U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1437, Volume 2
Revision 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Appendices

Draft Report for Comment

Office of Nuclear Reactor Regulation

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at http://www.nrc.gov/reading-rm.html.
Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the Code of *Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents
   U.S. Government Printing Office
   Mail Stop SSOP
   Washington, DC 20402–0001
   Internet: bookstore.gpo.gov
   Telephone: 202-512-1800
   Fax: 202-512-2250
2. The National Technical Information Service
   Springfield, VA 22161–0002
   www.ntis.gov
   1–800–553–6847 or, locally, 703–605–6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:
Address: U.S. Nuclear Regulatory Commission
Office of Administration
Mail, Distribution and Messenger Team
Washington, DC 20555-0001
E-mail: DISTRIBUTION@nrc.gov
Facsimile: 301–415–2289

Some publications in the NUREG series that are posted at NRC's Web site address http://www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—
The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852–2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—
American National Standards Institute
11 West 42nd Street
New York, NY 10036–8002
www.ansi.org
212–642–4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor-prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

NUREG-1437, Volume 2
Revision 1

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Appendices

Draft Report for Comment

Manuscript Completed: June 2009
Date Published: July 2009

Office of Nuclear Reactor Regulation

Cover Sheet

Responsible Agency: U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation

Title: *Draft Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) Volumes 1 and 2, Revision 1

For additional information or copies of this draft GEIS, contact:

Jennifer Davis
Office of Nuclear Reactor Regulation
Mail Stop O-11F1
11555 Rockville Pike
Rockville, Maryland 20852
Phone: 1-800-368-5642, extension 3835
Fax: (301) 415-2002
Email: LRGEISUpdate@nrc.gov

To submit comments:

Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop TWB-05-B01
Washington, DC 20555-0001

Electronic comments may be submitted to the NRC by e-mail at LRGEISUpdate@nrc.gov
Fax: (301) 415-2002

Abstract

U.S. Nuclear Regulatory Commission (NRC) regulations allow for the renewal of commercial nuclear power plant operating licenses, depending on the outcome of an assessment to determine whether the nuclear plant can continue to operate safely and protect the environment during the 20-year period of extended operation. Renewal of a nuclear power plant operating license requires the preparation of an environmental impact statement (EIS). To support the preparation of these EISs, the NRC published the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) in 1996. The proposed action considered in the GEIS is the renewal of nuclear power plant operating licenses.

The NRC committed to review and revise the GEIS on a 10-year cycle, if necessary. Since publication of the GEIS, approximately 30 plant sites (50 reactor units) have applied for license renewal and undergone environmental reviews, the results of which were published as supplements to the 1996 GEIS. This GEIS revision reviews and reevaluates the issues and findings of the 1996 GEIS. Lessons learned and knowledge gained during previous license renewal reviews provides a significant source of new information for this assessment. In addition, new research, findings, and other information were considered in evaluating the significance of impacts associated with license renewal.

The intent of the GEIS is to determine which issues would result in the same impact at all nuclear power plants, and which issues could result in different levels of impact at different plants and thus require a plant-specific analysis for impact determinations. The GEIS is intended to improve the efficiency of the license renewal process by (1) providing an evaluation of the types of environmental impacts that may occur as a result of renewing the license of a nuclear power plant, (2) identifying and assessing the impacts that are expected to be generic (the same or similar), and (3) defining the number and scope of impacts that need to be addressed in plant-specific EISs. The GEIS revision identifies 78 environmental impact issues for consideration in plant-specific supplements to the GEIS.

In addition to the impacts of continued operations and refurbishment, the GEIS evaluates other consequences of license renewal, including the environmental effects of postulated accidents and the effects of an additional 20 years of operation on the impacts of shutdown and decommissioning and on the uranium fuel cycle. The GEIS evaluates a full range of alternatives to the proposed action, including a no-action alternative (denial of license renewal), fossil energy alternatives, nuclear energy alternatives, renewable energy alternatives, conservation (demand-side management), and the purchase of power. For most impact areas, the proposed action would have impacts that would be similar to or less than impacts of the alternatives, in large part because most alternatives would require new power plant construction, whereas the proposed action would not.

Public Comments: In preparation of this Draft GEIS, NRC considered comments received from the public during the scoping period. Comments received after the close of the scoping comment period have been considered to the extent practicable. Locations and times of public meetings on this document will be announced in the *Federal Register*. Comments on this Draft GEIS will be accepted for a period of 75 days following publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register* and will be considered in the preparation of the Final GEIS. Any comments received after the 75-day period will be considered to the extent practicable for the preparation of the Final GEIS.

Paperwork Reduction Act Statement

This NUREG contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval numbers 3150-0021.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

Contents

Figures

Tables

Abbreviations and Acronyms

ABWR	advanced boiling water reactor
AC	alternating current
ACS	American Cancer Society
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act
AGNIR	Advisory Group on Non-ionizing Radiation
ALARA	as low as reasonably achievable
ALI	annual limit on intake
ALWR	advanced light water reactor
ASME	American Society of Mechanical Engineers
BEIR	Biological Effects of Ionizing Radiation (National Research Council Committee)
BLS	U.S. Bureau of Labor Statistics
BPA	Bonneville Power Administration
BWR	boiling water reactor
CAA	Clean Air Act
CADHS	California Department of Health Services
CCS	carbon capture and storage
CCW	coal combustion waste
CDC	Centers for Disease Control and Prevention
CDF	core damage frequency
CEC	Commission for Environmental Cooperation
CEDE	committed effective dose equivalent
CEG	Constellation Energy Group
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CF	capacity factor
CFR	*Code of Federal Regulations*
CH_4	methane
CHP	combined heat and power
CO	carbon monoxide
CO_2	carbon dioxide
COL	combined operating license

CSP	concentrating solar power
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DC	direct current
DDREF	dose and dose rate effectiveness factor
DNC	Dominion Nuclear Connecticut
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DSM	demand-side management
EA	environmental assessment
EAB	exclusion area boundary
ECRR	European Committee on Radiation Risk
EEI	Edison Electric Institute
EERE	Energy Efficiency and Renewable Energy
EEZ	Exclusive Economic Zone
EF	enhanced Fujita (scale)
EFH	essential fish habitat
EI	exposure index
EIA	Energy Information Administration
EIML	Environmental Incorporated Midwest Laboratory
EIS	environmental impact statement
EJ	environmental justice
ELF-EMF	extremely low frequency-electromagnetic field
EMF	electromagnetic field
EMF-RAPID	Electric and Magnetic Fields Research and Public Information Dissemination (Program)
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPCRA	Emergency Planning and Community Right-to-Know Act
EPRI	Electric Power Research Institute
ER	environmental report
ERCOT	Electric Reliability Council of Texas
ERO	Electric Reliability Organization
ESA	Endangered Species Act
ESP	early site permit
F	Fujita (scale)
FAA	Federal Aviation Administration
FCC	Federal Communications Commission

FDOH	Florida Department of Health
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FES	final environmental statement
FGD	flue gas desulfurization
FICN	Federal Interagency Committee on Noise
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPL	Florida Power & Light Company
FR	*Federal Register*
FRCC	Florida Reliability Coordinating Council
FWS	U.S. Fish and Wildlife Service
GALL	Generic Aging Lessons Learned
GAO	U.S. General Accounting Office (now U.S. Government Accountability Office)
GEIS	generic environmental impact statement
GIS	geographic information system
GNEP	Global Nuclear Energy Partnership
GTCC	greater than Class C
HAP	hazardous air pollutant
HAPC	habitat area of particular concern
HAWT	horizontal axis wind turbine
HCCP	Harvard Center for Cancer Prevention
HDR	hot dry rock
HFC	hydrofluorocarbon
HCFC	hydrochlorofluorocarbon
HHV	higher heating value
HLW	high-level (radioactive) waste
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
IARC	International Agency for Research on Cancer
ICRP	International Commission on Radiological Protection
IDPH	Illinois Department of Public Health
IEEE	Institute of Electrical and Electronic Engineers
IGCC	integrated gasification combined cycle
INIRC	International Non-Ionizing Radiation Commission
IPEEE	Individual Plant Examination of External Events
IRPA	International Radiation Protection Association
ISFSI	independent spent fuel storage installation
ISI	in-service inspection

LERF	large early release frequency
LET	linear energy transfer
LLAP	*Legionella*-like amoebal pathogen
LLD	lower limit of detection
LLW	low-level (radioactive) waste
LLRWPA	Low-Level Radioactive Waste Policy Act
LLTF	Lessons Learned Task Force
LLWPAA	Low-Level Radioactive Waste Policy Act Amendments
LOEL	lowest observed effects level
LWR	light water reactor
MACT	maximum achievable control technology
MCAQ	Maricopa County Air Quality Department
MCL	maximum contaminant level
MEI	maximally exposed individual
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSW	municipal solid waste
MTBE	methyl tertiary butyl ether
NAAQS	National Ambient Air Quality Standards
NaCl	sodium chloride (salt)
NAICS	North American Industry Classification System
NAGPRA	Native American Graves Protection and Repatriation Act
$NaNO_2$	sodium nitrate
NAS	National Academy of Sciences
NCDC	National Climatic Data Center
NCRP	National Council on Radiation Protection and Measurement
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NETL	National Energy Technology Laboratory
NGCC	natural gas combined cycle
NHPA	National Historic Preservation Act of 1966
$(NH_4)SO_4$	ammonium sulfate
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NJDEP	New Jersey Department of Environmental Protection

NMC	Nuclear Management Company
NMFS	National Marine Fisheries Service
NO	nitrogen oxide
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NORM	naturally occurring radioactive material
NOS	National Oceanic Service
NO_x	nitrogen oxides
NPCC	Northeast Power Coordinating Council
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRHP	*National Register of Historic Places*
NRPB	National Radiological Protection Board
NSPS	New Source Performance Standards
NWI	National Waste Initiative; National Wetland Inventory
NWPA	National Waste Policy Act
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Labor
O_3	ozone
ODCM	Offsite Dose Calculation Manual
OPPD	Omaha Public Power District
OTA	Office of Technology Assessment
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PARS	Publicly Available Record System
Pb	lead
PC	pulverized coal
PCB	polychlorinated biphenyl
PDR	Public Document Room
PEIS	programmatic environmental impact statement
PFC	perfluorinated carbon
PI	performance indicator
PILOT	payments in lieu of tax
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of 2.5 μm or less
PM_{10}	particulate matter with a mean aerodynamic diameter of 10 μm or less
PPE	personal protective equipment
PSD	prevention of significant deterioration

PTC	production tax credit
PURPA	Public Utility Regulatory Act of 1978
PV	photovoltaic
PWR	pressurized water reactor
RCRA	Resource Conservation and Recovery Act of 1976
RDF	refuse-derived fuel
REMP	Radiological Environmental Monitoring Program
RER	radiological effluent release
RERR	radiological effluent release report
RFC	Reliability First Corporation
ROW	right-of-way
RRC	Regional Reliability Council
RRY	reference reactor year
SAAQS	State Ambient Air Quality Standards
SAMA	severe accident mitigation alternatives
SCE	Southern California Edison
SCR	selective catalytic reduction
SDWA	Safe Drinking Water Act
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SFP	spent fuel pool
SHPO	State Historic Preservation Office or Officer
SIP	State implementation plan
SMITTR	surveillance, monitoring, inspection, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SOARCA	state-of-the-art reactor consequence analysis
SPAR	standardized plant analysis risk
SPDES	State Pollutant Discharge Elimination System
SPP	Southwest Power Pool
SSCs	systems, structures, and components
Stat.	Statutes at Large
TDS	total dissolved solids
TEDE	total effective dose equivalent
TESS	threatened and endangered species system
TLD	thermoluminescence dosimeter
TSCA	Toxic Substances Control Act
TSS	total suspended solids
TTU	Texas Tech University

TVA	Tennessee Valley Authority
TXU	TXU Generation Company
UCB	upper confidence bound
UCS	Union of Concerned Scientists
UF_6	uranium hexafluoride
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UO_2	uranium dioxide
U_3O_8	triuranium octaoxide
USACE	U.S. Army Corps of Engineers
USC	*United States Code*
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WCGS	Wolf Creek Generating Station
WCNOC	Wolf Creek Nuclear Operating Corporation
WEC	wave energy capture
WHO	World Health Organization

Abbreviated Power Plant Names

Arkansas	Arkansas Nuclear One
Beaver Valley	Beaver Valley Power Station
Braidwood	Braidwood Station
Browns Ferry	Browns Ferry Nuclear Plant
Brunswick	Brunswick Steam Electric Plant
Byron	Byron Station
Callaway	Callaway Plant
Calvert Cliffs	Calvert Cliffs Nuclear Power Plant
Catawba	Catawba Nuclear Station
Clinton	Clinton Power Station
Columbia	Columbia Generating Station
Comanche Peak	Comanche Peak Steam Electric Station
Cooper	Cooper Nuclear Station
Crystal River	Crystal River Nuclear Power Plant
Davis-Besse	Davis-Besse Nuclear Power Station
Diablo Canyon	Diablo Canyon Power Plant
D.C. Cook	Donald C. Cook Nuclear Plant
Dresden	Dresden Nuclear Power Station
Duane Arnold	Duane Arnold Energy Center
Farley	Joseph M. Farley Nuclear Plant
Fermi	Enrico Fermi Atomic Power Plant
FitzPatrick	James A. FitzPatrick Nuclear Power Plant
Fort Calhoun	Fort Calhoun Station
Ginna	R.E. Ginna Nuclear Power Plant
Grand Gulf	Grand Gulf Nuclear Station
Harris	Shearon Harris Nuclear Power Plant
Hatch	Edwin I. Hatch Nuclear Plant
Hope Creek	Hope Creek Generating Station
Indian Point	Indian Point Energy Center
Kewaunee	Kewaunee Power Station
LaSalle	LaSalle County Station
Limerick	Limerick Generating Station

Abbreviated Power Plant Names

McGuire	McGuire Nuclear Station
Millstone	Millstone Power Station
Monticello	Monticello Nuclear Generating Plant
Nine Mile Point	Nine Mile Point Nuclear Station
North Anna	North Anna Power Station
Oconee	Oconee Nuclear Station
Oyster Creek	Oyster Creek Nuclear Generating Station
Palisades	Palisades Nuclear Plant
Palo Verde	Palo Verde Nuclear Generating Station
Peach Bottom	Peach Bottom Atomic Power Station
Perry	Perry Nuclear Power Plant
Pilgrim	Pilgrim Nuclear Power Station
Point Beach	Point Beach Nuclear Plant
Prairie Island	Prairie Island Nuclear Generating Plant
Quad Cities	Quad Cities Nuclear Power Station
River Bend	River Bend Station
H.B. Robinson	H.B. Robinson Steam Electric Plant
St. Lucie	St. Lucie Nuclear Plant
Salem	Salem Nuclear Generating Station
San Onofre	San Onofre Nuclear Generating Station
Seabrook	Seabrook Station
Sequoyah	Sequoyah Nuclear Plant
South Texas	South Texas Project Electric Generating Station
Summer	Virgil C. Summer Nuclear Station
Surry	Surry Power Station
Susquehanna	Susquehanna Steam Electric Station
Three Mile Island	Three Mile Island, Unit 1
Turkey Point	Turkey Point Nuclear Plant
Vermont Yankee	Vermont Yankee Nuclear Power Station
Vogtle	Vogtle Electric Generating Plant
Waterford	Waterford Steam Electric Station
Watts Bar	Watts Bar Nuclear Plant
Wolf Creek	Wolf Creek Generating Station

Units of Measure

ac	acre(s)
bbl	barrel(s)
Btu	British thermal unit(s)
°C	degree(s) Celsius
cm	centimeter(s)
d	day(s)
dB	decibel(s)
°F	degree(s) Fahrenheit
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
gal	gallon(s)
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWd/MT	gigawatt per day/metric tonne(s)
Gy	gray(s)
ha	hectare(s)
hr	hour(s)
Hz	hertz
in.	inch(es)
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
L	liter(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)

Units of Measure

m^3	cubic meter(s)
mA	milliampere(s)
mg	milligram(s)
mG	milligauss
mGy	milligray(s)
MHz	megahertz
mi	mile(s)
min	minute(s)
mL	milliliter(s)
MMBtu	million Btu
MPa	megapascal(s)
mph	mile(s) per hour
mrad	milliard(s)
mrem	millirem(s)
mSv	millisievert(s)
mT	milliTesla(s)
MT	metric tonne(s)
MTHM	metric tonne(s) of heavy metal
MTU	metric tonne(s) of uranium
MW	megawatt(s)
MWe or MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt-hour(s)
pCi	picocurie(s)
ppm	part(s) per million
ppmv	parts per million by volume
ppmvd	parts per million by volume, dry
ppt	part(s) per thousand
psi	pound(s) per square inch
rad	radian
rem	roentgen-equivalent-man
s	second(s)
scf	standard cubic foot (feet)
sV	sievert(s)
T	tesla(s)
TPY	ton(s) per year

V	volt(s)
yr	year(s)
μCi	microcurie(s)
μGy	microgray(s)
μm	micrometer(s)
μT	microtesla(s)

Conversions

Multiply	By	To Obtain
To Convert English to Metric Equivalents		
acres	0.4047	hectares (ha)
cubic feet (ft^3)	0.02832	cubic meters (m^3)
cubic yards (yd^3)	0.7646	cubic meters (m^3)
curies (Ci)	3.7×10^{10}	becquerels (Bq)
degrees Fahrenheit (°F) -32	0.5555	degrees Celsius (°C)
feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m^3)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
pounds (lb)	0.4536	kilograms (kg)
rads	0.01	grays (Gy)
rems	0.01	sieverts (Sv)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft^2)	0.09290	square meters (m^2)
square yards (yd^2)	0.8361	square meters (m^2)
square miles (mi^2)	2.590	square kilometers (km^2)
yards (yd)	0.9144	meters (m)
To Convert Metric to English Equivalents		
becquerels (Bq)	2.7×10^{-11}	curies (Ci)
centimeters (cm)	0.3937	inches (in.)
cubic meters (m^3)	35.31	cubic feet (ft^3)
cubic meters (m^3)	1.308	cubic yards (yd^3)
cubic meters (m^3)	264.2	gallons (gal)
degrees Celsius (°C) +17.78	1.8	degrees Fahrenheit (°F)
grays (Gy)	100	rads
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
sieverts (Sv)	100	rems
square kilometers (km^2)	0.3861	square miles (mi^2)
square meters (m^2)	10.76	square feet (ft^2)
square meters (m^2)	1.196	square yards (yd^2)

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

A.1 Public Scoping

On June 3, 2003, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* to provide the public with an opportunity to participate in the environmental scoping process as defined in Title 10, Section 51.29, of the *Code of Federal Regulations* (10 CFR 51.29). This step was the initial opportunity for stakeholder participation in the revision of the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, which occurred before the NRC had determined the results or recommendations for the revision. The NRC staff reopened scoping with a Notice of Intent published in the *Federal Register* on October 3, 2005 (Volume 70, page 57628).

Participation in the scoping process by members of the public and local, State, Tribal, and Federal government agencies was encouraged and used to accomplish the following:

- Determine whether the purpose and need for the revision (the proposed action) is clear;

- Determine the scope of the revision of the GEIS and identify whether there are any significant issues that should be analyzed in depth;

- Identify and eliminate from detailed study those issues that are peripheral or that are not significant or that have been covered by prior environmental review;

- Identify any environmental assessments and other environmental impact statements (EISs) that are being or will be prepared that are related to but are not part of the scope of the revision of the GEIS being considered;

- Identify other environmental review and consultation requirements related to the proposed action;

- Indicate the relationship between the timing of the preparation of the environmental analyses and the NRC's tentative planning and decision-making schedule;

- Identify any cooperating agencies and, as appropriate, allocate assignments for preparation and schedules for completing the GEIS revision; and

- Describe how the revision of the GEIS will be prepared, including any contractor assistance to be used.

The NRC invited the following entities to participate in the scoping process:

- Any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved, or that is authorized to develop and enforce relevant environmental standards;

- Any affected State and local government agencies, including those authorized to develop and enforce relevant environmental standards;

- Any affected Native American Tribe; and

- Any person who has requested an opportunity to participate in the scoping process.

The NRC held a public meeting in each of the four NRC regions for the GEIS revision. The scoping meetings were held at the following locations:

- July 8, 2003, DoubleTree-Atlanta Perimeter, 6120 Peachtree Dunwoody Road, Atlanta, GA 30328;

- July 10, 2003, Hilton-Oak Lawn, 9333 South Cicero Avenue, Oak Lawn, IL 60453;

- July 15, 2003, Hilton-Anaheim, 777 Convention Way, Anaheim, CA 92802; and

- July 17, 2003, Executive Conference Center at Bayside, 200 Mount Vernon Street, Boston, MA 02125.

Each meeting convened at 7:00 p.m. with an NRC overview of the role of the GEIS in the license renewal process, the experience gained in its use, and criteria that may be used to consider changes. Members of the public were given the opportunity to present their views, and each meeting was transcribed by a certified court reporter. In addition to the formal meeting, the NRC staff held informal discussions with members of the public one hour before the start of the session at each location; general information on the NRC and related NRC programs was available for meeting participants as supplies permitted.

Sixty-eight (68) attendees provided either oral comments or written statements. The meeting summaries are available electronically at the NRC Public Document Room or from NRC's Web-based Agencywide Documents Access and Management System (ADAMS) available at http://www.nrc.gov/reading-rm/adams.html under accession numbers ML032250338, ML032260318, ML032260702, and ML032270109.

The initial scoping period for this revision of to the GEIS was from June 3, 2003, to September 17, 2003, but scoping was subsequently reopened between September 27, 2005, and December 30, 2005. The NRC staff reviewed the transcripts and all written material received during the scoping period and identified individual comments. All comments and suggestions received orally during the scoping meetings or in writing were considered. Each set of comments from a given commenter was given a unique alphanumeric identifier (Commenter Identification Number), allowing each set of comments from a commenter to be traced back to the transcript, letter, or e-mail in which the comments were submitted.

Table A-1 identifies the individuals providing comments and the Commenter Identification Number associated with each person's set(s) of comments. The Commenter Identification Number is preceded by LRG-S (short for License Renewal GEIS scoping). For oral comments, the individuals are listed in the order in which they spoke at the public meeting. Accession numbers indicate the location of the written comments in ADAMS.

Comments were consolidated and categorized according to topic. Comments with similar specific topics were grouped to capture the common essential issues that had been raised. Once comments were grouped, the NRC staff determined the appropriate action for the comment. For each comment, the NRC staff made a determination that it was one of the following:

- A comment that was actually a question and introduced no new information;
- A comment that was either related to support of or opposition to license renewal or nuclear power in general or that makes a general statement about the license renewal process. The comment may make only a general statement regarding environmental impact issues. In addition, it provides no new information and does not pertain to 10 CFR Part 54;
- A comment about an environmental impact issue in the GEIS that provided no new information that would require evaluation during the review;
- A comment about an environmental impact issue in the GEIS that provided new information that would require evaluation during the review;
- A comment that raised an environmental impact issue that was not addressed in the GEIS;
- A comment regarding alternatives to the proposed action;
- A comment outside the regulatory scope of license renewal (not related to 10 CFR Parts 51 or 54).

Table A-1. Individuals Providing Comments During the Scoping Period

Commenter Identification Number[(a)]	Commenter Name	Affiliation (if stated)	Comment Source and ADAMS Accession Number
LRG-S-02-AT	Rita Kilpatrick	Southern Alliance for Clean Energy	Atlanta Scoping Meeting-ML032170942
LRG-S-03-AT	Joanne Steele	Action for a Clean Environment, Oconee Project	Atlanta Scoping Meeting-ML032170942
LRG-S-04-AT	Mary Olson	Southeast Conference for Nuclear Information and Resource Service	Atlanta Scoping Meeting-ML032170942
LRG-S-05-AT	Charles Utley	Blue Ridge Environmental Defense League	Atlanta Scoping Meeting-ML032170942
LRG-S-06-AT	Jen Kota	Sierra Club	Atlanta Scoping Meeting-ML032170942
LRG-S-08-AT	Pete Sipp	GANE	Atlanta Scoping Meeting-ML032170942
LRG-S-09-CH	Oscar Shirani	Quality Assurance Consultants	Chicago Scoping Meeting-ML032260339
LRG-S-10-CH	Cynthia Sauer		Chicago Scoping Meeting-ML032260339
LRG-S-11-CH	Sarah Sauer		Chicago Scoping Meeting-ML032260339
LRG-S-12-CH	Corey Conn	Nuclear Energy Information Service	Chicago Scoping Meeting-ML032260339
LRG-S-13-LA	Rochelle Becker	San Luis Obispo's Mothers for Peace	Anaheim Scoping Meeting-ML032260715
LRG-S-14-LA	Darcie Houck	California Energy Commission	Anaheim Scoping Meeting-ML032260715
LRG-S-15-LA	Guillermo Gonzales	Representative of Senator Feinstein	Anaheim Scoping Meeting-ML032260715
LRG-S-16-BO	David Agnew	Cape Cod Downwinders	Boston Scoping Meeting-ML032170934
LRG-S-17-BO	Mary Lampert	Pilgrim Security Watch	Boston Scoping Meeting-ML032170934
LRG-S-18-BO	Tim Judson	Citizens Awareness Network	Boston Scoping Meeting-ML032170934
LRG-S-19-BO	Pat Skibbee	Citizens Within A 10-Mile Radius	Boston Scoping Meeting-ML032170934
LRG-S-20-BO	Vera Cohen	Toxic Actions Center Women's Community Cancer Project	Boston Scoping Meeting-ML032170934

Table A-1. (cont.)

Commenter Identification Number[(a)]	Commenter Name	Affiliation (if stated)	Comment Source and ADAMS Accession Number
LRG-S-21-BO	Roberto Pena	Representative of Congressman Edward Markey	Boston Scoping Meeting-ML032170934
LRG-S-22-BO	Andre Martechini	Selectman of the Town of Duxbury	Boston Scoping Meeting-ML032170934
LRG-S-23-BO	Sandra Gavutis	C-10 Research and Education Foundation	Boston Scoping Meeting-ML032170934
LRG-S-24-BO	Diane Turco	Town of Harwich	Boston Scoping Meeting-ML032170934
LRG-S-25-BO	Debbie Grinnell	C-10 Research and Education Foundation	Boston Scoping Meeting-ML032170934
LRG-S-26-BO	Oliver Hall	Massachusetts Public Interest Research Group	Boston Scoping Meeting-ML032170934
LRG-S-27-BO	Barbara Pye	Duxbury Nuclear Advisory Committee	Boston Scoping Meeting-ML032170934
LRG-S-28-BO	Kate Adams	Citizens Awareness Network	Boston Scoping Meeting-ML032170934
LRG-S-29-BO	James Milkey	Environmental Protection Chief for Attorney General Tom Reilly	Boston Scoping Meeting-ML032170934
LRG-S-30-BO	Deb Katz	Citizens Awareness Network	Boston Scoping Meeting-ML032170934
LRG-S-31-BO	Jeb Thorp	Clean Water Action	Boston Scoping Meeting-ML032170934
LRG-S-32-BO	Rita Arditti	Women's Community Cancer Project	Boston Scoping Meeting-ML032170934
LRG-S-33-E	Lorraine Cotter		E-mail-ML032260518
LRG-S-34-E	Nancy Norwood		E-mail-ML032260520
LRG-S-35-E	Oscar Shirani	Quality Assurance Consultants	E-mail-ML032260521
LRG-S-36-E	Justin Ruhge		E-mail-ML032260525
LRG-S-37-E	Mary Lampert	Pilgrim Security Watch	E-mail-ML032260727
LRG-S-38-E	Judi Misale		E-mail-ML032260731
LRG-S-39-E	Mark Reback		E-mail-ML032260733
LRG-S-40-E	Brian Hughes		E-mail-ML032260735
LRG-S-41-E	Frieda Berryhill		E-mail-ML032260736
LRG-S-42-E	Sidney Goodman		E-mail-ML032260737
LRG-S-43-E	Robert Rutkowski		E-mail-ML032260740
LRG-S-44-E	David Shelton		E-mail-ML032260741

Table A-1. (cont.)

Commenter Identification Number[(a)]	Commenter Name	Affiliation (if stated)	Comment Source and ADAMS Accession Number
LRG-S-45-E	Brian Pinkerton		E-mail-ML032260744
LRG-S-46-E	Leslie Seff		E-mail-ML032260746
LRG-S-47-E	Betty Smay		E-mail-ML032260747
LRG-S-48-E	Mary Halligan		E-mail-ML032260749
LRG-S-49-E	Edward Paul		E-mail-ML032260764
LRG-S-50-L	Judy Davidson		Letter-ML032410390
LRG-S-51-E	David Koen		E-mail-ML032410396
LRG-S-52-E	Jeff Frontz		E-mail-ML032410399
LRG-S-53-E	Mary Olson		E-mail-ML032410408
LRG-S-54-E	Andrew Berna-Hicks		E-mail-ML032410414
LRG-S-56-E	Jonathon Tromm		E-mail-ML032691024
LRG-S-57-E	Sherri Gooding		E-mail-ML032691043
LRG-S-58-L	Benjamin Tuggle	U.S. Fish and Wildlife Service	Letter-ML032691069
LRG-S-59-E	Alexander Marion	Nuclear Energy Institute	E-mail-ML032691099
LRG-S-60-E	James Boyd	California Energy Commission	E-mail-ML032691114
LRG-S-61-E	Ann Alexander/ Shannon Fisk	Environmental Law and Policy Center	E-mail-ML032691132
LRG-S-62-E	Paul Gunter	Watchdog Project, Nuclear Information and Resource Service	E-mail-ML032691152
LRG-S-63-E	Kay Drey		E-mail-ML032691173
LRG-S-64-E	Kathryn Sutton	Winston and Strawn, LLP	E-mail-ML032691194
LRG-S-65-E	Barbara Youngberg	New York State Department of Environmental Conservation	E-mail-ML032691209
LRG-S-66-E	Jay Adams/Klaus Schumann	San Luis Obispo Green Party	E-mail-ML032691217
LRG-S-67-L	Frank Snapp		Letter-ML032691272
LRG-S-68-L	Pamela Blockey-O’Brien		Letter-ML032691283

(a) Commenter Identification Numbers ending in “AT,” “BO,” “CH,” or “LA” indicate that comments were provided at the Atlanta, Boston, Chicago, or Anaheim scoping meetings, respectively. Commenter Identification Numbers ending in “E” indicate that comments were provided by e-mail. Commenter Identification Numbers ending in “L” indicate that comments were provided by letter.

Each comment is provided in the following pages. For reference, the unique identifier for each comment (Commenter Identification Number listed in Table A-1 plus the comment number) is provided. In those cases where no new information was provided by the commenter, no further evaluation was performed.

The revised GEIS takes into account relevant issues raised during the scoping process. The revision addresses both Category 1 and 2 issues evaluated in the 1996 GEIS, along with any new information identified as a result of scoping. After receipt and consideration of the comments on the draft, the NRC will prepare a final GEIS revision, which will also be available for public review and comment.

A.1.1 Comments and Responses

The following pages summarize the comments and suggestions received as part of the scoping process and discuss their disposition. Parenthetical numbers after each comment refer to the Commenter Identification Number and the comment number. Comments can be tracked to the commenter and the source document through the Commenter Identification Number listed in Table A-1. Comments are grouped by category as follows:

A.1.1.1 Comments in Support of License Renewal and Nuclear Power

A.1.1.2 Comments in Opposition to License Renewal and Nuclear Power

A.1.1.3 Comments Concerning Water Quality, Hydrology, and Use

A.1.1.4 Comments Concerning Ecology: Aquatic Ecology; Terrestrial Ecology; Threatened and Endangered Species

A.1.1.5 Comments Concerning Human Health

A.1.1.6 Comments Concerning Socioeconomics

A.1.1.7 Comments Concerning Historic and Cultural Resources

A.1.1.8 Comments Concerning Alternatives to License Renewal

A.1.1.9 Comments Concerning Postulated Accidents

A.1.1.10 Comments Concerning the Uranium Fuel Cycle and Waste Management

A.1.1.11 Comments Concerning Decommissioning

A.1.1.12 Comments Concerning the License Renewal Process

A.1.1.13 Comments Concerning Issues Outside the Scope of License Renewal: Safety and Security; Emergency Preparedness; Economics and Need for Power; Aging Management; Potential Allegations; and Other.

A.1.1.1 Comments in Support of License Renewal and Nuclear Power

Comment: These misguided "tree huggers" who oppose to the use of Nuclear Power and think that solar, wind and others will be substitutes do not understand that the real issue is in the numbers. Those nuclear power plants turn out 2-3 billion watt-hours of power every hour of every day, night and day! That is enough for 2 million homes! California's power needs peaks at 45 billion watt hours. The alternative power sources are good for about 3-4 million watt-hours but only when the sun is shining or the wind is blowing. That is good for about 200 homes. 20 nuclear power plants would provide all the power needs of California for the foreseeable future. (LRG-S-36-E-1)

Comment: With the approval of the Yucca Mountain storage facilities by the federal government, there is no reason why California should not go full speed ahead with new and expanded nuclear power plants. (LRG-S-36-E-3)

Comment: The source of power, uranium, is almost limitless. The U.S. controls the nuclear fuel sources not the Arabs. We have unlimited nuclear fuel sources in the continental U.S. With nuclear, the U.S. can free itself from any and all foreign threats to our energy requirements. (LRG-S-36-E-5)

Comment: Concerned taxpayers for the Initiative for National Change (I.N.C.) supports energy independence for America. (LRG-S-36-E-7)

Comment: Our recommended solution to our power needs is nuclear plants to power electric homes, cars and trucks, and nuclear power for air and sea travel. We will still need oil and gas to produce all those plastics which we have all become used too. (LRG-S-36-E-6)

Response: *The comments are supportive of nuclear power. The comments are general in nature, provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.*

A.1.1.2 Comments in Opposition to License Renewal and Nuclear Power

Comment: I don't really believe in the friendly atom, I think it's a charade to keep the atomic weapons going, because as has been stated in the past here the cost of, the true cost of nuclear energy makes no sense, and it's only 20 percent of the energy in our country, and yet we have these huge agencies and the different departments that are supposedly overseeing the whole process, and yet we get incomplete answers to our questions, or referred to some other I-don't-know-where to try to answer them. (LRG-S-03-AT-3)

Comment: We have nuclear power because the public was misled by statements of electricity "too cheap to meter,"… We now know that we were being lied to... Because the public was once fooled into believing that nuclear energy was safe and cheap does not make it acceptable to perpetuate the lie. (LRG-S-16-BO-12)

Comment: As the recent Northeast blackout reminds us, our power system is a fragile and unpredictable creation – especially in an era of deregulation – and if these old reactors are allowed to remain in operation, the risks of catastrophe are simply unacceptable. (LRG-S-54-E-2)

Comment: It is too late for my home state [Pennsylvania]- please do not spread this legacy of sorrow and suffering anywhere else in our nation. (LRG-S-33-E-3)

Comment: What is wrong with you people? To merely consider re-licensing plants for another 20 years is not science. It is technological prostitution. (LRG-S-42-E-1)

Comment: I certainly do not believe that the NRC should renew the operating licenses for up to an additional 20 years. In fact, I do not believe nuclear power plants are safe enough to operate for the full 40- year duration of their existing licenses. (LRG-S-63-E-7)

Comment: Please do not renew any certificates of operation for any nuclear power plant, anywhere. Period. The only exception would be college research facilities for academic studies of nuclear physics/energy/fusion, etc., but not for the purpose of becoming public utilities- only for the sake of pure science and advancement of knowledge. We, as humans, must stop being arrogant wastrels of multi-dimensional earth resources. (LRG-S-67-E-1)

Comment: Small wonder there is a draft letter now being circulated which calls for a vote of no confidence in the Nuclear Regulatory Commission.

