRC staff also asked NextEra to provide justification for the screening of SAMA 105, “delay containment spray actuation after a large LOCA,” and SAMA 191, “remove the 135 °F temperature trip of the PCCW pumps,” in the Phase I evaluation on the basis that they would violate the CLB for Seabrook (NRC 2010a). In response to the RAI, NextEra provided a Phase II evaluation of these SAMAs, the results of which are further discussed in Section F.6.2 (NextEra 2011a).

The NRC staff requested that NextEra clarify the basis for screening SAMA 127, “revise emergency operating procedures (EOPs) to direct isolation of a faulted steam generator,” in the Phase I evaluation on the basis that it is already implemented (NRC 2010a). NextEra responded that the context of SAMA 127 was to have specific EOPs for isolation of the SG for the purpose of reducing the consequences of an SGTR, and existing EOPs direct specific operator actions to diagnose an SGTR and to perform its isolation. Additionally, existing plant EOPs also specifically provide actions for the identification and isolation of a faulted SG (NextEra 2011a). The NRC staff considers NextEra's basis for screening SAMA 127 reasonable.

The NRC staff asked NextEra to clarify the screening of SAMA 188, "containment flooding—modify the containment integrated leak rate test (ILRT) 10-in. test flange to include a 5-in. adapter with isolation valve" based on the statement that "flange and procedures exist" (NRC 2010a). NextEra responded that the 10-in. flange with fire hose adapter has been pre-fabricated, is stored in a designated and controlled area, and is available for attaching to the 10-in. ILRT flange to provide containment flooding via Severe Accident Guideline instructions (NextEra 2011a). NextEra further explained that pre-installation of the flange adapter will provide no significant time savings in light of the containment flooding scenario evolution via the fire hose connection which takes several days. The NRC staff considers NextEra's basis for screening SAMA 188 reasonable.

The NRC staff notes that the set of SAMAs submitted is not all-inclusive since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would be unlikely to cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that NextEra used a systematic and comprehensive process for identifying potential plant improvements for Seabrook, and the set of SAMAs evaluated in the ER and 2012 SAMA supplement (NextEra 2012a), together with those evaluated in response to NRC staff inquiries, is reasonably comprehensive and, therefore, acceptable. This search included reviewing insights from the plant-specific risk studies and reviewing plant improvements considered in previous SAMA analyses.

F.4 Risk Reduction Potential of Plant Improvements

NextEra evaluated the risk-reduction potential of the 78 SAMAs retained for the Phase II evaluation in the ER and the 2012 SAMA supplement (NextEra 2012a). NextEra also evaluated the risk-reduction potential of the additional SAMAs discussed in Section F.3 that were identified in the 2012 SAMA supplement (NextEra 2012a) and in response to NRC staff RAIs (NextEra 2012b). The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to eliminate the risk associated with the proposed enhancement. On balance, such calculations overestimate the benefit and are conservative.

NextEra used model re-quantification to determine the potential benefits. The CDF, population dose, and offsite economic cost reductions were estimated using the SSPSS-2011 PRA model with a truncation level of 1×10^{-14} per year. The changes made to the model to quantify the impact of SAMAs are detailed in Tables 1 and 2 of the 2012 SAMA supplement (NextEra 2012a) and in Tables RAI-3-2, RAI-3-3 and RAI-4-1 of the response to NRC staff RAIs on the 2012 SAMA supplement (NextEra 2012b). Tables F-4 and F-5 list the assumptions considered to estimate the risk reduction for each of the evaluated SAMA analysis cases, the estimated risk reduction in terms of percent reduction in CDF and population dose, the estimated total benefit (present value) of the averted risk, and the Phase II SAMAs evaluated for each analysis case. The estimated benefits reported in Tables F-4 and F-7 reflect the combined benefit in both internal and external events. The Phase II SAMAs included in Table F-4 are the 78 Phase II SAMAs identified from industry sources, plant experts, or the IPE or IPEEE. The

Phase II SAMAs included in Table F-5 are from plant-specific importance analyses. The determination of the benefits for the various SAMAs is further discussed in Section F.6.

The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction estimates of certain SAMAs (NRC 2012a). For example, Table 1 of the 2012 SAMA supplement (NextEra 2012a) presents SAMA case CONTX1, which eliminates AC, DC, and PCCW support for one division of CBS. The NRC staff asked how eliminating these support system failures bounds the hardware improvement SAMAs represented by this case (i.e., SAMA 91-Install Passive Containment Spray System, SAMA 94-Install Filtered Containment Vent System, SAMA 99-Strengthen Containment, SAMA 102-Construct Containment Ventilation System, and SAMA 107-Install Redundant Containment Spray System). In response to the RAI (NextEra 2012b), NextEra provided a revised evaluation of these SAMAs using more differentiated SAMA analysis cases (i.e., CBSP, FVENT, CONST, and CBSR). Descriptions of these SAMA analysis cases and revised results for the corresponding SAMAs are provided in Table F-4. The NRC staff also asked NextEra to explain the basis for using SAMA analysis case NOATWS to evaluate the risk reduction of potential modifications addressing initiating events (IE) #23, #24, #25, #26, #27, and #28. Initiating events #23 through IE #27 are seismic initiators of different seismic acceleration levels (0.7 g, 1.0 g, 1.4 g, 1.8 g, and 2.5 g) which lead to ATWS while IE #28 is loss of main feedwater (MFW) that also leads to ATWS. In response to the RAI, NextEra clarified (NextEra 2012b) that SAMA analysis case NOATWS assumes all ATWS initiating events (both seismic and non-seismic initiators) are eliminated; therefore, it is a conservative evaluation for all of these initiating events. NextEra further clarified that the description of IE #28 is incorrect and should be ATWS with loss of MFW initially available, which provides further support for the assessment that the use of the SAMA analysis case NOATWS for this initiating event is conservative. The NRC staff considers NextEra's explanations reasonable.

The NRC staff has reviewed NextEra's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on NextEra's risk reduction estimates.

Table F–4. SAMA cost and benefit screening analysis for Seabrook [(a)]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[(j)]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
NOSBO1 2—Replace lead-acid batteries with fuel cells	Eliminate failure of the EDGs	22	6	220K (470K)	525K (1.1M)	>1.75M[(w)]
14[(m)]—Install a gas turbine generator						>2M[(w)]
16[(m)]—Improve uninterruptable power supplies						>2M[(w)]
20—Add a new backup source of diesel cooling						>2M[(w)]
161—Modify EDG jacket heat exchanger SW supply & return to allow timely alignment of alternate cooling water source (supply & drain) from firewater, reactor makeup water, dewatering, etc.						>2M[(w)]
190—Add synchronization on capability to SEPS diesel						>6.4M[(w)]
NOLOSP 13—Install an additional buried offsite power source	Eliminate LOOP events	18	17	530K (1.2M)	1.2M (2.7M)	>3[(w)]
24—Bury offsite powerlines						>3M[(l)]
156—Install alternate offsite power source that bypasses the switchyard; for example, use campus power source to energize Bus E5 or E6						>7M[(l)]
BREAKER 21—Develop procedures to repair or replace failed 4 kV breakers	Eliminate failure of the 4 KV bus infeed breakers	1	<1	8K (17K)	15K (32K)	Screened[(n)]
CSBX 25—Install an independent active or passive HPI system	Eliminate failure of the HPI system	22	34	1.1M (2.3M)	2.5M (5.3M)	8.8M[(w)]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[l]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
26—Provide an additional HPI pump with independent diesel						8.8M[w]
LOCA03 28—Add a diverse low-pressure injection system	Eliminate failure of the low-pressure injection system	2	2	68K (140K)	160K (340K)	>1M
LOCA04 35—Throttle low-pressure injection pumps either in medium or large-break LOCAs to maintain RWST inventory	Eliminate RWST running out of water	13	10	310K (655K)	730K (1.5M)	>3M[w]
106—Install automatic containment spray pump header throttle valves						>3M[w]
DSIPP 39—Replace two of the four electric SI pumps with diesel-powered pumps	Eliminate dependency of the existing intermediate head SI pump trains on AC power	<1	0	<1K (<1K)	<1K (<1K)	>5M[l]
LOCA01 41—Create a reactor coolant depressurization system	Eliminate all small LOCA events	2	1	27K (57K)	64K (130K)	>1M
SW01 43—Add redundant DC control power for SW pumps	Eliminate the dependency of the SW pumps on DC power	<2	0	11K (24K)	26K (55K)	>100K
CCW01 44—Replace ECCS pump motors with air-cooled motors	Eliminate failure of the component cooling water (CCW) pumps	14	31	920K (1.9M)	2.15M (4.6M)	>6M[w]
PCCABCD 59—Install a digital feed water upgrade	Eliminates CCW pump failure when AC & DC power support is available	4	11	335K (700K)	785K (1.7M)	>6.1M[w]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
CSBX 55—Install an independent RCP seal injection system with dedicated diesel	Eliminate failures of support systems (e.g., AC & DC power, cooling) for division B of high-pressure injection	28	34	1.0M (2.2M)	2.45M (5.2M)	>6.4M[w]
56[b]—Install an independent RCP seal injection system without dedicated diesel						>6.4M[w]
167—Install independent seal injection pump (low volume pump) with automatic start						>6.4M[w]
168—Install independent seal injection pump (low volume pump) with manual start						>6.4M[w]
169—Install independent charging pump (high volume pump) with manual start						>6.4M[w]
170—Replace the positive displacement pump (PDP) with a 3rd centrifugal pump; consider low volume & cooling water independence						>6.4M[w]
MAB[r] 65—Install digital feed water upgrade	Eliminate all plant risk	100	100	3.05M (6.4M)	7.15M (15M)	>30M
77—Provide a passive, secondary-side heat-rejection loop consisting of a condenser & heat sink						>15M[w]
PORV 79[d]—Install bigger pilot operated relief valve so only one is required	Eliminate all PORV failures	<1	0	1.7K (4K)	4.1K (9K)	>2.7M[w]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
HVAC2 80—Provide a redundant train or means of ventilation	Eliminate the dependency of the CS, SI, RHR, & CBS pumps on HVAC	3	5	150K (320K)	360K (750K)	>1M[w]
OEFWVS 84[e]—Switch for EFW room fan power supply to station batteries	Eliminate loss of EFW ventilation	<1	0	<1K (<2K)	<2K (<4K)	>250K
CBSP 91[b][g]—Install a passive containment spray system	Eliminate CBS power, signal, & cooling support system failures, & common cause failure among similar components for one division of CBS	0	58	1.7M (3.5M)	4.0M (8.3M)	>10M[w]
102[b][g][v]—Construct a building to be connected to primary & secondary containment & maintained at a vacuum						>56.7M
FVENT 94[g]—Install a filtered containment vent to remove decay heat; Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Eliminate release category LL3 (containment vent) & prevents 80 percent of release category LL5 (basemat melt-through)	0	69	2.0M (4.1M)	4.6M (9.7M)	>20M[w]
CONST 99[b][g]—Strengthen primary & secondary containment (e.g., add ribbing to containment shell)	Reduce by a factor of 10 the non-recovery of offsite power before late containment pressure failure occurs	0	4	120K (245K)	270K (570K)	11.5M[w]
CBSR 107[b][g]—Install a redundant containment spray system	Add redundant train of CBS	0	1	29K (62K)	69K (140K)	>10M[w]
XOVNTS 93[b]—Install an unfiltered hardened containment vent	Eliminate failure of the human action to vent containment[u]	0	1	39K (82K)	92K (190K)	>3M