The letter cites chapter and verse a long list of documented betrayals of the public safety and health by the NRC. Obviously, NRC stands for Nobody Really Cares. How do you people live with yourselves? (LRG-S-42-E-3)

Comment: This [license renewal] is unconscionable considering the facts that the industry has aged sooner than expected. (LRG-S-37-E-3)

Response: *The comments express opposition to license renewal and nuclear power. The comments are general in nature, provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.*

Comment: The operation and maintenance costs of nuclear power plants are very high, but what really involves significant outlay of capital for investors (despite the government's history of providing massive subsidies to the industry) are the construction costs. Nuclear power plants are notorious for construction cost overruns. It can take many years for private investors to break even and begin to see a return on their investment in nuclear power. Thus, operating license renewals are another means by which investors in nuclear can further amortize their costs, i.e. give them more time (20 additional years) to recoup the money spent in building the reactor, regardless of the increased safety risks from running an aging reactor. Those 20 years also give the plant owners more time to formulate the cheapest – and shoddiest - decontamination and decommissioning (D&D) plan for the reactor and the entire site when it is finally, permanently shut down, and to find the money to pay for it (at least that portion beyond what is foisted upon taxpayers and ratepayers). Reactor licensees will always attempt to dodge the expense of a thorough, proper cleanup of a site – thus endangering the public and possibly exposing them to further radiation risks. (LRG-S-48-E-4)

Comment: The last order for a nuclear power plant in the United States that was not subsequently canceled was placed in October 1973 --- thirty years ago. That is because the public --- including the majority of the directors of America's investor-owned electric utilities --- recognized that nuclear plants are expensive, dirty and dangerous. (LRG-S-63-E-1)

Comment: Phase out nuclear power now and stop producing the dreadful radioactive waste.

How much sense does it make to continue with a technology which benefits just one of two generations but then burdens the next 12,000 with safeguarding the extremely toxic radioactive waste!?! Without taxpayer subsidies, bailouts, "recovery of stranded costs" and similar schemes, nuclear power cannot compete with benign and sustainable energy sources. Why continue to expose the residents of our planet to the risk of nuclear catastrophe when other forms of energy production are readily available?

Therefore, the SLO GREEN Party opposes any re-licensing of existing nuclear power plants, whether generic or site specific. (LRG-S-66-E-1)

Comment: Please do not give any funding to build Nuclear Reactors. Is the production of electricity so important that our children's lives must be sacrificed to obtain it. (LRG-S-33-E-2)

Comment: Given all of the above, re-licensing, especially 20 years ahead of time, whether generic or site specific, is a disservice to public health and safety. Re-licensing of the existing nuclear plants would therefore be a violation of your mandate. (LRG-S-66-E-6)

Response: *The comments express opposition to nuclear power and emphasize the cost of building and operating nuclear plants. The comments are general in nature, provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments. It should be noted that the NRC does not fund the construction of nuclear reactors. The NRC is responsible for licensing and regulating the operation of nuclear power plants to ensure the protection of public health and safety and protection of the environment.*

Comment: From cancer risks to being targeted for a terrorist attack, having a nuclear power plant in the community poses unique hazards. Whether it's a permitted, routine release of radiation; an "incident;" an accident or worse, nuclear reactors are hardly just another industrial facility. The U.S. nuclear industry and its alleged regulators, much like the nuclear industry worldwide, have a shoddy record, at best, of keeping this inherently dangerous technology under control. From the meltdown at Pennsylvania's Three Mile Island in 1979 to the recent brush with disaster at Ohio's Davis-Besse, nuclear power's history is riddled with failures and their severe consequences. After the tragic events of 9/11 we "learned" that terrorists consider nuclear reactors potential targets. License renewals only increase the chances of another Three Mile Island, or worse. If there were an accident or attack on a U.S. nuclear power plant, it's far from certain that emergency evacuation plans could adequately protect the public. (LRG-S-48-E-2)

Response: *The comment expresses opposition to nuclear power and identifies a number of concerns. The comment is general in nature, provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment. The license renewal process proceeds along two tracks – one for review of safety issues (10 CFR Part 54) and another for environmental issues (10 CFR Part 51). Safety issues and enhancements to safety that are deemed necessary (e.g., security enhancements at power plants following 9/11) are considered outside the scope of the environmental review.*

A.1.1.3 Comments Concerning Water Quality, Hydrology, and Use

Comment: Water concerns, water impacts certainly that affect us at the Georgia plants, and this is true throughout the Southeast Region.

As we know, the nuclear energy industry has an enormous thirst for large quantities of water resources, and that's been very well documented. You can pretty easily compare fuel types across a host of environmental factors ranging from water quantity, water quality, going on to air quality, air quantity, land use, et cetera. (LRG-S-02-AT-4)

Comment: So considering those -- discharge temperatures, I spoke a little earlier about the water, excessive water consumption, looking at the water that is permanently lost to the environment because these plants don't just run and then spit all the water back into the river. (LRG-S-02-AT-12)

Response: *The power industry in general does require a large quantity of water. While the NRC does review and assess issues related to consumptive water usage and discharge temperatures back to the environment, water usage is ultimately dictated by each individual State through its water appropriations permit system and the National Pollutant Discharge Elimination System permitting program, not the NRC. The licensee is required by the NRC to operate in compliance with all its permits, therefore minimizing the impacts to the environment. Permits must be renewed on a periodic basis and any public concern about those permit requirements can be addressed then. The comments are general in nature, provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.*

Comment: I believe that the environmental issue regarding “impacts of refurbishment on surface water quality” should not be treated as a Category 1 item --- that is, as one that is not to be assessed for each reactor site independently. (I apologize if I have read the “Appendix B to Subpart A” table incorrectly, but my computer was not able to let me view or print out the right and left margins concurrently.) (LRG-S-63-E-8)

Response: *The issue of impacts of refurbishment on surface water was determined as a Category 1 issue in the 1996 GEIS. However, this and other environmental issues will be re-evaluated as part of the GEIS revision. If new and significant information is found that suggests that re-categorization of this or other issues is appropriate, Table B-1 will be revised accordingly.*

Comment: I would also urge you to study the “discharge of chlorine or other biocides” on a site- specific basis. I have read of concerns that even some of the NRC licensees have had about the excessive amounts of chlorine needed for their cooling towers. (LRG-S-63-E-10)

Response: *The amount of the water discharged by each individual plant and the chemical levels in that water are determined by individual States through the National Pollutant Discharge Elimination System permitting program, not the NRC. The licensee is required by the NRC to operate in compliance with all its permits, therefore minimizing the impacts to the environment. However, this and other environmental issues will be re-evaluated as part of the*

GEIS revision. If new and significant information is found that would suggest that re-categorization of this or other issues is appropriate, Table B-1 will be revised accordingly.

A.1.1.4 Comments Concerning Ecology

Aquatic Ecology

Comment: Requirements for cooling towers to reduce thermal degradation of coastal waters and aquatic sea life. (LRG-S-13-LA-9)

Comment: Until the once-through reactor cooling systems are reengineered to meet existing environmental protection requirements; nukes dependent upon them should be closed. Once through cooling with its destruction of fish, shell fish, birds, sea turtles, and marine mammals due to impingement and temperature shock, is unnecessary and unacceptable. The thermal pollution of a billion gallons of water per reactor per day is evidence of the insufficiency of this outdated technology, and the full effect of this primitive practice is not understood. To suggest the continuation of this violation of environmental protection laws for an additional 20 years is absurd. At a minimum, the addition of cooling towers, which would reduce thermal pollution and attendant environmental destruction to 1/25th of its present rate should be required. (LRG-S-16-BO-13)

Comment: I thought that was a requirement that the least damaging technology to the environment is what is supposed to be used. Quite clearly, once through cooling is the most damaging technology that can be used… In pulling in all that water you have the tiny larvae and fish, and eggs, being pulled in. You have the larvae being pulled in and the larger animals being damaged or pulled in, and then the super heated water going back out and having its negative effect on the plant life there, the fish there. And then when you shut the plant down, those who can survive in a hotter water temperature now are nailed because the water gets cold again. There is another technology, being cooling towers, or dry cooling, and I would think that this should be a requirement of any relicensing. (LRG-S-17-BO-13)

Comment: The provisions of Clean Water Act section 316 (b) should be made a requirement of all projects at the time of renewal, unless the Environmental Protection Agency, in consultation with the Service specially waives these requirements. (LRG-S-58-L-4)

Comment: The default procedures should either include implementing the best technology available for screening cooling water intakes or for developing necessary studies in consultation with the Service to determine if other alternatives would be sufficient. (LRG-S-58-L-5)

Comment: 10 CFR 51.53 (c)(3)(A): The necessity of screening cooling water intakes should be determined on a case-by-case basis and should not be subject to an arbitrary threshold based on river discharge. (LRG-S-58-L-10)

Comment: Thermal Damage to Marine Environments: Damage to the coastal marine environment and biota from warm seawater discharges from California nuclear plants is a continuing problem. Efforts are underway to offset the damage of the cooling system discharges, which dump large amounts of seawater into the ocean each day at much warmer temperatures. California utilities have conducted extensive studies on thermal damage to marine environments. The plant-specific environmental review during license renewal should include the findings from these and other studies. The review should evaluate the cumulative impacts to the coastal marine environment adjacent to the plant associated with plant license renewal and extended operation. These potential impacts and mitigation strategies should be reviewed on a site-specific basis during license renewal proceedings. (LRG-S-60-E-6)

Comment: Increased Damage to Marine and Aquatic Environments as the Result of Once-Through Cooling System Damage and 20-year license extension.

Appendix B to Subpart A "The Environmental Effect of Renewing the Operating License of a Nuclear Power Plant" for Aquatic Ecology states that cold shock, thermal plume and scouring be treated as Category 1 items with small impact. Recent studies conducted at the state level surpass NRC's earlier conclusions.

On July 11, 2003 the State of New York publicly released a study including an assessment of the Indian Point once-through cooling system environmental impact on fish eggs, larvae, small fish and aquatic vegetation in the Hudson River that directly contradicts earlier NRC findings regarding Thermal Plume Barriers To Migrating Fish--Category 1--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."

On July 11, 2003 the California Water Quality Control Board-Central Coastal Region abandoned a proposed settlement with Pacific Gas and Electric on once-through cooling system for Diablo Canyon nuclear power station's severe thermal pollution of Diablo Cove and destruction of marine habitat. The findings of the California Water Quality Control Board assessment of the thermal discharge from Diablo Canyon are in direct contradiction to NRC finding "Scouring caused by discharged cooling water--Category 1--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." In fact, CWQCB concluded that Diablo Canyon's thermal discharged had scoured significant portions of Diablo Cove to "essentially bare rock."

Similarly, the State of Vermont has additional requested that a study of Vermont Yankee nuclear power station's to assess the proposed 20 % power uprate and thermal plume impact on fish populations in the Connecticut River.

Therefore, NIRS contends that the environmental impact on aquatic ecology assessment and treatment as a Category 1 item has been surpassed by more recent studies released by the State of New York and the State of California. These items should therefore be re-evaluated as Category 2 items for NEPA contentions admissible in site specific proceedings for license extension. (LRG-S-62-E-13)

Response: *Since the development of the 1996 GEIS, new studies and data have been published on the effects of power plant cooling water withdrawal and thermal discharges. The U.S. Environmental Protection Agency (EPA) and the States, not the NRC, regulate cooling water intakes and thermal discharges through National Pollutant Discharge Elimination System (NPDES) permits and Clean Water Act regulations. Power plants cannot operate without valid NPDES permits. Per the National Environmental Policy Act (NEPA), the NRC is required to assess potential environmental impacts, including those resulting from cooling water intakes and thermal discharges. The NRC staff will review new data and studies published since the 1996 GEIS, and will incorporate any new information as appropriate in the GEIS revision. The NRC staff will consider the comments above for the GEIS revision.*

Comment: Inadequate analysis requiring review

In addition to the analyses discussed above, at least one section of the GEIS contains significant factual gaps and inaccuracies, and needs to be reviewed and revised accordingly:

Section 4.2, Once-Through Cooling Systems; Section 4.3, Cooling Towers. In the sections concerning impacts of cooling systems on receiving or nearby waterbodies, the GEIS repeatedly describes environmental consequences as "of small significance," and the changes that would be required to mitigate them as "costly," concluding that NRC does not consider the changes warranted. No further information is provided as to either the cost of these changes or the degree of mitigation they would likely accomplish. More information needs to be provided regarding the measures cited – operating additional wastewater treatment systems, reducing the plant's generation rate, and changing to a closed-cycle cooling system – as well as any additional water quality mitigation measures that may be evaluated in the updated GEIS. (LRG-S-61-E-7)

Response: *In preparing the revised GEIS, the NRC will revisit impact determinations made in the 1996 GEIS and update these if necessary on the basis of the best available information, including any new and significant information that would change the conclusions in the 1996 GEIS. After the completion of the revised GEIS, the NRC will reconsider the appropriateness of* *the conclusions regarding the Category 1 and Category 2 issues in Table B-1 of 10 CFR 51 Subpart A, Appendix B and revise this table accordingly. The comment will be considered when developing the revised GEIS.*

Comment: NRC should clarify the language that defines the applicability of the issue addressing the impacts of thermophilic organisms in the affected water [10CFR51.53(c)(3)(ii)(G)]. The GEIS specifically limits the concern to 25 plants. Current language in the GEIS and the rule, as well as, treatment in GEIS supplements issued to date is inconsistent. (LRG-S-59-E-7)

Response: *The comment refers to text in 10 CFR 51.53 that describes the content of environmental reports to support license renewal applications. In preparing the revised GEIS, the NRC will revisit impact determinations made in the 1996 GEIS and update these if necessary on the basis of the best available information, including any new and significant information that would change the conclusions in the 1996 GEIS. After completing the revised GEIS, the NRC will reconsider the appropriateness of the conclusions regarding the Category 1 and Category 2 issues in Table B-1 of 10 CFR 51 Subpart A, Appendix B and revise this table accordingly. The comment will be considered when developing the revised GEIS.*

Comment: With respect to aquatic ecology issues and, specifically, the "accumulation of contaminants in sediments or biota," again I believe that a site-specific analysis is warranted. Because of variations in the plants' operating histories --- including unplanned events, the quality of the fuel rods, etc. --- the amounts of corrosion, activation and fission products released to the cooling water source from each nuclear plant is different. The buildup in the sediment at the discharge pipe of cobalt-60, and other isotopes released with the discharge water, is potentially available to bottom-feeding fish. The longer a reactor operates, of course, the greater will be the accumulation of contaminants. It should also be essential to analyze the drinking water intakes of the closest downstream towns or cities, especially if those communities have larger populations than when the plant's initial environmental statement was prepared and its construction permit was issued.

As a nuclear plant ages, solvents like chelating agents are used to dissolve radioactive corrosion products and other materials that have plated out over the years on surfaces of pipes, pumps and other components. Because the radioactive materials may stay bonded to the chelates, and thus remain in solution, they can pass out through the liquid-waste filtering system and be released into the environment. The buildup of crud and the need to use solvents increase as the plant ages. (For example, chelates are used to reduce corrosion products that emit penetrating gamma rays that may have accumulated within pipe elbows, making the pipes dangerously less efficient and precluding the ability of inspectors and repair personnel to get near a leaking pipe.) Only by analyzing the sediment near a specific plant's discharge structure can an evaluation be made of the environmental impacts of the liquid effluent during the plant's 40-year operating life and an estimate be made of the impacts to be expected during the requested 20-year license extension. The downstream aquatic ecology is also, of course, affected. (We can only hope that someday soon better environmental monitoring technologies will become available for water, air and land.) (LRG-S-63-E-11)

Response: *The NRC staff will consider impacts of radioactive and nonradioactive contaminants on bottom-feeding fish and other biota for the revised GEIS. The EPA and the States regulate contaminant release through NPDES permits, and power plants cannot operate without valid NPDES permits. In addition, more than 10 Federal laws give the EPA, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, and other Federal, State, and Tribal agencies authority to address sediment quality. The NRC staff will review new data and studies published since the 1996 GEIS, and will incorporate any new information as appropriate in the GEIS revision.*

Terrestrial Ecology

Comment: 10 CFR 51.53(c)(3)(H): The assessment described in this section should also include an analysis of effects on migratory birds, pursuant to the Migratory Bird Treaty Act and the eagle acts as appropriate. (LRG-S-58-L-11)

Response: *Potential impacts to migratory birds and eagles will be considered for the revised GEIS.*

Comment: Both the "ECRR 2003" Report and countless other studies, including my own (unpublished), are very concerned with serious effects to wildlife and migrating birds from emissions/noble gas releases/crop and wild vegetation radioactive uptake (ingested)/tritium recycling through forest canopies increasing exposure (established in the 1970's at the D.O.E.'s Savannah River Nuclear Site - measurements of chromosome aberrations and other markers of radiation damage should be done of humans, animals, birds, plants, fish, insects, in a 20-mile radius of all nuclear plants and results disclosed to the public prior to any decision on a license renewal. The public needs to know the damage caused and be able to extrapolate further damage. (LRG-S-68-L-3)

Response: *Potential impacts to terrestrial and aquatic biota from exposure to radionuclides will be considered for the revised GEIS.*

Threatened and Endangered Species

Comment: The GEIS and Part 51 currently require that transmission lines that were considered in the original environmental impact statement for the plant must be reviewed as part of the Environmental Review under Part 51. For these lines, the environmental review must look at two issues: the impact of electrical shock and impact on threatened and endangered species. Also, of consideration for transmission lines is the issue of chronic effects of EMF, a topic that has not yet been categorized as Category 1 or 2. Chronic effects of EMF will be discussed separately in this letter. When nuclear plants were constructed, they were often connected to the high voltage electrical grid by new transmission lines, substations, and switchyards that were constructed solely to connect the nuclear plants to the grid. This review as part of the original environmental impact statement was appropriate. However, with time and changes to the high voltage grid system, the industry believes that this treatment of transmission lines is no longer appropriate, and the GEIS and Part 51 should be revised to reflect these changes. As the grid has changed, many of the transmission lines that were originally installed to connect the nuclear plant to the grid are now an integral part of the high voltage grid system. The industry believes that transmission lines, substations, and switchyards that were reviewed in the original EIS that are now part of the grid should not have to be included in the environmental review. If the nuclear plant would not have its license renewed and the plant were no longer operating, these transmission lines, substations, and switchyards would remain in service as part of the high voltage grid system. Any impacts that these lines have on electrical shock and T&ES would not change when the nuclear plant would be removed from operation. This results in no change to the impacts caused by the transmission lines. Therefore, since there are no changes in the impacts, whether the plant continues to operate or is removed from operation, there is no impact of the proposed major licensing activity. There is thus no reason to have to review these two issues for environmental impacts from continued operation of the nuclear plant. Transmission lines, substations, and switchyards that would remain in service only to connect the nuclear plant to the grid would be subject to review for impacts on the two issues listed above. (LRG-S-59-E-2)

Comment: Also regarding the scope of the NRC's environmental review with respect to transmission lines, the Group agrees with NEI that the NRC should narrow the scope of its consideration of the acute effects of electric shock to include only those transmission lines that would remain in service only to connect the nuclear plant to the grid. As a matter of law, the National Environmental Policy Act of 1969 ("NEPA") does not require an evaluation of environmental effects that are not related to the proposed action (here, license renewal). Where transmission lines, substations, and switchyards would remain in service regardless of whether the subject nuclear plant would continue to operate, any effects related to transmission lines are not effects of the proposed action, and therefore no assessment is required by NEPA. The same logic would apply to the NRC's consideration of threatened and endangered species in the plant's transmission corridors. (LRG-S-64-E-3)

Response: *The NRC staff will consider these comments for the Revised GEIS.*

A.1.1.5 Comments Concerning Human Health

Comment: Considering the vast knowledge on genetic damage to all species from any exposure to any level of ionizing radiation, it is wicked to re-license any of these radiation spewing nuclear behemoths. (LRG-S-68-L-5)

Comment: I have already mentioned that you need regulations at the generic level that reflect all of the population -- baby cancer rates, child cancer rates, and I'm going to get real explicit here, I had fibroid tumors ten years. Women bleed a lot, we are different than men. You have to look at women too. There needs to be the standard woman, the standard child, the standard infant, and the standard fetus in addition to the standard man, and the standard elder, and then we'll quibble about whether they're correct. (LRG-S-04-AT-12)

Comment: Now, the initial license is for forty years, so that would be 2,472 [deaths and]…the additional twenty years which what we're talking about here, the additional 1,236 on top of 2,472 we come up with 3,708, 3,708 deaths from cancer associated with sixty years of operating 103 reactors… these are fuel cycle only, these are fuel cycle only, and they have been evaluated as a generic impact. (LRG-S-04-AT-2)

Comment: The standard man is not an adequate indicator for your impacts on the environment, we don't care about your regulations under NEPA, we care about your impacts, and your impacts on babies are many times greater than your impacts on standard men. You need to come clean and have standards that reflect the population you are mandated under law to protect. (LRG-S-04-AT-4)

Comment: Blinky [a cartoon character fish with 3 eyes] Is here because Blinky absorbs -- I think he lives in water -- a high amount of tritium by organic molecules inside his little body, much like a fetus inside of a woman would have high amounts, high amounts of tritium found in its little body.

Now, there are cells that are like the ovaries in a female, the nervous system of any female which are not regenerated quickly is among themselves. So this means that the tritium in those cells will be around practically for the lifetime of this individual. So we're talking long-term genetic defects, we are talking mental impairment.

How many of you listen to music from another generation which -- In any case, as far as the tritium in-utero involves special dosimetric considerations. Also fetal cells require rapid -- from organic tissues, and certain things provide very little or no subsequent cell proliferation. That would be the central nervous system that would be the ovaries and a woman's fetus. (LRG-S-06-AT-5)

Comment: In Grundy County, under the cancer mortality rate of all ages, from 1996 to 1999, was eighteen percent above the U.S. Infant mortality rate has been on a steady increase. And in the county from, and I want to make sure I state these right, from 1995 through '99, it is forty-eight percent above other Illinois counties and sixty percent above the U.S. The incidence of pediatric cancer is on the rise. (LRG-S-10-CH-1)

Comment: I have been advised by physicians, by medical researchers, by geologists, physicists and yes, even and I want to stress unofficially, by the EPA, to keep asking about the safety of the nuclear facility in my area and why the leading cause of death in an area that it says here economically is not at high risk of cancer, has as the leading cause of death, cancer. I challenge you to take the responsibility to strictly enforce your current standards and to become much more actively involved in preventative health issues and environmental issues. (LRG-S-10-CH-3)

Comment: What are the agency's assumptions regarding risk of health effects from ionizing radiation? If they are not consistent with those of Dr. John Gofman, they are probably wrong. He has the only track record for being right on this subject. The GEIS should assess risk, which is an impact, using assumptions of biological harm from ionizing radiation that are at least as cautious as Dr. Gofman's. Continuing radiation doses to the public at current levels is unacceptable. Millirem by millirem this agency facilitates cumulatively raising the background radiation levels worldwide. Genetic damage to the entire biosphere, save humans, is stridently ignored, without even estimating the repercussions. (LRG-S-16-BO-11)

Comment: The American public does not want to be dosed with radiation. Since there [are] no safe doses of ionizing radiation, referring to radiological impacts as small is akin to saying that a restaurant regularly serves only a little botulism. The doses may be small to you, but for the parents of a child with birth defects, they are not. Shouldn't this agency at least pretend to respect the citizens that it is mandated to protect? (LRG-S-16-BO-16)

Comment: Radiation exposure to the public is small and radiation doses will continue at the current levels associated with normal operations. Somehow that is supposed to be good news. It is clear that from the current levels the footprints of radiation linked disease are found around our reactor communities. There was a case control study that dealt with leukemia, for example, around Pilgrim, showing a four-fold increase the closer you lived to work. There have been statistical studies of higher than expected thyroid cancers, and there have been studies of higher than expected Downs Syndrome in the Deerfield River Valley, and it goes on, and on, and on. So clearly then the current levels are too high. And we know the effects of radiation are cumulative, and there is certainly far more research since Chernobyl showing the effects of radiation on human health; that they are cumulative, and that they are carcinogenic with other toxic compounds. (LRG-S-17-BO-7)

Comment: So it is very clear that in relicensing that there has to be a reassessment in lowering the dose, and stopping the baloney of ALARA. You have to have a standard like a standard from a chemical release, for example, and other toxins. You don't see on the highway that we suggest that you go 65 miles an hour. You have a standard, and it would make sense to do the same, for example, with the release of a chemical is to the standard of one cancer incidence per million. Now, if we are to meet the same standard, which is only reasonable, then that would be reducing to .025 millirem per year. A standard, not a goal. Not a suggestion, but a standard. (LRG-S-17-BO-8)

Comment: If you have radiation, and if you are considering a power plant to relicense, and they are in biologically compromised communities already, you have to have adequate monitoring. Technologically, the monitoring that is on, for example, the Pilgrim Nuclear Power Plant is antiquated. You need to have upgraded monitoring to measure alpha, beta, and gamma on a continuous basis from all egress routes on-site, and that similar type monitoring off-site located according to wind direction and topography, and to have instantaneous readouts to the Department of Public Health in the State, the Department of Emergency Management, and to the local communities. (LRG-S-17-BO-9)

Comment: As David, the fellow from the Cape discussed, you mentioned that 20 more years of operation will bring about 1,200 cancer deaths. I think if we all picked up the paper tomorrow and we saw that 1,200 American soldiers who were killed yesterday, we would think that it was serious. Why isn't this serious? That is a good question. Plus, it is an insulting underestimation, because all it considers is cancer deaths, and not the other impacts which should be considered; reproductive disorders, cell damage, compromised immune systems, etcetera. Also it assumes accidents, and it does not take into account accidents and non-routine releases, such as that occurred in my neighborhood nuclear plant in 1982. Somehow that does not count. (LRG-S-17-BO-11)

Comment: You can't play games as you are doing with risk assessments. That what has to be considered, and whether it is standard now is irrelevant, is the impact of a radiation dose on the people who are most at risk, and who in fact live by this reactor that you are going to allow to go for another 20 years. That is not a hypothetical reference man who is 30 years old, and who weighs 170 pounds and is healthy, but rather who lives there and is most at risk, pregnant women, small children, the elderly, the sick. We do not have homogenized requirements to live near a nuclear plant. So therefore if you are going to be discussing health impact, it is critical that it is done in an honest way to in fact protect the people who are there. (LRG-S-17-BO-10)

Comment: I think that we should be requiring as part of a plant relicensing certainly, and I think we should require it anyway, but it certainly is the relicensing, but that we install monitors, and a lot of them around, that could be doing two things. One, monitoring the long term health, because a lot of the projections and calculations that you make in a GEIS are based on theoretical calculations, risk probabilities and things. What I would be much more comfortable in, and I am sure that the public would be, is if you can say, yes, we have made a calculation that says that the chance and probability of developing cancer is X based on some theoretical analysis. But then to actually monitor it over a period of time, and much more extensively than we are doing today. And the second benefit of course is during any kind of a nuclear event that you would be able to in real time monitor much -- and have it wired to FEMA's headquarters, to the NRC headquarters (LRG-S-22-BO-5)

Comment: Nuclear reactors release radioactivity to the air and water as part of their normal day to day operation. There is no safe dose of radiation. Its effects are cumulative. Many studies have demonstrated that low constant levels of radiation exposure can cause cancer and genetic mutations. Continuing at current levels associated with normal operations is no comfort. Do we really need more radiation to add to our existing biological burden? The allowable rate of release has been too large, and must be decreased. (LRG-S-26-BO-9)

Comment: The NRC currently grossly underestimates the risk of the public's exposure to radiation released by licensees through a number of statistical and methodological errors. Therefore, calculations have to be readjusted to determine real impact. Lower allowable limits must be established, and monitoring put in place, and an alternative assessment performed. (LRG-S-26-BO-10)

Comment: I want to end with the health consequences, because they are real and immediate. I mean, when Pixie was talking about the Down’s syndrome in and around where I live, we have a 10-fold increase in Down’s syndrome. We have statistical significance in non-Hodgkins Lymphoma, and statistical significance in multiple myeloma and breast cancer, and that may not mean much to people outside of my community, except if you live in another reactor community, or you live in a waste community where everyone has the same statistics. And so when you talk about small impacts, these may be small to you, but the suffering and loss of our children is unacceptable to us, and is not a small impact, and it is an insult to us that it is talked about that way. (LRG-S-30-BO-8)

Comment: Our organization is committed to the precautionary principle, and the precautionary principle and what you guys are doing are just completely opposite. The precautionary principle is about prevention, and is about if there is suspicion of harm, you stop doing what you are doing, and you look at the bigger picture, and just a suspicion of harm should be enough to prevent a release in your plants. We are going to take from this session and what we learned today to the Women's Cancer Movement, and you are going to hear about it. (LRG-S-32-BO-1)

Comment: This [license renewal] is unconscionable considering the facts... that footprints of radiation-linked disease are found in reactor communities surrounding our reactors. (LRG-S-37-E-5)

Comment: Lastly, the health risks from routine radiation releases from nuclear plants, and from contamination of groundwater, air and soil is likewise unacceptable. (LRG-S-38-E-4)

Comment: I do not accept…the health risks from routine radiation releases from nuclear plants, and from contamination of groundwater, air and soil. (LRG-S-39-E-5; LRG-S-40-E-5; LRG-S-44-E-5; LRG-S-46-E-4; LRG-S-47-E-5; LRG-S-49-E-4; LRG-S-51-E-5)

Comment: During the Peach Bottom hearing, Mr. McDowell stated that there is NEAR unanimous agreement in the Scientific Community in the radiological public health sector that the existing standards are adequately protective of public health. (Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, September 10 NUREG-1437) With all due respect NEAR is not good enough! (LRG-S-41-E-3)

Comment: Please protect the children from this awful disease and don't put bad things in our water, air and -- thank you. (LRG-S-11-CH-1)

Comment: The NRC acknowledges that there are human health risks for any radiation exposures, and even NRC Commissioner Jeffrey Merrifield has stated that in these release practices "there is a potential that the radioactive component may be concentrated in the recycling process or that the material will be recycled in a form resulting in more actual contact with the general public." Additionally, little is known regarding the synergistic impacts resulting from radiation exposures in combination with exposures to other toxics. The Commission nonetheless supports such a program, despite these risks and massive public outcry. The consequences from 20 additional years of operation and waste generation at 104 nuclear plants in conjunction with massive dispersal of wastes into the unregulated environment would certainly be quite significant. (LRG-S-43-E-6)

Comment: Within the scope of license extension, this is type of response is increasing inappropriate. Nuclear power station operations routinely discharge radioactive gas, particulate and effluent. Annual radioactive release filings by licensees to the NRC document the ongoing discharge of persistent radioactive toxins (measured in half-lives) that are bio-concentrating and bio-accumulative. For example, licensee annual radioactive release reports identify that a typical nuclear power station will routinely discharge short-lived noble gases that decay into long-lived radioactive particulate. The fallout of radioactive particulate then bio-magnifies in downwind environments of operating nuclear power stations.

For example, typical routine discharges contain the following gas-to-particulate isotopes:
*krypton-89 (3.2 minute half-life) decays into strontium-89 (52 day half-life)
*xenon-137(3.9 minute half-life decays into cesium-137 (30 year half-life)
*xenon-135 (9.17 hour half-life) decays into cesium-135 (3 million year half-life)

There remains no known or established safe threshold level for human exposure to radiation. Each additional exposure raises, not lowers, the risk of deleterious health and genetic consequences. The current EIS for license extension fails to seriously address this matter. It is unreasonable for the EIS to go into considerable detail when evaluating the impact of station operation on fish and shellfish populations and, at best, only superficially evaluate potential radiological impacts of station operation on human populations downwind, downstream, in close proximity and long duration of residency.

During the initial licensing of nuclear power stations, the NRC assumed that the various regulations governing routine releases of radioactive materials provided adequate protection of public health. The NRC has failed to ensure that its original assumption is valid. An environmental impact statement with considerably less attention paid to potential human health consequences from routine radiation releases than from impingement of fish and shellfish is totally inconsistent with the NRC's federal mandate to protect public health and safety. (LRG-S-62-E-4)

Comment: Each reactor or set of reactors will have been releasing its own unique collections of radioisotopes into its cooling water source (river, lake or ocean) during the duration of its license, and each receiving body of water has its own flow rates, volume, drought history, accumulation of sediments, etc. The effluents that will be released into the environment during the 20-year license renewal term would also be uniquely determined --- based on the reactor’s operating history, including the designs and operating history of its systems, structures and components.

We are often told that pollutants are of little concern when they are diluted or dispersed into the vast atmosphere or into large bodies of water. In fact, the NRC’s draft License Renewal GEIS of August 1991 implies just that: “Radioactive material released to the atmosphere tends to spread and disperse in air and dilute in water.” (NUREG-1437, Vol. 1, p.5-44) Similar dispersal and dilution claims are made for the carbon dioxide, sulfur dioxide, nitrogen oxide, and mercury that are released from fossil-fuel plants, and yet we now know that the impacts of the Mid-Western coal-fired plants on Pennsylvania and other East Coast states are harmful, and contribute to global warming. Some of a nuclear power plant’s gaseous effluents and liquid discharges --- containing long-lived radioactive wastes --- may disperse and become diluted over time, but they will nevertheless persist in the human environment. The radiological releases from the entire uranium fuel cycle, from mining through waste disposal, will likewise continue to pose risks to the biosphere.

No economically feasible technology exists that can filter such beta-emitters as tritium, krypton, and xenon from the routine releases of a nuclear plant, and no equipment exists that can monitor precisely the full range of components in the releases into the atmosphere (during venting, purging and mini-purging) or into the cooling water source (during continuous and batch releases). Therefore, radioactive materials are released into the environment in unknown quantities and concentration levels. In other words, no one really knows how much is released or where it ends up. At the very least, the NRC should attempt to assess, as judiciously as possible, the impacts on surface and groundwater, air and soil that the routine and accidental releases of radioactive wastes would have during the requested 20 years of additional operation. (LRG-S-63-E-9)

Comment: …the following should be included or used: (1) all recommendations and dosimetry in the "European Committee on Radiation Risk (ECRR) 2003 Recommendations of the ECRR, Health Effects of Ionizing Radiation Exposure at Low-Dose for Radiation Purposes, Regulator Edition, Brussels 2003" (www.euradcom.org2003) ISBN.1-897761-24-4. (LRG-S-68-L-1)

Comment: If you place a map of cancer clusters in the US on top of a map of where Nuclear Reactors are in the US- the maps are almost identical. (LRG-S-33-E-1)

Response: *The NRC's primary mission is to protect the public health and safety and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities. The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects of radiation on humans. The limits are based on the recommendations of standards-setting organizations. Radiation standards reflect extensive scientific study by national and international organizations (International Commission on Radiological Protection [ICRP], National Council on Radiation Protection and Measurements [NCRP], and the National Academy of Sciences [NAS]) and are conservative to ensure that the public and workers at nuclear power plants are protected.*

Health effects from exposure to radiation range from no effect at all to death and can be responsible for inducing diseases such as leukemia, breast cancer, and lung cancer. Very high (hundreds of times higher than a roentgen-equivalent-man [rem]), short-term doses of radiation have been known to cause acute effects, such as vomiting and diarrhea, skin burns, cataracts, and even death. Although radiation can cause cancers at high doses and high dose rates, currently there are no data to unequivocally establish the occurrence of cancer following exposures to low doses and dose rates below 0.1 Sv (10 rems). For example, people living in areas of the country that receive greater levels of background radiation (such as Denver, Colorado) do not show higher rates of cancer.

As stated above, there are no reputable scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses and dose rates, below about 0.1 Sv (10 rem). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a hereditary effect and that the *risk is higher for higher 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, with the recognition that the model probably overestimates those risks. On the basis of this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public, as found in 10 CFR Part 20. In addition, for nuclear power reactors, the NRC imposes special license conditions that require radioactive gaseous and liquid effluent to be as low as reasonably achievable (ALARA) in accordance with the dose objectives contained in Appendix I to 10 CFR Part 50.*

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 that resulting cancers have not been observed and would not be expected. Although a number of studies of cancer incidence in the vicinity of nuclear power facilities have been conducted, there are no studies to date that are accepted by the scientific community that show a correlation between radiation dose from nuclear power facilities and cancer incidence in the general public. Specific studies that have been conducted include the following:

- *In 1990, at the request of Congress, the National Cancer Institute conducted a study of cancer mortality rates around 52 nuclear power plants and 10 other nuclear facilities. The study covered the period from 1950 to 1984 and evaluated the change in mortality rates before and during facility operations. The study concluded that there was no evidence that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby.*

- *In January 2001, the Connecticut Academy of Sciences and Engineering issued a report on a study around the Haddam Neck nuclear power plant in Connecticut and concluded that radiation emissions were so low as to be negligible.*

- *In 2001, the American Cancer Society concluded that although reports about cancer clusters in some communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population. Likewise, no evidence links strontium-90 with increases in rates of breast cancer, prostate cancer, or childhood cancer. Radiation emissions from nuclear power plants are closely controlled and involve negligible levels of exposure for nearby communities.*

- *Also in 2001, the Florida Bureau of Environmental Epidemiology reviewed claims of striking increases in cancer rates in southeastern Florida counties caused by increased radiation exposures from nuclear power plants. However, using the same data to reconstruct the calculations on which the claims were based, Florida officials were not able to identify unusually high rates of cancers in these counties compared with the rest of the State of Florida and the nation.*

- *In 2000, the Illinois Public Health Department compared childhood cancer statistics for counties with nuclear power plants to similar counties without nuclear plants and found no statistically significant difference.*

As part of the GEIS revision, the studies listed above and recent reports such as the National Academy of Sciences' Committee on the Biological Effects of Ionizing Radiation (BEIR) Report, BEIR VII: Health Risks from Exposure to Low Levels of Ionizing Radiation, *and recommendations concerning health effects associated with radiation exposure will be thoroughly reviewed to ensure that the NRC's primary mission to protect the public health and safety and the environment continues to be met. The comments challenge the adequacy of the NRC's radiation protection regulations, which is outside the scope of this process. Therefore, no change will be made to the GEIS based on these comments.*

Comment: I got the 2001 radiation monitoring report from the Oconee Plant, and I haven't seen the 2002, maybe it's out and available, but I haven't found it, I would love to have a copy of that.

But it was a 93- or 97-page report from the different sites around the plant in a ten-mile radius and on with the vegetation, and air, and water, and sedimentation, and things like that that they test for isotopes, and I was having a hard time trying to figure out where the hot spots were, but I thought I had circled a few, and I sent them to Dave Close who is on the board of the Institute for Energy and Environmental Research, and he was saying that the way that the monitoring is done and compiled that it dilutes the findings, so that it was hard to really see exactly where some of the problems were, but that he did notice that there were high levels of tritium in some of the places, and high levels of cesium and sediment in some places from the Oconee plant, but ways of tracing that back to events and situations that caused that were hard to follow in the way that monitoring and records are kept, so I guess my question is how can it be traced back, and when the three-eyed fish reminded me of that question that I had had originally, and I do bring it up, but a more clear way of monitoring releases and the accumulation of some of the radioactive isotopes that get released from the plants during operation, what was in place and what's available to us to see those things. (LRG-S-03-AT-10)

Comment: When we look at the fusion sediment [fission products] produced each year by a 1,000-megawatt nuclear power plant it amounts to about 4 million curies, and since the half-life is about thirty years it becomes a very limited case over the year.

If we assume 99 percent containment, and that's a pretty high figure I think you will all agree, if we look at the hundred nuclear power reactors that we have operating, and an extent of 25 years, the amount of the curies released by those hundred power plants in 25 assuming 99 percent containment is equal to four Chernobyls. If you assume a life for these nuclear power reactors beyond 50 years, that would be eight Chernobyls. 99 percent containment. (LRG-S-06-AT-4)

Response: *All nuclear plants were licensed with the expectation that they would release some radioactive materials to both the air and water during normal operation. Airborne and liquid releases of radionuclides from nuclear power plants must meet radiation dose-based criteria specified in 40 CFR Part 190, 10 CFR Part 20, and the as low as reasonably achievable (ALARA) criteria in Appendix I to 10 CFR Part 50. Regulatory limits are placed on the radiation dose that members of the public might receive from all of the radioactive material released by the nuclear plant combined. Licensees are required to report liquid, gaseous, and solid effluent releases as well as the results of their radiological environmental monitoring program annually to the NRC. The annual effluent release and radiological environmental monitoring reports submitted to the NRC are available to the public through the NRC's Agencywide Documents Access and Management System (ADAMS) electronic reading room available through the NRC Web site (www.nrc.gov/reading-rm/adams.html). The comments provide no additional information; therefore, no change will be made to the GEIS as a result of these comments.*

Comment: According to the NRC's own estimates the proposed GEIS will allow the killing of over 1,000 people over 20 years… (LRG-S-16-BO-3)

Comment: The technical guidance documents used to calculate the costs associated with human deaths attributable to commercial nuclear activity…. You know, the 12 per 20 years of operations. (LRG-S-53-E-2)

Response: *This calculated value of 12 additional deaths from fatal cancer over the 20 years of additional operation of a nuclear power plant is the result of several conservative assumptions. This value is, in fact, a calculated upper bound value based on cancer risk factors for radiation exposure. It does not mean that 12 people will die from cancer as a direct result of an additional 20 years of continued routine operation of any nuclear power plant. These calculations use the concept of collective dose. Collective dose estimates effects across a very large population, assuming that a small amount of radiation dose spread out among a large population would yield similar effects to a larger amount of radiation dose to a much smaller population. This is a very conservative assumption.*

The Health Physics Society (www.hps.org) states that "[b]elow the dose of ten rem, estimations of adverse health effect is [sic] speculative. Collective dose remains a useful index for quantifying dose in large populations and in comparing the magnitude of exposure from different radiation sources. However, for a population in which all individuals receive lifetime doses of less than 10 rem above background collective dose is a highly speculative and uncertain measure of risk and should not be quantified for the purposes of estimating population health risks."

The cancer risk factors used in this calculation are also quite conservative. They are taken from the BEIR-V report, Health Effects of Exposure to Low Levels of Ionizing Radiation*. In this report, it is estimated that "if 100,000 persons of all ages received a whole body dose of 0.1 Gy (10 rad) [roughly equivalent to 10 rem] of gamma radiation in a single brief exposure, about 800 extra cancer deaths would be expected to occur during their remaining lifetimes in addition to the nearly 20,000 cancer deaths that would occur in the absence of radiation. Because the extra cancer deaths would be indistinguishable from those that occurred naturally, even to obtain a measure of how many extra deaths occurred is a difficult statistical estimation problem." The radiation dose contribution to the population from current nuclear power plants is estimated to be 4.8 person-rem per year, whereas the dose contribution to the population from the complete uranium fuel cycle is 136 person-rem per year. The dose to an individual is only a very small fraction of these population doses. The nuclear fuel-cycle contribution to an individual's average radiation dose is less than 0.001 rem per year, as shown by the NCRP Report 93,* Public Radiation Exposure from Nuclear Power Generation in the United States*, as abstracted by the University of Michigan (http://www.umich.edu/~radinfo/). The comments provide no additional information; therefore, no change will be made to the GEIS as a result of these comments.*

Comment: Lack of Analysis for Increased Public Health Risk Associated with Additional Radiation Exposures to Routine Operational Releases as a Result from 20-year License Extension

The Environmental Impact Statement (EIS) fails to properly consider the potential impact on human health from radioactive releases during normal plant operation.

On one hand, Section 4.1.2 of the Supplemental Environmental Impact Statement (SEIS) for Calvert Cliffs discusses the impacts of routine plant operating on fish and shellfish, reporting that "…approximately 1,600,000 finfish and blue crabs would be collected on the traveling screens, 260,000 would die…".

On the other, Section 4.3 of the SEIS for Calvert Cliffs discusses the potential impact on human health from radioactive material released during normal plant operation. On page 4-16, the EIS states, "No significant new information has been identified by the staff in the review process and in the staff's independent review."

Why are the environmental impacts on fish and shellfish discussed in detail while radiation impacts on human health are not detailed?

The NRC typically replies that an evaluation for radiation impacts on humans is outside the scope of the environmental reviews... The final report must include a detailed assessment of potential health consequences from routine and bio-magnifying radiation releases. This assessment should [be] made by a station-specific evaluation involving independent and peer review. The evaluation can not be the simply repackaging of past generic studies.

If detailed assessments of potential health consequences from cumulative and routine radiation releases from nuclear power stations seeking license renewal contradict NRC's previous assumption, then it becomes necessary to conduct this assessment effort for all subsequent license renewal applications. Otherwise, it is imprudent for the NRC to continue to grant 20-year extensions without such public health assessments. (LRG-S-62-E-3)

Response: *The radiological impact on humans is within the scope of the GEIS. This area is evaluated for each license renewal application for new and significant information that may contradict the Category 1 classification in the GEIS. The radiological impacts on human health as a result of license renewal are discussed in Section 4.9 of the GEIS. The impacts will be reconsidered as part of the revised GEIS.*

Comment: NRC should update the analysis of chronic effects from exposure to electric and magnetic fields and categorize it appropriately. Two major U.S. reports have concluded that limited evidence exists for an association between EMF exposure and increased leukemia risk, but that when all the scientific evidence is considered, the link between EMF exposure and cancer is weak. The World Health Organization in 1997 reached a similar conclusion. The two reports were the U.S. National Academy of Sciences (NAS) report issued in 1997 (Ref 1) and, in 1999, the National Institute of Environmental Health Sciences (NIEHS) report to the U.S. Congress at the end of the U.S. EMF Research and Public Information Dissemination Program (RAPID) (Ref. 2). A National Research Council committee of the NAS made the following conclusion in a report documenting its evaluation of research on potential associations between EMF exposure and cancer, reproduction, development, learning, and behavior: Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.

Based on the results of the EMF RAPID program, the NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm. (LRG-S-59-E-6)

Comment: I know it's real common to save the environment, and where T-H-E has the way of separating the subject from, the topic from where we live, and I think it would be real good in your information also for the NRC to place, it would take the same amount of space in the sentence, take out "the" and put in "our" -- I can't find any examples in front of me right now -- but when you say our environment then it has to do with us personally because we can't live here without it. And that would be a help. (LRG-S-08-AT-3)

Response: *The comment is within the scope of the GEIS and will be considered for the GEIS revision.*

Comment: The NRC's mandate is to protect public health and safety. More than anything, the Mothers for Peace wishes that our mission and the NRC's actions could provide that future. (LRG-S-13-LA-11)

Response: *The comment is general in nature, provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: My parents, when I look when I looked at the radiation fallout from nuclear bomb testing they were in high-exposure zones, and they say that a lot of this, a lot of the problems identified as exposure to radiation can come up in the third generation, which is my children, and I'm seeing it in my sister's and brother's children who have died from different things that could be attributed, but how do you trace it back. Like Mary was saying, who are these deaths, and who are these people, and how can you have a flag on them to say this person was exposed and so their child has leukemia, or this person. (LRG-S-03-AT-7)

Response: *The populations discussed in the comment were subjected to radionuclides from fallout from weapons testing, not from routine low-level offsite exposures associated with the nuclear fuel cycle. The NRC is committed to preventing detrimental health impacts to the public and has regulations covering all phases of the uranium fuel cycle. NRC regulations related to exposure to the public are found at 10 CFR Part 20. In addition, EPA regulations related to radiation are found at 40 CFR Parts 190 through 194. Radiation standards reflect extensive scientific study by national and international organizations (International Commission on Radiological Protection [ICRP], National Council on Radiation Protection and Measurement [NCRP], and National Academy of Sciences [NAS]) and are conservative to ensure that public and workers at nuclear power plants are protected. As a result, the dose rates expected from* *all phases of the nuclear fuel cycle are expected to be very low from chronic exposure, even to maximally exposed individuals. The comment provides no additional information; therefore, no change will be made to the GEIS as a result of this comment.*

A.1.1.6 Comments Concerning Socioeconomics

Comment: The additional economic burden that nuclear plant owner-operators pass on to ratepayers is also unacceptable. (LRG-S-38-E-3; LRG-S-39-E-4; LRG-S-40-E-4; LRG-S-44-E-4; (LRG-S-46-E-3; LRG-S-47-E-4; LRG-S-49-E-3; LRG-S-51-E-4; LRG-S-52-E-2)

Response: *As stated in 10 CFR 51.95(c)(2), the economic costs and benefits of renewing an operating license are not required to be addressed in the GEIS, primarily because the issues raised by these comments involve energy planning decisions that are made by State regulators and utility officials. The NRC has no role in these energy planning decisions. Therefore, because the comments are not within the scope of license renewal and provide no new information, they will not be evaluated in this GEIS.*

Comment: The NRC should consider revising the scoping of the current Category 2 socioeconomic issues associated with augmented workforce due to license renewal. Industry experience to date indicates that many of the activities associated with license renewal are bounded by current programs and activities, and, in most cases, do not require any staff augmentation. As stated in the GEIS (section 4.7), "Estimates…of additional work force required during license-renewal-term operations indicate that only one additional worker will be required on a continuous basis for maintenance and inspection activities." The GEIS then goes on to contemplate an additional 60 workers "to account for workers (contractors or rotating utility employees) who are not associated with refueling but may be on-site intermittently." Industry experience to date indicates that the number of workforce additions required to support operation during the period of extended operation, if any, are much lower than the 60 additional staff per site contemplated to be necessary intermittently in the original GEIS. The industry has not identified any activities that would require such staff augmentation above and beyond that which already occurs during routine refueling outages (which is already analyzed in the GEIS). Even considering 60 additional intermittent staff, as the GEIS asserts, industry evaluations to date indicate the impact is insignificant and, consequently, all Category 2 issues associated with workforce augmentation should be transferred to Category 1. (LRG-S-59-E-4)

Response: *The comment is within the scope of the GEIS and will be considered for the GEIS revision.*

Comment: But we rarely, though we do express not only our appreciation but our pride in the Nuclear Regulatory Commission, and certainly the decision about Environmental Justice impacts of the Louisiana Energy System's proposal for Homer, Louisiana is something that we take pride in as an organization having worked with the local affected community in helping them with their struggle, but we also have repeatedly taken pride in announcing the Nuclear Regulatory Commission's backing of the Atomic Safety Licensing Board decision on the Environmental Justice portions of that case. (LRG-S-04-AT-14)

Response: *The comment is supportive of NRC's environmental justice analysis. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: Gentlemen, I'm here just to tell you that you have an awesome responsibility, and I don't envy the seat that you're sitting in, but you're sitting there as a regulator and one who has to take this information back.

I think it is important that you look at a few things. Not only do I represent the Blue Ridge Environmental Defense League, but I also represent the High and Algin Park Improvement Committee.

I think that's important for me to tell you because it also represents not only poor blacks, but poor whites. And when I look at the implications of having a generic, and the term kind of bothers me because it tells me that I'm missing something. When it's generic you know I can go to the doctor and he says I can have the real thing, or you can get this generic, but it also tells me that something may not work as well as the original intent.

So I would like for if it's going to be generic let's put everything that's conceivable that will cause a problem for the patient to be addressed.

And in particular when we look at Plant Vogtle, it's in Burke County east of the Mississippi, the poorest county, evacuation routes all go through EJ [Environmental Justice] communities, a community even through now is one of the poorest, yet it's bounded by a big nuclear factory.

But this company has an opportunity to do generic stuff, we're looking to meet all the obligations to those farmers, we're going to meet all the obligations to the babies that haven't been born and hope to be born.

One thing about it, when we do things in a generic form we have to be sure that we cross all of the Ts and dot all of the Is, and I for one, if I could, I would afford the best of life, but I can't.

But whenever I have to take a generic anything I try to take one that's representative of the original. But all I'm saying is today I want to give you something to take back, and it is that all of you sitting here at some point in your life have liked to have had an extended family, which means that you want babies, you want a husband, or you want a wife, you want grandchildren, or you want generations to follow after you, but it also makes sure that those things happen.

I have to reflect it as I see it, and then I'm going to close because I won't have a sermon until Sunday, and that is that it always goes to the first born boy to carry on the legacy of the family. Am I right about it?

So if we intend to have our strong boys looking after our young ladies then we must provide for them, irregardless of where they come from, irregardless of socioeconomics, irregardless of black, white, poor, or whatever, during that impact statement be it a generic or the original, must address those things.

So I'm asking that if it's an E.J. issue it should be not put on the back burner, or not left up to the plant, because I would write anything I wanted to if it was my plant, because my job other than as a minister I am counselor by profession, but I am also one who looks at children, and when I study kids we do a thing called an SST. That's where a child is having problems learning in school.

And I look where that child comes from. Most of them have been exposed to some form of radiation. Most of them I have been informed have been exposed to less health care.

Now I represent a community that has 240 known deaths that's been related to chemical exposure -- disproportionate I should say -- and that is not fair, because if they could they would have moved, but they couldn't move.

But it's up to us, the gentlemen here in particular, and where appropriate, ladies, you are too, to fight the battle for those who cannot fight, to speak for those who cannot speak, and to stand for those who cannot stand.

So I tell you now just let us put some faith in your ability to do what you've been designed to do. All of us are brothers of one another, like it or not, and we have to take care of one another, and if I can take care of Charles Utley I can take care of you. Let us take care of one another.

It's good to have good power. Yes, I came from kerosene lights. That works too. So we'll have to also learn that we can't have everything, but the things that we can have let's have them in a clean, wholesome environment.

We're all God's children as Martin Luther King would say, black children and white children.

And I'm going to sit down, because you know when I visit the hospital, have you ever been able to determine when you went to the maternity ward whether it was a black baby, a Japanese baby, or a white baby that was crying. When you can answer that then you've answered yourself. Thank you. (LRG-S-05-AT-1)

Comment: I want to bring to your attention that there's a new coalition of Navajos who are saying not us, not us any more. If you look at fuel cycle, you will look, and you will look, and you will look, and you will have a hard time finding white people, you will have a hard time finding rich people, and so I am challenging the Nuclear Regulatory Commission to reconsider whether socioeconomic impact is the correct parameter for Environmental Justice, since these people are not rich and they are not white. They are dead. And if they're babies, there's a lot more of them than 1,236. (LRG-S-04-AT-3)

Comment: I understand in my point of view why we do a site-specific analysis and Environmental Justice impacts for license renewal. Was there any generic analysis of Environmental Justice done?...with regard to environmental impacts that are in the GEIS currently that do have Environmental Justice implications, and so therefore is it correct to say that the agency has not evaluated those?... Let's be specific. Fuel cycle impacts... are a generic issue, have an Environmental Justice component. (LRG-S-04-AT-1)

Comment: If you consider your EIS for fuel cycle complete without the Environmental Justice angle attached then it's not complete. And then again you're saying that you are looking at the Environmental Justice angle for license renewal. This doesn't include the fuel cycle portion? And so therefore it sounds like you're saying that EJ issues for fuel cycle treatment are not being considered at all. (LRG-S-06-AT-1)

Comment: Are Environmental Justice issues relating to fuel cycle going to be addressed in any future Environmental Justice issuance by the NRC? (LRG-S-06-AT-2)

Comment: And so that when you conceive of there being 20 more years of operation,…but you have also got a tremendous environmental justice problem, with literally 2 tons of radioactive waste produced through the operation of that reactor before the fuel even goes into it. I mean, this is absolutely abominable. I know that it is not accounted for in the GEIS, or as an environmental justice issue, or as a consequence of the continued operation of the reactor. (LRG-S-18-BO-2)

Response: *These comments concern environmental justice issues, are within the scope of the GEIS, and will be considered for the GEIS revision.*

A.1.1.7 Comments Concerning Historic and Cultural Resources

Comment: The NRC Staff has taken the position that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land disturbing operation or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land disturbing operations or projected refurbishment activities, specifically related to license renewal, potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest (e.g., ADAMS Accession No. ML031830303, from Pao-Tsin Kuo, Program Director, License Renewal and Environmental Impacts to Maynard Crossland, Director, Illinois Historic Preservation Agency). (LRG-S-59-E-5)

Comment: Regarding historical and archaeological resources, the NRC Staff has now taken the position that the area of potential effect ("APE") under the National Historic Preservation Act for a license renewal action is "the area at the power plant site and its immediate environs that may be impacted by post-license renewal land disturbing operation or project refurbishment activities associated with the proposed action." It has further concluded that the APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities, specifically related to license renewal, potentially have an effect on known or proposed historic sites. These determinations effectively remove transmission lines from the agency's consideration of this issue. This conclusion should be codified in the updated GEIS to reflect the agency's revised position. (LRG-S-64-E-2)

Response: *The comments concern the impacts of license renewal on historic and cultural resources; within the scope of the GEIS, and will be considered for the GEIS revision.*

A.1.1.8 Comments Concerning Alternatives to License Renewal

Comment: And when you look at these from not just the cleaner alternative fuels that are starting to come onto the market now, but also the traditional conventional fuels, the nuclear fuel ranks the worst, and it ranks the worst for good reason that it has the biggest impact on the environment. (LRG-S-02-AT-5)

Comment: Many other alternatives for energy use and energy efficiency… to keep our lights on and our air conditioning, because we're killing our children and their children with this process. (LRG-S-03-AT-8)

Comment: Is there any requirement for an alternative assessment, because I think that it is very clear -- we know that there are cheaper ways to generate electricity if you remove all the subsidies. We know that there are safer ways to generate electricity. I don't think that many people are worried about a terrorist attacking a wind farm. No other type of generation produces wastes that is poisonous for thousands of years. So if you do an honest alternatives assessment, I don't even see why we are doing this. (LRG-S-17-BO-17)

Comment: Ocean wave power: The nuclear industry in Great Britain killed it's implementation there back in the early 1990's. It's making a slow recovery because good ideas won't die, but we will if we don't start implementing them. This is probably the number one most efficient and largest possible source of power for cities and industries worldwide.

Solar power: Is definitely part of the solution. I believe I a multifaceted or integrated approach to meet urban and industrial power needs and solar panels are a good part of an integrated solution for residential use in particular. Power costs to produce solar technology are high, but the components can be recycled, which nuclear power cannot honestly claim and nuclear power isn't even fractionally close to being as safe as solar power panel manufacture.

Solar thermal power generation plants: They work, more new jobs again and have minimal impact on the environment compared to the long-term effects of nuclear power and fossil fuel power generation.

Wind power, it's working to cut the power deficit in California, very clean and efficient. (LRG-S-67-E-3)

Comment: Or even point out that there has been a serious lack of assessment of alternatives to nuclear power generation in this country as a whole. (LRG-S-28-BO-1)

Response: *The NRC staff must evaluate the environmental impact of alternatives as part of the NEPA process. Impacts of reasonable alternative technologies, which may include conservation, coal, natural gas, and a combination of technologies, including renewables, are evaluated for each individual license renewal, and the NRC staff compares the resultant environmental impacts to those of continued operations during the license renewal term. The NRC's evaluation of alternatives is limited to an assessment of the environmental impact of each alternative. On the basis of the analyses of alternative technologies presented in many past Supplemental Environmental Impact Statements (SEISs), construction and operation of facilities implementing alternative technologies typically result in environmental impacts equal to or greater than renewal of the current operating license. This result is primarily due to the need to construct these new facilities. In addition, the decision to employ an alternative technology is not within the jurisdiction of the NRC. While the NRC makes its decision whether or not to renew the license on the basis of safety and environmental considerations, the final decision on whether or not to continue operating the nuclear plant will be made by the utility, State, and - in some cases - Federal (non-NRC) decisionmakers on the basis of economics, energy reliability goals, and other objectives over which the other entities may have jurisdiction. The comments concern alternatives to license renewal and will be considered for the GEIS revision.*

Comment: Nuclear does not pollute the atmosphere while providing our maximum power needs while using a minimum of land for power generation. Nuclear plants cover about 16-30 acres to generate the billions of watts of power while renewable sources must cover thousands of acres to equal one nuclear plant in power generation. (LRG-S-36-E-4)

Comment: While alternate power sounds good, it is in itself not sufficient to meet the present or growing needs of the California population! The story is in the numbers. Alternate sources can reduce the amount of fuel that is used by the present big power producers but they are no substitute for the 24 hour a day plants that we need to meet our daily requirements in the biggest state in the Union. (LRG-S-36-E-2)

Response: *The evaluation of alternatives in the revised GEIS will include consideration of a range of environmental impacts resulting from power production and will take into consideration characteristics of energy technologies, including capacity factors that may affect their ability to serve as alternatives to renewing a nuclear power plant's operating license. More generally, the NRC staff is currently revising the GEIS to reflect changes in technology since the 1996 publication. The comments will be considered for the GEIS revision.*

Comment: Section 8.1 of the GEIS states that the NRC will conduct a full analysis of alternatives during individual license renewal reviews. To support the NRC review, utilities provide analyses of replacement energy alternatives. Based on previously approved applications, alternatives for replacement power are generally the same from plant to plant. Applications to date have indicated that the environmental impacts of license renewal are small and less than the environmental impacts of alternatives for replacement power.

It is recommended that the NRC perform a bounding analysis of license renewal environmental impacts relative to environmental impacts of alternative energy sources. Based on the bounding analysis, individual licensee analysis of the environmental impacts of alternative energy sources would not be required. The industry believes that the results of these analyses will conclude that the environmental impact of alternate generation is larger than the impact of renewing the license. (LRG-S-59-E-3)

Response: *The NRC staff is currently revising the GEIS and will consider changes in energy technologies that have occurred since the 1996 publication. Changes in energy technologies after the GEIS revision will be addressed in plant-specific supplements to the GEIS.*

Comment: Alternative Electricity Sources: Regions of the U.S. differ in their reliance upon and availability of alternative electricity generation technologies (gas-fired plants, renewables, demand-side management, etc.). A regional or site-specific evaluation of alternative electricity sources, in comparison to nuclear power plant license renewal, should be provided in the environmental evaluation. (LRG-S-60-E-3)

Response: *In fulfilling the NRC's responsibility under NEPA, the NRC staff currently provides a site-specific evaluation of environmental impacts for reasonable energy alternatives and compares those impacts to the potential environmental impacts of each plant's proposed license renewal. The comments are related to alternatives to license renewal and will be considered for the GEIS revision.*

Comment: Cut the need for power by vastly expending the efficient of our industrial products to reduce the need for disposability. (LRG-S-67-E-4)

Response: *The NRC staff's evaluation of alternatives in the GEIS includes consideration of opportunities for conservation of power. It is not, however, within the NRC's regulatory authority to implement actions relating to the efficiency of industrial products, or to make other decisions regarding energy policy or the implementation of an alternative to license renewal; these decisions are made by State, utility, and Federal (other than the NRC) decisionmakers. The NRC's authority regarding environmental impacts of license renewal is limited to determining whether the impacts of the proposed action are so great – relative to the impacts of reasonable alternatives – that they make extended operation of a nuclear power plant an unreasonable option for decisionmakers. The comment concerns alternatives to license renewal and will be considered for the GEIS revision.*

Comment: Section 8.3, Environmental Impacts of Alternative Energy sources. The GEIS does not reach any conclusions regarding alternatives to license renewal but instead provides data regarding alternative energy sources that is to be used to analyze those alternatives in each supplemental EISs. The data in the GEIS (most of which is from the early 1990s), however, presents a very outdated view of the viability and environmental impacts of renewable energy sources such as wind, solar, and biomass, and the potential of energy efficiency efforts to reduce the need for power generation. Today, renewable energy sources and energy efficiency present a lower-cost, safer, and environmentally cleaner approach to meeting the nation's energy needs than renewing licenses for aging nuclear power plants. Technological improvements and market developments have greatly increased the efficiency and capacity of renewable energy, while at the same time reducing its cost and environmental impact. Reacting to these changes, twelve states have enacted Renewable Portfolio Standard ("RPS") legislation, requiring that a proportion of all power generated in the state be from renewable sources. The NRC should update the GEIS to reflect the current reality that wind, solar, biomass, and energy efficiency are reasonable alternatives to the renewal of license for aging nuclear power plants. Following is some of the new data regarding these energy sources:

i. Section 8.3.1, Wind. The GEIS states that wind power is not appropriate for baseload power, that no utilities are planning to construct large wind power plants, and that wind power would use large amounts of land, be noisy, and negatively impact birds. These statements are not accurate and should be updated in the revised GEIS. Technological advancements have led to wind turbines with a capacity factor of up to 40%, a figure that increases significantly when turbines are combined with storage facilities. In addition, wind turbines have an availability factor of 98%, higher than most other power sources. These improvements have reduced the cost of wind power to less than 5 cents per kilowatt hour, which is competitive with most other energy sources. They have also led to a substantial increase in the amount of wind power installed – in 2001 and 2002 a total of 2,106 megawatts of wind energy was installed nationwide, raising the total wind energy in the U.S. to 4,685 megawatts. Federal studies estimate that wind energy could supply around 20% of the electricity used in the United States, which is the same proportion that is currently provided by nuclear energy. Such reliance on wind power would not come at the high environmental cost suggested by the GEIS. Unlike with nuclear power plants, nearly 95% of the land devoted to a wind power site remains available for other uses such as agriculture. In fact, many farmers see wind power as a cash crop that can supplement their agriculture income. In addition, concerns about the impact of wind turbines on birds arise almost completely from the fact that one of the earliest wind farms, Altamont Pass, was unfortunately located in an area with high year-around raptor use. Outside of Altamont Pass, there is an average of only 1 to 2 bird kills per wind turbine per year.

ii. Section 8.3.2 and 8.3.3, Photovoltaic Cells and Solar Thermal Power. As with wind power, the GEIS suggests that solar photovoltaic (“PV”) and thermal power is not appropriate for baseload power, is costly, and would have significant land impacts. In fact, however, solar PV and thermal power are increasingly viable alternatives. Solar PV technology has advanced to the point where PVs are a good source of power, especially in remote areas and to help meet peak power demand. Meanwhile, solar thermal systems are an economically efficient way for household water heating. Numerous cities, individuals, and even the White House currently use PV and/or solar thermal systems to help meet their power needs. Finally, the GEIS substantially overstates the land impacts of relying on solar PV and thermal power. Most solar power units are located on rooftops of buildings, meaning that no new land disturbance is caused by those units.

iii. Section 8.3.14, Conservation. The GEIS properly notes that energy conservation efforts could help reduce the demand for energy in the U.S., thereby removing the need for some additional power plants. More recent data than that included in the GEIS, however, shows that the potential of energy conservation to reduce energy demand is even greater than that cited in the GEIS. For example, the American Council for an Energy-Efficient Economy estimates that a comprehensive energy efficiency program could reduce energy demand by 18 % in 2010 and 33% in 2020. Similarly, an expansion of state and utility electricity conservation programs could reduce electricity demand by 17% in 2020. In addition, the potential environmental impacts of energy conservation efforts identified in the GEIS (indoor air quality and impacts from manufacture of conservation equipment) are extremely minor in comparison to the impacts avoided by reducing the need for additional energy production. (LRG-S-61-E-5)

Response: *The NRC recognizes that there are new data available on the performance and environmental impacts of many energy technologies. The NRC staff is currently working to update the GEIS with current information for energy alternatives, including, as the commenter notes, wind, solar, biomass, and other technologies, as well as information regarding demand-side management approaches, such as conservation. The staff's evaluation of alternatives in the context of license renewal is limited to an assessment of their environmental impacts relative to those of continued operations of a nuclear power plant during the license renewal term. The NRC does not, however, make energy policy decisions or decide whether to use a nuclear power plant or an energy alternative; this decision is reserved for State, other Federal, or utility-level decisionmakers. The comment concerns alternatives to license renewal and will be considered for the GEIS revision.*

Comment: In Section 8.2.4.7, the SEIS states, "None of these technologies [biomass-derived fuels] have progressed to the point of being competitive on a large scale or of being reliable enough to replace a base load plant such as CCNPP." Other renewable energy technologies are comparably dismissed in Section 8.2.4 of the draft SEIS.

On one hand, the SEIS gives full credit to one uncertain, unproven and unlicensed technology (i.e., disposal of high-level nuclear waste). Nuclear utilities have filed suit against the Department of Energy for breach of contract related to overdue acceptance of high level nuclear waste. That lawsuit clearly suggests some doubt regarding the reliability and availability of a repository.

On the other hand, the SEIS tosses aside renewable technologies claiming that their development has not progressed enough to be reliable at this time, even though the SEIS is typically submitted more than a decade in advance of the expiration of the applicant's operating license. The draft SEIS apparently presumes that the repository will someday become available but that renewable technologies will not. Thus, the draft SEIS appears to apply separate standards to favor nuclear power and penalize alternatives. Inequitable treatment must be removed from the final report. (LRG-S-62-E-10)

Response: *The NRC has evaluated the safety and environmental effects of long-term storage of spent fuel onsite or at offsite independent storage facilities, and has determined that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life of plant operation (existing license plus any license renewals; see 10 CFR 51.23). The NRC believes that there is reasonable assurance that a mined, geologic repository will be available in the first quarter of the 21st century and that sufficient capacity will exist to dispose of spent fuel and commercial high-level waste within 30 years beyond the licensed term of operation for a nuclear reactor. As for the NRC's treatment of alternative energy sources, the NRC has evaluated and will continue to evaluate the environmental* *impacts of reasonable alternative energy sources in each SEIS, on the basis of the site-specific and technology-specific characteristics that may affect whether technologies or combinations of technologies can serve as alternatives to renewing a nuclear power plant's operating license. The NRC staff is currently revising the GEIS; and will consider changes in energy technologies that have occurred since the 1996 GEIS publication. This comment provided no new information on the scope of the GEIS, but concerns conclusions in a plant-specific SEIS, and will not be considered for the GEIS revision.*

Comment: Why play with nuclear energy when it is not at all cost effective? It simply costs too much to produce when there are better alternatives that are more dependable and much more simple to produce. I can see the need for research around nuclear energy, but implementation has been extremely premature as we haven't been able to produce nuclear power in a cost effective manner and we are not at all able to safely dispose of the by-products of nuclear power generation. The long-term costs, which should always be considered, are far too great and easily dwarf any current utility benefit. (LRG-S-67-E-2)

Response: *As stated in 10 CFR 51.95(c)(2), the economic costs and benefits of renewing an operating license are not required to be addressed in the GEIS, primarily because the issues raised by these comments involve energy planning decisions that are made by State regulators and utility officials. The NRC has no role in these energy planning decisions. From the perspective of the licensee and the State regulatory authority, the purpose of renewing an operating license is to maintain the availability of the nuclear plant to meet system energy requirements beyond the terms of the plant's current license. Therefore, because the comments are not within the scope of license renewal and provide no new information, they will not be evaluated in the revision to the GEIS.*

A.1.1.9 Comments Concerning Postulated Accidents

Comment: In April of 1985, testimony before Congress, the Nuclear Regulatory Commission's Palladino said, quote, there is a 45 percent chance of another severe core melt accident at a U.S. reactor by the year 2005. Does this mean that such a failure is highly likely in the near future, or are we to believe that as the nation's commercial reactors continue to corrode, crack, and become embrittled, that they become safer? (LRG-S-16-BO-5)

Comment: There are questions of liability that link to accidents. Looking at the cracked tube report that we hold up frequently that was issued through a subcommittee of the Oversight Investigations Committee on Interior and Insular Affairs, … there are a lot of very specific documentations of what the peak early fatalities are projected to be, the peak early injuries, peak cancer deaths, fatality figures, et cetera for individual plants throughout the country, and those numbers are very high [copy of CRACII Report released by Oversight Investigation Committee was provided]. (LRG-S-02-AT-6)

Comment: The GEIS should evaluate the potential accident consequences and not just risk probabilities. Consequences are potentially so catastrophic to the communities surrounding these plants that they must be considered. For example, federal studies estimate that a core melt at ENVY would cause 7,000 peak fatalities within the first year in a 15 mile radius and 17,000 peak cancer fatalities. A spent fuel pool fire could be equally disastrous. (LRG-S-50-L-4)

Comment: The "CRAC-2" Report prepared by Sandia and NRC and issued by the Committee on Interior and Insular Affairs, U.S. House of Representatives, Washington D.C., November 1, 1982, with their added. Comments. Class 9 Accidents, i.e. "meltdown," must be included. (LRG-S-68-L-2)

Comment: We can't be continuously making false assumptions on projecting probabilities of something happening. We have to recognize the fact that if the spent fuel pool, for example, is drained of water in 25 years of research at the NRC, it has demonstrated that there would be a pool fire and a release of radioactivity three times the size of Massachusetts, making Chernobyl look like a picnic. That is the consequence and therefore all measures have to go into it as a result. (LRG-S-17-BO-2)

Comment: The fallacy of the categorization of the size of the impacts -- you know how you have got small, moderate, large? And there is a footnote on this on the last page of the Schedule B-1, Number 3. It is stated in this footnote that when the large categorization is used, the probability of that accident or situation is figured into the categorization process. Therefore, I think that process is flawed and some impacts categorized as small or moderate ought to be categorized, or might be categorized as large if the probability factor were excluded. Apparently, and as far as I can figure out, the probability factor is not used for small or moderate categorization. And if it is not used for small or moderate, it should not be used for large either. And this goes back to something that the Selectman said, that it seems like that in the GEIS that the thought is really for the probability of an accident or something going wrong, as opposed to the consequence, and I think you really need to figure on both of those things. (LRG-S-19-BO-1)

Comment: Further, NRC's "findings" in Table B-1 of Appendix B to Subpart A of 10 CFR 51, regarding postulated accidents, should be clearly presented as "probability weighted" rather than the current misleading presentation. Also, the NRC should reassess the probability factors assigned to certain issues, in consideration of the fact that "improbable" disasters – such as the 9/11 attacks, the rusted hole in the lid of the Davis-Besse reactor, the Columbia space shuttle failure – appear in fact to be occurring with alarming frequency.