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
H2Burn 96—Provide post-accident containment inerting capability	Eliminate all hydrogen ignition & burns	0	1	18K (39K)	43K (90K)	>100K
108—Install an independent power supply to the hydrogen control system using either new batteries, a nonsafety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel						>100K
109—Install a passive hydrogen control system						>100K
OLRP[t] 105[f]—Delay containment spray actuation after a large LOCA	Eliminate the human failure to complete & ensure the RHR & low-head safety injection (LHSI) transfer to long-term recirculation during large LOCA events	3	0	12K (25K)	27K (58K)	>100K
HPME 110—Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure	Eliminate high-pressure core ejection occurrences	0	0	<1K (<1K)	1K (2K)	>10M
CONT02[p] 112—Add redundant & diverse limit switches to each CIV	Eliminate CIV failures	0	6	115K (240K)	270K (570K)	>1M[w]
114—Install self-actuating CIVs						>2M[w]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
LOCA06[q] 113—Increase leak testing of valves in ISLOCA paths	Eliminate ISLOCA contribution	<1	3	48K (100K)	110K (240K)	>1M[w]
115—Locate RHR inside containment						>1M
187—Install RHR isolation valve leakage monitoring system						>500K[w]
NOSGTR 119—Institute a maintenance practice to perform a 100% inspection of SG tubes during each refueling outage	Eliminate all SGTR events	5	2	67K (140K)	160K (330K)	>500K
121—Increase the pressure capacity of the secondary side so that a SGTR would not cause the relief valves to lift						>500K
125—Route the discharge from the main steam safety valves (MSSVs) through a structure where a water spray would condense the steam & remove most of the fission products						>500K
126—Install a highly reliable (closed loop) SG shell-side heat removal system that relies on natural circulation & stored water sources						>15M[w]
129—Vent MSSVs in containment						>500K
NOATWS 130—Add an independent boron injection system	Eliminate all ATWS events	4	2	60K (130K)	140K (290K)	>500K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[i]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
131—Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS						>500K
133—Install an ATWS sized filtered containment vent to remove decay heat						>500K
174—Provide alternate scram button to remove power from MG sets to CR drives						>500K
LOCA05 147—Install digital large break LOCA protection system	Eliminate all piping failure LOCAs	9	2	77K (160K)	180K (380K)	>500K
NOSLB 153—Install secondary side guard pipes up to the main steam isolation valves	Eliminate all steam line break events	<1	0	5K (11K)	11K (24K)	>500K
OSEPALL 154[k]—Modify SEPS design to accommodate automatic bus loading & automatic bus alignment	Eliminate failure of all operator actions to align & load the SEPS DGs	8	2	64K (135K)	150K (320K)	>750K
Case INDEPAC **157—Provide independent AC power source for battery chargers; for example, provide portable generator to charge station battery**	**Eliminate failure of operator action to shed DC loads to extend batteries to 12 hours. Also, eliminate failure to recover offsite power for plant-related, grid-related, & weather-related LOOP events[h]**	**<2**	**1**	**34K** **(72K)**	**80K** **(170K)**	**30K**
159—Install additional batteries						>1M
CST01 162—Increase the capacity margin of the CST	Eliminate CST running out of water	<2	1	35K (73K)	81K (170K)	>2.5M[w]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[l]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
164—Modify 10" condensate filter flange to have a 2½" female fire hose adapter with isolation valve						**>40K**
TDAFW 163—Install third EFW pump (steam-driven)	Eliminate failure of the TDAFW train	5	12	360K (750K)	835K (1.8M)	>2M[l]
NORMW 165—RWST fill from firewater during containment injection—modify 6" RWST flush flange to have a 2½" female fire hose adapter with isolation valve	**Guaranteed success of RWST makeup for long-term sequences where recirculation is not available**	**5**	**2**	**57K (120K)**	**130K (280K)**	**50K**
RCPL 172—Evaluate installation of a "shutdown seal" in the RCPs being developed by Westinghouse	**Eliminate loss of RCP seal cooling initiating event & RCP seal failures subsequent to a plant transient**	**34**	**49**	**1.5M (3.2M)**	**2.5M (7.4M)**	**>2M(l)**
FIRE2 175—Improve fire detection in turbine building relay room	This SAMA has been implemented (NextEra, 2011b).					
FIRE1A 179—Fire-induced LOCA response procedure from alternate shutdown panel	Eliminate operator failure to close PORV block valve during a control room fire	0	0	<1K (<1K)	<1K (<2K)	>20K[l]
SEISMIC01 181—Improve relay chatter fragility	Eliminate all seismic relay chatter failures	12	3	87K (180K)	204K (470K)	>600K[l]
SEISMIC02 182—Improve seismic capacity of EDGs & steam-driven EFW pump	Eliminate all seismic failures of EDGs or turbine-driven emergency feedwater (TDEFW)	<1	0	2.4K (6K)	5.6K (12K)	>500K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
COP 184—Control & reduce time that the containment purge valves are in open position	Eliminate possibility of containment purge valves being open at the time of an event	0	0	<1K (<1K)	<1K (<2K)	>20K
CISPRE 186[o]—Install containment leakage monitoring system	Eliminate all CDF contribution from pre-existing containment leakage	0	0	4.4K (12K)	10K (27K)	>500K
SEPS 189—Modify or analyze SEPS capability; one of two SEPS for LOOP non-SI loads, two of two for LOOP SI loads	Modify fault tree so that one of two SEPS DGs are required rather than both SEPS DGs being required	6	2	63K (130K)	150K (310K)	>2M[w]
PCTES 191[f]—Remove the 135 °F temperature trip of the PCCW pumps	Eliminate inadvertent failure of the redundant TE/logic of the associated PCC division for both loss of PCCW initiating events & loss of PCCW mitigative function	<1	0	<1K (<1K)	<1K (<2K)	>100K
NOCBFLD 192[i]—Install a globe valve or flow limiting orifice upstream in the fire protection system	**Eliminate control building fire protection flooding initiators**	**24**	**11**	**470K (990K)**	**1.1M (2.3M)**	**370K[w]**
CSV167 193[c]—Hardware change to eliminate MOV AC power dependency	**Eliminate operator failure to close CIV CS-V-167 locally**	**0**	**5**	**86K (180K)**	**200K (420K)**	**300K**
MSSVRS 194—Purchase or manufacture a “gagging device” that could be used to close a stuck-open SG safety valve	Eliminate failure of MSSVs to reseat	0	0	<1K (<1K)	<1K (<2K)	>30K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
CCTE1 195[s]—Make improvements to PCCW temperature control reliability	**Eliminate failure of temperature control & modulation for PCC Trains A & B that could fail PCCW**	**3**	**5**	**140K (300K)**	**340K (710K)**	**300K**

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[j]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	

[a] SAMAs in bold are potentially cost beneficial. This table summarizes the results of the revised SAMA analysis provided in the 2012 SAMA supplement (NextEra 2012a), which revised all results reported for “% Risk reduction” and “Total benefit ($),” and included changes to “Analysis case & applicable SAMAs,” “Modeling assumptions,” and “Cost ($).”