More importantly, NRC regulatory action should not be so singularly focused on probability-weighted risk assessments. Table B-1 purports that the consequences from severe accidents would be "small," which, according to NRC's definition therein, may be translated to mean "negligible." Based on this table, it appears that because the Commission continues to insist that an accident is so unlikely, then the consequences of such must necessarily be trivial. This is illogical, and the additional, unnecessary risks that the public face from the license renewal of nuclear plants should not be downplayed as though it were a game of Russian roulette with very good odds of survival. (LRG-S-43-E-2)

Comment: Another 20 years of risks that catastrophic accidents like Three Mile Island may be repeated in our communities, or that another close call like that at Davis-Besse will go too far is unacceptable. (LRG-S-38-E-2), (LRG-S-39-E-3), (LRG-S-40-E-3), (LRG-S-44-E-3), (LRG-S-46-E-2), (LRG-S-47-E-3), (LRG-S-49-E-2), (LRG-S-51-E-3)

Response: *The NRC staff concluded in the 1996 GEIS that the probability-weighted environmental consequences from severe accidents (i.e., beyond design-basis accidents) are small for all plants. See 10 CFR 51.53(c)(3)(ii)(L). This finding will be revisited during the GEIS revision. The revised GEIS will include an assessment of more recent information on severe accidents that could affect the assumptions made in the 1996 GEIS, including information regarding internal and external event core damage frequency, severe accident source terms, and risk impacts of reactor power uprates and higher fuel burn-up levels.*

Comment: Section 5.3.1, Regulatory Interface Between License Renewal and Accident Impacts. In the section concerning accident potential associated with extended operation of nuclear facilities, the GEIS states that effects of age-related degradation will be addressed "by identifying, in an integrated plant assessment process, those structures and components which are susceptible to age-related degradation and whose functions are necessary to ensure that the facility's licensing basis is maintained." Events in recent years demonstrate that this method – mandated by amendments to 10 C.F.R. 54.21 promulgated around the time the GEIS was completed – is not effective to protect against the dangerous ravages of aging on nuclear facilities. Indian Point's broken steam generator tube (2000), Summer's leaking hot leg pipe (2000), Oconee's broken control rod drive mechanism nozzles (2001), Quad Cities' broken jet pump (2002), and Davis-Besse's broken reactor vessel head are good examples of how aging is already taking a toll on nuclear facilities even during their originally-licensed term of operation. We recommend that that GEIS re-examine the potential accident impacts of relicensing in light of evidence of the failure of this policy, and evaluate the benefits of reinstating the age-related degradation unique to license renewal (ARDUTLR) standards to reduce these impacts. (LRG-S-61-E-4)

Response: *The NRC's ongoing safety program focuses on prevention of safety problems so that potential issues like aging and thermal shock do not lead to accidents. The comment* *provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: Re-licensing should not be permitted until nuclear plants are required to store their spent fuel in a low-density configuration (to reduce the potential for a spent fuel pool fire). (LRG-S-50-L-6)

Comment: The effects to the lake/river/ocean on which the plant sits, resulting from the rupture of the liner (or other release) from the spent fuel pool, both with and without spent fuel meltdown, should be included - it may require special study, as other studies left the lake/river/ocean/fish etc. out.

Each EIS should be site-specific. (LRG-S-68-L-4)

Response: *The 1996 GEIS did not include an explicit assessment of the environmental impacts of accidents at the spent fuel pools (SFPs) located at each reactor site, but did discuss qualitatively the reasons why accidents at SFPs would be much less than those resulting from reactor accidents. The revised GEIS will include an evaluation of the risk from severe accidents in SFPs relative to the risk from severe accidents in reactors, including a comparison against the findings in the 1996 GEIS.*

Comment: The NRC has gained enough information through License Renewal Applications to date to make a determination, on a generic basis that SAMAs should be classified as Category 1 through this rulemaking process. No age-related cost-effective SAMAs have been identified. In the Federal Register notice outlining the denial of NEI's petition for rulemaking (66 FR 10834; February 20, 2001, at 10838), the NRC stated that "if new information becomes available that indicates it is feasible to reclassify SAMAs to Category I, the staff will notify the Commission and provide a recommendation as to a course of action." To date, 30 units have submitted applications that represent all reactor vendors for renewal of their licenses. Out of those, the NRC has not identified any age-related SAMAs that are cost beneficial. We believe that, through the use of the IPE/IPEEE evaluations and modifications, along with the track record of license renewal applications to date, there exists enough information to reclassify severe accidents as a Category I issue. In addition, draft NUREG DG-1122 is being considered to guide plants in maintaining PRAs up-to-date. Since many of the SAMA questions query the current status of PRA, these questions will no longer be necessary when final regulatory guidance provides for maintaining PRAs current. (LRG-S-59-E-1)

Comment: With respect to Severe Accident Mitigation Alternatives ("SAMAs"), we believe the NRC has gained sufficient knowledge, through individual plant examinations ("IPEs") and IPEs for externally initiated events ("IPEEEs"), as well as from its evaluation of license renewal applications to date, such that it is now able to make a reasonable generic determination that the evaluation of SAMAs should be re-classified as a Category 1 issue in the updated GEIS. (LRG-S-64-E-1)

Response: *The comments are within the scope of the GEIS and will be considered for the GEIS revision.*

Comment: I will close by quoting just one additional observation from the NRC's "Appendix B to Subpart A [of 10 CFR 51] --- Environmental Effect of Renewing the Operating License of a Nuclear Power Plant."

The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants. This statement is so unbelievable, it calls into question other staff conclusions. (LRG-S-63-E-12)

Response: *As stated in Section 5.3.2 of the 1996 GEIS, the environmental impact from design basis accidents was assessed in the individual plant-specific EISs at the time of the initial license application review and was determined to be small. Since the licensee is required to maintain the plant within acceptable design and performance criteria, including during any extended life operation, these impacts are not expected to change. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: There are many significant issues that do in fact require updates under the category of postulated accidents, and it is very clear that the issue of security is something that has to be evaluated. (LRG-S-17-BO-1)

Response: *The NRC's ongoing safety program focuses on prevention of safety problems so that potential issues like security concerns do not lead to accidents. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: Regarding the size of populations surrounding our nuclear stations, the value of property and the risk of injury from ionizing radiation, that document is extremely outdated. Is the GEIS based on a newer study of accident consequences? Is that document secret? The GEIS should be based on a new public, independent study of accident consequences, funded by those who profit from placing the public at risk. (LRG-S-16-BO-9)

Response: *The NRC staff concluded in the 1996 GEIS that the probability-weighted environmental consequences from severe accidents (i.e., beyond design-basis accidents) are small for all plants. This finding will be revisited during the GEIS revision. The revised GEIS will include an assessment of more recent information on severe accidents that could affect the* *assumptions made in the 1996 GEIS, including information regarding internal and external event core damage frequency, severe accident source terms, and offsite population dose.*

Comment: The NRC is reliant on the industry's risk assessment. The NRC has not established standards for probabilistic risk analysis or the PRAs, and must do so. The NRC has also not developed requirements for updating the industry's PRAs, or a process for establishing their accuracy. The quality of the industry's PRAs is currently unknown to the NRC. If a plant manifests serious safety problems, it is at that point that the NRC knows that the PRAs were flawed. This renders the process seriously flawed, while really useless in heading off a potentially serious safety problem. Also, industry assessments are used to legitimize delayed attention to fixing problems, or to side step costly shutdowns to fix safety problems…the process is flawed, as the PRAs submitted to the NRC were flawed. There is no standard. (LRG-S-25-BO-2)

Comment: The technical guidance documents used to calculate ... the trade-off calculations for the SAMA analysis. (LRG-S-53-E-3)

Response: *The use of probabilistic risk analysis (PRA) in the regulatory process has evolved. Actions taken have included the development and implementation of NRC guidance and consensus standards regarding PRA quality (e.g., Regulatory Guide 1.200 and ASME RA-Sb-2005), NRC standardized plant analysis risk (SPAR) models for all operating plants, and NRC tools for determining the risk significance of inspection findings. As stated above, the Revised GEIS will include an assessment of more recent information on severe accidents that could affect the assumptions made in the 1996 GEIS. This will include consideration of information from the SPAR models as well as more recent, updated industry PRAs.*

Comment: Seismic Risks: In California, operating nuclear power plants are located in seismically active areas. Site-specific seismic safety information should be provided to update plant safety and environmental impact analyses in license renewal applications. Because geologists are learning more about earthquake faults and seismic potential on a continuing basis, that new geologic information should be included and considered on a plant-specific basis during license renewal. (LRG-S-60-E-5)

Response: *The NRC staff concluded in the 1996 GEIS that the probability-weighted environmental consequences from severe accidents (i.e., beyond design-basis accidents) are small for all plants. This finding will be revisited during the GEIS revision. The revised GEIS will include an assessment of more recent information on severe accidents that could affect the assumptions made in the 1996 GEIS, including information regarding internal and external event core damage frequency.*

The NRC staff also concluded in the 1996 GEIS that alternatives to mitigate severe accidents, i.e., severe accident mitigation alternatives (SAMAs), must be considered for all plants that have not considered such alternatives. Because SAMA is considered a Category 2 issue, it requires a site-specific evaluation that is performed by the applicant and critically reviewed by the NRC staff. Seismic vulnerabilities were considered site-specifically in the Individual Plant Examination of External Events (IPEEE) study, and are further evaluated in the plant-specific SAMA evaluation for the purpose of identifying potential plant improvements that can further reduce the risk from seismic events.

A.1.1.10 Comments Concerning the Uranium Fuel Cycle and Waste Management

Comment: We need tougher regulation on the Nuclear industry. We need to stop creating nuclear waste and fewer radioactive releases. Force the Nuclear industry to be absolutely safe. (LRG-S-56-E-1)

Response: *The NRC continuously monitors the performance of licensees and operators, including frequent onsite inspections and the use of resident inspectors. The comment is general in nature, and provides no new or significant information. No change will be made to the GEIS as a result of this comment.*

Comment: We've got the situation now where there's this long-term vision of developing Yucca Mountain storage. That's not going to help in terms of offering any reduction on the ISFSI front with Plant Hatch for years because it won't be in place for so long into the future, so when we're looking at relicensing issues and bringing the ISFSI questions up as to how do you handle this we're setting up a parking lot outside the reactor because the spent fuel capacity inside the reactor has been maxed, it's getting ready to be maxed out, as was the case when relicensing was going on we asked a basic question what's going to happen? How are you factoring this in? and we're told we're sorry, it just doesn't relate right here, it's out of scope.

Then our question is where does that get addressed if not through the relicensing process. And so we're very frustrated that we haven't had a mechanism to address those ISFSIs yet with the NRC. (LRG-S-02-AT-9)

Comment: So what to do with the waste, how can that be a separate thing from the relicensing process, how the waste is being handled is just beyond me to understand, so I would suggest that you all make that a much more prominent part of the environmental impact study that's done. It's the really responsible handling of the nuclear waste from the whole process, from the mining of the uranium, and the water that's contaminated in that process, all the way to the disposing of the waste after the fuel rods are removed and stored. (LRG-S-03-AT-6)

Comment: I'm asking you now whether Waste Confidence was ever updated, or will be updated in relation to twenty additional years of reactor operations across the fleet, because the base case scenario that the Department of Energy used for the Yucca Mountain scenarios did not assume license renewal, and there is not currently a second repository program. (LRG-S-04-AT-15)

Comment: Relicensing will result in increased spent fuel storage on-site, and it has not been demonstrated that on-site storage as currently executed is safe. (LRG-S-26-BO-3)

Comment: Twenty more years of operations would clearly produce more wastes of all classes. It is unreasonable to allow continued generation of wastes until a final solution is developed and current waste is transported to it. In the interim safer on-site storage must be required. (LRG-S-26-BO-5)

Comment: Most nuclear facilities store large quantities of irradiated fuel and will continue to store it for many years to come. Recently removed fuel is too hot to be moved to long term storage even if a suitable repository has space available, and this fuel must remain on site. Fuel storage problems will thus not magically disappear when waste hits the roads and rails and tries to make its way to Yucca Mountain. Mitigative measures required by the GEIS must be specified to address this challenge. (LRG-S-28-BO-3)

Comment: The NRC needs to fully evaluate the potential benefits of alternative means of storing so-called spent fuel rods, including hardened dry cask storage as so many other speakers have eloquently mentioned. (LRG-S-29-BO-2)

Comment: There is no solution to the waste problem as we all know, and in fact to start a second generation through the relicensing of reactors when we have not solved the waste from the first generation, except to think of dumping it on Native American land seems ludicrous. (LRG-S-30-BO-7)

Comment: This [license renewal] is unconscionable considering... what to do with the long-lived, toxic waste remains a mystery. (LRG-S-37-E-4)

Comment: An additional 400-600 tons of high-level waste from every re-licensed nuclear reactor - waste that poses unacceptable health and safety risks for generations to come is unacceptable. We must stop creating this waste! (LRG-S-38-E-1; LRG-S-39-E-2; LRG-S-40-E-2; LRG-S-44-E-2; LRG-S-46-E-1; LRG-S-47-E-2; LRG-S-49-E-1; LRG-S-51-E-2; LRG-S-52-E-1)

Comment: History does not evoke confidence in your decisions. On December 5th, 1978 Dr. Joseph Hendrie, Chairman of your agency at that time wrote a letter to Mr. James Schlesinger, Chairman of DOE which stated in part:

"The Commission would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely. Thus, the Commission has itself linked continued reactor licensing and waste disposal. The Commission is committed to reassessing its basis for confidence as new data are developed and progress is made in the federal program." (LRG-S-41-E-4)

Comment: No plants should be re-licensed until there is a permanent solution to the storage of radioactive waste that is up and running. Yucca Mountain, if it is ever built, will not be operating for many years. (LRG-S-50-L-5)

Comment: This is just absurd - you can't re-license plants when you don't have the answer to radioactive waste. (LRG-S-13-LA-16)

Comment: Even in normal, "safe" operations, every nuclear reactor produces between 20 and 30 tons of lethal, high-level radioactive waste every year - waste that will remain radioactive for tens of thousands of years. In addition, reactor facilities produce massive quantities of low-level waste – waste that isn't immediately lethal, but still poses substantial health and environment hazards. There is no known way to safely dispose of any of this waste. Even the controversial Yucca Mountain repository in Nevada isn't designed to accommodate the additional waste that would be generated by extending the life of current reactors by 20 years. (LRG-S-54-E-3)

Comment: For example, generic resolution of the high-level radioactive waste issue through the reliance on the Waste Confidence Decision does not necessarily lead to the timely removal and successful isolation of high-level radioactive waste accumulating on sites located on the shores of the Great Lakes. Confidence can be shaken by reality. (LRG-S-62-E-2)

Comment: Well, there are three reactors with these fuel pools six stories up in the air, and there is already 1,350 tons of spent fuel sitting on that site. And what I have become aware of actually since doing a little research is that for every pound of reactor fuel that is produced there is 4,000 pounds of uranium tailings that are produced in the mining process. (LRG-S-18-BO-1)

Comment: When I was the age of my children, no nuclear power plants existed. When my daughter was growing up they were just beginning to be built. Now there is over 77,000 tons of high-level radioactive waste that still has no safe storage facility and no method of transportation. We, you, cannot turn back the clock, but we can stop the insanity. The future is in your hands. (LRG-S-13-LA-10)

Comment: Lack of Analysis for Nuclear Waste Proliferation and Unfair Treatment of Alternatives and 20-year Extensions

The issues of nuclear waste proliferation are widely recognized as worthy of regulatory attention and public due process within the context of the license extension proceeding. In one of the more obvious examples for such a need, the International Joint Commission called for site specific proceedings for reactors on the Great Lakes.

“All environmental requirements for nuclear reactor facilities call for sufficient on-site storage for high-level wastes, primarily fuel rods. At virtually all nuclear power plants, spent fuel rods continue to accumulate in storage facilities originally intended to be only temporary. The on-going actions by the U.S. government to develop storage facilities in Nevada may mitigate this situation. Under the license renewal guidelines, the on-site storage problem is exempted from consideration in license applications. However, the possibility of radioactive waste discharges to the Great Lakes from breaching of the sites must be considered in the application for license renewal and extension. The issue of security at nuclear power plants has also been raised.”

The supplement environmental impact statements (SEIS) appear unfairly biased. For example, page 6-4 of the SEIS for Calvert Cliffs nuclear power station states, "...in accordance with Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site..." (LRG-S-62-E-9)

Comment: I am here really speaking on behalf of the Town of Duxbury. We passed a resolution recently at a town meeting requesting that -- and in particular this one was requesting the Pilgrim Power Plant to utilize dry cask storage for its spent nuclear fuel. (LRG-S-22-BO-2)

Comment: I actually have no confidence. As mentioned, a Commissioner in the NRC in a March transcript directing NRR Director Thadani to in a day that you can essentially deep-six the study on spent fuel pool dangers and hazards put out in the Princeton Journal in January. It has given us a lot of trouble, and you can read it, and I think it begins on page 44, number 1. (LRG-S-17-BO-14)

Comment: I believe our nation’s nuclear power plants should be shut down unless and until a safe solution and location can be found for the radioactive wastes already stockpiled nationwide, and unless and until workers assigned to retrofit leaking, corroded, embrittled and outmoded parts can be provided with precise and accurate monitoring equipment and with protective clothing and masks that are impenetrable to radiation. (LRG-S-63-E-6)

Comment: And also I share the concerns about the nuclear waste, and the response I get from Oconee is, well, we just store it on site, and have a capacity to store it until we are given permission, and then it's the Department of Energy responsibility, it's not the utility's responsibility any more to handle it, so then it goes to a different agency to handle it and they just pay money to handle that.

You know, the so-called Yucca Mountain repository is going to be the solution, but it doesn't have the capacity to handle the waste that we have all around the country from all the different sites right now, and to continue for another twenty years that is an environmental, that is a very serious environmental concern of what is going to happen with all of this waste, and it goes across the board from energy to weapons production, and it's all tied in with from having learned how to navigate atoms this past year and looking at all the things that you all deal with it deals with all of that stuff. (LRG-S-03-AT-5)

Comment: Defense in depth including, but not limited to, containment over highly radioactive spent fuel pools and returning the pools to capacity required in original licenses - no double or triple re-racking. (LRG-S-13-LA-3)

Comment: Your conclusion was that the issue of on-site spent fuel storage was small. Well, that is patently ridiculous. You again are making foolish assumptions. We know that Yucca Mountain is not going to be available at 2015 probably, and there are questions, and there are legal issues involved, issues involving transportation. And I think that Nevada is going to continue to have a Governor and two Senators. So therefore it is not a sure thing. However, even if it were to open, there is no requirement that the licensees send their waste to, and empty all their waste, and empty what they have accumulated for 40 years out there right away.

Even if it were a requirement, they would be unable to do it. As was pointed out by one of the Congressman from Nevada in a Congressional hearing that Yucca Mountain will be filled to capacity in 2032. Then we are going to be in the exact same boat we are in right now, having generated 20 more years worth. So therefore, For relicensing to even be discussed without a requirement of low density pool storage and secured camouflaged dry casks is unconscionable. And that does not mean putting dry casks as you are now up like bowling pins waiting for a strike. They cannot be just 6 feet apart. They have to be separated further so that if you hit one, you don't hit them all. We also in talking about waste management, it was pointed out that in low level waste storage, impacts to the environment will remain small during the term of the license, and there is not going to be impact in apparently the waste community.
Now, where did this radioactive waste fairy come from I ask? No new low level radioactive waste site has been developed. The ones that are existing, like Barnwell, South Carolina, are environmental disasters, unlined pits, and they are gathering evidence of health impacts from what is there now. So to assume that there will be no further impacts is ludicrous. And what guarantee do we have that the sites that now exist will continue to accept our waste? We do not know that by and well we continue to take Massachusetts' waste. So then what? Are the host communities to these reactor sites going to be low level waste dump sites, too? We know

that they are unsuited to be dump sites because of their proximity to water and population. So that has to be reconsidered. The assumptions again are baloney. (LRG-S-17-BO-3)

Comment: One other specific thing that I will talk about, which is a change in—well, since 1996, and really since 1999, too, when the last GEIS and its addendum were issued, is the increase in the amount of spent fuel stored on site.

This is a very specific change, because I think that everyone in the NRC I would hope contemplated many years ago that by the time that we got to 2003 that there was going to be a permanent place for the highly radioactive spent fuel.

And as we all know, there is not. So a really serious change that has happened since 1996 and 1999 is the increase in the amount of spent fuel stored on site, and there is no new way to deal with these amounts. We talked about HOSS, Hardened On-Site Storage, and this is obviously an intermittent solution. So in the GEIS, when you are considering relicensure, we are already in a situation with licensure, and never mind relicensure, where there is no place to put this stuff.

And this has got to be in my opinion a potentially large impact. So I think that this is a serious, serious, change in human environment from '96 to '99 and probably the most important thing that needs to be considered. (LRG-S-19-BO-3)

Comment: The long term storage of highly radioactive waste, and just this evening I picked up a bunch of NRC literature dealing with radioactive waste production, storage, and disposal. And I was noting in here that the candidate site, Yucca Mountain, according to this NRC document, the specs for the containment vessels at Yucca Mountain or wherever the site ends up being at, have to maintain their integrity for between 300 and a thousand years. But the half-life of plutonium 239 is 24,000 years. So we are talking about what to do with the waste long term, I think this is an unsolvable problem…the only thing that can be done at this point is to stop generating power in this totally irresponsible manner. (LRG-S-19-BO-4)

Comment: Clearly any update to the GEIS must revisit the undesirable environmental impacts of expanding the stockpile of irradiated fuel at reactors across the country. Well before the end of their initial license periods, most if not all operating reactors have already inadvisably "reracked" spent fuel pools to cram in more irradiated fuel assemblies. The NRC acknowledged, in NUREG-1738 the potential for a selfigniting fire in densely-racked fuel pools if an accident or attack caused the water to partially drain. A recent independent report published in Princeton's Science and Global Security journal (the "Alvarez study") concluded that a terrorist attack on a high-density fuel pool could result in consequences "significantly worse than those from Chernobyl." (LRG-S-43-E-7)

Comment: The NRC's assessment of offsite radiological impacts of spent fuel and high-level waste disposal, which assumes that the proposed Yucca Mountain repository will open, must also be revised. There continue to be problematic uncertainties in surmising the environmental impacts of this project over its lifetime. These uncertainties can be expected to be magnified if additional waste from 20-year relicensed reactors were somehow crammed into the proposed facility (a scenario that is illegal under current law), particularly since this was not anticipated by the Department of Energy (DOE) in the Yucca Mountain Environmental Impact Statement. Faced with such uncertainties, for the purposes of the GEIS, the NRC should apply the precautionary principle and conservatively assess risks both of dumping this waste in a repository and of indefinitely storing it onsite at reactors. (LRG-S-43-E-9)

Comment: There is no known way to safely dispose of any of this waste. For high-level waste, the industry and government are hoping to put the waste into the controversial Yucca Mountain repository in Nevada – but this plan does not account for additional waste that would be generated by reactors with a 20-year license extension. For low-level waste, the industry and government are attempting to deregulate much of the waste, and even allowing it to be "recycled" into everyday consumer goods such as frying pans and bedsprings. Every license renewal would, in effect, equal 400-600 additional tons of nuclear waste for which there is no viable disposal method. (LRG-S-48-E-1)

Comment: Accumulation of Spent Nuclear Fuel Onsite: The long-term risk of extended onsite storage and accumulation of spent fuel should be evaluated given the uncertainties regarding when a permanent repository or offsite interim storage facility will become available. Plant-specific estimates of the total volume of spent fuel that could be stored onsite in wet and dry storage should be provided. (LRG-S-60-E-4)

Comment: Even if they were cheap, however, and clean and safe, no technology or location has been found to isolate radioactive wastes for the requisite millennia. The longer nuclear power plants operate in the United States, the greater will be the waste burden.

Even the oldest radioactive wastes of the Atomic Age, those that were generated right here in St. Louis, starting in April 1942, still have no place to go. (LRG-S-63-E-2)

Comment: I believe our nation's nuclear power plants should be shut down unless and until a safe solution and location can be found for the radioactive wastes already stockpiled nationwide. (LRG-S-63-E-5)

Comment: Storage of Spent Fuel

Section 6.4.6.7 of the Generic EIS (GEIS) concludes, "On-site storage of spent fuel during the term of a renewed operating license is a Category 1 issue." Therefore, site-specific information on spent fuel storage is not provided in the Supplemental EIS for individual plants. While there are generic aspects to on-site fuel storage that are adequately discussed in the GEIS, we recommend that certain issues associated with the on-site storage of spent fuels be addressed in the Supplemental EIS prepared for each facility. These include the current status of storage capacity at a facility and the plans for storage of the additional spent fuel to be generated during the term of the renewed license. These are clearly impacts of continued operation and will vary from facility to facility. The GEIS should not preclude the disclosure of this information during the license renewal process by deeming all discussion of on-site storage as a Category 1 issue. (LRG-S-65-E-1)

Comment: My concern is the waste which is being produced and will necessarily be stored permanently on-site since no other option is available. Adequately safe storage options on-site are being considered. Allowing Diablo to continue to operate beyond 2006 and produce additional waste for which there is not presently even any room or an agreed-upon way to store it, would not be prudent. (LRG-S-34-E-1)

Comment: How does that [the President's initiative regarding Yucca Mountain] play into this? Does that mean that you are assuming Yucca Mountain will occur in updating this? What did that mean exactly when you mentioned Yucca Mountain? (LRG-S-14-LA-1)

Comment: Since the Diablo Canyon Nuclear Power Plant is already in operation in SLO County and has already piled up vast amounts of High Level Nuclear Waste on its site and for as long as the plant continues to operate despite of the GREEN Party's position the SLO GREEN Party feels compelled to offer the following comments:

The SLO GREEN Party generally agrees with the comments as filed by SLO Mothers for Peace and make them part of ours. We also refer to our comments as submitted on 3-24-03 to NRC's Atomic Safety and Licensing Board. (LRG-S-66-E-2)

Comment: Section 6.4, Generation and Storage of Radioactive Waste During the Term of the Renewed License. Under the Waste Confidence Rule, 10 C.F.R. 51.23, the NRC has determined that: (a) spent fuel can be stored in on-site storage facilities “safely and without significant environmental impacts” for at least 30 years beyond the operation of a nuclear power plant, (b) that at least one permanent repository will be opened within the first quarter of the 21st century, and (c) that sufficient repository capacity will be available within 30 years of the licensed life of any reactor to permanently store all of the spent fuel from such reactors. The GEIS then concludes that the additional spent fuel created during any license renewal period can be stored on-site “safely and without environmental impacts.” The NRC should reconsider the Waste Confidence Rule and revise the GEIS analysis of this issue for three reasons. First, the heightened threat of terrorist attacks on U.S. soil since September 11, 2001 (see Section 2.e below) calls into question the Waste Confidence Rule’s conclusion that spent fuel can be safely stored in on-site spent fuel pools for 30 or more years after a plant's license expires. Second, there are not sufficient grounds for the NRC to be confident that sufficient repository capacity will be available to store all spent fuel within 30 years of the license life of each reactor. Even assuming that the Yucca Mountain repository receives final approval, it would not begin receiving spent fuel until at least 2010, nearly 30 years after consideration of the repository first began. Yucca Mountain would not have the capacity to store all existing spent fuel, much less additional fuel created during any license renewal periods. Therefore, an additional one or two repositories would be needed, yet no additional repositories are currently even under consideration. Given the lengthy and still not concluded struggle over the Yucca Mountain site, the NRC should not assume that additional repositories will be approved in a timely fashion. Third, the GEIS acknowledges that the on-site storage pools are reaching their capacity at many facilities, requiring those facilities to either expand their storage pools or ship the spent fuel to other facilities. License renewals at a plant facing a full storage pool would only exacerbate the problem, thereby raising questions about the safety and environmental impact of storing spent fuel generated during any license renewal period. This issue relies heavily on the storage pool capacity at each facility and, therefore, should be considered in supplemental EISs for each license renewal application. (LRG-S-61-E-6)

Response: *The NRC is committed to ensuring that both spent nuclear fuel and low-level radioactive wastes are managed to prevent health impacts to the public. Spent nuclear fuel is currently stored at reactor sites in the spent fuel pools and/or in a independent spent fuel storage installations (ISFSIs). This practice is expected to continue until DOE is ready to take possession of the spent nuclear fuel. At this time, it is uncertain when this will happen.*

Interim storage needs vary among plants, with older units having less available pool storage capacity than newer ones. However, given the uncertainty as to when a geologic repository will open and lack of other options, it is likely that some sort of expanded spent fuel storage capacity beyond the original design capacity will be needed at all nuclear power plants.

Under the Waste Confidence Rule (see below), the NRC determined that spent nuclear fuel can be safely stored onsite for at least 30 years beyond the operating life of nuclear power plants including the renewal term with minimal environmental impact. This decision does not address the environmental impacts of storage during the current license term or the additional 20 years of operation after license renewal. The impacts of storing spent nuclear fuel when the reactor is operating are addressed on an ongoing basis as part of reactor operations or under a separate license for an ISFSI.

Current and potential environmental impacts from spent fuel storage onsite at the current reactor sites have been studied extensively by the NRC and are well understood. The storage of spent nuclear fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and operating license stage. The NRC *studied the safety and environmental effects from storage of spent nuclear fuel after a reactor ceases operations and published a generic determination of no significant environmental impact in 10 CFR Part 51.23. 10 CFR 51.23 (a) states:*

> *The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impact for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent-fuel storage basin or at either on-site or off-site independent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geological repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.*

In accordance with this determination, no discussion is required concerning the environmental impacts of spent fuel storage for the period following the term of the reactor operating license, including a renewed license. The Waste Confidence Rule was first published on August 31, 1984 in 49 FR 34694, and was amended on September 18, 1990 in 55 FR 38474 and on August 28, 2007 in 72 FR 49509. In a Federal Register Notice published on October 9, 2008, the Commission announced that it is "proposing to revise its generic determination on the environmental impacts of storage of spent fuel at, or away from, reactor sites after the expiration of reactor operating licenses" (73 FR 59547). In the revision, the Commission "proposes to find that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations (ISFSIs) until a disposal facility can reasonably be expected to be available." The comments provide no new information and will not be evaluated further.

Comment: Transportation is related. When these storage facilities are set up which we call DOMs, they are little dump sites that are not that little, they're highly dangerous sites, when you set these up you're looking at transportation at some point down the road which affects a lot of points in Georgia out beyond the reactor community. So that was another question I think was sort of pushed aside that's not an issue for relicensing to look at. (LRG-S-02-AT-10)

Comment: Recently there was a train accident in the City of Commerce. Four houses were demolished when the train left the tracks. It is impossible to fathom what would have happened if radioactive waste had been on that train. (LRG-S-13-LA-5)

Comment: This [long-term storage of nuclear waste] is also an issue of safe transport, safe storage for a period of time beyond most of our comprehension. A period of time that neither this agency nor any other agency is able to guarantee will remain safe. (LRG-S-13-LA-1)

Comment: California is concerned about transportation issues as well. (LRG-S-14-LA-2)

Comment: To protect them [the public] from the production of tons of high-level radioactive waste, they will either need to be transported somewhere or be left in earthquake prone coastal zones. (LRG-S-13-LA-15)

Comment: Transportation. Currently over 7 million Californians live within one mile of proposed routes. (LRG-S-13-LA-4)

Response: *The regulations for the transportation of radioactive material are located in the NRC regulations, 10 CFR Part 71, and the Department of Transportation regulations, 40 CFR 173. Compliance with these requirements will not be altered by license renewal. Transportation casks are designed to withstand severe accidents involving impact, puncture, fire, and submersion. See NUREG/BR-0292,* Safety of Spent Fuel Transportation*, for more information. The Commission has made the determination that spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. The comments provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.*

Comment: The related issue of transporting nuclear waste generated as a result of 20-year license extensions to a proposed repository or other off-site storage facility similarly deserves more detailed attention. The NRC should insist that the DOE provide detailed routing scenarios for transporting this waste, then evaluate the specific health, safety, security, and environmental justice consequences involved. (LRG-S-43-E-10)

Comment: Transportation Impacts: The environmental review should evaluate the potential transportation impacts from the increased number of spent fuel shipments that will result from extended plant operation. Spent fuel from California nuclear power plants will be transported to a repository or offsite storage facility by truck, rail and/or barge. Although the U.S. Department of Energy's Final Environmental Impact Statement for the Yucca Mt. Repository discusses the potential impacts from transporting spent fuel to the repository, there is no route-specific evaluation of potential impacts. The environmental review should evaluate the site-specific and route-specific transportation impacts from the planned spent fuel shipments offsite. (LRG-S-60-E-8)

Comment: Changed circumstances since 1996 requiring revised analysis. The GEIS states that "[c]urrently, the only spent-fuel shipments from nuclear plants are to other plants." This statement will clearly no longer be accurate once Yucca Mountain opens as a waste repository, an eventuality made substantially more likely by last year's decision by Congress to approve a DOE application for that site. To the extent that waste created during the license renewal period will be shipped to Yucca Mountain – not a certainty given severe constraints on the site's capacity (see Section 2.d below), but nonetheless a possibility – the environmental impacts of these shipments need to be considered in the EIS process. (LRG-S-61-E-2)

Comment: Since 1996, when the current version of the license renewal GEIS was finalized, numerous circumstances relevant to the GEIS analysis have shifted. We have listed below the major areas in which the document needs to be revised to reflect these shifts.

A. Section 2.2.4.4, Transportation of Radioactive Materials….These impacts should be evaluated as a Category 2 issue, considered separately at each site, because the impacts of off-site transportation will vary from location to location, depending on population, ecological sensitivity, etc. (LRG-S-61-E-3)

Response: *The impacts of transporting spent nuclear fuel from reactor sites to the proposed repository at Yucca Mountain are addressed in U.S. Department of Energy's (DOE's) Final and Supplemental Environmental Impact Statements for a "Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (Yucca Mountain FEIS, February 2002 and Repository SEIS, June 2008). The Yucca Mountain FEIS and Repository SEIS provide estimates of state-specific transportation impacts and representative transportation routes for 44 states and the District of Columbia. DOE identified representative highway routes in accordance with U.S. Department of Transportation routing regulations (49 CFR 397, Part D), which require the use of preferred routes (Interstate System highway, beltway or bypass, or state or tribal designated alternate) that reduce time in transit. Since it will be many years before shipments could begin, DOE cannot determine the exact routes that would be used for shipments to Yucca Mountain. Construction and modification of highways may require changes to preferred routes, and states and tribes may designate alternate preferred highway routes in the interim.*

The NRC has conducted several studies to evaluate the risks associated with the transportation of radioactive material. The NRC issued Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NUREG-0170 (NRC 1977b), which was published in 1977 to support the 10 CFR Part 71, "Packaging and Transportation of Radioactive Material" rulemaking. Based on the NRC staff's recommendations in NUREG-0170, the Commission concluded that the transportation regulations are adequate to protect the public from the risks associated with the transportation of radioactive materials, including spent nuclear fuel. The NRC sponsored another study in the 1980s titled Shipping Container

Response to Severe Highway and Railway Accident Conditions, NUREG/CR-4829 (Fischer et al. 1987), also known as the "Modal Study." Based on the results of NUREG/CR-4829, the NRC staff concluded that NUREG-0170 overestimated spent fuel accident risks by about a factor of three. In the 1990s, the NRC initiated a spent fuel study titled Reexamination of Spent Fuel Shipment Risk Estimates, NUREG/CR-6672, which was published in 2000 (Sprung et al. 2000). NUREG/CR-6672 focused on the risks of a modern spent fuel transport campaign from reactor sites to possible interim storage sites and/or permanent geologic repositories. This study concluded that accident risks were much less than those estimated in NUREG-0170 and that more than 99.99 percent of transportation accidents are not severe enough to cause a release of radioactive material from a NRC-certified spent fuel cask. While very severe accidents could cause cask damage, the studies show that releases of material would be small and pose little risk to the local population/public. The most severe accidents might cause greater releases, but their likelihood is so remote that the NRC considers the risk to public health to be low.

The NRC has also sponsored studies to analyze the consequences of specific accident scenarios on rail and truck transportation casks carrying spent fuel. For example, the NRC undertook an investigation of a July 2001 accident that involved a freight train carrying hazardous materials that derailed and caught fire while passing through the Howard Street railroad tunnel in downtown Baltimore, Maryland, to determine the possible regulatory implications of this particular event for the transportation of spent fuel by railroad. The NRC assembled a team of experts from the National Institute of Standards (PNNL) to determine the thermal conditions that existed in the Howard Street tunnel fire and to analyze the effects of this fire on various spent fuel transportation cask designs. The staff concluded that the spent fuel transportation casks analyzed would withstand a fire with thermal conditions similar to those that existed in the Baltimore tunnel fire event. No release of radioactive materials would result from exposure of the casks analyzed to such an event. No change will be made to the GEIS as a result of these comments.

Comment: The classification system for radioactive wastes fails to serve the public interest because the classification is based on how waste is generated, and not on how toxic or how long-lived it is. Therefore, dangerous and very long lived radionuclides are in so-called low level radioactive wastes. Wastes need to be reclassified according to longevity and toxicity. (LRG-S-26-BO-4)

Response: *The NRC has established regulations for the classification of radioactive wastes which are protective of public health and safety and the environment. Any changes to these regulations will be made in accordance with the rulemaking process. No changes will be made to the GEIS as a result of this comment.*

Comment: Spent fuel pools were designed for a certain capacity by "Experts." The design was gutted and the pools were densely compacted. (LRG-S-41-E-1)

Response: *The design of a spent fuel pool is outside the scope of this environmental review. The design of a spent fuel pool has its own separate licensing action, performed when the pool is designed or modified in some manner. The design of a spent fuel pool is considered outside the scope of this environmental review and, therefore, will not be evaluated further.*

Comment: Regarding nuclear waste issues, I question NRC's "findings" on the risks and dangers posed by nuclear waste that is produced at reactor facilities. For low-level waste storage and disposal, mixed waste storage and disposal, radiation doses, and offsite radiological impacts, the anticipated consequences are all listed as "small." Considering that substantial quantities of low-level waste are produced each year at nuclear power plants, and that the NRC is currently conducting a rulemaking which could allow massive quantities of radioactively-contaminated waste materials to be released without restriction and "recycled" (above and beyond the current "case-by-case" releases that NRC allows) into everyday consumer products, these assessments of "small" consequences are irresponsible. (LRG-S-43-E-5)

Comment: Where is the evidence for reasonable assurance that sufficient low level waste disposal capacity will be made available? (LRG-S-16-BO-15)

Response: *Management of wastes generated during the operation of a nuclear reactor is part of the licensing basis of the facility. Impacts associated with waste management during operations are addressed in the 1996 GEIS and will be addressed in the GEIS revision. They are also evaluated on a plant-specific basis in the supplements to the GEIS for specific license renewal applications. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: The proposed Yucca Mountain, Nevada, site, [is] an area prone to earthquakes and volcanoes, and revered by the Western Shoshone who have lived there for generations. If the Nuclear Regulatory Commission were to approve the Yucca Mountain site, and if the repository were to be built and become operable, it is estimated my hometown would have to accept one shipment of high-level waste every other day, on the average, for the next thirty years. (LRG-S-63-E-4)

Response: *Presently, the NRC is reviewing an application from the DOE to construct, operate, monitor, and eventually close a high-level waste geologic repository at Yucca Mountain in Nye County, Nevada. As part of its application, DOE submitted an environmental impact statement that considers and evaluates the environmental impacts of the Yucca Mountain facility and the transport of spent nuclear fuel on the environment. Information about DOE's Yucca Mountain*

Project and the environmental documents are available on the Internet at http://www.ocrwm.doe.gov. Refer to the NRC's Web site at http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html for more information on the NRC's review. The proposed Yucca Mountain site is considered outside the scope of this environmental review and, therefore, will not be evaluated further.

Comment: If the waste products cannot be used, then the industry needs to be phased out and replaced consciously and methodically by a sustainable industry. (LRG-S-67-E-5)

Response: *Complete recycling and reuse of waste materials is a goal, however, it is not feasible at this time for the production of nuclear energy at existing reactors. The DOE has initiated a new program, Global Nuclear Energy Partnership (GNEP), which aims to recycle a major fraction of the spent nuclear fuel. However, GNEP is currently in the early planning stages. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: On-Site Storage of Low-Level Radioactive Waste

Since the date of the GEIS finalization (1996), the situation regarding future capacity for LLRW disposal has changed. It can no longer be assumed that additional disposal facilities will be developed during the term of the renewed licenses. We recommend that the NRC update the discussion of on-site LLRW storage in the GEIS. (LRG-S-65-E-2)

Response: *Environmental impacts associated with low-level radioactive waste generated by nuclear power plants are discussed in Chapter 6 of the 1996 GEIS. The NRC will reconsider the information in Chapter 6 as part of the GEIS revision. The comments provide no new information and, therefore, will not be evaluated further.*

A.1.1.11 Comments Concerning Decommissioning

Comment: Decommissioning. Waste management small. Decommissioning at the end of a 20 year license renewal period would generate no more waste than the end of the current license. Now, where did that come from? Again, where is the radioactive waste fairy? This is a fiction. It is clear that 20 more years of generation is going to be producing more waste. (LRG-S-17-BO-4)

Response: *Impacts related to the uranium fuel cycle and solid waste management will be addressed in the revised GEIS. Generation and management of solid nonradioactive waste during the terms of extended license are not expected to result in significant environmental impacts. No changes to plant systems or mode of operation have been identified that would increase the quantities of waste generated or change the nature and types of waste in a manner that would be of environmental concern. In fact, regulatory and operational trends* *suggest a gradual decrease in quantities generated annually and the impacts during the terms of renewed licenses. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants. Consequently, the generation and management of solid nonradioactive waste for up to 20 years beyond the terms of the original 40-year license of nuclear power plants are anticipated to result in only small impacts to the environment. The siting and construction of a national waste repository are the responsibility of the DOE. The Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the 21st century (10 CFR Part 51.23). The amount of wastes generated by the decommissioning process itself (i.e., removal of equipment, pipes, buildings, etc.) would not appreciably change with or without license renewal. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

A.1.1.12 Comments Concerning the License Renewal Process

Comment: And so here we are today wondering what the scope of this really is. The kind of separation that occurs in putting issues in categories has been very challenging for us to even follow, and to know where is the opportunity when you're looking at a site-specific review and you're raising these profound questions of environmental impact, and safety impact, and a host of other impacts, including economic, when we're told that's really outside the scope we're wondering where are we supposed to provide that concern then, because each plant is being brought up in an individual basis for review and ultimate approval, and as has been said there really hasn't been one denied yet it just raises concerns for us as to what the real process is, and the public has -- we're not alone. There are other public commentors that raise concerns. And honestly in looking at the results, the findings that the agency came out with we felt that our basic concerns were not addressed, and we were very dissatisfied by the analysis provided back to the public of this or that concern has been taken up by the agency and this is how the agency feels the problem fits in. (LRG-S-02-AT-3)

Response: *The current process is the public's opportunity to bring issues and concerns to the NRC's attention, provide new data, and discuss system-wide environmental issues that may apply to more than one individual plant. Classifying issues as Category 1 and Category 2 is designed to make the overall review process more efficient by dealing with those impacts that are similar for all plants at one time, so that reviews of individual power plants need focus only on those environmental effects that are unique to that plant or exceptional in size and scope for those issues ordinarily assumed to be similar for all plants. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: Concerns about how everything has been compartmentalized within the Nuclear Regulatory Commission and other agencies, the Department of Energy, and Department of

Defense, and all of these agencies that are related to the whole atomic energy/atomic weapons scenario which I feel like are so tightly connected. (LRG-S-03-AT-2)

Comment: I have never been to a meeting where NRC was present where they have forgotten to say that they were neutral about nuclear power. Never. You have always said that, always.

And I have never been to a meeting where you have said you are neutral, neither pro or con about nuclear power in which you haven't said pleased and positive things about nuclear power…I don't want to hear any of you say nuclear power is so economical. These are published in your statements, you need to strike them from anything you write because it's your role to appear to be nonpartisan to the public, and you are answerable to the public.

You need to get your industry-friendly jargon out of your minds before you come and see us, because you're not the industry, and we don't need to talk to you like the industry. We are stakeholders, so please take that into consideration. (LRG-S-06-AT-3)

Comment: We need to hear the word "safe," like we need to hear the word economical because we just need a neutral stance [on the part of the NRC]. (LRG-S-06-AT-10)

Comment: But I think what I am most struck by being in this room tonight is this sense of being at this diminishing point in our relationship with the NRC. That there is this profound attachment between the regulators of nuclear power and what they are considering, and moving forward with this bureaucratic process that you have been put on by the mandate of the Commission that is completely out of step with where the public is, in terms of where in fact the issue of nuclear power is in this country.

And that this is going to come to a screeching halt sometime soon either by catastrophe or by mandate of Congress, and I am really wondering what the point is to moving forward with relation to this GEIS at this point given the state that we are in. (LRG-S-18-BO-3)

Response: *The perceived compartmentalization is a result of a series of U.S. Federal laws and regulations that apportion the responsibility for nuclear-related activities among Federal agencies and the States. The mission of the NRC includes the protection of public health, safety, and the environment. The Energy Reorganization Act of 1974 established the Nuclear Regulatory Commission. Previously, under the Atomic Energy Act of 1954, a single agency, the Atomic Energy Commission, had responsibility for the development and production of nuclear weapons and for both the development and the safety regulation of the civilian uses of nuclear materials. The Act of 1974 split these functions, assigning to one agency, now DOE, the responsibility for the development and production of nuclear weapons, promotion of nuclear power, and other energy-related work. The NRC was assigned the regulatory work associated with the civilian use of nuclear materials. The President's Reorganization Plan No. 3 of 1970* *established the EPA and gave it a role in establishing "generally applicable environmental standards for the protection of the general environment from radioactive material." The Nuclear Waste Policy Act (NWPA) of 1982, as amended, establishes both the Federal government's responsibility to provide a place for the permanent disposal of high-level radioactive waste and spent nuclear fuel, and the generators' responsibility to bear the costs of permanent disposal. Amendments to the NWPA have focused the Federal government's efforts, through the DOE, on studying a possible site at Yucca Mountain, Nevada.*

Presently, the NRC is considering a licensing request from DOE for the disposal of high-level nuclear waste at Yucca Mountain, Nevada. Refer to the NRC's Web site at www.nrc.gov for more information on this license review.

Comment: There is a clear and obvious, and disgusting conflict of interest regarding the way that the NRC is set up, which is that you guys are all paid for by the industry. If you refuse a license and you refuse a utility operator a license that is less money for the NRC. So that is totally bogus. (LRG-S-16-BO-17)

Response: *Consistent with the requirements of the Omnibus Budget Reconciliation Act of 1990, as amended, fees are collected from licensees and license applicants to offset approximately 90 percent of NRC's budget. Additional information on licensing fees is available at: http://www.nrc.gov/about-nrc/regulatory/licensing/fees.html. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: So this interaction between the public getting involved in Yankee-Rowe, the industry doing what it does to generate electricity, and collect money, and pay your bills results in what, a rule that simply assumes that everything is okay until and unless it fails. (LRG-S-04-AT-6)

Comment: There was an interesting thing that happened with Yankee-Rowe in the initial consideration of license renewal, and I think we really have to take this update opportunity on the GEIS of license renewal to reflect on the response, but you know it's like a dance, you know it's like you do something, we do something, you do something, the industry does something, we do something. It's a dance, and you know the public really got involved in Yankee-Rowe, and different things happened than anyone thought was going to happen.

So we then have to look at what NRC did. And quite frankly your rules are not anticipating the problems that are occurring.

In honor of Jess Riley who was one of our members who I represented in the license intervention for the Duke reactors I have to say that he was quite right in saying that the NRC's regulations do not anticipate what you don't anticipate. (LRG-S-04-AT-5)

Response: *The licensee of Yankee Rowe considered applying for renewal of its operating license but discovered safety problems in the initial phases of its investigation and terminated the action. The Yankee Rowe decision has not affected the license renewal process. While it is not possible for the NRC to anticipate every problem with operating reactors, the NRC assesses plant performance continuously and communicates its assessment of plant performance in letters to licensees, typically semi-annually. The assessment program collects information from inspections and performance indicators (PIs) to enable the agency to arrive at objective conclusions about the licensee's safety performance. Assessment letters are available on the plant performance summary page for each plant, and are posted on this Web site as they become available. More detailed information on the NRC's assessment process is available in Inspection Manual Chapter 0305, "Operating Reactor Assessment Program," available at the NRC's Web site. The NRC determines its regulatory response in accordance with an Action Matrix that provides for a range of actions commensurate with the significance of the PI and inspection results. Findings are color-coded for significance to safety. For a plant that has all of its PIs and inspection findings characterized as having very low safety significance ("green"), the NRC will implement only its baseline inspection program. For plants that do not have all green PIs and inspection findings, the NRC will perform additional inspections and initiate other actions commensurate with the safety significance of the issues. The comments provide no new information and, therefore, will not be evaluated further. No change to the GEIS will be made as a result of these comments.*

Comment: We believe that if the industry is following its mandate to protect public health and safety and to limit the liability of the industry and do the industry a favor you should shorten the operating licenses to 25 years and facilitate either phase-out or, you know, if they're trying to get new ones we'll see if that works. (LRG-S-04-AT-9)

Response: *The original licenses for commercial nuclear power facilities were granted for a 40-year period, which was set by the Atomic Energy Act of 1954 and the NRC's regulations. It was imposed for economic and antitrust reasons rather than technical limitations of the nuclear facility. Studies and experience to date have shown that commercial nuclear power facilities can be safely operated for more than 40 years. The NRC regulations allow owners of nuclear power reactors to seek license renewal for up to an additional 20 years with no limitations on the number of times the license may be renewed. The decision of whether to seek license renewal rests entirely with the owners of the nuclear power reactor, and it is typically based on the plant's economic viability and whether it can continue to meet NRC safety and environmental requirements. The NRC bases its license renewal decision on whether the facility will continue to meet the requirements for safe operation and whether the protection of the environment can be assured.*

Comment: I don't know why the Nuclear Regulatory Commission decided to do a generic treatment of plutonium fuel, but you all did. You have rules for anybody who builds a plutonium fuel factory, so what about Table B-1? It only applies to LEU [low-enriched uranium] I need to remind you. It's not that I'm endorsing plutonium fuel, but I am suggesting that uranium has no bearing on plutonium. (LRG-S-04-AT-13)

Response: *Table B-1 in 10 CFR 51 Subpart A, Appendix B contains a summary of findings on environmental issues for license renewal of nuclear power plants, such as the uranium fuel cycle and human health issues. The commenter is correct in stating that Table B-1 does not include a generic evaluation of the plutonium fuel cycle. The use of mixed-oxide fuel, which is a combination of highly enriched uranium and plutonium, is not presently permitted in a U.S. power reactor without special licensing provisions. For more information on the regulation of mixed-oxide fuel, see the NRC Web site at http://www.nrc.gov/materials/fuel-cycle-fac/mox/licensing.html#1. The use of mixed-oxide fuel is considered outside the scope of this environmental review and, therefore, will not be evaluated further.*

Comment: If I could just get clarity on -- you mentioned two categories, Category 1 and Category 2. Who determines those categories? (LRG-S-05-AT-1)

Response: *The impact evaluation performed by the NRC staff and presented in the GEIS identified 92 environmental issues that were associated with the renewal of commercial reactor licenses in the United States. These categories and the associated environmental issues were determined by the NRC with input from industry, Federal, State, and local governmental agencies, members of the public, and citizen groups during the preparation of the GEIS.*

Comment: The GEIS needs to be upended to allow it to be generic. Actually I don't like it... Generic places important aspects out of reach of merely the stakeholders, and that's the sensibility that's an important aspect to any nuclear process' accessibility to the process by the stakeholders that are local to the plant. (LRG-S-06-AT-8)

Response: *A generic environmental impact statement is an environmental impact statement that assesses the scope and impact of environmental effects that are common to many nuclear plant sites. For license renewal, the NRC issued a GEIS that assesses the scope and impact of environmental effects that are common to all existing U.S. nuclear power plants. The GEIS identifies impact issues that were resolved generically and identifies impact issues requiring plant-specific analysis. A plant-specific supplemental EIS (SEIS) updates and/or supplements the information in the GEIS. For license renewal, the Commission directed the NRC staff to issue plant-specific supplements to the GEIS for each license renewal application. Preparation of these plant-specific supplements requires the evaluation of all the environmental issues including the generic impact issues addressed in the GEIS. During preparation of these* *supplements, input is gathered from a wide variety of sources including Federal and State agencies, local authorities, the public, and other stakeholders.*

Comment: When decisions are made around relicensing the outcome in the Hatch relicensing was from the NRC saying specifically that federal agencies other than NRC, and state regulatory agencies, and owners of plants will ultimately decide whether the plant will continue to operate.

At the State when we talk to them about this if they have the authority to move to get these plants closed on a reasonable time line they indicate that that's really the NRC's purview, that that's really outside their control.

So when you go through this relicensing and look at impacts and such and come out with findings if you can offer something for the states to actually work with, something concrete that lays out here's what options you have that's very clear to them, because they act like it's very confusing.

They may know full well that they have the ability to take care of these problems, but they kind of put their hands up and say we can't do too much here. (LRG-S-02-AT-8)

Response: *Although a licensee must renew its license to operate a reactor beyond the term of the existing license, the possession of a renewed license is just one of a number of conditions that must be met to continue operation. Once a license is renewed, other factors and entities such as State regulatory agencies and the owners of the nuclear power facility will ultimately decide whether the facility will continue to operate. Whether or not the facility will continue to operate is based on factors such as the need for power or other matters within the State's jurisdiction or the financial interests of the owners.*

Comment: 10 CFR 51.53(c)(2): The Service believes that the environmental analysis should not be limited to proposed modifications, but should address the continuation of project operations as a new commitment of resources. As such, the analysis should consider as its baseline, the status of environmental resources without the project. Effects of the project from that point in time should be avoided to the extent possible and minimize through the development and implementation of specific project features and operations. Appropriate mitigation for all unavoidable project effects on fish and wildlife resources should be developed in early consultation stages with the applicable resource agencies and included in the preferred alternative. (LRG-S-58-L-7)

Response: *The GEIS and site-specific SEISs evaluate not only the impacts of proposed modifications (refurbishment), but also the impacts of continued operations over the license renewal period. Where considered appropriate, mitigation to reduce the magnitude of* *environmental impacts is recommended in individual SEISs. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: The scope of the GEIS needs to either expand or be qualified to include impacts from contemplated continued operation of the plant. In other words, if there is a relicensure procedure, and I think the maximum relicensure procedure or time rather is 20 years, if the plant is relicensed for, say, 10 years after its 40 year license time, the impacts considered in the GEIS need to take into account the contemplated impacts for the extra licensure time, and not just the contemplated impacts during refurbishment time. And you could do that by using each of the 92 issues and having a section for refurbishment period and a section for additional contemplated licensure time. (LRG-S-19-BO-2)

Comment: The renewed license process has not included in it evaluation a plant's operating experience. (LRG-S-25-BO-7)

Response: *The GEIS evaluates the environmental impacts of continued operation of nuclear power plants for up to 20 years after expiration of a plant's current operating license. Refurbishment impacts are considered if refurbishment is planned during the renewal period, but the evaluation is not limited to a consideration of refurbishment impacts. Additionally, by conducting environmental reviews prior to license renewal, a plant's operating experience forms an important basis for the impact determinations. The comments provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.*

Comment: I think that the Congressional offices -- and I represent Congressman Edward Markey, and if we were notified by the NRC of a hearing, we would be happy to submit a secondary press release to the local newspapers. I think that it is a good way for our local communities to become more involved in the process. (LRG-S-21-BO-1)

Response: *The NRC appreciates the offer to provide press assistance. The comment was forwarded to the NRC Office of Public Affairs for consideration.*

Comment: The new GEIS should apply to licensees who submit applications prior to 2006. (LRG-S-26-BO-1)

Response: *The NRC's current plan is to apply the revised GEIS to all license renewal applications submitted after the date the Record of Decision for the revised GEIS is printed in the* Federal Register*. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: I am just curious as to -- we are going through this process of reevaluating this whole process, and why are you renewing licenses? I mean, you know that there is a problem, along with everything else that we are talking about, and that we might want to consider stopping your renewal process until you have made a determination as to what should be done. It just does not seem like the right thing to do. (LRG-S-27-BO-1)

Comment: I am kind of sad that this whole conversation seems to be predicated upon the assumption that there will be a proliferation in the number of nuclear power plants in the U.S. And I almost feel like no matter what we say tonight, that process is going to continue and go forward. And that to me is a little sad because I think as some people pointed out here tonight, there is a mass movement in this country of people who are posing the question of whether nuclear power should go further at all. (LRG-S-31-BO-1)

Response: *Section 103 (of the Atomic Energy Act [42 USC 2133]) allows for the renewal of nuclear power plant operating licenses. The NRC's reasons for moving forward with the revised GEIS are set out in the Notice of Intent in the June 3, 2002,* Federal Register *at page 33209. The NRC is updating the GEIS to ensure that the evaluation is technically sound and accurate. It will incorporate any new information that may have been uncovered through past experience with the review process, and any new information that was discovered during the scoping period. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: Please DO NOT rubber stamp renewals at the nuclear plants which are due for close down phasing. Do your job to protect the public from the increased risk associated with extending these plants operating life.

Energy at any cost is no deal and the NRC's mission is to protect the public, not the industries or their bottom line. The cost in $ and health risk are unacceptable. (LRG-S-45-E-1)

Comment: I am extremely concerned that the license renewal process has thus far been primarily a rubber-stamping process, wherein NRC is not only accommodating to industry demands, but actually promotes the industry at every turn, and at nearly any cost, including public health and safety. Thus far, the NRC has approved license renewals for 8 nuclear facilities comprising 16 reactors, and it appears that NRC's approval process is a rather perfunctory evaluation and little more than a bureaucratic formality that a licensee must tolerate to arrive at a predetermined conclusion, which is, invariably, approval. (LRG-S-43-E-11)

Response: *The NRC makes a detailed, site-specific analysis of each license renewal application. Further information on the process, regulations, guidance, opportunities for public involvement, and status of current activities associated with renewal of licenses for commercial operating power reactors is available on the NRC's Web site at http://www.nrc.gov/reactors/*

operating/licensing/renewal.html. The comments provide no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of these comments.

Comment: We support the basic tenets of the NRC's licensing process and find the combination of a General Environmental Impact Statement and a site specific supplement to the FEIS an efficient way to process applications for license renewals. (LRG-S-58-L-1)

Response: *The comment is supportive of the license renewal process and is general in nature. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: We recommend that NRC improve this process by including in its regulations a requirement for applicants to consult with the [Fish and Wildlife] Service prior to and during the development of their supplemental Environmental Reports (10 CFR 51.60). This would provide the Service maximum flexibility for addressing our statutory responsibilities including, for example, the Endangered Species Act and the Migratory Bird Act. This could benefit NRC by reducing the time period for consultations with the Service. (LRG-S-58-L-2)

Response: *The NRC's guidance for license renewal applicants concerning coordination of threatened or endangered species issues with the U.S. Fish and Wildlife Service (FWS) is in Section 4.10 of Supplement 1 to Regulatory Guide 4.2,* Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*, September 2000. In this section of the regulatory guide, the NRC directs the applicant to determine whether the site and vicinity are within the range of listed species, and if they are, to prepare an assessment that determines the extent to which refurbishment activities associated with license renewal and continued plant operation are likely to jeopardize the continued existence of those listed species or to result in the destruction or adverse modification of critical habitat. If, during compilation of information and assessment of the effects of license renewal on threatened and endangered species, a need arises to consult with either the FWS or the National Marine Fisheries Service (NMFS), the prospective applicant is directed to notify the NRC so that the NRC can coordinate the consultation. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: 10 CFR 51.53(a): Although the provisions specific to license renewals begin at (c), the Nuclear Regulatory Commission should include a requirement to analyze all project effects for licenses under their authority with the best available information. For example, the Service has a special interest in developing and implementing the most efficient techniques for preventing entrainment and impingement of aquatic organisms at cooling water intakes. In cases where the applicable nuclear facility information is outdated, inconsistent with related information from other intake structures (i.e. non-nuclear), or fails to address specific species of concern, we believe that NRC should require license applicant to consult with the Service (and other applicable resource agencies) during the early stages of the development of their Environmental Report in an effort to expeditiously develop needed information. (LRG-S-58-L-6)

Response: *The NRC reviews in detail the environmental reports submitted by license applicants. When information in a report is not the best available information, the NRC typically requests that the applicant provide new and additional information to supplement the environmental report. No change to the GEIS will be made as a result of this comment.*

Comment: Considering re-licensing without updating GEIS standard is not in the best interest of America's future. (LRG-S-13-LA-13)

Comment: From the impact that nuclear plants have on marine habitats (reactors must be near a source of water for cooling) to the potential targeting of a plant for a terrorist attack, the Nuclear Regulatory Commission either struggles to look the other way or just bury its head in the sand. The National Environmental Policy Act requires that the NRC periodically re-assess its findings of the environmental effects of renewing plant licenses. The current findings attempt to generically downplay or dismiss all effects, current and potential, at nuclear plants. From groundwater contamination to waste storage to accidents, the recurring theme from the NRC is that any negative result is unlikely, and its consequences would be minor. (LRG-S-48-E-5)

Comment: The Service believes that the NRC should analyze information collected since the completion of their systematic inquiry into the environmental impacts of activities associated with license renewals and environmental impacts of continued project operations. This analysis should be used to verify the assumption made of all Category 1 conclusions summarized in Table B-1. Table B-1 should be updated to state affirmatively the findings for all Category 1 issues. The NRC may find it necessary, based on the results of this analysis, to reclassify some impacts as Category 2, thus requiring additional site specific investigations during the license renewal process. (LRG-S-58-L-3)

Comment: Table B-1: We suggest that all category 1 summary findings should be reassessed and information provided to support the assumptions. Category 2 summary findings for Aquatic Ecology, specifically once through cooling water systems, should require the use of the best technology available. (LRG-S-58-L-13)

Response: *The NRC is currently in the process of revising the 1996 GEIS. The purpose of this revision is to review and update the technical basis for the findings in Table B-1 using best available information, including any new and significant information that would change the conclusions in the 1996 GEIS. As a result of the review, the NRC will reevaluate the conclusions regarding Category 1 and Category 2 impact issues in Table B-1 of 10 CFR 51 Subpart A, Appendix B and revise the table accordingly. The NRC has no authority to require* *specific technologies beyond those imposed by the EPA or other jurisdictional agencies. The comments provide no new information, and will not be evaluated further.*

Comment: 10 CFR 51.53(c)(3)(ii): We encourage NRC to specifically require the installation of the best technology available pursuant to Clean Water Act 316(b) or to require new project specific studies as determined necessary by Federal and State resource agencies and Tribes to determine appropriate alternatives to the best technology available. (LRG-S-58-L-9)

Response: *Section 316 of the Clean Water Act (33 USC 1326) covering thermal discharges is administered by the EPA or a State with delegated authority from the EPA. The authority of the NRC is limited in matters that are expressly assigned to the EPA as shown by the decision on Yellow Creek, a Tennessee Valley facility, in 1978. Specifically, the decision determined that the NRC's authority is limited for those matters that are expressly assigned to the EPA by the Federal Water Pollution Control Act Amendments of 1972. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: But even if you don't look at this problem from an accident or a catastrophe point of view, we are hearing a lot of concerns about cumulative impacts that we don't feel the agency is properly looking at. (LRG-S-02-AT-7)

Response: *Cumulative impacts were evaluated in the 1996 GEIS, and those conclusions will be reviewed and modified if deemed appropriate in the revised GEIS.*

Comment: 10 CFR Part 53(c)(2): We recommend that NRC require the use of the best available information the environmental report (see comment #4) and to require new studies to meet this objective as determined necessary by Federal and State resource agencies and affected Indian Tribes. In addition, the report should include a detailed assessment of cumulative, direct, and indirect effects of project operations on the environment. (LRG-S-58-L-8)

Comment: 10 CFR 51.60: We believe that the environmental reports file for license renewals should be based on the most current information available. (LRG-S-58-L-12)

Response: *The NRC's guidance for the preparation of environmental reports (ERs) by license renewal applicants is provided in Supplement 1 to Regulatory Guide 4.2,* Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*, September 2000. In this regulatory guide, the NRC describes the format and content of the ER to be submitted as part of an application for the renewal of a nuclear power plant operating license submitted pursuant to 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." In developing the ER, the applicant is directed* *to identify new and significant information relevant to an evaluation of impacts. In addition, applicants are specifically directed to evaluate cumulative, direct, and indirect effects of license renewal. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: It is patently ridiculous that for the purposes of license renewals and the GEIS, the NRC has dispensed with the NEPA requirement to meaningfully demonstrate a need for the proposed action. Fundamentally, the various risks associated with extending operations at U.S. nuclear power plants are unnecessary and therefore unjustified. It is nothing short of farcical that the NRC has deemed these considerations outside the scope of its NEPA obligations. (LRG-S-43-E-12)

Response: *The purpose and need for the proposed action are discussed in the site-specific environmental impact statements and in GEIS Section 1.3: "The purpose and need for the proposed action (renewal of an operating license) is to provide 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, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decisionmakers." The definition reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954 or findings in the 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 of State regulators and utility officials as to whether a particular nuclear power plant should continue to operate. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: NIRS continues to take issue with the determination by NRC that an environmental issue is "resolved" or absolved of redress in simply by listing it as a generic consideration. The mere listing does not necessarily translate into actual resolution and the meaningful mitigation of environmental issues at site specific reactors. NIRS takes note that in fact such treatment currently removes it from challenge by contentions in a public intervention process. Through such means, NRC and the nuclear industry currently enjoy the advantage to indefinitely table resolution at increasing risk to public safety and environmental health and avoid addressing such issues during the licensing proceeding. (LRG-S-62-E-1)

Response: *All Category 1 and 2 issues are evaluated in the GEIS and in subsequent supplements to the GEIS. In preparing SEISs, the NRC staff evaluates each of the Category 1 issues to determine if the conclusions in the GEIS are still valid. It uses information provided by the public during scoping or review of the draft SEIS, information provided by agencies, information collected by the applicant in developing the license renewal application, and information gathered during the NRC staff's site audit. The comment provides no new* *information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: If the NRC is to comply with the mandates of the National Environmental Policy Act, I believe a site-specific environmental impact statement should be prepared for any nuclear power plant for which an NRC licensee is requesting an operating license or construction permit extension --- with no exclusions permitted of Category 1 generic issues. (LRG-S-63-E-13)

Response: *A site-specific environmental impact statement that analyzes the environmental impacts of license renewal at that particular site is prepared each and every time a licensee submits an application for license renewal. Category 1 issues are not excluded from the site-specific environmental impact statement. The conclusions in the GEIS relative to each Category 1 issue are reviewed for appropriateness to the specific plant being evaluated. Specifically, the NRC staff consider whether there is new and significant information that would lead them to alter the conclusions regarding the magnitude of Category 1 impacts. Sources of such new and significant information include public comments provided during the scoping period or draft SEIS review, comments from agencies, information gathered by the licensee in preparing the license renewal application, and information gathered by the NRC staff during each plant site audit. The comment provides no new information and, therefore, will not be evaluated further. No change will be made to the GEIS as a result of this comment.*

Comment: Since we have seen by the recent near failure of a reactor vessel head that the NRC is unwilling to enforce its own regulations, does the GEIS presuppose the regular and continuing failure to regulate by this agency. It should. It is clear that little was learned from 3-Mile Island, and safety equipment to avoid the hydrogen explosion portion of that disaster have been non-functional at Davis-Besse for over 25 years. (LRG-S-16-BO-7)

Comment: I am heartened by the fact that the public unanimously who has turned out to speak tonight has a voice that they pretty much have zero confidence in the NRC. And if I am wrong about that, I would like to have someone correct me, and if no one corrects me, I would like the record to reflect that the public at this meeting has no confidence in the Nuclear Regulatory Commission. (LRG-S-16-BO-18)

Comment: Your mission is to make sure that under the Federal Code that you are assuring public safety by enforcing the regulations. You are not enforcing the regulations. The culture now seems to be voluntary. The industry apparently is being asked by your agency to come into compliance politely, and that seems to be the culture. We expect more of you and we are paying your salary, and Congress has mandated you with the task that you are not fulfilling. (LRG-S-25-BO-6)

Comment: Pilgrim Security Watch wishes to add our organization's name to the comments by Mothers for Peace, attached, regarding the public's ability to meaningfully participate in NRC's decision making process affecting our communities.