[b] This is retained as a quantitatively evaluated Phase II SAMA in response to NRC staff RAI 3.g (NextEra 2011a).

[c] This is a new SAMA identified in response to NRC staff RAI 2.f (NextEra 2011a) and conference call clarification #7 (NRC 2011a).

[d] Evaluation of this SAMA is provided in response to NRC staff RAIs 5.g (NextEra 2011a) and conference call clarification #14 (NRC 2011a), and it was subsequently updated in the 2012 SAMA supplement (NextEra 2012a).

[e] Evaluation of this SAMA is provided in response to NRC staff RAI 5.j (NextEra 2011a) and was subsequently updated in the 2012 SAMA supplement (NextEra 2012a).

[f] Evaluation of these SAMAs is provided in response to NRC staff RAI 5.n (NextEra 2011a) and conference call clarification #15 (NRC 2011a), and it was subsequently updated in the 2012 SAMA supplement (NextEra 2012a).

[g] In response to an NRC staff RAI, NextEra subdivided previous SAMA analysis case, CONTX1, into separate SAMA analysis cases CBSP (SAMA s 91 and 102), FVENT (SAMA 94), CONST (SAMA 99), and CBSR (SAMA 107) given the potentially high benefits (NextEra 2012b). NextEra refers to these as sensitivity cases.

[h] Information is provided for SAMA 157 in response to NRC staff RAI 6.h (NextEra 2011a), and it subsequently updated in the 2012 SAMA supplement (NextEra 2012a).

[i] This is a new SAMA (#192) identified and evaluated in response to NRC staff RAI 1.a (NextEra 2011a) and conference call clarification #1 (NRC 2011a) and subsequently updated in the 2012 SAMA supplement (NextEra 2012a).

[j] Values in parenthesis are the results of the sensitivity analysis applying a multiplier of 2.1 to account for the additional risk of seismic events (NextEra 2011b).

[k] The analysis case for SAMA 154 changed from NOSBO to OSEPALL in response to followup NRC staff RAI 4 (NextEra 2011b).

[l] Cost updated in supplement to response to followup NRC staff RAI 4 (NextEra 2011c).

[m] The analysis case for SAMAs 14 and 16 changed from NOLOSP to NOSBO in response to followup NRC staff RAI 4 (NextEra 2011b).

[n] In response to followup NRC staff RAI 4, NextEra determined that detailed procedures already exist for inspection and repair of the Seabrook 4 kV breakers, and this SAMA was, therefore, screened from further consideration (NextEra 2011b).

[o] The analysis case for SAMA 186 changed from CONT01 to CISPRE in response to followup NRC staff RAI 4 (NextEra 2011b).

[p] NextEra notes (NextEra 2010) that although calculated as eliminating all CIV failures, the limit switches actually contribute no more than 50 percent to the containment isolation function; thus, the upper bound benefit is more accurately $566*0.5 = $283K (NextEra 2012a).

[q] NextEra notes (NextEra 2010) that although calculated as eliminating all ISLOCAs pressure isolation valve testing could be assumed to reduce ISLOCA by half, thus the upper bound benefit is more accurately $240K * 0.5 = $120K (NextEra 2012a).

[r] In response to NRC staff RAI, NextEra clarified that the analysis case for SAMAs designated MAB are evaluated using the MACR (NextEra 2012b).

[s] In response to an NRC staff, NextEra clarified that SAMA analysis case CCTE1 addresses both the reliability of PCCW and loss of CCW as an initiator (NextEra 2012b).

[t] Although the name of this SAMA analysis case was changed from “OLPRS” in the 2012 SAMA supplement to ”OLPR” in the ER, the modeling assumptions are unchanged (NextEra 2012a).

[u] Description of analysis case provided in response to NRC staff RAI 2f (NextEra 2011b).

[v] The analysis case CBSR was used to represent this SAMA because CBSP would prevent containment overpressure (NextEra 2012b).

[w] Cost updated in 2012 SAMA supplement (NextEra 2012a).

F.5 Cost Impacts of Candidate Plant Improvements

NextEra developed plant-specific costs of implementing the 78 Phase II candidate SAMAs evaluated in the ER and the 2012 SAMA supplement (NextEra 2012a). This SAMA group consisted of SAMAs identified from industry, by plant experts, by identifying important failures, and by plant improvements identified in the Seabrook IPE and IPEEE. NextEra also developed implementation cost for the additional SAMAs discussed in Section F.3 that were identified in the 2012 SAMA supplement (NextEra 2012a) and in response to NRC staff RAIs (NextEra 2012b). An expert panel—composed of senior plant staff from the PRA group, the design group, operations, and license renewal—developed the cost estimates based on their experience with developing and implementing modifications at Seabrook. The NRC staff requested that NextEra describe the level of detail used to develop the cost estimates (NRC 2010a). In response to the RAI, NextEra explained that the cost estimates were based on the experience and judgment of the plant staff serving on the expert panel and that, in most cases, detailed cost estimates were not developed because of the large margin between the estimated SAMA benefits and the estimated implementation costs (NextEra 2011a). The cost estimates conservatively did not specifically account for inflation, contingencies, implementation obstacles, or replacement power costs (RPC).

The NRC staff reviewed the bases for the applicant's cost estimates provided in the ER (presented in Section F.7.2 and Table F.7-1 of Attachment F to the ER). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other applicants' analyses of SAMAs for operating reactors and advanced light-water reactors. In response to an RAI requesting a more detailed description of the changes associated with Phase II SAMAs 44, 59, 94, 112, 114, 163, 186, and 187, NextEra provided additional information detailing the analysis and plant modifications included in the cost estimate of each improvement (NextEra 2011a). The NRC staff reviewed the costs and found them to be reasonable and generally consistent with estimates provided in support of other plants' analyses. In many cases, the cost estimates and their descriptions were superseded by the estimates performed for the 2012 SAMA supplement (NextEra 2012b), and they were generally higher than the cost estimates provided in the ER and associated RAI responses. Based on its review of this supplement, the NRC staff requested more detailed justification of the cost estimates for Phase II SAMAs 162 and 189 (NRC 2012a). In response to the RAI, NextEra provided additional justification as to why the cost estimates increased for these SAMAs (NextEra 2012b). For SAMA 162, NextEra explained that the original cost estimate of greater than $100,000 was made to represent a non-complex hardware change because a detailed estimate was not needed due to the low benefit estimated for the SAMA, but that the higher benefit estimated in the 2012 SAMA supplement necessitated reassessing the implementation cost to reflect the expected scope of the modification. Similarly, for SAMA 189, NextEra explained that the original cost estimate of greater than $300,000 was a conservative minimum estimate made based on the assumption that the SAMA would primarily be an analytical task, while the higher benefit estimate in the 2012 SAMA supplement for this SAMA necessitated the development of a more detailed cost estimate of the expected scope of the modification, which includes engineering analysis, hardware modifications, and testing.

The NRC staff also asked NextEra to provide the basis for the implementation cost estimates for the plant modifications to address IE #23, #24, #25, #26, #27, and #28. Initiating events #23 through IE #27 are seismic initiators of different seismic acceleration levels (0.7 g, 1.0 g, 1.4 g, 1.8 g, and 2.5 g), which lead to ATWS while IE #28 is loss of MFW that also leads to ATWS. In response to the RAI, NextEra clarified (NextEra 2012b) that modifications to reduce risk from IE #23 through IE #27 all include structural upgrades to the reactor internals to increase seismic capacity, which would be expected to significantly exceed the $500,000 cost estimate for this SAMA case. Additionally, NextEra clarified that IE #28 is dominated by failure of control rods to insert and failure to initiate emergency boration of RCS and that a hardware modification to upgrade reactor internals and emergency boration system are expected to significantly exceed $500,000. The NRC staff considers NextEra's clarification reasonable.

The NRC staff noted that Phase I SAMA 65, "install a digital feed water upgrade," has an estimated implementation cost of $30 million, which is much larger than the estimated implementation cost of more than $500,000 for Phase II SAMA 147, "install digital large break LOCA protection system." The NRC staff asked NextEra to explain the reason for this difference between what appear to be similar modifications (NRC 2010a). NextEra responded that the estimated implementation cost of $30 million for Phase I SAMA 65 was based on a detailed assessment of the costs associated with the Seabrook long-range plan for a digital upgrade of the feedwater control system, while the estimated cost of more than $500,000 for SAMA 147 was based on the judgment of the expert panel (NextEra 2011a). NextEra also noted that since the conservatively estimated benefit for SAMA 147 was much less than the estimated implementation cost, developing a more detailed cost estimate for this SAMA was not necessary. The NRC staff considers NextEra's clarification reasonable.