It is more than clear that industry has no difficulty in securing closed meetings with the NRC to essentially write their own rules. (LRG-S-37-E-1)

Comment: The Boston meeting made it clear that the public safety community holds the NRC in little to no respect – mere apologists for the industry. (LRG-S-37-E-2)

Comment: NRC attorneys clearly support the industry and the utilities. (LRG-S-37-E-15)

Comment: The NRC is long overdue to take their job seriously as regulators of the nuclear industry. The NRC must stop catering to the nuclear industry[1]s every whim, and actually fulfill their primary mission "to protect public health and safety, and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities." (LRG-S-39-E-1; LRG-S-40-E-1; LRG-S-44-E-1; LRG-S-51-E-1)

Comment: As the foremost regulator of this country's nuclear industry, the NRC must stop catering to the nuclear industry's every profit-motive, and fulfill its primary mission "to protect public health and safety, and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities." (LRG-S-46-E-5)

Comment: The NRC must stop catering to the nuclear industry's every profit-motive, and fulfill its primary mission "to protect public health and safety, and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities." (LRG-S-47-E-1)

Comment: As a government agency, you should be protecting the public interest thru enforcing stricter controls on nuclear facilities regarding public exposure to nuclear radiation, not enabling more exposure. (LRG-S-49-E-5)

Comment: The ineptitude of this agency in regulating is mind-boggling. (LRG-S-16-BO-8)

Comment: This process is a sham. The Nuclear Regulatory Commission regulates corporations which damage and destroy life in order to make a profit, in this case by generating electricity. (LRG-S-16-BO-2)

Comment: The NRC is long overdue to take its job seriously as regulator of the nuclear industry. The NRC must stop catering to the nuclear industry's every whim, and actually fulfill its primary mission "to protect public health and safety, and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities." Please act responsibly and in accord with your stated mission in drafting an environmental impact statement for the license renewal of nuclear power plants. (LRG-S-38-E-5)

Comment: I wanted to point out that it is absolutely essential to the underlying confidence and faith that anyone may ever have in the work of the Commission that a principal as important as the independence of quality assurance from production, that that be recognized and maintained. It is enshrined in the Appendix B, however I'm deeply concerned that there is an existing gentleman's agreement that these need not be unheard and can in fact be dismantled as needed during corporate mergers. (LRG-S-12-CH-2)

Comment: This is unacceptable and if the NRC can't in fact introduce a fair and equitable process and scientific one, then Congress has to, and the people have to, and the States have to, because if the NRC isn't go to protect us, then somebody better, because our communities are already suffering from epidemics of disease. And to now add terrorism to it just takes it over the top. (LRG-S-30-BO-3)

Comment: I think that there are so many cultural issues within your agency that are so disturbing as a bureaucracy, that as bureaucrats who have worked for this agency for a long time, if you are not aware of them yourself, then you are unable to see the forests for the trees. And I think as professionals that you need to look at your agency and the culture with which you are operating. And to voice these concerns in your departments, and within the agency…And there are a lot of good people in your agency, and there are a lot of good technical people in your agency who have done their work, and it has not been acknowledged within your agency. And I don't know quite where this culture falls apart, but there are good people at the NRC and you guys may be part of it, but the culture is falling apart and we know it. It is too big for you to handle because things were swept under the rug and not addressed and not dealt with by this agency. And the gig is up. It is very soon. (LRG-S-30-BO-10)

Response: *The comments are general in nature and express discontent with the NRC's performance as a regulatory agency. The Energy Reorganization Act of 1974 established the NRC and assigned it the job of regulating the nuclear industry. The NRC regulates the various commercial and institutional uses of nuclear energy, including nuclear power plants. Under its responsibility to protect public health and safety, the NRC has three principal regulatory functions: (1) establish standards and regulations; (2) issue licenses for nuclear facilities and users of nuclear materials; and (3) inspect facilities and users of nuclear materials to ensure compliance with the requirements. Every nuclear power plant licensed by the NRC must maintain a quality assurance program (10 CFR 50.54). The comments provide no new information and, therefore, will not be evaluated further.*

Comment: It is possible to state that there is an interval or main interval between actions that are severe. In particular, those which go as vessel or resultant fires that burn vigorously for days or eject molten fuel from the apparatus. But that interval is finite. It's difficult to estimate. You'll get different answers depending on who you speak to but where would each of us want to be when it is said that at the next hour the Governor is expected to make an address with regard to the new update to the changing boundary of the evacuation zone. Would we want to have enshrined and defended a process which scrunches and eviscerates the warnings given by the engineers or will we find that we've done our best to publicize and to develop and respond to the very real and I think insurmountable, possibly insoluble technical problems that this has presented. I can understand the investor's enthusiasm to pursue license renewal but I find it really unconscionable that we should be considering doing this with this pattern in place. (LRG-S-12-CH-4)

Comment: Re-licensing aging nuclear power plants 20 years before current licenses end is not in the best interest of America's future. (LRG-S-13-LA-12)

Comment: In consideration of public welfare, it appears as irresponsible for there even to be a procedure whereby a nuclear energy facility can apply for operating license approval for the technologically distant future. It cannot be known at the present time whether a facility's components will become outdated in terms of safety and / or deteriorated. I urge that NRC not approve the subject (premature) license extension. (LRG-S-57-E-1)

Comment: So essentially you are granting a relicensure to a plant that has 18 years to go on its existing license, and so you are making a decision based on the supposed conditions at that plant, 18 years hence? Okay. Here is a process that needs a change. (LRG-S-19-BO-5)

Response: *A nuclear power plant licensee can apply to the NRC to renew a license as early as 20 years before expiration of the current license. The NRC staff has determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. A licensee may submit an application for license renewal at a plant that has less than 20 years of operating experience; however, an exemption to the regulations is required. A major consideration for seeking license renewal so far in advance of the expiration date of the current license is that it takes about 10 years to design and construct major new generating facilities, and long lead times are required by energy-planning decisionmakers. The licensee is required to meet all Federal, State, and local environmental requirements throughout the operational period. Therefore, publication of the SEIS several years ahead of the renewal date for the operating license does not preclude the need for ongoing environmental compliance activities. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: The NRC has stripped citizens of any input into re-licensing hearings. In contrast, when nuclear plants were first being constructed, citizens and scientists outside the industry provided an important safety net by questioning the science of the utilities and the NRC scientist. Citizen input needs to be restored to re-licensing hearings. (LRG-S-50-L-2)

Comment: Theoretically, public input is valued, but this process allows just 12 hours of input from the entire U.S. populous on the issue of what is an acceptable amount of radiation poisoning for our nation for another 20 years or maybe more. (LRG-S-16-BO-4)

Comment: I want to start with a sense of this process. You know, this was one of the hardest places for me to get to than I have ever gone to an NRC hearing at, and I want to commend you for making it the most difficult public participation process to engage in yet. Now, we might do the next one in Canada, which would allow us an even greater struggle, and a sense of real determination to participate. So I wish we could make them a little easier to access for many people. (LRG-S-30-BO-1)

Comment: You say that you ensure that the public has the highest level of participation. And perhaps other agencies aren't as good. However, nuclear matters are perhaps more serious, and when you give the public 90 days and you are going to be going through this process until 2006, it seems to me that maybe the public could have a year also, and I would like you to consider that. (LRG-S-20-BO-1)

Comment: First of all, I would like to thank the NRC for hosting this meeting. Even if it is not required, I think it is a great opportunity to get some input from the public, and so I do appreciate that very much. (LRG-S-22-BO-1)

Comment: There is a general feeling that there always exists a “Catch 22,” and the private sector can not make a difference. (LRG-S-37-E-19)

Response: *The NRC considers all comments from the public submitted during periods of public comment. As with any licensing activity before the NRC, the public has an opportunity to participate in the NRC’s decision-making process with regard to license renewal. Numerous opportunities were provided for public participation in the GEIS revision. There were two scoping periods (June 3 to September 13, 2003, and September 27 to December 30, 2005) during which the public had the opportunity to provide comments on scope of the review. During the initial scoping period, the NRC held four public meetings at locations in different portions of the United States to consider public scoping comments on the GEIS revision. The public will also have an opportunity to comment on the revised GEIS. Hearings on license renewal applications are not mandatory; that is, hearings are held only if a petition that shows standing to intervene and sets forth at least one contention (issue) that is suitable for litigation in the proceeding is filed. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: Unless the NRC wants to pay people the air fare, travel, to come to these meetings you need to stop this generic attitude of yours and go right down elbow to elbow with people and talk to them about their plants…we're not paid for in all cases by a specialist group, we are not paid for by NGOs [non-governmental organizations]. We are here because we are concerned, we're here because we're talking for the 14,000 members of the Georgia Sierra Club, and they have concerns. We're here because a nationwide Sierra Club of half a million people have causes to give nuclear power because of some of the unsolved issues with nuclear power. You need to take it to the people, and not going to the individual sites about everything doesn't look too good. (LRG-S-06-AT-9)

Comment: Public meetings on generic issues are not held in reactor communities, resulting in low attendance and extra expense for the few public members that make the effort to attend. (LRG-S-37-E-11)

Response: *The NRC holds public meetings throughout the United States and accepts comments during the scoping period from members of the public who were unable to attend the meetings. The NRC also conducts public meetings in communities close to nuclear power plants who's owners have applied for license renewal.*

Comment: There is inadequate notice to states and organizations regarding public meetings. (LRG-S-37-E-10)

Response: *The public is notified at the beginning of the scoping process through the publication of a* Federal Register *notice, a meeting notice on the NRC Web site, through advertisements placed in local newspapers in communities near the nuclear power plant, and by flyers distributed throughout the local community. Specific meeting announcement information is provided to the public as soon as the NRC staff is reasonably confident that a meeting will be held and firm date, time, and facility arrangements have been made, but generally no fewer than 10 calendar days before the meeting. When a meeting must be scheduled but cannot be announced 10 calendar days in advance, the NRC staff provides as much advance notice as possible. Public notice of meetings is made via the Internet on the NRC Web site. Meeting changes or cancellations are announced promptly on the NRC Web site. Members of the public who cannot access the NRC Web site can contact the NRC Public Document Room staff via a toll-free number (1-800-397-4209) or by e-mail (pdr@nrc.gov) for information on scheduled NRC meetings. Some meetings having very high public interest are announced via a press release or paid advertisement in local newspapers, or both. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: I think that everyone should make note that the industry found no need to make comment, because as we know the industry and the NRC behind closed doors are writing the rules. So there has been no need for the industry to come and comment about how they may want things changed or relaxed, and I think that is just an interesting observation. (LRG-S-17-BO-16)

Response: *Stakeholders and members of the public may submit oral or written comments as part of the scoping process. The scoping process does not limit participation, rather it is up to the individual to submit comments. It should be noted that industry representatives did submit scoping comments to the NRC and those comments are included in this scoping summary report. The comment provides no new information and will not be evaluated further.*

Comment: The overuse of acronyms by the NRC staff in public notices make them meaningless to interested parties. (LRG-S-37-E-13)

Response: *The NRC agrees that the overuse of acronyms in public notices or other documents can reduce their effectiveness. In future notices, the NRC staff will attempt to limit acronym use.*

Comment: Members of the community who do attend meetings are often treated inappropriately, i.e. searches, metal detectors, weapon sniffing dogs, no signs, no speaking. (LRG-S-37-E-14)

Response: *The NRC establishes visitor controls and related security procedures for public meetings held in NRC regional offices or other remote locations on the basis of an overall assessment by the NRC's Physical Security Branch relative to potential security concerns. Security requirements nationwide may differ on the basis of various factors and, therefore, meetings are evaluated on a case-by-case basis. Additional information is in the May 28, 2002* Federal Register *beginning at page 36920. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: The ADAMS website is extremely difficult and exasperating to navigate. (LRG-S-37-E-9)

Response: *Information on using ADAMS is available on the NRC Internet Web site at: http://www.nrc.gov/reading-rm/adams/help-reference.html#ListofLicenses. The NRC Public Document Room (PDR) Reference staff is available to help the public with ADAMS. The PDR staff can assist with: (1) ADAMS installation questions, (2) ADAMS hardware and software issues, (3) searching ADAMS, (4) searching for documents created before November 1, 1999, that are not available in ADAMS, (5) arranging free ADAMS training (available at the PDR in Rockville, Maryland, near Washington, D.C.), and (6) obtaining paper copies of documents from ADAMS as well as copies of pre-ADAMS documents in various formats. These materials may be ordered for a fee via the PDR. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: For over 30 years the San Luis Obispo Mothers for Peace have brought important issues of safety to the attention of the NRC. We continue to participate, even though frustrated by NRC processes and are often left with the belief that no one at the NRC is listening. It is virtually impossible for the public to have the same relationship with the NRC that is available to the nuclear industry. (LRG-S-37-E-20)

Comment: The NRC refuses to allow full hearings on issues of safety that could seriously impact reactor communities. (LRG-S-37-E-12)

Response: *The public can always raise issues concerning either site-specific or generic issues. The public can raise issues by using any of several methods. If the licensee has requested an action requiring a license amendment, then the process for intervening in this action is to request or participate in a hearing. The process is set forth in NRC's regulations in 10 CFR Part 2, "Rules of Practice of Domestic Licensing Proceedings and Issuance of Orders." If the action of concern does not involve a license amendment, then any member of the public may raise potential health and safety issues in a petition to the NRC to take specific enforcement action against a licensed facility. This provision is contained in the NRC's regulations and is often referred to as a "2.206 petition" in reference to its location in the regulations (Chapter 2, Section 206 or 10 CFR). The comments provide no new information and, therefore, will not be evaluated further.*

A.1.1.13 Comments Concerning Issues Outside the Scope of License Renewal

Safety and Security

Comment: And if you are about safety and regulating safety I plead you to reconsider the process that you go through for relicensing these plants. (LRG-S-03-AT-9)

Comment: I would like to address the issue of spent fuel, and one of our concerns, and I think in listening to the presentation on the generic impact statement, the GEIS, when you look at something -- and I think that many of the issues that you are going to I'm sure hear about tonight is that if everything is working perfectly, there is no environmental impact. Or you might conclude as you do here in Table B-1 on spent fuel that the impact will be small, and the reason is because nothing has a problem. The problem always comes up when you have a problem, and then the environmental impact is huge.

And I think that this is where -- and I am sure that you are going to hear it, because I have just been chatting with people, that there is this discrepancy that if it is not a problem, because everything -- the mechanical systems, and the people are all trained well and everything is working as you anticipated, or as you hope it will, and certainly I hope it will, you just don't know what will happen when it does happen and if something goes wrong. (LRG-S-22-BO-3)

Comment: Perhaps the NRC believes that the economic pressures to cut operating budgets increase safety. (LRG-S-16-BO-6)

Comment: Your mandate is to protect public health and safety. Sadly, when safety issues are brought to the NRC's attention it is the utilities that have the financial means to provide experts to dissuade the NRC of their importance. Neither the NRC, nor the public have equal access or equal finances to provide credible opposing opinions. (LRG-S-37-E-21)

Response: *The Energy Reorganization Act of 1974 established the NRC and assigned it the job of regulating the nuclear industry. The NRC regulates the various commercial and institutional uses of nuclear energy, including nuclear power plants. Under its responsibility to protect public health and safety, the NRC has three principal regulatory functions: (1) establish standards and regulations; (2) issue licenses for nuclear facilities and users of nuclear materials; and (3) inspect facilities and users of nuclear materials to ensure compliance with the requirements. Operational safety is considered outside the scope of the environmental review. However, the NRC also performs a safety review to determine whether there is reasonable assurance that activities authorized by a renewed license will continue to be conducted in accordance with the current licensing basis. The intent of the NRC's safety review is to determine if the applicant has adequately demonstrated that the effects of aging will not adversely affect any systems, structures, or components, as identified in 10 CFR 54.4. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: Plant Safety Culture: A thorough site-specific review of a plant's "safety culture" among plant management should be included in any license renewal application. "Lessons Learned" from the Columbia Accident Investigation Board's report, released August 2003, may be very relevant to accident prevention and safety at nuclear power plants. The report, which identifies root causes for the Columbia shuttle disaster, noted that cultural constraints and organizational practices detrimental to safety were allowed to develop. These included: (a) reliance on past success as a substitute for sound engineering practices (such as testing to understand why systems were not performing in accordance with requirements); (b) organizational barriers that prevented effective communication of critical safety information and stifled professional differences of opinion; and (c) program managers that were clearly overconfident. NRC should examine the Lessons Learned from this comprehensive safety investigation and how these lessons may be applied to safety programs for our aging nuclear power plants.

A similar investigation of the Challenger disaster identified an ineffective "silent safety" system in which budget cuts resulted in a lack of resources, personnel, independence and authority. Although subsequent NASA briefings described a risk-adverse philosophy that empowered any employee to stop an operation at the mere hint of a safety problem, the Columbia Safety Board report concluded that NASA's views of its safety culture in those briefings "did not reflect reality." The report also concluded that Shuttle Program safety personnel failed to adequately assess anomalies and frequently accepted critically important risks without analytical support, even when the tools to provide more comprehensive assessments were available.

A 1990 U.S. General Accounting Office (GAO) questioned the effectiveness of NASA's safety organization. Similarly, a GAO report in 1999 criticized NRC's programs to ensure that utilities comply with NRC's regulations, take prompt actions to correct deficiencies found, and operate their plants safely. The GAO report concluded that NRC gives utilities considerable latitude to fix their problems—a strategy that may work well when utility managers place high priority on maintaining a strong safety culture. However, GAO found that this condition was not present in three plants that they examined and that the problems worsened when NRC did not hold the utilities accountable for fixing them. The GAO report found that NRC's safety oversight has not focused on the competency of nuclear plant management, even though the nuclear industry and NRC officials agree that such competency is perhaps the most critical factor in safe performance.

The Naval Reactor program was recognized in the Columbia Report for its high degree of engineering discipline, emphasis on total responsibility of individuals and organizations, and its redundant and rapid means of communicating problems to decision-makers. The NRC should review the findings from the Columbia disaster investigation for successful elements of the Naval Reactor safety program and any lessons learned that can be applied to nuclear power plant safety management. NRC should develop criteria for use in evaluating a licensee's "safety culture" based on findings from the Columbia report regarding shortcomings in the safety culture at NASA and strengths of the Naval Reactor safety program. The license renewal process should use these criteria for conducting a thorough plant-specific review of plant management and its safety culture. Renewing a plant's operating license should be conditioned upon an effective safety culture in plant management. (LRG-S-60-E-10)

Response: *Plant safety culture and operational safety matters are outside the scope of this environmental review. An NRC safety review for the license renewal period is conducted separately. Although a topic may not be within the scope of review for license renewal, the NRC is always concerned with protecting health and safety. Regarding safety culture, the Commission issued a policy statement on August 21, 1986 (51 FR 30028). Additionally, following the Davis-Besse reactor vessel head degradation, an NRC Lessons Learned Task Force recommended the NRC inspection and assessment processes be reviewed for potential enhancements to identify and disposition the types of problems that were experienced at Davis-Besse. In addition, the Commission directed the staff (Staff Requirements Memorandum-04-0111) to enhance the Reactor Oversight Program (ROP) to more fully address licensee safety culture.*

A number of ROP inspection guidance documents were enhanced in 2006 to incorporate inspection and assessment guidance for licensee safety culture. See Regulatory Issue Summary 2006-13, "Information on the Changes made to the Reactor Oversight Process to More Fully Address Safety Culture" for a comprehensive discussion of changes. The ROP safety culture changes were made to: (1) provide opportunities for the staff to identify safety culture weaknesses and to encourage licensees to take appropriate actions before the plant experiences significant performance degradation, (2) provide criteria for considering when to request licensees to perform a safety culture assessment, and (3) provide guidance on how the staff should evaluate a licensee's safety culture assessment and how to perform an independent NRC assessment of a licensee's safety culture.

The staff has performed a lessons learned evaluation of the initial implementation of the 2006 ROP safety culture enhancements. Further ROP enhancements have been discussed with external stakeholders and will be implemented by the NRC. Further, in response to a Commission Action Memoranda (COMGBJ-08-0001) issued February 25, 2008, the staff is working on an expansion of the Commission's safety culture policy and to address the unique aspects of security. Any matter potentially affecting safety can be addressed under processes currently available for an existing operating license in the absence of a license renewal application

Comment: The NRC must reassess and improve its problem identification and resolution programs. If the NRC had enforceable standards for problem identification and resolution programs at all facilities, then the number of plants that have been shut down for a year or more would not have occurred. There have been 26 plants that have been shut down since 1984 for over a year for extensive repairs. This data is clear evidence that leaving problem identification and resolution problems up to the industry to develop without an NRC standard allows flawed programs to be in place.

The NRC needs to establish a conservative and high standard for problem identification and resolution programs, and develop a reliable inspection process to verify that the industry executes them. (LRG-S-25-BO-1)

Comment: The waivers or exceptions given to a plant, or the need to bring an aging plant up to the current safety modification standards required of new and younger plants, is not a requirement. This process that you have undertaken is based on the assumption that every one of these plants is operating under its design.

We know that by the exceptions, the waivers, the event reports, that they are not. It's obvious that they are not. So you are starting from a point to establish a risk and an impact from small, medium, and large that you cannot do based on the assumption that you are starting with. (LRG-S-25-BO-8)

Comment: NRC should develop criteria for evaluating the safety of plants with significant design modifications or significant long-term safety violations: NRC assumes that plants are safe if they operate as designed and meet NRC's regulations. However, changes made to a plant over time, such as replacing components with different parts and reconfiguring systems can alter the plant's design and affect how certain safety systems may work in an emergency. The GAO recommended in its 1999 report that NRC should develop a means of quantifying the safety of plants that deviate from their approved designs. In the 1990's, NRC found that some utilities had not maintained current information on their plant's designs and had not examined the impact of modifications on the safety of the plant's operations. NRC identified instances in which utilities had not properly tested safety-related components and had made errors in their analyses of how emergency cooling systems would work in an accident. NRC concluded that most of the problems resulted from errors in the original design or from design modifications, inadequate testing, and discrepancies in documentation. The license renewal evaluation should include an analysis of the safety impacts of plants that deviate from their approved designs. (LRG-S-60-E-11)

Response: *Operational safety matters are outside the scope of this environmental review. It is important to note that the NRC has a comprehensive inspection program, as part of its Reactor Oversight Program (ROP). This includes Inspection Procedure IP 71152, "Identification and Resolution of Problems," which is used to perform detailed inspections of a licensees' problem identification and resolution process. Further the ROP baseline inspection program includes a variety of inspection procedures that address licensee design and modifications, such as Inspection Procedure IP 71111.21, "Component Design Bases Inspection." Additionally, an NRC safety review for the license renewal period is conducted separately and is part of the current operating license basis. When performing its review to renew an operating license of a nuclear plant, the NRC staff uses the standard that there is a reasonable assurance that the activities authorized by a renewed license will continue to be conducted in accordance with the current licensing basis for the facility. It reviews the application to see if there is reasonable assurance that the applicant has identified the components affected by aging and has demonstrated that adequate aging management practices are in place for those components for the extended term. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: Impact of Deregulation on Plant Safety: One of the major changes that has occurred since the GEIS was issued in 1996 is deregulation of the electricity market. As the electric utility industry is deregulated, safety margins may be compromised as licensees or utilities cut costs to remain competitive. One troublesome example of cost-cutting measures is curtailing maintenance programs, thereby reducing safety margins. The pressures for cost-cutting measures can be very high. The 1999 GAO report stated that as many as 26 of the nation's nuclear sites are vulnerable to shutdown because production costs are higher than the projected market prices of electricity. As a result, electricity production schedules, plant safety objectives, and cost reduction goals may conflict with one another. Therefore, license renewal evaluations should include an evaluation of the licensee's commitment to plant safety over and above the potentially conflicting goals of plant electricity production schedules and cost reduction. NRC must clearly state the goals and performance measures for which the licensees and plant operators and safety personnel will be held accountable. (LRG-S-60-E-12)

Response: *The comment relates to corporate liability and energy deregulation and their potential effects on operational safety. NRC requirements and regulatory processes are unaffected by deregulation, and the industry is held to the same high standards that existed prior to deregulation. Operational safety issues are considered outside the scope of this environmental review. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: Anyway, what can we do with all your impact statements regarding terrorism. This is a heavy issue, dudes. (LRG-S-06-AT-7)

Comment: Security. (LRG-S-13-LA-2)

Comment: Until it can be proven that the nation's reactors, and control rooms, and spent fuel storage could prevent or withstand a similar or more powerful terrorist attack [9/11], like a Learjet filled with C4, the purpose and need for the generic environmental impact statement update is not clear. If our consideration of license renewals is a waste of resources, then the renewal process should be terminated. However, should this agency continue relicensing, proceeding with criminal recklessness with no guarantee against a successful attack, then the GEIS update should address the impact of a catastrophically successful terrorist attack. (LRG-S-16-BO-10)

Comment: They are not required to or are able to resist or defend for an air attack. So we have this nonsense of the Commissioners trying to come up with new analysis of how rigid the reactor building is. Well, who cares. You don't have to hit the reactor building. There are softer targets that are necessarily for that fuel pool to keep going, and the reactor, such as the control room, the switch yard, and I could give you some other clues. I used to be a housewife. That is a joke isn't it? And so then you say, well, we will rely on the security at Logan Airport, major airports. That is ridiculous because we have all these secondary airports. You don't need a jet. You just need a small plane that is fuel laden and you have done the job. And so if you don't do what Congressman Markey and Senator Clinton, for example, are asking for, Avenger missiles on site, like we had at the Olympics, the summer Olympics and the winter Olympics, and they are hanging out around the White House at various times, if you can't come up with 65 for the 65 operating sites, then you are not taking it seriously. (LRG-S-17-BO-15)

Comment: The increased threat of terrorist attacks must be taken into account. Licensees must demonstrate that they have the means to resist an attack on the reactor building, and support structures, and spent fuel. (LRG-S-26-BO-2)

Comment: Through its design basis policies the NRC has taken the stance that protecting the fuel supplies is not the responsibility of the reactor operators or a condition for licensure. This flies in the face of common sense. (LRG-S-28-BO-5)

Comment: People are raising safety and security vulnerability of irradiated fuel pools, vulnerability of dry cask storage, and the NRC says it is taking it off the table already. That is what the Commissioners have decided. So what is this process about? I mean, this is unconscionable. It is unconscionable. It is unethical. That us poor people come here and say please do something for us and you have taken it off the table already. And in fact at a Commissioner's meeting, you made clear -- Commissioner McGaffigan made clear that he wanted the sense of the vulnerability of irradiated fuel pools to be attacked. That was the position that he took on it, without having an analysis done. So we are here in fact attempting to get a fair and reasonable process in which the NRC has already stacked the deck about what they are going to do. (LRG-S-30-BO-2)

Comment: The power plants and the security that is provided by the power plants needs to be improved. I mean, you have security guards that are walking out on strike because they feel like they are overworked. And this is something that is a serious problem if they can't protect the plant, and then we are all in danger, and that is something that is universal to all plants. (LRG-S-27-BO-2)

Comment: My main concern here today as a member of the Citizens Awareness Network is the security and the immediate need to do something about the irradiated fuel stored on site at nuclear facilities. As we all know, September 11th brought wide-scale threats to our infrastructure and full into our vision, and not that they weren't there before obviously, including those to these nuclear facilities. (LRG-S-28-BO-2)

Comment: The terrorist attack risk can only be reduced or shall we say mitigated by reducing the density of nuclear fuel in storage areas, or in other words spreading it out a bit, breaking the waste into multiple storage areas so you have a bowling pin here, and a bowling pin here, and not the strike that Ms. Lampert was mentioning.

And then armoring the resulted distributed containment. Hardened on-site storage systems would ideally consist of a dry storage canister of waste reinforced by concrete and steel, and protected by concrete, steel, and mounds of gravel, separated in space to prevent serial damage, and designed and tested to withstand reasonably foreseeable artillery and air attacks, and car bombs. The NRC has a responsibility to protect the American people from this clearly preventable terrorist threat by requiring the implementation of hardened on-site storage systems for irradiated fuel as a condition of any and all licensing of nuclear power generation facilities, be it licensing or relicensing. (LRG-S-28-BO-6)

Comment: 9/11 changed the world, and it is imperative to assess the impacts of that in the relicensing process. Simply put, the NRC needs to reopen the GEIS process to fully evaluate the risks of a potential terrorist attack. (LRG-S-29-BO-1)

Comment: We recognize that at the margins there are certainly some specific details that may be too sensitive not to be kept confidential, but we want to stress that otherwise the question of the potential risks that are posed by an attack on a nuclear plant should be fully debated in an open and democratic process as NEPA requires. (LRG-S-29-BO-3)

Comment: Since the tragic events of September 11, 2001, have greatly increased. We know that terrorists have considered targeting nuclear power plants as a form of attack. We also know, as the NRC has conceded, that U.S. nuclear reactors were not designed to withstand terrorist attacks of the scale and type as those committed on 9/11/01 and therefore it is questionable, at best, that a reactor would be able to endure a similar type of attack and not suffer significant damage that could result in a radiological disaster. The NRC should thoroughly evaluate the environmental impacts of a potential attack both in an update to the Generic Environmental Impact Statement and in the site-specific reviews of particular applications for license extension. For the NRC to continue to dismiss security-related contentions as a statistically incalculable probability and outside the agency's mandate would be irresponsible in the extreme. NRC environmental impact assessments should consider the security vulnerabilities of particular design and location features, on account of which extended operations at certain reactors pose unacceptable hazards.

The NRC should also reassess the vulnerability of nuclear power plants to more conventional attacks and internal sabotage, and the associated potential environmental impacts, in light of the reality that the facilities have had such a dismal performance record in advance-noticed "force-on-force" OSRE testing. .(According to the Union of Concerned Scientists, nearly half the reactors tested between 1991 and 2001 failed to protect equipment necessary to prevent a meltdown against small groups of mock intruders, even under relatively lax test conditions.) (LRG-S-43-E-1)

Comment: The NRC should use this "scoping" process as an opportunity to reassess both internal and external/terrorist vulnerability and the associated potential environmental impacts. The reality that nuclear facilities have had such a dismal performance record in advance-noticed "force-on-force" OSRE testing is frightening. (According to the Union of Concerned Scientists, nearly half the reactors tested between 1991 and 2001 failed to protect equipment necessary to prevent a meltdown against small groups of mock intruders, even under relatively lax test conditions.) (LRG-S-44-E-6)

Comment: In this post 9/11 era, the NRC needs to take seriously the possibility of a terrorist attack on a nuclear plant and needs to require a study of the environmental impacts of a terrorist attack from land, sea or air when it is licensing or re-licensing a nuclear reactor. (LRG-S-50-L-1)

Comment: Post-9/11 Terrorism Issues: Similarly, although NRC addresses nuclear power plant security issues outside of the power plant license renewal proceedings, the communities surrounding nuclear power plants are very concerned that plants may be vulnerable to multiple assaults and/or terrorist attacks by a large aircraft. The quantities of spent fuel accumulated and stored onsite with extended plant operation are far greater than originally envisioned when the plants were first licensed. With nuclear power plant license renewal, the large quantities of spent fuel accumulating onsite could pose a richer and more attractive target for potential terrorists.

The revised GEIS should recognize that environmental impact analyses and safety issues have changed significantly since Sept. 11. Although much of the information related to security issues with respect to nuclear power plants is considered “safeguarded” information, sufficient information should be provided during the license renewal process on whether all reasonable efforts are being made to minimize the risk of a potential terrorist attack. The environmental impact review for license renewal should include a meaningful analysis, excluding information that could compromise plant safety or security, of the potential risk and environmental impacts from a large-scale terrorist attack on a plant. (LRG-S-60-E-2)

Comment: Increased Security Risks Associated with 20-year License Extensions

The Commission must reconsider its unfair and unfounded treatment of security issues and contentions in context of the 20-year license extension process.

The Commission currently disallows license renewal contentions based on security issues and the associated increase in risk to public health, safety and the environment on the basis that terrorism is “too speculative” to be raised under National Environmental Protection Act. The Commission’s dismissal is unfounded by fact that President George Bush disclosed in a State of the Union speech that a credible threat to U.S. nuclear power stations exists from the al Qaeda network.

The threat to nuclear power stations from high-jacked, stolen, or rented cargo plans from general aviation fields is not currently evaluated for the risk posed to public health, safety and environment by security gaps or none existent security. The Federal Aviation Administration is no where near assessing the threat posed by acts of terrorism directed from general aviation fields against critical infrastructure, namely nearby nuclear power stations.

The Commission must therefore provide for a concerned and affected public to assess, address and contend under the National Environmental Protection Act the associated risks from terrorism to a site-specific licensing proceeding as Category 2 items. (LRG-S-62-E-5)

Comment: Security

In the past two years, there has been a significant change in the potential for, and public concerns about, terrorist activities. We recommend that the GEIS acknowledge this change and address the implications for license renewal, as these issues are very likely to be raised in license renewal proceedings for individual plants. This should include not only spent fuel shipments, but also nuclear reactors and any storage facilities for on-site spent fuel and LLRW. (LRG-S-65-E-3)

Comment: The SLO GREEN Party is particularly concerned with the threat the high level radioactive waste ("spent fuel") pools represent to surrounding communities. Especially, the possibilities of fires, due to the flammable nature of zirconium alloy in the cladding, has only been recognized by the NRC since its finding in October 2000. Unfortunately, the NRC has downplayed the significance of its own findings ever since. In light of 9/11, this finding has gained even more importance because, unlike the reactor domes, the pools lack containment and sufficient structural strength of their housing. This applies for the Boiling Water Reactors because their pools are usually located several stories above ground with the possibility of total drainage of the crucial cooling water. But Pressurized Water Reactors are also more vulnerable than the NRC has recognized so far where the possibility of partial drainage exists. Take for example the Diablo Canyon Nuclear Power Plant in our County: PG&E claims that the pools are safe because the spent fuel is stored below ground. While technically true by less than 1 foot, 25 feet of the cooling water in the pools are above ground level at Diablo, according to PG&E information. Draining the top 25 feet could cause a dangerous partial drainage with the results of the remaining water temperature reaching the boiling point. Additional water could be siphoned off by terrorists. More water will boil away. The NRC finding from 10/2000 found the critical water level for boiling just 3 feet above the top of the assemblies, that's more than 2 feet more than at Diablo if the water drains to ground level. In addition, partial drainage could result in the explosive build-up of hydrogen gas!

All of these problems are avoidable at reasonable costs by returning the pools to their original "low density" design combined with "hardened" dry cask storage.

Are any such alternatives being taking into consideration? (LRG-S-66-E-3)

Comment: Currently, Vermont Yankee and Pilgrim both store irradiated fuel in highly vulnerable configurations and irradiated fuel pools are present in 65 reactor sites throughout the United States. Without going into great detail, a terrorist attack using conventional weaponry could easily penetrate the external walls of most irradiated fuel storage systems and drain their cooling water. As these facilities typically concentrate all or nearly all of the waste from a single reactor in a single area, the water cooling loss could result in ignition of the irradiated fuel and the resulting fire could distribute more than a thousand time the radiation released during the Hiroshima bombing. A report commissioned by CAN calculated that such an attack on Vermont Yankee could render 24,000 square miles uninhabitable. As radiation doesn't know any borders, this would conceivably include parts of Quebec and Ontario, rendering this an international hazard. (LRG-S-28-BO-4)

Comment: My question is regarding safeguards for highly radioactive spent nuclear fuel. What if anything is being done to assure communities where these plants are that the storage is indeed safe? (LRG-S-15-LA-1)

Comment: This [license renewal] is unconscionable considering the facts... that nuclear reactors are on terrorist’s short lists. (LRG-S-37-E-7)

Comment: None of this matters to the NRC – these issues are “off the table.” NRC is either “studying them” or again have played the “risk-assessment game” – put false assumptions in the equation and, no surprise, get false answers out of the equation. (LRG-S-37-E-8)

Comment: The NRC made it clear in the design basis threat -- regulations have been put through basically that they will not make licensees meet post-9/11 attacks. I mean, that is right in there, and that in fact the military has to deal with that. It is right in the document. So although the NRC's job is to increase not just public health and safety, but it is also to make us have confidence in the agency that they are doing their job. You are at an all time low, and you need to know that, because we don't have any confidence at this point, and that you say that the GEIS is separate. Well, we have experienced it as just schizophrenic, and if the process isn't stopped to actually deal with reality, then all you have is just a bunch of paperwork that someone can make look good in the end, and we are still stuck with the terrorism. And we are still stuck with the vulnerability, and all you have done is push a bunch of papers and said it is okay. And it is not okay with us, and they have increased security, and I am really glad for that. I am glad for everything that they do, but it is nowhere near enough, and I have no confidence in the Commission given the clearly political and bias stance that they are starting with. (LRG-S-30-BO-9)

Comment: And what is mentioned in this generic issue that the Mark-1's are the most flawed reactors in terms of a vulnerable attack on the reactor, and of course we have the Pilgrim reactor, and we have Millstone, and we have Vermont Yankee. They have fuel pools dangling.

I shouldn't say dangling, but they are supported 6 or 7 stories up in the air, and in effect an attack on one of them would give the best bang for the buck in certain ways, because what you would have is the whole thing crumbling to the ground, and our expert has estimated that an attack on Vermont Yankee, just a medium-sized reactor, would in fact contaminate 25,000 square miles, making that area uninhabitable for decades. Now, I think that this is a generic impact issue personally, but I may be biased because I lived there. (LRG-S-30-BO-4)

Comment: And no safe, terrorist-proof container or route has been found to transport the nation's stockpiles of irradiated fuel rods to the proposed Yucca Mountain, Nevada, site. (LRG-S-63-E-3)

Comment: Re-licensing should not be permitted until…there are strict standards for hardened dry cask storage that will require these casks to be able to resist a determined terrorist attack. (LRG-S-50-L-7)

Comment: Moving right along, with the reactors we have 103 predeployed dirty bombs. (LRG-S-06-AT-6)

Comment: I would like to encourage some method of ensuring that prior to a licensing for those plants that are currently -- and I am sure that there are many of them out there, and I know that Pilgrim is one of them, but that are utilizing very high density storage, which potentially should a mechanical problem or a personnel problem, or a terrorist act, god forbid, happen, the conclusion of that could be catastrophic to a wide area.

So one of the things that I would like to suggest is if we can strongly look at the dry cask storage as a passive way to hold our spent fuel without relying on mechanical means. (LRG-S-22-BO-4)

Comment: With respect to the terrorist threat and the Federal Government's disclosure that nuclear power plants are known targets, we need to reevaluate emergency planning at the local, State, and Federal levels. (LRG-S-26-BO-12)

Comment: Moreover, NRC studies have found possible impacts up to 500 miles from the sites in the event of a spent fuel pool fire. Yet PG&E tries to convince the public that terrorist attacks on Diablo are unlikely due to the unpopulated area within 5 miles around the plant. The NRC has every obligation to inform the public about the true ramifications of such an attack and should put a stop to misleading public relations statements by the operators. (LRG-S-66-E-4)

Response: *Security measures are dealt with on an ongoing basis and are therefore part of the current operating license basis. Prior to September 11, 2001, the security measures in place provided reasonable assurance that the health and safety of the public would be protected in* *the event of an attack that involved radiological sabotage. The security measures were designed to protect against the threats described in 10 CFR 73.1. However, since September 11, 2001, the defensive capability of the nuclear power industry has been significantly enhanced. The NRC issued orders requiring security enhancements, conducted a three-phase audit of licensees' security programs in the weeks following the terrorist attacks, improved the process for conducting background investigations of new employees at nuclear power facilities, and initiated a number of studies related to the protection of nuclear material and facilities. The NRC also initiated a number of studies on the effects of a crash of a large commercial aircraft into a nuclear power plant. The NRC has also issued more than 60 advisories to its licensees describing changes in the threat environment and providing guidance on ways to enhance security.*

Major actions undertaken by the NRC since September 11, 2001, have included the following:

- *Ordering plant owners to increase physical security to defend against a more challenging adversarial threat,*

- *Requiring strict site access controls for personnel,*

- *Requiring licensees to conduct vehicle checks at greater stand-off distances,*

- *Improving liaison with Federal, State, and local agencies responsible for protection of the national critical infrastructure through integrated response planning,*

- *Enhancing communication and liaison with the intelligence community,*

- *Improving communication between military surveillance authorities, the NRC, and its licensees to prepare power plants and to effect safe shutdown should it be necessary,*

- *Ordering plant operators to improve their capability to respond to events involving explosions or fires,*

- *Enhancing readiness of security organizations by strengthening training and qualification programs for plant security forces,*

- *Enhancing force-on-force exercise to provide a more realistic test of plant capabilities to defend against an adversary force, and*

- *Working with national experts to predict the realistic consequences of terrorist attacks on nuclear facilities, including one from a large commercial aircraft. For the facilities analyzed, the results confirm a low likelihood both for damaging the reactor core and*

> *releasing radioactivity that could affect public health and safety. Even in the unlikely event of a radiological release due to a terrorist use of a large aircraft against a nuclear power plant, the studies indicate that there would be time to implement the required onsite mitigating actions. These results have also validated the offsite emergency planning basis.*

In addition, the NRC works with a variety of other Federal agencies, in particular the Department of Homeland Security and the Homeland Security Council, to ensure that security around nuclear power plants is well coordinated and that responders are prepared if a significant event occurs. If an event were to occur, the NRC would coordinate the resources of more than 18 Federal agencies in response to any radiological emergency.

Comment: I know that some of these concerns about security issues and what not are maybe outside the scope of what you guys are charged with here tonight, but it is obviously a concern, and what I want to know is where is the opportunity for public participation in that part of the process. (LRG-S-31-BO-2)

Response: *The NRC's environmental review is confined to the environmental matters relevant to the extended period of operation requested by the applicant. Safety and security matters are outside scope of this review. The NRC considers public involvement in, and information about, our activities to be an essential element of our regulatory process and recognizes the public's interest in the proper regulation of the nuclear industry. Information on opportunities for public involvement can be obtained at: http://www.nrc.gov/public-involve.html. The comments provide no new information and, therefore, will not be evaluated further.*

Comment: Criticality of the vessels, I think that should be put in the information the next time. (LRG-S-08-AT-2)

Comment: I want to talk about on Page 16 of the transporting spent fuel, the pamphlet [NUREG/BR-011, dated 1987], and on Page 16 on the lower right-hand part of it where it talks about for the purpose of this study all of this material was assumed to be released from the cask, although in reality a large part of the fungible fraction would play out or adhere to the surface within the cask. (LRG-S-08-AT-1)

Comment: Quality Assurance for Cask Manufacture: The potential radiological impacts from dry cask storage systems are a direct function of the structural integrity of the casks when subjected to stress under normal and accident conditions. Allegations have been made to the NRC regarding certain manufacturing and design code violations, Quality Assurance program violations, and reliability problems of the casks. Since safety depends on performance of the casks to design standards, the environmental review for license renewal should discuss extended spent fuel storage onsite, including dry cask storage, and describe on a plant-specific basis what assurances, for example, quality assurance programs, will be provided to help ensure that casks used for storing this fuel will be built to design specifications and will perform as designed. (LRG-S-60-E-9)

Response: *Transportation and storage casks are the subject of a separate licensing action and are outside the scope of the environmental review. An NRC-approved cask is one that has undergone a technical review of its safety aspects and been found to meet all of the NRC's requirements in 10 CFR Part 71. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: There are other specific concerns we had related to environmental analysis that we felt were important to be looked at. They relate to looking at drought impact. We have in Georgia the issue of drought, those concerns come up some seasons, and flooding comes up, so flooding impacts are an issue as well, looking at the dams upstream and where there could be flooding occurring and some breakage that can be devastating below, to the reactor area below. (LRG-S-02-AT-11)

Comment: So the only additional items that I can tell you that I think really are missing in your rule, whether it's for 25 years or 60 years, one is climate change considerations. (LRG-S-04-AT-10)

Comment: I'm suggesting that the severe weather and parameters of our climate that are changing impact reactor operations, and if you look at Catawba having to warn the Public Service Commission in South Carolina that they might have to go off line because of the drought lowering the water levels in the Catawba River, raising the temperatures in Lake Wylie, making it nearly impossible for them to cool their reactors you will have a concrete example of why this should be included as both the generic and site-specific bases. (LRG-S-04-AT-11)

Comment: In your environmental assessments, it seems that you take into account the effect on the nuclear plant on the environment, but I have not seen a reversal, and the effect of projected environmental climate changes on the nuclear plant. And I think that this is an issue that should be looked at, because we pick up the paper and excepting our President, George Bush, who apparently doesn't read, it seems that it is pretty evident that we are seeing an increase, a rise, in ocean water levels, and more severe coastal storms, erosion, and there are all of these issues and projections that clearly should be assessed in looking at license renewals, particularly on a category of nuclear plants that are on the ocean and would expect to be subjected to this. (LRG-S-17-BO-12)

Comment: Despite ongoing warnings, the nuclear industry and the Nuclear Regulatory Commission have failed to thoroughly analyze the multiple environmental impacts these accelerating climate changes will have on reactor operations, as well as the ways that it will change the type and magnitude of impact that the reactors have on their external surroundings.

Analysis of climate change must also include an analysis of the increased potential of Station Blackout by virtue of projected increased numbers of hurricanes, tornadoes, drought induced ground and forest fires, and other severe weather impacts...Because of the climatic impact on a variety of service and receiving water conditions (salt versus fresh, depth, available volumes, etc.) NIRS is opposed to categorization of the environmental impact as a Category 1 item. As each site can be uniquely impacted by climatic change thus NIRS contends that climatic changes need to be addressed as a Category 2 items. (LRG-S-62-E-12)

Comment: Less Than Thorough Analysis for Climate Change and the 20-year Extension of Nuclear Power Operations

The collective activity of the human race is in the process of altering the climate of the Earth. The nuclear industry does not dispute this fact and even goes so far as to make the claim that nuclear power can contribute to efforts to avert global warming. It is widely understood that mitigation can only change processes in the future, beyond the coming decade or two and perhaps longer. The effects of past human activity including air emissions will govern the changes in weather patterns now being documented and those for the license extension periods. The global outlook is increasing severity in weather patterns, particularly storms both in number and severity, increased temperatures, receiving water levels, precipitation and other variables. An article that appeared in the Washington Post linked higher temperatures from global warming to the melting of most of the Arctic’s summer icecap by the end of the century. The three year international study indicated that ice around the North Pole shrunk by 7.4% in the past 25 years with a record small summer coverage in September 2002.

Global warming was recently documented to have significantly changed government operations related to nuclear waste management in Russia. The Atomic Energy Ministry had approved the construction of a US$70 million nuclear waste storage facility on Novaya Zemlya in June 2002. Climate change was cited as “instrumental in Russia's decision not to construct a nuclear waste storage facility on the island of Novaya Zemlya in the Arctic Ocean. The decision puts an end to plans Russia has been formulating for more than a decade.”

Another area of concern is the once-through cooling system for nuclear power stations. Once-through cooling is widely used throughout the U.S. nuclear industry; 48 units rely exclusively on once-through cooling systems. Eleven units utilize a combination of once-through with cooling tower assistance. A typical once-through cooling system takes in on the order of 1 billion gallons of water per day per reactor unit. The water temperature must meet criteria to adequately service the condenser for the steam line in order to efficiently cool the reactor. Obviously, warm water is less efficient as a cooling agent. As the lake or river temperature goes up, the ability to cool the steam exiting the turbine goes down. The condenser becomes less and less able to convert the steam back into water. The pressure inside the condenser rises (it is at a vacuum to the atmosphere to help it pull the steam out of the turbine). If the condenser pressure rises too far, the steam "loiters" in the turbine longer than it should. This can damage the turbine. So, the turbine automatically trips on high condenser pressure. As such, service water temperatures warmer than specified can lead to unsafe operational conditions within the reactor.

For example, as a result of the summer of 2003 heat wave, the French and other European nuclear power stations were adversely impacted by a severe heat wave which has increased river water temperatures by 9° F (5° C). The crisis over nuclear safety at French reactors as rising atmospheric and water temperatures soared demonstrates the concern for prolonged climate change impacts that can defeat efforts to adequately cool the nuclear power stations. Moreover, nuclear power station operators are seeking relaxations to thermal pollution permits in order to discharge warmer coolant water that in fact will have an adverse effect on aquatic and marine habitat and wildlife. (LRG-S-62-E-11)

Response: *The comments identify concerns related to the effects of climate change on operations and operational safety at nuclear power plants. The NRC's environmental review is confined to environmental matters relevant to the extended period of operation. Operational safety issues are considered outside the scope of this environmental review and, therefore, will not be evaluated further. The Revised GEIS will evaluate environmental impacts, including direct, indirect, and cumulative impacts, anticipated to occur during the license renewal period. As part of this evaluation, climate change and its potential effect on operational effects will be reviewed.*

Emergency Preparedness

Comment: Emergency preparedness of reactor communities and all communities on the transport route. (LRG-S-13-LA-6)

Comment: The assumptions about emergency planning that held sway when present reactors designed their emergency preparedness plans, they presumed sufficiency of a 10 mile zone, and no awareness of shadow evacuation, blissful ignorance of the power of coordinated, multi-pronged terrorism, to name a few, those assumptions are now antiquated and all licensees should be required to develop new, independently approved, emergency preparedness plans, which plan for today's conditions, and those anticipated at the end of their relicensed period. (LRG-S-16-BO-14)

Comment: One of the big, big concerns in all of our communities are evacuation plans, and emergency preparedeness, especially since 9/11. Everything has really, really changed. The government has now said that we can give KI, potassium iodide, to a 20 mile radius. There are people who are very, very concerned that we couldn't even evacuate in a 10 mile radius. What are you planning to do about the shadow phenomenon of evacuation? (LRG-S-23-BO-1)

Comment: This is a very emotional issue for me and if I offend anyone, my comments are directed to the Nuclear Regulatory Commission and not to any individuals present. And my other prefacing comment is that I wanted to thank the Nuclear Regulatory Commission for reversing its position of 20 years, and no longer opposing the stockpiling of potassium iodide. Welcome to planet earth, and now I know that you really do care about human safety. (LRG-S-16-BO-1)

Comment: It really is a serious issue. These plans around plants have never ever been tested. There are exercises where the NRC and utility management get together at their EOCs, and their evacuation centers, and they have a paper plan. But if you talk to parents around nuclear facilities and you say to them, well, your children in the school are going to be bused to some reception center and you may be bused to another reception center, why can't we test these plans? It has been a problem that the NRC has just swept under the rug for years. I know that. I was a Selectwoman when the Seabrook Nuclear Power Plant's were written. I worked on those plans and I know that they cannot possibly work. The infrastructure is not there to evacuate people. On the 4th of July, we had 100,000 people on Hampton Beach at the fireworks. Your own FEMA, Ed Thomas, years ago said that evacuation plans could not work in Massachusetts. Governor Dukakis refused to submit those plans and I really think that it is an environmental issue. You may disagree with me, but I would like to have you certainly take a look at it. (LRG-S-23-BO-2)

Comment: This spring our town passed a public advisory question, asking that we be put in the emergency planning zone. We are 30 miles as the crow flies from Pilgrim. And your job is to ensure public safety and that the public is protected, and I don't even know why the plant was licensed in the first place because the public safety is not protected. (LRG-S-24-BO-1)

Comment: Former FEMA Director, James Lee Witt, was asked by the New York Governor to evaluate emergency planning for Indian Point, and concluded that, quote, the current radiological response system and capabilities are not adequate to protect the people from an unacceptable dose of radiation in the event of a release. His conclusions should be applied to other facilities and evaluated in the GEIS. For example, the radiological emergency plan covers the 10 mile radius around each reactor. However, radioactive collusion from a release can be dispersed much further. Additionally, population and traffic congestion is far different today and will be different over the next 30 years than when reactors were originally licensed. (LRG-S-26-BO-11)

Comment: We do not have realistic evacuation plans. If we are talking about a fast breaking attack, and then the ability to actually move people out of an area has to be addressed realistically, and if you are going to relicense, then there has to be proof that the plan is going to work. Otherwise, they can't get relicensing. (LRG-S-30-BO-5)

Comment: This [license renewal] is unconscionable considering the facts... that emergency plans are not worth the paper that they are written on. (LRG-S-37-E-6)

Comment: Serious attention must be given to the issue of emergency preparedness and evacuation plans for local communities surrounding nuclear reactors, in the event that a catastrophic accident or terrorist attack should occur. The recent brush with disaster at Davis-Besse and the clearly inadequate emergency and evacuation plans at the Indian Point reactor indicate that there are currently very real problems with reactors, reactor technology, licensees, emergency preparedness and NRC's ability to effectively regulate the nuclear industry. Yet, the NRC displays unchecked hubris in assuming that reactor structures and security are so very "robust," and the possibility of a catastrophic occurrence is so infinitesimally small, that the agency sees no need to impose any further "regulatory burden" upon licensees. I insist that if the NRC is to meet its primary mission to safeguard public health, more "regulatory burden" upon reactor licensees is essential. It is recklessly irresponsible for the NRC to even consider renewing the license for any reactor if these critical issues are not directly and substantively addressed. (LRG-S-43-E-3)

Response: *Emergency preparedness and planning are part of the current operating license and are outside the scope of the environmental analysis for license renewal. The NRC staff has an ongoing program for determining the adequacy of offsite emergency plans and is supported in that role by the Federal Emergency Management Agency (FEMA). Each nuclear plant must have an approved emergency plan in accordance with 10 CFR Part 50. Drills and exercises are conducted periodically to verify the adequacy of the plans. If a problem is identified, it is resolved in the context of the current operating license. The comments provide no new information and, therefore, will not be evaluated further. These comments will not result in a change in the GEIS.*

Economics and Need for Power

Comment: My question has to do with the assessment that occurs during relicensing, the relicensing process, assessment of the need for energy. And we addressed this some in our comments knowing that for Plant Hatch for example the Georgia Public Service Commission goes through a long-range planning process that it approves with a Southern Company affiliate every three years, and we know that the big picture was not including a relicensed Hatch, and the energy needs were stepped out and addressed through alternative supplies for the future, and it occurred to us that the NRC is not really the agency that would necessarily have the expertise to even address that question. The FERC deals with that, and the SEC in some ways deals with holding companies, but the NRC that's not your area of expertise, yet it's a category addressed and brought up as environmental issue because obviously the extension of the life of a plant has tremendous environmental impact, an adverse impact over many years. You mentioned during introduction topics such as emergent plants and issues that need to be resolved, and unbundling, and services, and deregulation, and you know these are really big issues, and how is this being tackled if there's not that base of expertise to address those questions as part of relicensing. (LRG-S-02-AT-13)

Response: *The NRC does not address State-level energy planning decisions such as unbundling or deregulation. Instead, the NRC leaves issues of energy policy to other decisionmakers including State regulators, utility firms, and other Federal agencies, including the Federal Energy Regulatory Commission (FERC). The purpose of renewing an operating license is to provide the appropriate decisionmakers with the option of using the nuclear power plant to meet future energy needs beyond the current license term. The NRC's responsibility is to determine whether the environmental impacts of renewing a plant's license are so great that maintaining this option for future energy supply would be unreasonable. While deregulation and unbundling may affect utility economics or decision-making, it does not affect the environmental impacts of possible alternatives and, therefore, should not affect the NRC's review process. This comment addresses the scope of license renewal but provides no new information to the NRC, and will not be considered for the GEIS revision.*

Comment: Reliability and Integration with the Transmission System: The reliability of California's aging nuclear power plants is a significant issue in terms of their integration with and impact on the reliability of the entire transmission system serving the state. The nuclear power plants in California provide significant quantities of energy and capacity to the state's electrical system and help to maintain the overall stability of the grid. The environmental review during license renewal should evaluate on a plant-specific basis the potential impact on transmission system reliability from the closure of nuclear power plants in California. (LRG-S-60-E-7)

Response: *The NRC does not have jurisdiction over the reliability of the nation's electricity transmission system. Through provisions in the Energy Policy Act of 2005, this is a role that now belongs primarily to the North American Electric Reliability Corporation (NERC) and its regional councils. To varying degrees, other organizations like the FERC, as well as regional, State, and utility-level decisionmakers or regulators also play a role in grid reliability and integration. This comment is outside the regulatory scope of license renewal, and will not be considered in the GEIS revision.*

Comment: A cost benefit analysis of continued production of high-level radioactive waste in earthquake prone coastal zone. (LRG-S-13-LA-7)

Comment: Inappropriate exclusion of "economic" factors from the EIS process.

At the outset, we note that the NRC has artificially constrained the scope of its environmental review in a manner violative of the purpose of NEPA. At Section 1.7.2 and 1.7.3, the GEIS cites 10 C.F.R. 51.53(c)(2) and 51.95(c), in which the Commission effectively prohibits itself and any license renewal applicants from considering in the NEPA process the "need for power, the economic costs and benefits of the proposed action and economic costs and benefits of alternatives to the proposed action." The prohibition applies specifically to plant-specific Supplemental EIS's and applicants' environmental reports, which eliminates these issues entirely from the environmental review process because the NRC does not consider them in the GEIS.

An EIS is not intended to provide environmental information in a vacuum, but to provide it in the context of an overall decisionmaking process. Its purpose is to integrate environmental considerations into the decisionmaking process, not to divorce them from other decisionmaking criteria and treat them as a thing apart. It is entirely out of keeping with this purpose for NRC to exclude from consideration the set of issues it terms "economic" and thus irrelevant to environmental review – but which in fact should be at the heart of the decision whether to continue to rely on nuclear power in any given location. Not only is consideration of cost of alternatives standard in every other sort of NEPA analysis, it is essential. How can the agency judge whether an alternative is "reasonable," and hence must be included, without information regarding economic need and economic cost for that alternative? And how can the agency use the EIS process to weigh alternatives against one another when it has excluded from consideration essential factors in that weighing process, like the need for power and how much it costs?

This stacked deck is clearly convenient for the nuclear industry, which would prefer for the agency and the public to disregard the fact that nuclear power has repeatedly demonstrated itself to be one of the most costly and uneconomic sources of power on the market today; while renewable technologies have been steadily dropping in price. But it is not what the drafters of NEPA intended. The CEQ regulations clearly reflect an intention that economic considerations be considered in the weighing process – neither trumping the environmental considerations nor being completely divorced from them. See 40 C.F.R. 1502.23 (explaining the role of cost benefit analysis in an EIS, and stating, "In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision." Indeed, the GEIS itself, when dismissing certain mitigation measures as infeasible, cites cost of the measures weighted against potential environmental benefits (albeit using insufficient information) (see section 3.a., infra).

One of the issues identified by the NRC as "economic" – the need for power – is not even correctly characterized in that manner. In fact, the need for power is not merely an economic weighing factor in the decision, but should be at the heart of the "purpose and need" that drives the remainder of the EIS process. The Commission asserts in the "purpose and need" section of the GEIS, Section 1.3, that only states can ultimately determine whether power from a particular plant is needed. But if that is the case, NRC needs to work with state energy decisionmakers as co-lead agencies in the EIS process to determine the purpose and need for relicensing, either in the GEIS or on a case-by-case basis in Supplemental EISs. Abdicating an essential element of the EIS to non-federal decisionmakers, however, is not an option.

We therefore strongly encourage NRC to use the update of the GEIS as an opportunity to reconsider its ill-conceived regulations prohibiting the Commission and the regulated community from conducting the weighing process that NEPA intends. (LRG-S-61-E-1)

Response: *In drafting the initial GEIS, the NRC attempted to include considerations of economics and need for power, but State-level decisionmakers protested that the proposal overstepped the NRC's jurisdiction (see* Federal Register 28467 *of June 5, 1996). As a result, current NRC regulations, specifically 10 CFR 51.95 (c)(2), note that the issue of need for power does not need to be considered in license renewal, nor do economic costs and benefits, except insofar as economic costs and benefits are essential to determining whether an alternative ought to be included for analysis. Given State decisionmakers' comments and other input, including comments from CEQ and EPA, the NRC determined that "The purpose and need for the proposed action (renewal of an operating license) is to provide 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, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decisionmakers." The comment provides information on the scope of the GEIS, but the information is not new to the NRC. As such, it will not be evaluated further.*

Aging Management

Comment: While "incidents," accidents and disasters have been a part of the nuclear industry since its inception, many problems at reactors today are age-related. Nuclear reactors are machines that operate at enormous pressure and intensity, and every part must be able to withstand not only the pressure and intensity, but also the toxic and radioactive stew that flows within it. Rapid aging – and failure – of equipment is the nature of nuclear reactors. Owner-operators are generally reluctant to replace parts, as that often interferes with production (and revenue) and occasionally even requires a plant to shut down. Instead of placing a priority on safety and security, the industry is charging full speed ahead, applying for uprates (to run the plants at higher intensities) and license renewals. But most plants are showing serious signs of age-related stress and disrepair long before their initial license terms have expired. Even while the NRC continues to add new problems to a list of nuclear plant aging concerns (the Generic Aging Lessons Learned, or "GALL" program), it smoothly approves the uprate and license renewal applications, as if they are unconnected. As pipes disintegrate, crack, and leak, and corrosion and acid degrade vital plant components, all parties simply attempt (but fail) to keep pace as problems arise. Neither the industry or the NRC appear capable to predict or prevent potentially catastrophic problems, as evidenced by the massive corrosion in the head of the Davis-Besse reactor. Clearly, time is an enemy of these facilities, and a terrorist attack is not required for a disaster to occur. (LRG-S-48-E-3)

Comment: So my concern with this environmental impact statement process is that it doesn't answer, or doesn't address all of the issues, all of the environmental issues of relicensing the nuclear power plants.

For one thing I've asked questions about the vessels themselves that are not replaced, that cannot be replaced, and in the refurbishing that goes on right now at Oconee (they have three vessel heads, one of them has been replaced, Unit 3). They can replace all six of the steam generators, but they cannot replace the vessels that hold the reactor cores, or the fuel rods, and the vessels expand and contract, and expand and contract, and age, and they become brittle, and I haven't had any kind of satisfactory answers as to how the integrity of that whole vessel is tested. And so if anyone can help me with that I certainly would like to know how the integrity of the entire vessel itself top to bottom, inside and out is tested for the strength and flexibility and holding that powerful radioactive chain reaction that goes on in the fission process. (LRG-S-03-AT-4)

Comment: To begin with their original license and their tech specs are not being adhered to now, and so therefore they have to be adhered to. As far as I understand both the NRC and the industry have stated unequivocally that they do not have the technology to identify cracks, and that a crack can develop to the point where the component can break in one cycle. (LRG-S-17-BO-6)

Response: *The NRC staff has determined that the reliability of equipment would not change substantially throughout the life of the plant, provided that the applicant has aging management programs that conform to 10 CFR Part 54. The NRC has a well established process for license renewal. The regulations governing license renewal are based on two guiding principles. The first principle is that the current regulatory process is adequate to ensure that the licensing basis of all operating plants provides and maintains an acceptable level of safety. The second principle is that the current plant-specific licensing basis must be maintained during the renewal term in the same manner, and to the same extent, as during the original license term. In addition, a renewed license will include conditions that must be met to ensure aging of structures and components important to safety are adequately managed so that the plant's current licensing basis is maintained during the period of extended operation. The adequacy of* *these programs will be addressed in the Safety Evaluation Report developed under 10 CFR Part 54.*

Comment: [What is] the relationship between GALL process/product and this new venture? (LRG-S-53-E-1)

Response: *The purpose of the Generic Aging Lessons Learned (GALL) Report is to provide the technical basis for the* Standard Review Plan for License Renewal *(NUREG-1800). GALL contains the NRC staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components for license renewal without change. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. NUREG-1800 and NUREG-1555,* Supplement 1 *(the* Environmental Standard Review Plan *that provides guidance in implementing 10 CFR Part 51) in combination provide for a complete safety and environmental review for license renewal. Aging management is considered outside the scope of this environmental review and, therefore, will not be evaluated further.*

Comment: The impact of aging components. The impacts of climate - seawater and salt air intrusion over time. (LRG-S-13-LA-8)

Comment: There are dangers of continued operation of aging nuclear power plants. (LRG-S-13-LA-14)

Comment: Under postulated accidents, quite clearly age degradation of components has to be considered…And we know that these power plants have aged more rapidly than expected. We know that there are problems with tubes, and we know that there are problems with embrittlement. We know that there are problems with cracking. Cracking of shrouds, and cracking of this, and cracking of that. Type-304 stainless steel, which is used throughout the BWRs, for example, are problematic. So you put old horses out to pasture if they are not holding up for the 40 years, and how are they supposed to hold up for another 20? How can you deal with this generically when our nuclear power plants are not made out of the same cookie cutters, and as the GAO identified there is a long list of counterfeit and substandard parts that is now in use throughout the industry.

So how can you say that this part is going to have a certain expected longevity or what have you when you don't even know whether it is the original part that it is supposed to be, and there has been no requirement to follow through to replace counterfeit and substandard parts. (LRG-S-17-BO-5)

Comment: The NRC does not have an effective aging management program as degradation caused by aging is revealed through failures, rather than through condition monitoring activities. This is a reflection of poor design and bad process. It points to the shortfall of requiring less than adequate inspection technology and personnel. Furthermore, it points to the lack of diverse and multiple inspection techniques, and a pressing need for more periodic random inspections of less vulnerable areas. (LRG-S-25-BO-4)

Comment: Our nuclear fleet is old and tired. As in any other industry the nuclear industry is experiencing problems with wear and tear of components and systems. The industry is now plagued with age-related deterioration of mechanisms unique to nuclear power operations. Chronic exposure to extreme radiation, heat, pressure, fatigue, and corrosive chemistry are combining to cause a long list of mechanical problems. As nuclear reactors get older and are relicensed the chance of failure of this equipment only increases. Aging management programs are intended to monitor the condition of the equipment and structures and implement repairs or replacements when necessary to prevent failures. The long list of aging related failures since 2000, occurring about once every 60 days, indicates beyond a reasonable doubt that the aging management programs are inadequate because they are not preventing equipment failures. The NRC must ascertain the effectiveness of aging management programs, and not just merely the scope of these programs before granting license extensions. (LRG-S-26-BO-6)

Comment: The NRC cannot continue with the generic approach to age-related degradation issues for reactor licensing extension. Our nation's reactors are not made from the same cookie cutter. In addition, many reactor components have been identified by the GAO as counterfeit and substandard. Therefore, industry experience is not applicable.
(LRG-S-26-BO-7)

Comment: Deterioration of material integrity under the onslaught of neutron bombardment and heat has already degraded the useful life of nuclear reactors. (LRG-S-42-E-2)

Comment: The GEIS should take seriously the effects of age degredation of components of nuclear plants and not rely upon the past reliability of plants. As these plants age, more and more unexpected failures are occurring, like the near-accident at Davis Besse. Scientists cannot accurately predict when such failures will occur as they have never dealt with plants this old before. (LRG-S-50-L-3)

Comment: Aging NPP issues: Plant aging issues have been addressed generically in NRC's "Generic Aging Lessons Learned (GALL) Report" (NUREG-1801), dated 2001, as well as in the ongoing NRC investigation and follow-up regarding corrosion problems in the Davis-Besse pressure vessel lid and South Texas Project Unit 1. As we enter an era of large numbers of aging and refurbished nuclear power plants, it is important that NRC begin developing proactive methods for identifying safety problems before they become significant. There is a need for a system-wide review to identify preliminary or potential “anticipatory indicators” of safety problems related to plant aging to identify any trends before a major safety problem actually occurs. NRC should look at trends, such as repeated unplanned reactor shutdowns or component or system failures that might indicate that a safety problem is developing.

In license renewal application proceedings, individual plants should be evaluated in detail for aging-issues and trends, e.g., steam generator tube cracking, vessel head corrosion, and long-term problems and/or repeated failures in safety-related equipment including reactor coolant systems. In addition, the cumulative effects of marine salt spray corrosion should be evaluated for coastal plants, such as California’s nuclear power plants. (LRG-S-60-E-1)

Comment: Age-related Degradation Surprises Are More Likely With 20-Year License Extension at the Same Time the Agency Has Demonstrated To Shirk Its Regulatory Duty

The agency wrongly assumes that the license extension process and the associated environmental impact statements can adequately manage into the license extension period. In fact, events contradict such agency and industry assertions. The Davis-Besse operating license is explicitly conditional on the NRC's having found that the facility will operate in conformity with the Commission's regulations. There is ample evidence to the contrary. The Davis-Besse reactor was shut down from June 1985 through December 1986 undergoing extensive repairs to return the facility to conformance with the Commission's regulations. The Davis-Besse reactor has been shut down since February 2002 undergoing extensive repairs to return the facility to the Commission's regulations. NIRS contends that the agency and the example licensee have miserably failed in the present to adequately manage age-related degradation of safety-related systems, structures and components. NIRS, therefore, cites the failure of the NRC to hold the operators of the Davis-Besse nuclear power station to its licensing agreements with regard to boric acid corrosion control and the subsequent unanticipated near failure of the primary pressure boundary at the its reactor vessel pressure vessel head. The NRC has reneged on its fiduciary responsibility to protect the public from a nuclear reactor operating outside of federal safety regulations.

Furthermore, an Office of the Inspector General report released in December 2002 concludes that the agency allowed Davis-Besse operators to place the company’s production agenda ahead of maintain reactor safety margins.

Aging nuclear power stations failure rates should therefore be anticipated to follow a Bathtub Curve where component failure rates are likely to unpredictably increase as reactors age and enter into the Break-down phase.

Critical age-related degradation mechanisms are not adequately understood to make the claim that the agency can adequately manage degradation to the exclusion of contentions in a site specific license extension proceeding. The predictability of crack initiation and crack growth rates in safety related components is presently unreliable. (LRG-S-62-E-6)

Comment: There has been an increase in unanticipated failure events that have significantly undermined critical industry and agency-held assumptions regarding degradation mechanisms.

The public has therefore lost confidence in the NRC’s willingness to regulate and enforce licensing commitments and corrective action programs. (LRG-S-62-E-7)

Comment: Pertinent to the issue of whether or not the country's fleet of 104 nuclear reactors should have their licensees renewed for another 20 years - and their actual and potential environmental impacts- is the question of how safely they have operated thus far. How much does NRC know about their rates of deterioration, and what are the risks when particular components do deteriorate? Considering the close call at Davis-Besse, the answer is not nearly enough. This is particularly relevant to NRC’s GALL (Generic Aging Lessons Learned) program to evaluate age-related degradation at reactors. It appears that new issues surprise the NRC (such as those at Davis-Besse, and South Texas 1) at a rate faster than old issues are closed (such as steam generator tubes). Nonetheless, the NRC is all too accommodating to the industry as reactor licensees put in applications many years in advance. Davis-Besse is a relatively young reactor, which began operating in 1978. It has recently been listed as a planned 2004 applicant for license renewal, despite the fact that its original 40-year license does not expire until 2017. Is it not ill-advised to consider license renewals on reactors that have not even been able to demonstrate an ability to function safely for their original license term? (LRG-S-43-E-4)

Comment: Why were the cracks at Oconee discovered after renewal? (LRG-S-04-AT-7)

Comment: Why was Davis-Besse allowed to go for five years with corrosion? (LRG-S-04-AT-8)

Comment: I think that the situation about Davis-Besse in Ohio is really unfortunate. I know that the Babcock & Wilcox company manufactured that reactor vessel, and a reactor in Texas where the bottom, a big part of it has got problems, and so to restore the public's confidence in the NRC when utilities with a B&W reactor vessel comes up for an extension, a license extension, tell them, yeah, you can have one, but you've got to buy a new reactor vessel, period. It's just that simple. You want us to really look, look at the NRC, they're looking out for us. And that's what you tell them. (LRG-S-08-AT-4)

Comment: In a nutshell that's what needs to happen, because we the public would like to know that the NRC is in fact really looking out for us because I know the NRC crowd at Davis-Besse were there in response to finding a football-sized hole in a six-inch-thick head with "Oh," and so that tells us that they didn't really know, or they did know and they tried to hide the fact, and they were letting the owner of the -- they were letting the people at Davis-Besse get away with it, and it's just real fuzzy there. So we were really worried that it could be worse somewhere else, and we would love to know with confidence that that's not going to be the case any more. (LRG-S-08-AT-5)

Comment: What has happened is that as an agency you have by polite suggestion thrown to the industry the caveat of we need to know if you are in compliance, because we honestly don't know if you are. (LRG-S-25-BO-5)

Comment: But these plants were dangerous to begin with, and after 40 years of operation under intense pressures, they are now susceptible to a variety of stress-related defects, such as the corrosion that ate through six inches of steel and nearly produced a disaster at the Davis-Besse nuclear station in Ohio. (LRG-S-54-E-1)

Comment: In addition, we have concerns that the NRC does not focus enough on the inevitable changes over the span of the next 50 years.

Re-licensing at Diablo would assure full pools until at least 2050. The populations near the plant can't afford a reactive mode by the authorities. The NRC is fully aware of the catastrophic consequences of a pool fire or a maximum severe reactor incident. Seismology is a science in flux. Population patterns are changing. The aging factor at the plants is not yet fully understood. Who knows what the political development will be over the next half a century, what kind of weapons will be in the wrong hands? (LRG-S-66-E-5)

Comment: I came in after the renewal of the Oconee Nuclear Plant, but I have questions about that process that went on when the time when I wasn't looking at it.

There were some questions that the NRC had for the Oconee Plant, and I haven't seen any documents available in the reading room about the responses in the licensing processes, and some of them and the aging effects of corrosion on structural steel, the rebar, and embedded in the concrete because of the accumulation of ingressive water through the cracks in the concrete that weakens the containment structure, and another thing was thermal fatigue, the effects that it has on the containment heat renewal system.

And perhaps these things have been -- another thing is providing the effects of temperatures and radiation on structural properties of the reactor cavities of spent-fuel buildings, and the spent-fuel buildings, and I don't know whether it's because of 9/11 that these responses aren't made public so that we don't know of any weaknesses that terrorists can get to, or what the reason is, but as someone concerned about what Duke Energy has to say in response to this, the fact that we might relicense them when we didn't hear how those issues were resolved. (LRG-S-03-AT-1)

Comment: What there also is in terms of the issues of age related degradation and also these power uprates that are going on, because in fact Vermont Yankee has gone for a 20 percent power uprate, and Pilgrim went for 1 or 2 percent. But Vermont Yankee is up there with the guys at this point now that GE has made it easier to operate larger amounts, and one of the issues in terms of the uprates and our concern is that in terms of an accident or an attack on a reactor, what the Union of Concerned Scientists has estimated is that 34 percent more contamination would be released into the environment, even though the uprate is only 20 percent, the amount of contamination released in an accident or in an attack would be 34 percent higher. That is an unacceptable increase in terms of vulnerability. (LRG-S-30-BO-6)

Response: *The NRC's environmental review is confined to environmental matters relevant to the extended period of operation requested by the applicant. Therefore, aging management is outside the scope of the environmental review. However, the license renewal inspection program consists of three separate inspections to support the decision on an application for license renewal. A scoping inspection and aging management inspection are conducted. An optional third inspection will be performed, if needed, to verify items identified by the NRC staff, Advisory Committee on Reactor Safeguards, and regional administrator that are needed to close open items from the technical review of the application or previous inspections. The inspection reports are available to the public through the NRC's Public Document Room in Washington, D.C.*

Comment: The plants were deemed by "Experts" to safely operate for 40 years. This too is now being ignored. Who are the "Experts" now busily doing the Companies bidding, when your job description is to protect the public. Who are the "Experts" with the mendacity to tell us that these plants can operate safely. (In spite of Bessie Davies and the numerous other "mishaps"). So now we have a new Department "aging management" .Is this to take charge of leaks, embrittlement, corrosions etc.? (LRG-S-41-E-2)

Response: *The Atomic Energy Act of 1954 specifies that licenses for commercial power reactors be granted for a 40-year period and allows for renewal of those licenses upon expiration of the original 40-year licensing period. The 40-year licensing period was not based on technical grounds or operating experience, rather it was based on economic and antitrust considerations. Current operational inspections ensure proper maintenance of leaks, corrosion, or embrittlement concerns. The license renewal inspection program, which is a separate programmatic action from current operational inspections and this environmental review, ensures that the applicant has demonstrated that adequate aging management practices are in* *place for components that will be in operation under the proposed renewed license. Aging management is considered outside the scope of this environmental review and, therefore, will not be evaluated further.*

Comment: Therefore, age-related degradation issues must be reconsidered as Category 2 items where contentions are admissible under NEPA in site-specific license extension proceedings. (LRG-S-62-E-8)

Response: *An aging management review for selected systems, structures, and components is required by 10 CFR 54.21. The NRC must have reasonable assurance under 10 CFR 54.29 that the effects of aging on the functionality of structures and components during the period of extended operation will be conducted in accordance with the current licensing basis. The Category 2 terminology refers to categorization of the issues identified in Table B-1 of 10 CFR 51 Subpart A, Appendix B. Age-related degradation is not specifically called out as one of the issues in Table B-1. The NRC will reconsider the contents of Table B-1 after completion of the revised GEIS. Aging management is considered outside the scope of this environmental review and, therefore, will not be evaluated further.*

Comment: Plant Hatch does have serious problems that it faces. It has a cracked core shroud, it has a problem with overflowing waste, the ISFSI which was set up, the independent spent fuel storage installation was a concern that we raised during relicensing process.