The NRC staff also requested additional clarification on the estimated cost of $30,000 for implementation of Phase II SAMA 157, "provide independent AC power source for battery chargers," which seems low for what is described as a hardware change (NRC 2010a). In response to the RAI, NextEra explained that the cost estimate is based on expert panel judgment and includes procurement of a small portable, nonsafety-related 480 V generator and associated connection cables, operation guideline development, and storage onsite in a convenient location for ease in moving into position/connected if ever needed during an extended SBO event (NextEra 2011a). The NRC staff considers NextEra's clarification reasonable.

As discussed in Section F.2.2, NextEra provided the results of a sensitivity analysis that applied a multiplier of 2.1 to account for the additional risk reduction from seismic events (NextEra 2011b, 2012a). In these analyses, NextEra revised the implementation costs for several SAMAs in which the estimated costs were determined to be overly conservative. The revised implementation costs are reflected in Tables F-4 and F-5. The NRC staff reviewed the basis for each of the revised costs and found them to be reasonable and, generally, consistent with estimates provided in support of other plants' analyses.

The NRC staff concludes that the cost estimates provided by NextEra are sufficient and appropriate for use in the SAMA evaluation.

F.6 Cost-Benefit Comparison

NextEra's cost-benefit analysis and the NRC staff's review are described in the following sections.

F.6.1 NextEra's Evaluation

The methodology used by NextEra was based primarily on NRC's guidance for performing cost-benefit analysis (i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a)). The guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) – COE where, APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure costs ($)

AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA, and it is not considered cost beneficial. NextEra's derivation of each of the associated costs is summarized below, which reflects updated values provided in the 2012 SAMA supplement (NextEra 2012a).

NUREG/BR-0058 has recently been revised to reflect the NRC's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3 percent and one at 7 percent (NRC 2004). NextEra provided a base set of results using the 7 percent discount rate and a sensitivity study using the 3 percent discount rate (NextEra 2012a).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δperson-rem/year)

x monetary equivalent of unit dose ($2,000 per person-rem)

x present value conversion factor (10.76 based on a 20-year period with a 7 percent discount rate)

As stated in NUREG/BR-0184 (NRC 1997a), the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal and external events, NextEra calculated an APE of approximately $815,100 for the 20-year license renewal period (NextEra 2012b).

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction

x offsite economic costs associated with a severe accident (on a per-event basis)

x present value conversion factor

This term represents the sum of the frequency-weighted offsite economic costs for each RC, as obtained for the Level 3 risk analysis. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NextEra calculated an annual offsite economic cost of about $23,500 based on the Level 3 risk analysis (NextEra 2011a). This results in a 7 percent-discounted value of approximately $1,950,600 for the 20-year license renewal period (NextEra 2012b).

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction

x occupational exposure per core damage event

x monetary equivalent of unit dose

x present value conversion factor

NextEra derived the values for AOE from information provided in Section 5.7.3 of the *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a). Best estimate values provided for immediate occupational dose (3,300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2,000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NextEra calculated an AOE of approximately $4,600 for the 20-year license renewal period (NextEra 2012b).

Averted Onsite Costs (AOSC)

AOSC include averted cleanup and decontamination costs (ACC) and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. NextEra derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a).

NextEra divided this cost element into two parts—the onsite cleanup and decontamination cost, also commonly referred to as ACC, and the RPC.

ACC were calculated using the following formula:

ACC = Annual CDF reduction

x present value of cleanup costs per core damage event

x present value conversion factor

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in NUREG/BR-0184 to be $\$1.5\text{x}10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NextEra calculated an ACC of approximately $141,700 for the 20-year license renewal period.

Long-term RPC were calculated using the following formula:

RPC = Annual CDF reduction

x present value of replacement power for a single event

x factor to account for remaining service years for which replacement power is required

x reactor power scaling factor

NextEra based its calculations on the rated Seabrook gross electric output of 1,290 MWe and scaled up from the 910 MWe reference plant in NUREG/BR-0184 (NRC 1997a). Therefore, NextEra applied a power scaling factor of 1,290/910 to determine the RPC. For the purposes of initial screening, which assumes elimination of all severe accidents caused by internal events, NextEra calculated an RPC of approximately $136,500 and an AOSC (AOSC = ACC + RPC) of approximately $278,200 for the 20-year license renewal period (NextEra 2012b).

Using the above equations, NextEra estimated the total present dollar value equivalent associated with eliminating severe accidents from internal and external events at Seabrook to be about $3,048,500. Use of a multiplier of 2.1 to account for the additional risk from seismic events in the sensitivity analysis increases the value, as estimated by the NRC staff, to $6.4 million. This represents the dollar value associated with completely eliminating all internal and external event severe accident risk at Seabrook, and it is also referred to as the maximum averted cost risk (MACR). NextEra explained (NRC 2012b) that the value of $3,048,500, reported in a response to an RAI (NextEra 2012b), was slightly updated from the value of $3,051,800 reported in the 2012 SAMA supplement (NextEra 2012a). The value was updated because of refinements in the calculation that were made related to time used to declare a general emergency. The small reduction had negligible impact on the SAMA cost benefit analysis. The NRC staff agrees that this change would have negligible impact on the SAMA cost benefit analysis.

NextEra's Results

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost beneficial. In the baseline analysis contained in the 2012 SAMA supplement (NextEra 2012a), using a 7 percent discount rate, NextEra identified three potentially cost-beneficial SAMAs (SAMAs 157, 165, and 192). Based on the consideration of analysis uncertainties, NextEra identified three additional potentially cost-beneficial SAMAs (SAMAs 164, 172, and 195). In addition, as a result of the sensitivity analysis using a multiplier of 2.1 to account for the additional risk from seismic events, NextEra identified one additional cost-beneficial SAMA (SAMA 193). The potentially cost-beneficial SAMAs for Seabrook are listed below:

- SAMA 157—provide independent AC power source for battery chargers,
- SAMA 164—modify condensate filter flange to incorporate a 2.5-in female hose adapter and isolation valve,
- SAMA 165—RWST fill from firewater during containment injection—modify 6-in. RWST flush flange to have a 2½-in. female fire hose adapter with isolation valve,
- SAMA 172—evaluate installation of a RCP "shutdown seal" being developed by Westinghouse,
- SAMA 192—install a globe valve or flow limiting orifice upstream in the fire protection system,
- SAMA 193—hardware change to eliminate MOV AC power dependency, and
- SAMA 195—make improvement to PCCW temperature control.

The potentially cost-beneficial SAMAs, and NextEra's plans for further evaluation of these SAMAs, are discussed in more detail in Section F.6.2.

F.6.2 Review of NextEra's Cost-Benefit Evaluation

The cost-benefit analysis performed by NextEra was based primarily on NUREG/BR-0184 (NRC 1997a) and discount rate guidelines in NUREG/BR-0058 (NRC 2004), and it was executed consistently with this guidance. Three SAMAs were determined to be cost beneficial in NextEra's baseline analysis in the 2012 SAMA supplement (SAMAs 157, 165, and 192, as described above). NextEra stated that these SAMAs would be entered into the Seabrook long-range plan development process for further implementation consideration (NextEra 2012a).

NextEra considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. In the 2012 SAMA supplement (NextEra 2012a), NextEra presents an uncertainty multiplier of 2.35 based on the ratio of the CDF mean value of 1.23×10^{-5} per year to the 95th percentile value of 2.86×10^{-5} per year. Since none of the Phase I SAMAs were screened based on excessive cost or very low benefit, a reexamination of the Phase I SAMAs based on the 95th percent upper bound benefits was not necessary. NextEra examined the Phase II SAMAs to determine if any would be potentially cost beneficial if the baseline benefits were increased by a factor of 2.35. As a result, three SAMAs became cost beneficial (SAMAs 164, 172, and 195, as described above). Although not cost beneficial in the baseline analysis, NextEra stated that these SAMAs would be entered into the Seabrook long-range plan development process for further implementation consideration (NextEra 2012a).

The NRC staff asked NextEra to describe how the uncertainty distribution was developed to derive the 95th percentile CDF value and how the distribution is different for internal, fire, and seismic CDF (NRC 2010a). In response to the RAI, NextEra explained that the uncertainty distribution was developed using a Monte Carlo sample size of 10,000 and a sequence bin cutoff of 1×10^{-9}, that the distribution included the integrated contribution from both internal and external events, and that individual contributions for internal, fire, and seismic events were not developed (NextEra 2011a). In response to a followup RAI, NextEra further clarified that the uncertainty analysis included uncertainty distributions for fire-initiating events, seismic-initiating events, component seismic fragilities, operator actions, and component random failures (NRC 2011b). NextEra also noted that, while uncertainty distributions were not specifically considered for hot short probabilities and non-suppression probabilities, numerous sensitivity studies were performed to support the fire events and seismic events models to ensure the reasonableness of key input parameters. The results of these sensitivity studies indicate that the baseline fire and seismic results are relatively insensitive to reasonable variations in key input parameters. Based on the results of these studies and the level of uncertainty applied in the fire and seismic events analyses, NextEra concluded that the uncertainty distribution used for the SAMA evaluation adequately reflects the uncertainty for both internal and external events.

NextEra provided the results of additional sensitivity analyses in the ER, including the use of 3 percent and 8.5 percent discount rates, variations in MACCS2 input parameters (as discussed in Section F.2.2), and a 41-year analysis period representing the remaining operating life of the plant accounting for the expected 20-year period of extended operation. Cost benefits are determined using the 3 percent discount rate, as clarified in an RAI response, and the 41-year extended period are bounded by the cost benefits determined using 95 percent upper bound MACR. These analyses did not identify any additional potentially cost-beneficial SAMAs.

SAMAs identified primarily on the basis of the internal events analysis could provide benefits in certain external events, in addition to their benefits in internal events. Since the SSPSS-2011 PRA model is an integrated internal and external events model, NextEra's evaluation accounted for the potential risk reduction benefits associated with both internal and external events. The

NRC staff asked NextEra to assess the impact of updated 2008 seismic hazard curves by the USGS on the Seabrook SAMA analysis (NRC 2010a). As indicated in Section F.2.2, NextEra responded with a sensitivity analysis in which a 2.1 multiplier is applied to the estimated benefits for internal and external events to account for the higher seismic CDF developed from the 2008 USGS seismic hazard curves (NextEra 2011a). This same multiplier was subsequently used in the 2012 SAMA supplement (NextEra 2012a). Since no SAMAs were screened in the Phase I analysis on very low benefit or excessive implementation cost, NextEra did not reexamine the Phase I SAMAs.

However, NextEra did provide a sensitivity analysis that reexamined the Phase II SAMAs to determine if any would be potentially cost beneficial if the baseline (7 percent real discount rate), uncertainty benefits (95th uncertainty percentile), and a 2.1 seismic multiplier were considered together (NextEra 2012a). As a result of this sensitivity analysis, one additional SAMA (SAMA 193) became cost beneficial. Although not cost beneficial in the baseline analysis, NextEra stated that this SAMA would be entered into the Seabrook long-range plan development process for further implementation consideration (NextEra 2012a).

As indicated in Section F.3.2, in response to NRC staff RAIs and followup RAIs related to the ER (NextEra 2010) and 2012 SAMA supplement (NextEra 2012a), NextEra performed cost-benefit analyses on risk-significant Level 1 and Level 2 basic events, including human error basic events and risk-significant initiating events. The additional SAMAs and NextEra's evaluation of each is summarized in Table F-5 . This table also provides the results of the sensitivity analysis applying the multiplier of 2.1 to account for the additional risk of seismic events (NextEra 2012a, 2012b). While these analyses did not identify any additional potentially cost-beneficial SAMAs, two of the SAMAs were determined to be cost beneficial but were already identified as such in the baseline SAMA analyses after accounting for uncertainties (SAMA 195) and after accounting for the seismic multiplier of 2.1 (SAMA 193).

Table F–5. SAMAs Identified and Evaluated for Risk-Significant Basic Events and Initiating Events [a]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
OALTO Provide automatic alignment of alternate cooling based on applicable signals	Eliminate failure of operator to align alternate cooling	4	11	340K (710K)	800K (1.7M)	>2.4M
PCCABCD Install a diverse & independent CCW pump, reduce to reduce potential for common mode failure	Eliminate CCW pump failure if AC & DC power are available	4	11	335K (700K)	785K (1.65M)	>6M
SWG11AB Improve Bus 11A/B reliability to reduce common mode failure	Eliminate bus failures that could fail associated division during mission	3	10	290K (610K)	680K (1.4M)	>1.8M
XOINEO Implement hardware change to improve reliability of containment injection for sequences where containment pressure is low	Eliminate all failures of operators to perform early injection during AC power scenarios	<1	10	290K (610K)	680K (1.4M)	>1.5M
Implement hardware change in support of automatic initiation of containment injection gravity drain						>1.5M
OHSBO Implement hardware change to improve ability to maintain stable primary & secondary conditions with plant in hot standby	Eliminate all operator failures related to maintaining stable hot standby conditions for extended cooling using the SG	4	5	140K (300K)	335K (705K)	>1.5M[c]
ZZSY12 Provide power system upgrades that would significantly reduce or prevent consequential LOOP events	Eliminate LOOP events that occur subsequent to a plant trip	7	5	140K (300K)	340K (710K)	>2M

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
CCTE1 Install hardware to improve the reliability of the CCW to reduce the potential for loss of CCW initiators (SAMA 195)[f]	Eliminate PCCW temperature element failures towards the temperature control function	3	5	140K (300K)	340K (710K)	>300K
CCE17 Improve Primary Closed Cooling (PCC) heat exchanger reliability related to tube leakage	The Intent of this SAMA has already been implemented (NextEra 2012a)					
ORHP10 Improve reliability or capability of the operator to restore RCS makeup after support systems are made available	Eliminate failure of all actions to restore high pressure for long term	2	4	110K (230K)	260K (550K)	>5M
SWAFN Improve reliability of SW Cooling Tower SWGR Room Ventilation fans	Eliminate failures related to ventilation fan FN-64 & associated damper & temperature switch when support systems are available	1	3	91K (190K)	210K (445K)	>480K
	Eliminate failures related to ventilation fan FN-51A & associated damper & temperature switch	1	2	74K (160K)	170K (340K)	>1M
	Eliminate failures related to ventilation fan FN-64 & associated damper & temperature switch when support systems are available	1	2	91K (190K)	210K (445K)	>480K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
XOSMPO Implement hardware modification for automatic control of containment sump recirculation after core melt	Eliminate operator failure to align containment sump recirculation after core melt given recovery of CBS	<1	3	61K (130K)	140K (230K)	>1.5M
CISPRE Install containment leakage monitoring system	Eliminate all pre-existing small & large containment leakage events	0	<1	4K (12K)	10K (27K)	50K to 100K
NOSBO1 Install additional DG to improve overall reliability of onsite emergency power	Elimination of all SBO events	22	6	220K (470K)	525K (1.1M)	>2M
OSEPS Implement hardware change in support of auto closure of supplemental electrical power system (SEPS) breaker to replace operator action	Eliminate operator failures associated with align & load the SEPS DGs	8	2	64K (135K)	151K (320K)	>750K
SEPS Install or modify a SEPS DG to substantially improve reliability of DG start & run failures	Eliminate SEPS DG hardware failures	6	2	63K (130K)	148K (310K)	>2M
OC12 Implement hardware modification (additional signals or remote capability) to allow closure of MOV CS-V-167	This SAMA is address by SAMA 193 and SAMA analysis case CSV167 (NextEra 2012a)					
CSV167 Implement hardware change to eliminate MOV AC power dependencies (SAMA 193)	Eliminate operator failure to close CIV CS-V-167 locally.	0	5	86K (180K)	200K (420K)	>300K
TDAFW Install additional steam driven EFW pump	Eliminates all failures of the motor-driven EFW independent of AC power	5.3	12	360K (750K)	835K (1.75M)	>2M

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
OTS10 Implement hardware change to improve reliability of SGTR control to eliminate or reduce operator failure to terminate safety injection (SI)	Eliminate operator failure to terminate SI	3	1	26K (55K)	61K (130K)	>300K
OLPR Implement hardware change to improve reliability of ECCS transfer to long-term recirculation	Eliminate operator failure to complete transfer of RHR/LHSI to long-term recirculation following a LOCA	3	0	12K (25K)	27K (58K)	>100K
OHSB670 Implement hardware change to improve ability to maintain stable & secondary conditions with SG cooling with plant in hot standby during CR fire events	Eliminate operator failures related to evacuation & control at the remote safe shutdown panel after fire-induced transients & LOCAs	3	1	29K (61K)	68K (140K)	>420K
OSGLC0 Implement hardware change to improve operator reliability or provide automatic feature to control SG levels using the EFW discharge pathway	Eliminate operator failures related to controlling SG level via a EFW SUFP and EFW with the EFW discharge & SUFP with the MFW discharge	2	1	29K (62K)	68K (140K)	>500K
SWGE561 Improve 4 KV emergency Bus E6 reliability to eliminate potential for bus fault	Eliminate Bus 5 and 6 random failures in the initiating event model or eliminate associated power division failure or both [d]	6	3	100K (220K)	240K (510K)	>1.2M
XOEFW Implement hardware change to improve operator reliability to feed a failed SG during a SGTR	Eliminate operator failures related to feeding the SG to back pressure the leak	0	1	21K (44K)	50K (100K)	>500K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
ORWMZ Implement hardware change to improve operator reliability or provide automatic feature to throttle ECCS RCS to minimize leak for small break LOCA (SLOCA) and ISLOCA sequences	Eliminate operator failure to throttle ECCS flow for scenarios where the containment sump Is not available during SLOCA or ISLOCA	2	0	15K (32K)	35K (74K)	>500K
ORWCD1 Implement hardware change to improve operator reliability or provide automatic features to cool & depressurize the RCS to minimize leak for SLOCA and ISLOCA sequences	Eliminate operator failure control RCS cooldown & depressurization in scenarios where the containment sump is not available during SLOCA & ISLOCA	<1	0	5.3K (11K)	12K (26K)	>500K
ORWLT1 Implement hardware change to improve operator reliability or provide automatic features to maintain stable plant conditions for extended SG cooling after a LOCA or SGTR	Eliminate operator failure to maintain stable primary & secondary conditions to extend SG cooling following SLOCA, ISLOCA, or ISLOCA[e]	<1	0	5.3K (11K)	11K (24K)	>500K
ORWIN Implement hardware change to improve operator reliability or provide automatic feature to initiate RWST makeup	Eliminate operator failure to initiate makeup to the RWST to extend ECCS injection during SLOCA & ISLOCA with recirculation failed	<1	0	4K (8.4K)	9.3K (20K)	>500K
PS40XA Implement hardware change to improve reliability of the low-pressure permissive signal need to align RHR suction	Eliminate failure of Train A & B low-pressure permissive signals	2	0	9K (20K)	21K (44K)	>500K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
RCVR Implement hardware change to improve RHR Train A suction relief valve opening on demand	Eliminate failures of both RHR Train A relief valves to open & reclose	<1	2	24K (50K)	55K (120K)	>500K
CST01 Implement hardware & procedural changes to improve reliability of makeup to CST for long-term SG cooling	Eliminate failures of condensate storage tank (CST) source for EFW	1	1	35K (73K)	81K (170K)	>500K
SWOC6 Implement hardware & procedural changes to improve reliability of transferring SW from the ocean to the cooling tower	Eliminate failure to transfer SW from the ocean to the cooling tower	<1	1	28K (59K)	66K (140K)	>1.5M
SWA6 Implement hardware changes to improve reliability of the SW cooling tower SWGR ventilation	Eliminate failure to transfer SW from the ocean to the cooling tower	<1	1	22K (46K)	52K (110K)	>240K
OFCR0 Implement hardware and procedural changes to improve operator capacity to restore PCCW at the remote shutdown panel	Eliminate failure to restore PCCW at the remote shutdown panel	<1	1	27K (56K)	62K (130K)	>200K
SW64 Implement hardware changes to reduce the probability of spurious SW intake return valve opening	Reduces to a low probability that SW intake return valve spuriously opens	<1	1	25K (52K)	58K (120K)	>300K
SW7071C Implement hardware changes to improve reliability of SW cooling tower pump or SWGR room ventilation fans to reduce potential for common mode failure	Eliminate failure of CW cooling tower pump or SWGR room ventilation fans when support systems are available	1	3	84K (180K)	200K (410K)	>480K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[(b)]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
EA180C Implement hardware changes to improve reliability of the emergency air handing ventilation fans by eliminating potential for common mode failure	Eliminate failure of emergency air handing ventilation fans when support systems are available	1	2	58K (120K)	140K (285K)	>480K
SW51C Implement hardware changes to improve reliability of SW cooling tower fans to reduce potential for common mode failure	Eliminate failure of SW cooling tower fans when support systems are available	1	3	87K (180K)	205K (430K)	>1M
E7T Implement hardware changes to reduce or eliminate impact of 0.7 g seismic events	Eliminate the 0.7 g seismic initiator	8	2	77K (160K)	180K (380K)	>500K
NOLOSP Implement hardware changes to reduce the risk of weather-related loss of system pressure (LOSP)	Eliminate the LOSP initiator	18	17	530K (1.2M)	1.2M (2.7M)	>3M
F4TREL Provide analysis & hardware changes to protect relay room structure from postulated turbine bay flooding due to an HELB	Eliminate the HELB flooding initiator in the turbine bay	5	1	46K (97K)	110K (225K)	>300K
NOSGTR Install upgrades that would reduce or eliminate SGTR	Eliminate the SGTR initiator in addition to pressure and thermo-induced tube rupture	5	2	67K (140K)	160K (330K)	>500K
RXT1 Improve overall Seabrook reliability by installing digital control systems to reduce plant trip initiating frequency	Eliminate the plant trip initiator	4	7	205K (430K)	480K (1.0M)	>19M

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)(b)		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
LOCA05 Implement hardware changes to reduce or eliminate pipe break LOCA events	Eliminate all small, medium, & large pipe break LOCA events	9	2	77K (160K)	180K (380K)	>500K
F1SWCY Implement hardware changes to reduce the risk of SW common return line rupture event	Eliminate the SW common return line rupture event	3	9	260K (550K)	620K (1.3M)	>5M
FIRE1 Implement hardware change to reduce potential for PORV LOCA caused by fire in the control room	Eliminate spurious or fire-induced actuation of the PORV	3	0	14K (31K)	34K (71K)	>100K
FSGBE6 Implement hardware change to reduce potential for loss of electrical Bus E6 caused by fire in SWGR room B	Eliminate fire initiating events in SWGR room B that result in loss of electrical Bus E6	3	1	28K (58K)	65K (140K)	>500K
Implement hardware change to reduce potential for loss of electrical Bus E6 caused by fire in SWGR room A						
LACPA Improve Bus E5 reliability & eliminate or reduce bus faults contributing	Eliminate the loss of the Train A essential 4 KV power (Bus 5E) initiator	3	1	44K (92K)	100K (220K)	>3M
LOCA06 Implement hardware changes to reduce or eliminate ISLOCA risk in the RHR injection path	Eliminate ISLOCA events	<1	3	48K (101K)	110K (240K)	>500K
LOCA05 Implement hardware changes to reduce or eliminate impact of 2.5 g seismically induced LOCA (by installing digital large break LOCA protection system)	Eliminates pipe break LOCAs	9	2	77K (160K)	180K (380K)	>500K

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
E18T Implement hardware changes to reduce or eliminate impact of 1.8 g seismic transient event	Eliminate the 1.8 g seismic transient initiator	<1	3	48K (100K)	110K (240K)	>500K
NOATWS Implement seismic upgrades to the ATWS system to withstand up to a 2.5 g seismic event	Eliminate the ATWS initiator	4	2	60K (130K)	140K (290K)	>500K[g]
Implement hardware upgrades to ATWS to reduce potential for ATWS with loss of MFW						>500K
NOSLB Install secondary side guard pipes to up to the main steam isolation valves	Eliminate steam line breaks	<1	0	5K (11K)	11K (24K)	>500K
MSSVO Install “gagging device” to close a stuck open MSSV	Eliminate stuck open MSSV initiator	<1	0	1K (2K)	2K (4.5K)	>500K
LOSPP Implement hardware upgrades to reduce LOSP	Eliminate all plant centered LOSP events	2	2	80K (170K)	190K (395K)	>7M
F4TFPB Implement hardware changes to provide flood and spray protection of non-safety bus duct in turbine bay	Eliminate all flooding scenarios due to rupture of fire protection piping in the turbine bay impacting offsite power	1	0	14K (30K)	33K (70K)	>100K[h]
FCRAC Implement hardware changes to provide fire protection features to eliminate or reduce the potential for fire on the Main Control Room panel	Eliminate all scenarios where fire in the Main Control Room leads to AC power loss	1	0	15K (31K)	35K (70K)	>100K[h]

Analysis case & applicable SAMAs	Modeling assumptions	% Risk reduction		Total benefit ($)[b]		Cost ($)
		CDF	Population dose	Baseline (internal + external)	Baseline with uncertainty	
LOC1LG Implement hardware changes to eliminate or reduce the potential for large LOCA events	Eliminate all large LOCAs	1	0	15K (31K)	35K (70K)	>100K[h]

[a] SAMAs in bold are potentially cost beneficial. This table summarizes the results of the revised SAMA analysis provided in the 2012 SAMA supplement (NextEra 2012a).

[b] Values in parenthesis are the results of the sensitivity analysis applying a multiplier of 2.1 to account for the additional risk of seismic events (NextEra 2011a).

[c] In response to an NRC staff RAI, NextEra clarified that the cost reported in the “Expected Cost” column of the 2012 SAMA supplement (NextEra 2012a) was incorrect, but it was reported correctly (i.e., $1.5M) in the “Evaluation” column (NextEra 2012b).

[d] In response to an NRC staff RAI, NextEra clarified that PRA case SWGE61 eliminated both the initiating and basic events associated with 4 kV essential buses E5 and E6 (NextEra 2012b).

[e] In response to an NRC staff RAI, NextEra clarified that PRA case ORWLT1 applied to small LOCA, interfacing LOCA, and SGTR (NextEra 2012b).

[f] In response to an NRC staff RAI, NextEra clarified that PRA case CCTE1 addresses both the reliability of PCCW and loss of CCW as an initiator (NextEra 2012b).

[g] In response to an NRC staff RAI, NextEra clarified that the cost of PRA case NOATWS reflects structural upgrades to reactor internals to reduce seismic capacity as well as non-seismically related reactor internals and emergency boration system upgrades (NextEra 2012b).

[h] NextEra explained in a telephone clarification meeting (NRC 2012b) that $100K is a nominal value used because of the very low calculated benefit. This value reflects the minimum cost of a hardware change.

As indicated in Section F.3.2, in response to an NRC staff RAI, NextEra identified and evaluated a SAMA to make “seismic upgrades to the CST” (NextEra 2011a). This SAMA was estimated to have an implementation cost of more than $100,000. NextEra performed a bounding analysis of the benefit of this SAMA by assuming that it eliminated structural failures of the CST during all seismic-initiating events. The total baseline benefit (using a 7 percent real discount rate) was estimated to be $1,000 and, after accounting for uncertainties, to be $2,000. Based on this result, NextEra concluded that this SAMA was not cost beneficial in either the baseline or the uncertainty analysis. This SAMA was not re-evaluated in the 2012 SAMA supplement (NextEra 2012a). However, based on the very low potential benefit for this SAMA, the NRC staff concludes that this SAMA would not be cost beneficial even after accounting for the higher MACR in the 2012 SAMA supplement, which is about a factor 3.7 increase over the MACR presented in the ER, and after applying the multiplier of 2.1 to account for the additional risk from seismic events.

Also, in response to an NRC staff RAI, NextEra provided a Phase II evaluation of the following SAMAs, which were originally screened in the Phase I evaluation (NextEra 2011a, 2011b):

- SAMA 79—install bigger pilot operated relief valve so only one is required,
- SAMA 84—switch for EFW room fan power supply to station batteries,
- SAMA 105—delay containment spray actuation after a large LOCA, and
- SAMA 191—remove the 135 °F temperature trip of the PCCW pumps.

The 2012 SAMA supplement (NextEra 2012a) evaluated these SAMAs (in Table F-4, and determined them to not be cost beneficial in either the baseline or uncertainty analysis or in the sensitivity analysis applying the seismic multiplier of 2.1.

As indicated in Section F.3.2, in response to an NRC staff RAI, NextEra provided an evaluation of the following two SAMAs identified as a result of its review of the cost-beneficial SAMAs from prior SAMA analyses for five Westinghouse four-loop PWR sites (NextEra 2011a):

- SAMA “procedure change to ensure that the RCS cold leg water seals are not cleared” has an estimated implementation cost of $15,000 to $20,000. NextEra performed a bounding analysis of the benefit of this SAMA by assuming that it eliminated all thermally induced SGTR events (Analysis Case XSGTIS). The total baseline benefit (using a 7 percent real discount rate) was estimated to be less than $1,000 and, after accounting for uncertainties, to be less than $1,000. Based on this result, NextEra concluded that this SAMA was not cost beneficial in either the baseline or the uncertainty analysis. NextEra also concluded that this SAMA would not be cost beneficial after applying the multiplier of 2.1 to account for the additional risk from seismic events (NextEra 2011b). This SAMA was not re-evaluated in the 2012 SAMA supplement (NextEra 2012a). However, based on the very low potential benefit for this SAMA, the NRC staff concludes that this SAMA would not be cost beneficial even after accounting for the higher MACR in the 2012 SAMA supplement, which is about a factor 3.7 increase over the MACR presented in the ER.
- SAMA “installation of redundant parallel service water valves to the EDGs” was estimated to have an implementation cost similar to SAMA 161 (NextEra 2011b), or $2 million (NextEra 2012a). In response to RAIs on the ER, NextEra performed a bounding analysis of the benefit of this SAMA by assuming that it eliminated all SBO events (SAMA analysis case NOSBO1). It concluded that this SAMA was not cost beneficial either in the baseline (using a 7 percent real discount rate) nor after accounting for uncertainties and the seismic risk multiplier of 2.1 (NextEra 2011a, 2011b). This SAMA was not re-evaluated in the 2012 SAMA supplement (NextEra 2012a). However, using the benefit results for SAMA analysis case NOSBO1 provided in Table F-4, the NRC staff estimates total baseline benefit (using a 7 percent real discount rate and the seismic multiplier of 2.1) to be $470,000 and, after accounting for uncertainties, to be $1.1 million. The NRC staff concludes that this SAMA is not cost beneficial.

Based on review of the ER (NextEra 2010), the NRC staff noted that the evaluation of SAMA 80, “provide a redundant train or means of ventilation,” assumes removal of HVAC dependence for CS, SI, RHR, and CBS pumps. The NRC staff asked NextEra to provide an evaluation of a SAMA to remove the HVAC dependency for just the highest risk system (NRC 2010a). In response to the RAI, NextEra explained that the estimated implementation cost to install a redundant HVAC train to either a single ECCS pump/system or multiple ECCS pumps and systems was estimated to be greater than $500,000. NextEra further noted that this cost estimate is significantly greater than the estimated benefit, after accounting for uncertainties and the seismic multiplier of 2.1, and which conservatively assumes elimination of 100 percent of the ECCS dependency on HVAC during long-term recirculation sequences. The analysis of this SAMA was updated in the 2012 SAMA supplement (NextEra 2012a), which shows a maximum benefit of $750,000, after accounting for uncertainties and the seismic multiplier of 2.1) and an updated cost estimate of greater than $1 million. NextEra points out

(NextEra 2012a) that this cost is judged to be comparable to other plants that do not have this redundancy. The NRC staff concludes that this SAMA has been adequately addressed.

The NRC staff notes that all of the potentially cost-beneficial SAMAs (SAMAs 157, 164, 165, 172, 192, 193, and 195) identified in the 2012 SAMA supplement (NextEra 2012a) are included within the set of SAMAs that NextEra plans to enter into the Seabrook long-range plan development process for further implementation consideration. The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the other SAMAs evaluated would be higher than the associated benefits.

F.7 Conclusions

NextEra compiled a list of 191 SAMAs in the ER (NextEra 2010) and 4 additional SAMAs in the 2012 SAMA supplement (NextEra 2012a) based on a review of the most significant basic events from the plant-specific PRA, insights from the plant-specific IPE and IPEEE, review of other industry documentation, and insights from Seabrook personnel. A qualitative screening removed SAMA candidates that had modified features not applicable to Seabrook due to design differences, that were determined to have already been implemented at Seabrook or Seabrook meets the intent of the SAMA, or that could be combined with another similar SAMA under consideration. Based on this screening, 117 SAMAs were eliminated, leaving 78 candidate SAMAs for evaluation.

For the remaining SAMA candidates, more detailed design and cost estimates were developed, as shown in Table F-4. The cost-benefit analyses showed that three of the SAMA candidates were potentially cost beneficial in the baseline analysis (SAMAs 157, 165, and 192). NextEra performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, three additional SAMAs were identified as potentially cost beneficial in the 2012 SAMA supplement (SAMAs 164, 172, and 195). In addition, NextEra performed a sensitivity analysis accounting for the additional risk of seismic events and identified one additional SAMA (SAMA 193) as being potentially cost beneficial. NextEra has indicated that all seven potentially cost-beneficial SAMAs would be entered into the Seabrook long-range plan development process for further implementation consideration.

NextEra provided a sensitivity analysis of the meteorological model using the EPA's CALMET wind field model. NextEra's analysis indicated that the use of the more complex CALMET model could potentially increase the calculated benefit of a SAMA by about 32 percent. The NRC staff determined that if the CALMET model was used in the baseline SAMA analysis and NextEra's uncertainty factor was applied, several additional SAMAs would be identified as potentially cost-beneficial including: SAMAs 13, 24, 44, 55, 56, 77, 96, 108, 109, 147, 163, 167, 168, 169, and 170.

However, based on an analysis of the conservatisms used in NextEra's baseline SAMA analysis and the overestimation of the increased benefits associated with NextEra's EI determination, the NRC staff concludes that NextEra's SAMA analysis was performed in a more conservative manner relative to accepted practices used in other applicant's evaluation of severe accidents and that NextEra's results represent a reasonable assessment of the identification of potentially cost beneficial SAMAs, notwithstanding any variations resulting from the use of the more complex CALMET wind field model. Therefore, the NRC staff finds that SAMAs 157, 165, 164, 172, 192, 193, and 195 are the only SAMAs that should be considered as being potentially cost-beneficial. Regarding the entire SAMA analysis, the NRC staff reviewed the NextEra analysis and concludes that the methods used and their implementation were sound. In reviewing insights from plant-specific risk studies, the SAMA evaluation included explicit consideration of external as well as internal hazards. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by NextEra are reasonable and sufficient for the license renewal submittal.

The NRC staff agrees with NextEra's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial SAMAs. Given the potential for cost beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by NextEra is warranted. However, the applicant stated that the seven potentially cost-beneficial SAMAs are not aging-related in that they do not involve aging management of passive, long-lived systems, structures, and components during the period of extended operation. Therefore, the NRC staff concludes that the potential cost beneficial SAMAs are not aging related and they need not be implemented as part of license renewal pursuant to 10 CFR Part 54.

F.8 References

American Society of Mechanical Engineers (ASME), 2003, "Addenda to ASME RA-S-2002, Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME RA-Sa-2003, December 5, 2003.

ASME, 2009, "Addenda to ASME RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME RA-Sa-2009, February 2, 2009.

Electric Power Research Institute (EPRI), 1988, "A Methodology for Assessment of Nuclear Power Plant Seismic Margin," EPRI NP-6041, Revision 0, Palo Alto, CA, August 1988.

EPRI, 1992, "Fire-Induced Vulnerability Evaluation (FIVE)," EPRI TR-100370, Revision 0, Palo Alto, CA, April 1992.

[Hanna] Hanna Consultants, 2013, "Analysis of Annual Wind Roses within about 50 Miles of the Seabrook Station, and Use of CALMET to Calculate the Annual Distribution of Trajectories from the Seabrook Station," Report Number 150-01, March 2013, which is Attachment 3 to "Nextera's Motion for Summary Disposition of Friends of the Coast/New England Coalition Contention 4D (SAMA Analysis Atmospheric Modeling)," May 10, 2013. ADAMS Accession No. ML13130A215.

New Hampshire Yankee (NHY), 1991, "Individual Plant Examination Report for Seabrook Station," March 1, 1991.

NextEra Energy Seabrook, LLC. (NextEra), 2010, "Seabrook Station—License Renewal Application, Applicant's Environmental Report, Operating License Renewal Stage," May 25, 2010, ADAMS Accession Nos. ML101590092 and ML101590089.

NextEra, 2011a, Letter from Paul O. Freeman, NextEra, to U.S. NRC Document Control Desk. Subject: "Seabrook Station, Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application," Seabrook, NH, January 13, 2011, ADAMS Accession No. ML110140810.

NextEra, 2011b, Letter from Paul O. Freeman, NextEra, to U.S. NRC Document Control Desk. Subject: "Seabrook Station, Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application," Seabrook, NH, April 18, 2011, ADAMS Accession No. ML11122A075.

NextEra, 2011c, Letter from Paul O. Freeman, NextEra, to U.S. NRC Document Control Desk. Subject: “Seabrook Station, Supplement to Response to Request for Additional Information, NextEra Energy Seabrook License Renewal Application,” Seabrook, NH, June 10, 2011, ADAMS Accession No. ML11166A255.

NextEra, 2012a, Letter from Paul O. Freeman, NextEra, to U.S. NRC Document Control Desk. Subject: “Seabrook Station, Supplement 2 to Severe Accident Mitigation Alternatives Analysis, NextEra Energy Seabrook License Renewal Application,” Seabrook, NH, March 19, 2012, ADAMS Accession No. ML12080A137.

NextEra, 2012b, Letter from Kevin T. Walsh, NextEra, to U.S. NRC Document Control Desk. Subject: “Seabrook Station, Supplement 3 to Severe Accident Mitigation Alternatives Analysis, Response to RAI Request dated July 16, 2012, NextEra Energy Seabrook License Renewal Application,” Seabrook, NH, September 13, 2012, ADAMS Accession No. ML12262A513.

North Atlantic Energy Service Corp. (NAESC), 1992, “Individual Plant Examination External Events Report for Seabrook Station,” October 2, 1992, ADAMS Accession No. ML080100029.

Nuclear Energy Institute (NEI), 2005, “Severe Accident Mitigation Alternative (SAMA) Analysis Guidance Document,” NEI 05-01 (Revision A), Washington, D.C., November 2005. ADAMS Accession No. ML053500427.

Pickard, Lowe, and Garrick, Inc. (PLG), 1983, “Seabrook Station Probabilistic Safety Assessment,” prepared for the Public Service Company of New Hampshire and Yankee Atomic Electric Company, PLG-0300, December 1982.

U.S. Geologic Survey (USGS), 2008, “2008 NSHM Gridded Data, Peak Ground Acceleration,” Available URL: http://earthquake.usgs.gov/hazards/products/conterminous/2008/data/.

U.S. Nuclear Regulatory Commission (NRC), 1975, “Standard Review Plan for the Review of Safety Analysis Report for Nuclear Power Plants,” NUREG-0800, Washington, D.C., November 1975.

NRC, 1983, *PRA Procedure Guide,* NUREG/CR-2300, Washington, D.C., January 1983.

NRC, 1988, GL 88-20, “Individual Plant Examination for Severe Accident Vulnerabilities,” November 23, 1988.

NRC, 1990, “Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants,” NUREG-1150, Washington, D.C., December 1990.

NRC, 1991, GL No. 88-20, “Individual Plant Examination of External Events for Severe Accident Vulnerabilities,” NUREG-1407, Washington, D.C., Supplement 4, June 28, 1991.

NRC, 1992, Letter from Gordon E. Edison, U.S. NRC, to Ted C. Feigenbaum, NHY, Subject: “Staff Evaluation of Seabrook Individual Plant Examination (IPE)—Internal Events, GL 88-20 (TAC No. M74466),” Washington, D.C., February 28, 1992.

NRC, 1997a, *Regulatory Analysis Technical Evaluation Handbook,* NUREG/BR-0184, Washington, D.C., January 1997.

NRC, 1997b, “Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance,” NUREG-1560, Washington, D.C., December 1997.

NRC, 1998, *Code Manual for MACCS2: Volume 1, User’s Guide*, NUREG/CR-6613, Washington, D.C., May 1998.

NRC, 2001, Letter from Victor Nerses, U.S. NRC, to Ted C. Feigenbaum, NAESC. Subject: “Seabrook Station, Unit No. 1—Individual Plant Examination of External Events (IPEEE) (TAC No. M83673),” Washington, D.C., May 2, 2001, ADAMS Accession No. ML010320252.

NRC, 2003, “Sector Population, Land Fraction, and Economic Estimation Program,” SECPOP: NUREG/CR-6525, Washington D.C., April 2003

NRC, 2004, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” NUREG/BR-0058, Washington, D.C., Revision 4, September 2004.

NRC, 2010a, Letter from Michael Wentzel, U.S. NRC, to Paul Freeman, NextEra. Subject: “Request for Additional Information for the Review of the Seabrook Station License Renewal Application-SAMA Review (TAC No. ME3959),” Washington, D.C., November 16, 2010, ADAMS Accession No. ML103090215.

NRC, 2010b, NRC Information Notice 2010-18: GI-199, “Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants,” Washington, D.C., September 2, 2010, ADAMS Accession No. ML101970221.

NRC, 2011a, Memorandum to NextEra from Michael J. Wentzel, U.S. NRC. Subject: “Summary of Telephone Conference Calls held on February 15, 2011, between the U.S. Nuclear Regulatory Commission and NextEra Energy Seabrook, LLC, to Clarify the Responses to the Requests for Additional Information Pertaining to the Severe Accident Mitigation Alternatives Review of the Seabrook Station License Renewal Application (TAC No. ME3959),” Washington, D.C., February 28, 2011, ADAMS Accession No. ML110490165.

NRC, 2011b, Letter from Bo Pham, U.S. NRC, to Paul Freeman, NextEra. Subject: “Schedule Revision and Request for Additional Information for the Review of the Seabrook Station License Renewal Application Environmental Review (TAC Number ME3959),” Washington, D.C., March 4, 2011, ADAMS Accession No. ML110590638.

NRC, 2012a, Letter from Micheal Wentzel, U.S. NRC, to Kevin Walsh, NextEra. Subject: “Request for Additional Information for the Review of the Seabrook Station License Renewal Application Environmental Review—SAMA Review (TAC Number ME3959),” Washington, D.C., July 16, 2012, ADAMS Accession No. ML12180A355.

NRC, 2012b, Memorandum to File. Subject: “Summary of Telephone Conference Call held on October 3, 2012, between the U.S. Nuclear Regulatory Commission and NextEra Energy Seabrook, LLC, Clarifying Responses to Requests for Additional Information Pertaining to the Seabrook Station License Renewal Application Environmental Review (TAC. No. ME3959),” dated November 1, 2012, ADAMS Accession No. ML12278A25

[URS] URS Professional Solutions LLC, “Exposure Index Study Using MACCS2 and CALMET: A Sensitivity Study Supporting the Seabrook Station SAMA Analysis,” URS-PS-TR-13-0003, March 2013, which is Attachment 4 to “Nextera's Motion for Summary Disposition of Friends of the Coast/New England Coalition Contention 4D (SAMA Analysis Atmospheric Modeling),” May 10, 2013. ADAMS Accession No. ML13130A215.

[Sandia] Sandia National Laboratories, 2013, “Review of Conservatism in the Seabrook Consequence Analysis,” April 25, 2014. ADAMS Accession No. ML14225A156.

NRC FORM 335 (12-2010) NRCMD 3.7 — U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1437, Supplement 46, Volume 2
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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

This final supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by NextEra Energy Seabrook, LLC (NextEra) to renew the operating license for Seabrook Station (Seabrook) for an additional 20 years. This final SEIS includes the analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include replacement power from new natural-gas-fired combined-cycle generation; new nuclear generation; a combination alternative that includes some natural-gas-fired capacity, and a wind-power component; and the no-action alternative of not renewing the license.

The NRC's preliminary recommendation is that the adverse environmental impacts of license renewal for Seabrook are not great enough to deny the option of license renewal for energy planning decision makers. This recommendation is based on the following:

• analysis and findings in the generic environmental impact statement (GEIS);
• the Environmental Report (ER) submitted by NextEra;
• consultation with Federal, state, and local agencies;
• the NRC staff's own independent review, as documented in the 2011 draft SEIS and the 2013 supplement to the draft SEIS;
• the NRC staff's consideration of public comments received during the scoping process; and
• consideration of public comments received on the draft supplemental environmental impact statement and the 2013 supplement to the draft SEIS.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)	
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