We were told that along with a host of other major issues were not really part of the scope of the site-specific analysis that would be taken up to look at the relicensing of Plant Hatch, but rather those were generic issues. (LRG-S-02-AT-2)

Response: *The commenter is correct in stating that aging management issues, such as a cracked core shroud, and independent spent fuel storage installation issues were outside the scope of the environmental review performed for the Plant Hatch license renewal. However, those issues are handled under the safety review.. They are evaluated each and every time a licensee applies for a license renewal or separately during placement of an independent spent fuel storage installation. Plant-specific aging management issues are evaluated under the license renewal inspection program and its associated activities authorized by 10 CFR Part 54. The licensing requirements and the associated activities of independent spent fuel storage installations are authorized under 10 CFR Part 72. This environmental review is performed in accordance with 10 CFR Part 51. The comment provides no new information and, therefore, will not be evaluated further.*

Comment: All that generic approach accomplishes is to effectively eliminate site specific public participation and intervention in the relicensing proceedings on aging issues. In turn, this approach eliminates independent experts and public review of the potential impact of age related degradation issues from the license extension process. It removes the affected public's discovery process and their ability to scrutinize and cross-examine industry and regulatory assumptions pertaining to aging safety components and public safety within the context of an adjudicatory proceeding. (LRG-S-26-BO-8)

Response: *The results of the NRC staff's safety review are available to the public. However, the highly technical nature of the staff's safety review does not lend itself to a public involvement process such as that used for the environmental review. As a result, there are no* Federal Register *notices related to an opportunity to comment on the safety review prior to its issuance. However, a draft Safety Evaluation Report is available electronically from the Publicly Available Records System (PARS) component of the NRC's Agency-wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. Additionally, the public can provide comments to the Advisory Committee on Reactor Safeguards (ACRS) on the NRC staff's review of the license renewal application in advance of the ACRS meeting.*

In addition, any person who believes he or she would be adversely affected by a specific reactor license renewal may request a hearing. Members of the public may also petition the Commission, in accordance with the provisions of 10 CFR 2.206, for consideration of safety issues during current operation and the period of extended operation of the plant.

Potential Allegations

Several potential allegations were raised at the LR GEIS public scoping meetings and were referred to the allegations coordinator.

Other

Comment: I have a question about liability. When the public raises a concern before the NRC, and let's just look at in dealing with generic environmental impact, and the NRC does not adequately set up protections that address those concerns that the public raised, who pays for the damage in terms of contaminated waterways that result and the host of environmental impacts that occur that can impact people's livelihood and their health? Who covers that liability? (LRG-S-02-AT-1)

Response: *The consideration of liability is outside the scope of this document and is an NRC policy issue. However, regulations are in place to minimize the occurrence and consequences of accidents and to respond to them if they occurred. The missions of the NRC include the protection of public health and safety and protection of the environment. The comment provides no new information and, therefore, will not be evaluated further.*

Appendix B

Comparison of Environmental Issues in the GEIS Revision to Issues in Table B-1 of 10 CFR Part 51

Appendix B

Comparison of Environmental Issues in the GEIS Revision to Issues in Table B-1 of 10 CFR Part 51

This appendix provides a comparison of the issues presented in the GEIS revision and those issues presented in Table B-1 of 10 CFR Part 51. For the most part, Table B-1 of 10 CFR Part 51 reflected the findings of the 1996 GEIS, although a few issues were modified or added after publication of the GEIS (e.g., environmental justice). The issues evaluated in the GEIS revision, their significance level, and their Category designation were presented in Table 2.1-1 and are included in Table B-1. Table B-1 of this appendix indicates the relationship between these issues and those in 10 CFR Part 51. Table B-2 shows those issues in Table B-1 of 10 CFR Part 51 that were eliminated from further consideration in the GEIS revision.

Table B-1. Environmental Issues and Findings in the GEIS Revision, and Related Issues and Findings in Table B-1 of 10 CFR Part 51

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Land Use			
Onsite land use	Small impact (Category 1). Changes in onsite land use from continued operations and refurbishment associated with the license renewal term would be a small fraction of any nuclear power plant site and would involve only land that is controlled by the licensee.	Onsite land use	Small (Category 1). 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.
Offsite land use	Small impact (Category 1). Offsite land use would not be affected from continued operations and refurbishment associated with the license renewal term.	Offsite land use (refurbishment)	Small or moderate (Category 2). Impacts may be of moderate significance at plants in low population areas.
		Offsite land use (license renewal term)	Small, moderate, or large (Category 2). Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal.
Offsite land use in transmission line rights-of-way (ROWs)	Small impact (Category 1). Use of transmission line ROWs from continued operations and refurbishment associated with the license renewal term would continue with no change in land use restrictions.	Power line right-of-way	Small (Category 1). Ongoing use of power line ROWs would continue with no change in restrictions. The effects of these restrictions are of small significance.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Visual Resources			
Aesthetic impacts	Small impact (Category 1). No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishment associated with the license renewal term.	Aesthetic impacts (refurbishment)	Small (Category 1). No significant impacts are expected during refurbishment.
		Aesthetic impacts (license renewal term)	Small (Category 1). No significant impacts are expected during the license renewal term.
		Aesthetic impacts of transmission lines (license renewal term)	Small (Category 1). No significant impacts are expected during the license renewal term.
Air Quality			
Air quality (nonattainment and maintenance areas)	Small, moderate, or large impact (Category 2). Air quality impacts of continued operations and refurbishment activities associated with the license renewal term are expected to be small. However, emissions during these activities could be a cause for concern at locations in or near air quality nonattainment or maintenance areas. The significance of the impact cannot be determined without considering the compliance status of each site and the activities that could occur.	Air quality during refurbishment (nonattainment and maintenance areas)	Small, moderate, or large (Category 2). 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

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Air Quality (cont.)			
Air quality (nonattainment and maintenance areas) (cont.)	These impacts would be short-lived and cease after projects were completed. Emissions from testing emergency diesel generators and fire pumps and from routine operations of boilers used for space heating would not be a concern, even for those plants located in or adjacent to nonattainment areas. Although particulate emissions from cooling towers may be a concern for a very limited number of plants located in States that regulate such emissions, the impacts in even these worst-case situations have been small.		expected to be employed during the outage.
Air quality effects of transmission lines	Small (Category 1). Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.	Air quality effects of transmission lines	Small (Category 1). Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
Noise			
Noise impacts	Small impact (Category 1). Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with the license renewal term.	Noise	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Geology and Soils			
Impacts of nuclear plants on geology and soils	Small impact (Category 1). Impacts on geology and soils would be small at all nuclear plants if best management practices were employed to reduce erosion associated with continued operations and refurbishment.	Not addressed	Not applicable
Surface Water			
Surface-water use and quality	Small impact (Category 1). Impacts are expected to be negligible if best management practices are employed to control soil erosion and spills. Water use associated with continued operation and refurbishment projects for license renewal would not increase significantly or would be reduced if a plant outage is necessary to accomplish the action.	Impacts of refurbishment on surface water quality (all plants)	Small (Category 1). 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 (all plants)	Small (Category 1). Water use during refurbishment will not increase appreciably or will be reduced during plant outage.
Altered current patterns at intake and discharge structures	Small impact (Category 1). Altered current patterns would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.	Altered current patterns at intake and discharge structures (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Surface Water (cont.)			
Altered salinity gradients	Small impact (Category 1). Effects on salinity gradients would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.	Altered salinity gradients (all plants)	Small (Category 1). 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	Small impact (Category 1). Effects on thermal stratification would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.	Altered thermal stratification of lakes (all plants)	Small (Category 1). 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.
Scouring caused by discharged cooling water	Small impact (Category 1). Scouring effects would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.	Scouring caused by discharged cooling water (all plants)	Small (Category 1). 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.
Discharge of metals in cooling system effluent	Small impact (Category 1). Discharges of metals 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. Discharges are monitored as part of the National	Discharge of other metals in waste water (all plants)	Small (Category 1). 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

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Surface Water (cont.)			
Discharge of metals in cooling system effluent (cont.)	Pollutant Discharge Elimination System (NPDES) permit process.		other plants. They are not expected to be a problem during the license renewal term.
Discharge of biocides, sanitary wastes, and minor chemical spills	Small impact (Category 1). The effects of these discharges are regulated by State and Federal environmental agencies. Discharges are monitored as part of the NPDES permit process. These impacts have been small at operating nuclear power plants.	Discharge of chlorine or other biocides (all plants)	Small (Category 1). 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 (all plants)	Small (Category 1). Effects are readily controlled through NPDES permit rules and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.
Water use conflicts (plants with once-through cooling systems)	Small impact (Category 1). These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.	Water use conflicts (plants with once-through cooling systems)	Small (Category 1). These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a river with low flow)	Small or moderate impact (Category 2). Impacts could be of small or moderate significance, depending on make-up water requirements, water availability, and competing water demands.	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Small or moderate (Category 2). The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Surface Water (cont.)			
Water use conflicts (cont.)			communities near these plants could be of moderate significance in some situations.
Effects of dredging on water quality	Small impact (Category 1). Dredging to remove accumulated sediments in the vicinity of intake and discharge structures and to maintain barge shipping has not been found to be a problem for surface water quality. Dredging is performed under permit from the U.S. Army Corps of Engineers.	Not addressed	Not applicable
Temperature effects on sediment transport capacity	Small impact (Category 1). 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.	Temperature effects on sediment transport capacity	Small (Category 1). 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.
Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	Addressed in Aquatic Resources	Eutrophication (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Groundwater			
Groundwater use and quality	Small impact (Category 1). Extensive dewatering is not anticipated from continued operations and refurbishment activities associated with the license renewal term. The application of best management practices for handling any materials produced or used during activities would reduce impacts.	Impacts of refurbishment on groundwater use and quality	Small (Category 1). 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.
Groundwater use conflicts (plants that withdraw less than 100 gallons per minute [gpm])	Small impact (Category 1). Plants that withdraw less than 100 gpm are not expected to cause any groundwater use conflicts.	Groundwater use conflicts (potable and service water; plants that use <100 gpm)	Small (Category 1). Plants using less than 100 gpm are not expected to cause any groundwater use conflicts.
Groundwater use conflicts (plants that withdraw more than 100 gpm, including those using Ranney wells)	Small, moderate, or large impact (Category 2). Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.	Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	Small, moderate, or large (Category 2). Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users.
	Rolled into issue above:	Groundwater use conflicts (Ranney wells)	Small, moderate, or large (Category 2). Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Groundwater (cont.)			
Groundwater use conflicts (cont.)			Ranney wells must be evaluated at the time of application for license renewal.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw make-up water from a river)	Small, moderate, or large impact (Category 2). Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on make-up water requirements, water availability, and competing water demands.	Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	Small, moderate, or large (Category 2). 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 groundwater or upstream surface water users come on line before the time of license renewal.
Groundwater quality degradation resulting from water withdrawals	Small impact (Category 1). Groundwater withdrawals at operating nuclear power plants would not contribute significantly to groundwater quality degradation.	Groundwater quality degradation (Ranney wells)	Small (Category 1). Groundwater 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 groundwater and is not expected to be a problem during the license renewal term.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Groundwater (cont.)			
Groundwater quality degradation (cont.)		Groundwater quality degradation (saltwater intrusion)	Small (Category 1). Nuclear power plants do not contribute significantly to saltwater intrusion.
Groundwater quality degradation (plants with cooling ponds in salt marshes)	Small impact (Category 1). Sites with closed-cycle cooling ponds could degrade groundwater quality; however, because groundwater in salt marshes is brackish, this is not a concern for plants located in salt marshes.	Groundwater quality degradation (cooling ponds in salt marshes)	Small (Category 1). Sites with closed-cycle cooling ponds may degrade groundwater quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes.
Groundwater quality degradation (plants with cooling ponds at inland sites)	Small, moderate, or large impact (Category 2). Sites with closed-cycle cooling ponds could degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds could be affected. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.	Groundwater quality degradation (cooling ponds at inland sites)	Small, moderate, or large (Category 2). Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses.
Groundwater and soil contamination	Small or moderate impact (Category 2). Industrial practices involving the use of solvents, hydrocarbons, heavy metals, or other chemicals and unlined wastewater lagoons have the potential to contaminate site groundwater, soil,	Not addressed	Not applicable

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Groundwater (cont.)			
Groundwater and soil contamination (cont.)	and subsoil. Contamination is subject to State- and U.S. Environmental Protection Agency-regulated cleanup and monitoring programs.		
Radionuclides released to groundwater	Small or moderate impact (Category 2). Underground system leaks of process water have been discovered in recent years at several plants. Groundwater protection programs have been established at all operating nuclear power plants.	Not addressed	Not applicable
Terrestrial Resources			
Impacts of continued plant operations on terrestrial ecosystems	Small, moderate, or large impact (Category 2). Continued operations, refurbishment, and maintenance activities are expected to keep terrestrial communities in their current condition. Application of best management practices would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.	Refurbishment impacts	Small, moderate, or large (Category 2). 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.
Exposure of terrestrial organisms to radionuclides	Small impact (Category 1). Doses to terrestrial organisms are expected to be well below exposure guidelines developed to protect these organisms.	Not addressed	Not applicable

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Terrestrial Resources (cont.)			
Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	Small impact (Category 1). No adverse effects to terrestrial plants or animals have been reported as a result of increased water temperatures, fogging, humidity, or reduced habitat quality. Due to the low concentrations of contaminants in cooling system effluents, uptake and accumulation of contaminants in the tissues of wildlife exposed to the contaminated water or aquatic food sources are not expected to be significant issues.	Cooling pond impacts on terrestrial resources	Small (Category 1). Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.
Cooling tower impacts on plant communities (plants with cooling towers)	Small impact (Category 1). Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have the potential to affect adjacent plant communities, but these impacts have been small at operating nuclear power plants and are not expected to change over the license renewal term.	Cooling tower impacts on crops and ornamental vegetation	Small (Category 1). 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	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Terrestrial Resources (cont.)			
Bird collisions with cooling towers and transmission lines	Small impact (Category 1). Bird collisions with cooling towers and transmission lines occur at rates that are unlikely to affect local or migratory populations.	Bird collisions with cooling towers	Small (Category 1). 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.
		Bird collisions with power lines	Small (Category 1). Impacts are expected to be of small significance at all sites.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using make-up water from a river)	Small or moderate impact (Category 2). Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance in some situations.	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Small or moderate (Category 2). 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.
Transmission line ROW management impacts on terrestrial resources	Small impact (Category 1). Continued ROW management during the license renewal term is expected to keep terrestrial communities in their current condition. Application of best management practices would reduce the potential for impacts.	Power line right-of-way management (cutting and herbicide application)	Small (Category 1). The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Terrestrial Resources (cont.)			
Transmission line ROW management impacts on terrestrial resources (cont.)		Floodplains and wetland on power line right of way	Small (Category 1). 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.
Electromagnetic fields (EMFs) on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	Small (Category 1). No significant impacts of EMFs on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	Small (Category 1). No significant impacts of EMFs on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.
Aquatic Resources			
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Small, moderate, or large impact (Category 2). The impacts of impingement and 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, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.	Impingement of fish and shellfish (plants with once-through cooling and cooling-pond heat dissipation systems)	Small, moderate, or large (Category 2). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Impingement and entrainment of aquatic organisms (cont.)		Entrainment of fish and shellfish in early life stages (plants with once-through and cooling-pond heat dissipation systems)	Small, moderate, or large (Category 2). 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.
		Entrainment of phytoplankton and zooplankton (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Impingement and entrainment of aquatic organisms (plants with cooling towers)	Small impact (Category 1). Impingement and entrainment rates are lower at plants that use closed-cycle cooling with cooling towers because the rates and volumes of water withdrawal needed for makeup are minimized.	Impingement of fish and shellfish (plants with cooling-tower-based heat dissipation systems)	Small (Category 1). 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.
		Entrainment of fish and shellfish in early life stages (plants with cooling-tower-based heat dissipation systems)	Small (Category 1). 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.
		Entrainment of phytoplankton and zooplankton (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Small, moderate, or large impact (Category 2). Most of the effects associated with thermal discharges are localized and are not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.	Cold shock (all plants)	Small (Category 1). 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 (all plants)	Small (Category 1). 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.
		Heat shock (plants with once-through and cooling-pond heat dissipation systems)	Small, moderate, or large (Category 2). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Thermal impacts (cont.)		Distribution of aquatic organisms (all plants)	Small (Category 1). Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.
		Premature emergence of aquatic insects (all plants)	Small (Category 1). 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.
Thermal impacts on aquatic organisms (plants with cooling towers)	Small impact (Category 1). Thermal effects associated with plants that use cooling towers are small because of the reduced amount of heated discharge.	Cold shock (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Thermal impacts (cont.)		Thermal plume barrier to migrating fish (all plants)	Small (Category 1). 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.
		Heat shock (plants with cooling-tower-based heat dissipation systems)	Small (Category 1). 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.
		Distribution of aquatic organisms (all plants)	Small (Category 1). Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.
		Premature emergence of aquatic insects (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	Small impact (Category 1). Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. Low dissolved oxygen was a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. Eutrophication (nutrient loading) and resulting effects on chemical and biological oxygen demands have not been found to be a problem at operating nuclear power plants.	Gas supersaturation (gas bubble disease) (all plants)	Small (Category 1). 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 (all plants)	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Effects of cooling water discharge (cont.)		Eutrophication (all plants)	Small (Category 1). 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.
Effects of nonradiological contaminants on aquatic organisms	Small impact (Category 1). Best management practices and discharge limitations of NPDES permits are expected to minimize the potential for impacts to aquatic resources. Accumulation of metal contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those made of another metal.	Accumulation of contaminants in sediments or biota (all plants)	Small (Category 1). 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.
Exposure of aquatic organisms to radionuclides	Small impact (Category 1). Doses to aquatic organisms are expected to be well below exposure guidelines developed to protect these aquatic organisms.	Not addressed	Not applicable
Effects of dredging on aquatic resources	Small impact (Category 1). Effects of dredging on aquatic resources tend to be of short duration (years or less) and localized. Dredging requires permits from the U.S. Army Corps of Engineers, State environmental agencies, and other regulatory agencies.	Not addressed	Not applicable

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river with low flow)	Small or moderate impact (Category 2). Impacts on aquatic resources in instream communities affected by water use conflicts could be of moderate significance in some situations.	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Small or moderate (Category 2). 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.
Refurbishment impacts on aquatic resources	Small impact (Category 1). Refurbishment impacts with appropriate mitigation are not expected to change aquatic communities from their current condition.	Refurbishment (all plants)	Small (Category 1). 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.
Impacts of transmission line ROW management on aquatic resources	Small impact (Category 1). Application of best management practices to ROW near aquatic systems would reduce the potential for impacts.	Not addressed	Not applicable
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	Small impact (Category 1). 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.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Aquatic Resources (cont.)			
Stimulation of nuisance organisms (e.g., shipworms)	Small impact (Category 1). 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.	Stimulation of nuisance organisms (e.g., shipworms)	Small (Category 1). 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.
Threatened, Endangered, and Protected Species and Essential Fish Habitat			
Threatened, endangered, and protected species and essential fish habitat	Small, moderate, or large impact (Category 2). The magnitude of impacts on threatened, endangered, and protected species and essential fish habitat would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether special status species or habitats are present and whether they would be adversely affected by activities associated with license renewal.	Threatened or endangered species (all plants)	Small, moderate, or large (Category 2). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Historic and Cultural Resources			
Historic and cultural resources	Small, moderate, or large impact (Category 2). Continued operations and refurbishment associated with the license renewal term are expected to have no more than small impacts on historic and cultural resources located onsite and in the transmission line ROW because most impacts could be mitigated. The National Historic Preservation Act (NHPA) requires the Federal agency to consult with the State Historic Preservation Officer (SHPO) and appropriate Native American Tribes to determine the potential impacts and mitigation. See § 51.14(a).	Historic and cultural resources	Small, moderate, or large (Category 2). Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and cultural 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.
Socioeconomics			
Employment and income, recreation and tourism	Small impact (Category 1). Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment and income impacts from continued operations and refurbishment are expected to be small. Nuclear plant operations, employee spending, power plant expenditures, and tax payments have an affect on local economies. Changes in plant operations, employment and expenditures would have a greater effect on rural	Public services: tourism and recreation	Small (Category 1). Impacts to tourism and recreation are expected to be of small significance at all sites.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Socioeconomics (cont.)			
Employment and income, recreation and tourism (cont.)	economies than on semi-urban economies.		
Tax revenues	Small impact (Category 1). Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount of tax revenue paid during the license renewal term from continued operations and refurbishment is not expected to change, since the assessed value of the power plant, payments on energy production, and PILOT payments are also not expected to change.	Considered in the 1996 GEIS, but not identified as an issue	Not applicable

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Socioeconomics (cont.)			
Community services and education	Small impact (Category 1). Changes to local community and educational services from continued operations and refurbishment associated with the license renewal term would be small. With no increase in employment, value of the power plant, payments on energy production, and PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations. Changes in employment and tax payments would have a greater effect on jurisdictions receiving a large portion of annual revenues from the power plant than on jurisdictions receiving the majority of their revenues from other sources.	Public services: public safety, and social services	Small (Category 1). Impacts on public safety and social services are expected to be of small significance at all sites.
		Public services: public utilities	Small or moderate (Category 2). An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability.
		Public services, education (license renewal term)	Small (Category 1). Only impacts of small significance are expected.
		Public services, education (refurbishment)	Small, moderate, or large (Category 2). Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors.
Population and housing	Small impact (Category 1). Changes to regional population and housing availability and value would be small from continued operations and refurbishment associated with the license renewal term. With no increase in employment expected during the license renewal term,	Housing impacts	Small, moderate, or large (Category 2). 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

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Socioeconomics (cont.)			
Population and housing (cont.)	population and housing availability and values would not be affected by continued power plant operations. Changes in housing availability and value would have a greater effect on sparsely populated areas than areas with higher density populations.		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.
Transportation	Small impact (Category 1). Changes to traffic volumes would be small from continued operations and refurbishment activities associated with the license renewal term. Changes in employment would have a greater effect on rural areas, with less developed local and regional networks. Impacts would be less noticeable in semi-urban areas depending on the quality and extent of local access roads and the timing of plant shift changes when compared to typical local usage.	Public services, transportation	Small, moderate, or large (Category 2). Transportation impacts 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Human Health			
Radiation exposures to the public	Small impact (Category 1). Radiation doses to the public from continued operations and refurbishment associated with the license renewal term are expected to continue at current levels, and would be well below regulatory limits.	Radiation exposures to the public during refurbishment	Small (Category 1). 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.
		Radiation exposures to the public (license renewal term)	Small (Category 1). Radiation doses to the public will continue at current levels associated with normal operations.
Radiation exposures to occupational workers	Small impact (Category 1). Occupational doses from continued operations and refurbishment associated with the license renewal term are expected to be within the range of doses experienced during the current license term, and would continue to be well below regulatory limits.	Occupational radiation exposures during refurbishment	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Human Health (cont.)			
Radiation exposures to occupational workers (cont.)		Occupational radiation exposures (license renewal term)	Small (Category 1). 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.
Human health impact from chemicals	Small impact (Category 1). Chemical hazards to workers would be minimized by observing good industrial hygiene practices. Chemical releases to the environment and the potential for impacts to the public are minimized by adherence to discharge limitations of NPDES permits.	Not addressed	Not applicable
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	Small, moderate, or large impact (Category 2). 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 rivers. Impacts would depend on site-specific characteristics.	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	Small, moderate, or large (Category 2). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Human Health (cont.)			
Microbiological hazards to plant workers	Small impact (Category 1). Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.	Microbiological organisms (occupational health)	Small (Category 1). Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.
Chronic effects of EMFs	Uncertain impact. Studies of 60-Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.	EMFs, chronic effects	Uncertain. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.
Physical occupational hazards	Small impact (Category 1). Occupational safety and health hazards are generic to all types of electrical generating stations, including nuclear power plants, and are of small significance if the workers adhere to safety standards and use protective equipment.	Not addressed	Not applicable

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Human Health (cont.)			
Electric shock hazards	Small, moderate, or large impact (Category 2). Electrical shock potential is of small significance for transmission lines that are operated in adherence with the National Electrical Safety Code (NESC). Without a review of each nuclear plant transmission line conformance with NESC criteria, it is not possible to determine the significance of the electrical shock potential.	EMFs, acute effects (electric shock)	Small, moderate, or large (Category 2). 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.
Postulated Accidents			
Design-basis accidents	Small impact (Category 1). The NRC staff has concluded that the environmental impacts of design-basis accidents are of small significance for all plants.	Design basis accidents	Small (Category 1). The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Postulated Accidents (cont.)			
Severe accidents	Small impact (Category 2). The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, 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.	Severe accidents	Small (Category 2). The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, 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.
Environmental Justice			
Minority and low-income populations	Small or moderate impact (Category 2). Impacts to minority and low-income populations and subsistence consumption will be addressed in plant-specific reviews. See NRC Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040).	Environmental justice	None. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Solid Waste Management			
Low-level waste storage and disposal	Small impact (Category 1). 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 would remain small during the license renewal term.	Low-level waste storage and disposal	Small (Category 1). 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 onsite 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Solid Waste Management (cont.)			
Onsite storage of spent nuclear fuel	Small impact (Category 1). The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated onsite with small environmental effects through dry or pool storage at all plants, if a permanent repository or monitored retrievable storage is not available.	Onsite spent fuel	Small (Category 1). The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated onsite with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.
Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	(Category 1). For the high-level waste and spent fuel disposal component of the fuel cycle, the EPA established a dose limit of 15 millirem (0.15 mSv) per year for the first 10,000 years and 100 millirem (1.0 mSv) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada. The Commission concludes that the 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	Offsite radiological impacts (spent fuel and high-level waste disposal)	The NRC did not assign a single level of significance for the impacts of spent fuel and high-level waste disposal, but considered the issue Category 1.[(a)]

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Waste Management (cont.)			
Offsite radiological impacts (cont.)	single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.		
Mixed waste storage and disposal	Small impact (Category 1). 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 would 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.	Mixed waste storage and disposal	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Waste Management (cont.)			
Nonradioactive waste storage and disposal	Small impact (Category 1). No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.	Nonradiological waste	Small (Category 1). 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.
Cumulative Impacts			
Cumulative impacts	(Category 2). Cumulative impacts of license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.	Not addressed	Not applicable
Uranium Fuel Cycle			
Offsite radiological impacts – individual impacts from other than the disposal of spent fuel and high-level waste	Small impact (Category 1). The impacts to the public from radiological exposures have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste	Small (Category 1). Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, are small.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Uranium Fuel Cycle (cont.)			
Offsite radiological impacts – collective impacts from other than the disposal of spent fuel and high-level waste	(Category 1). There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission concludes that the collective impacts are acceptable. The Commission concludes that the 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 impacts of the uranium fuel cycle, this issue is considered Category 1.	Offsite radiological impacts (collective effects)	The NRC did not assign a single level of significance for the collective effects of the fuel cycle, but considered the issue Category 1.[b]
Nonradiological impacts of the uranium fuel cycle	Small impact (Category 1). The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant would be small.	Nonradiological impacts of the uranium fuel cycle	Small (Category 1). The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Uranium Fuel Cycle (cont.)			
Transportation	Small impact (Category 1). The impacts of transporting materials to and from uranium-fuel-cycle facilities on workers, the public, and the environment are expected to be small.	Transportation	Small (Category 1). 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 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Termination of Nuclear Power Plant Operations and Decommissioning			
Termination of plant operations and decommissioning	Small impact (Category 1). License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.	Air quality	Small (Category 1). 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	Small (Category 1). 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	Small (Category 1). Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Termination of Nuclear Power Plant Operations and Decommissioning (cont.)			
Termination of plant operations and decommissioning (cont.)		Socioeconomic impacts	Small (Category 1). 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.
		Radiation doses	Small (Category 1). 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.

Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Termination of Nuclear Power Plant Operations and Decommissioning (cont.)			
Termination of plant operations and decommissioning (cont.)		Waste management	Small (Category 1). 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.

(a) 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 that 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}.

Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and 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 maximally exposed individual (MEI) 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 the 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

Footnotes continued on next page.

Table B-1. (cont.)

Footnotes (cont.)

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 have 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, the 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 limitations on the amount of radioactive material released over 10,000 years. The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric tonne (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 of spent fuel and high-level waste disposal, this issue is considered in Category 1.

(b) 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 United States. 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 that will never be mitigated (e.g., no cancer cure in the next thousand years), and that these doses projected over thousands of years 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.

Appendix C

General Characteristics and Environmental Settings of Domestic Nuclear Power Plants

Appendix C

General Characteristics and Environmental Settings of Domestic Nuclear Power Plants General

This appendix contains brief descriptions of each commercial nuclear power plant site in the United States. The material is intended to serve as an overview of the important characteristics of each plant and its environmental setting. The information was taken from the 1996 GEIS and updated with information available from recently published supplemental environmental impacts statements (SEISs), environmental assessments, CEC (2006), EIA (2007), USCB (2007), EPA (2007), USFWS (2007), and USGS (2003).

ARKANSAS NUCLEAR ONE

Location: Pope County, Arkansas
10 km (6 mi) WNW of Russellville
Latitude 35.3100°N; longitude 93.2308°W
Licensee: Entergy Arkansas, Inc.

Unit Information	Unit 1	Unit 2
Docket Number:	50-313	50-368
Construction Permit:	1968	1972
Operating License:	1974	1978
Commercial Operation:	1974	1980
License Expiration:	2034	2038
Licensed Thermal Power [MW(t)]:	2568	3026
Net Capacity [MW(e)]:	836	988
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	B&E	CE

Cooling Water System

Type: Unit 1: Once-through; Unit 2: Natural draft cooling tower
Source: Dardanelle Reservoir
Source Temperature Range: 4–28°C (40–83°F)
Condenser Flow Rate: 48.1 m^3/s (762,400 gpm) for Unit 1
26.6 m^3/s (422,000 gpm) for Unit 2
Design Condenser Temperature Rise: 8.3°C (15°F) for Unit 1
17.1°C (30.7°F) for Unit 2
Intake Structure: 1340-m (4400-ft) canal
Discharge Structure: 158-m (520-ft) canal

Site Information

Total Area: 471 ha (1164 ac)
Exclusion Distance: 1 km (0.7 mi) radius
Low Population Zone: 6.44 km (4 mi) radius
Nearest City: Little Rock; 2000 population: 183,133
Site Topography: Flat
Surrounding Area Topography: Hilly to mountainous
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Arkansas Valley
Percent Wetland Within 8 km (5 mi): 11.7, mostly lake
Nearby Features: The nearest town is London 3 km (2 mi) NW. The size of Lake Dardenelle is 15,000 ha (37,000 ac). The reservoir is part of the Arkansas River. The Missouri Pacific Railroad and U.S. Highway I-40 are just north of the site.
Population Within an 80-km (50-mi) Radius: 267,664

BEAVER VALLEY POWER STATION

Location: Beaver County, Pennsylvania
40 km (25 mi) NW of Pittsburgh
Latitude 40.6219°N; longitude 80.4339°W
Licensee: FirstEnergy Nuclear Operating Company

Unit Information	Unit 1	Unit 2
Docket Number:	50-334	50-412
Construction Permit:	1970	1974
Operating License:	1976	1987
Commercial Operation:	1976	1987
License Expiration:	2016	2027
Licensed Thermal Power [MW(t)]:	2900	2900
Net Capacity [MW(e)]:	849	832
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Natural draft cooling towers
Source: Ohio River
Source Temperature Range: 2.5–26.4°C (36.5–79.5°F)
Condenser Flow Rate: 30.31 m^3/s (480,400 gpm) each unit
Design Condenser Temperature Rise: 14°C (26°F)
Intake Structure: Concrete structure at river edge
Discharge Structure: At river edge

Site Information

Total Area: 183 ha (453 ac)
Exclusion Distance: 0.61 km (0.38 mi)
Low Population Zone: 5.79 km (3.60 mi)
Nearest City: Pittsburgh; 2000 population: 334,563
Site Topography: Flat
Surrounding Area Topography: Hilly
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Western Allegheny Plateau
Percent Wetland Within 8 km (5 mi): 5.5, mostly riverine

Nearby Features: The nearest town is Midland 1.6 km (1 mi) NW. A large industrial area is about 1.6 km (1 mi) WNW. The Penn Central Railroad State Parks are within 16 km (10 mi).

Population Within an 80 km (50 mi) Radius: 3,274,451

BRAIDWOOD STATION

Location:	Will County, Illinois
	39 km (24 mi) SSW of Joliet
	Latitude 41.2436°N; longitude 88.2297°W
Licensee:	Commonwealth Edison Company

Unit Information	Unit 1	Unit 2
Docket Number:	50-456	50-457
Construction Permit:	1975	1975
Operating License:	1987	1988
Commercial Operation:	1988	1988
License Expiration:	2027	2028
Licensed Thermal Power [MW(t)]:	3587	3587
Net Capacity [MW(e)]:	1178	1152
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Closed-cycle cooling pond
Source: Kankakee River
Source Temperature Range: 0–31°C (32–87°F)
Condenser Flow Rate: 46.05 m^3/s (729,800 gpm)
Design Condenser Temperature Rise: 12°C (21°F)
Intake Structure: Concrete structure at lake shore
Discharge Structure: Surface discharge flume to lake

Site Information

Total Area: 1804 ha (4457 ac)
Exclusion Distance: 0.48 km (0.3 mi) minimum
Low Population Zone: 1.810 km (1.125 mi) radius
Nearest City: Joliet; 2000 population: 106,221
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Central Corn Belt Plains

Percent Wetland Within 8 km (5 mi): 11.4, mostly lake

Nearby Features: The nearest town is Godley 0.8 km (0.5 mi) SW. There are 4 state parks within 16 km (10 mi). Midewin National Tallgrass Prairie and Abraham Lincoln National Cemetery are about 13 km (8 mi) NE. Dresden Nuclear Power Station is about 16 km (10 mi) N and LaSalle County Station (nuclear) is about 32 km (20 mi) WSW. The Illinois Central Gulf Railroad is just NW. U.S. Highway I-55 is about 3 km (2 mi) NW.

Population Within an 80 km (50 mi) Radius: 4,272,003

BROWNS FERRY NUCLEAR PLANT

Location: Limestone County, Alabama
16 km (10 mi) NW of Decatur
Latitude 34.7042°N; longitude 87.1186°W
Licensee: Tennessee Valley Authority

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number:	50-259	50-260	50-296
Construction Permit:	1967	1967	1968
Operating License:	1973	1974	1976
Commercial Operation:	1974	1975	1977
License Expiration:	2033	2034	2036
Licensed Thermal Power [MW(t)]:	3458	3458	3458
Net Capacity [MW(e)]:	1065	1118	1114
Type of Reactor:	BWR	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE	GE

Cooling Water System

Type: Once-through with helper towers
Source: Tennessee River
Source Temperature Range: 4–32°C (40–90°F)
Condenser Flow Rate: 139 m^3/s (734,000 gpm); for all three units
Design Condenser Temperature Rise: 15.9°C (28.7°F)
Intake Structure: Concrete structure in small inlet
Discharge Structure: Diffuser pipes

Site Information

Total Area: 340 ha (840 ac)
Exclusion Distance: 1.22 km (.76 mi) radius
Low Population Zone: 11.3 km (7 mi)
Nearest City: Huntsville; 2000 population: 158,216
Site Topography: Flat
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, open water, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Interior Plateau

Percent Wetland Within 8 km (5 mi): 42.2, mostly lake (some freshwater forested/shrub wetland)

Nearby Features: The nearest town is Lawngate 1.6 km (1 mi) NE. The Redstone Arsenal is 40 km (25 mi) E. The Southern Railroad is 10 km (6 mi) S and the Louisville and Nashville Railroad is 10 km (6 mi) E. Two wildlife management areas are located within 5 km (3 mi) of the plant.

Population Within an 80 km (50 mi) Radius: 872,478

BRUNSWICK STEAM ELECTRIC PLANT

Location:	Brunswick County, North Carolina
	26 km (16 mi) S of Wilmington
	Latitude 33.9583°N; longitude 78.0106°W
Licensee:	Progress Energy

Unit Information	Unit 1	Unit 2
Docket Number:	50-325	50-324
Construction Permit:	1967	1968
Operating License:	1976	1974
Commercial Operation:	1977	1975
License Expiration:	2036	2034
Licensed Thermal Power [MW(t)]:	2923	2923
Net Capacity [MW(e)]:	938	937
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Once-through
Source: Cape Fear River
Source Temperature Range: 4–30°C (40–86°F)
Condenser Flow Rate: 42.6 m^3/s (675,000 gpm)
Design Condenser Temperature Rise: 9°C (17°F)
Intake Structure: 5 km (3 mi) canal from Cape Fear River
Discharge Structure: 10 km (6 mi) canal to Atlantic Ocean

Site Information

Total Area: 490 ha (1200 ac)
Exclusion Distance: 0.92 km (0.57 mi)
Low Population Zone: 3.22 km (2 mi)
Nearest City: Wilmington; 2000 population: 75,838
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Wetland, open water, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Middle Atlantic Coastal Plain

Percent Wetland Within 8 km (5 mi): 60.5, mostly estuarine and marine deepwater; freshwater forested/shrub wetland; estuarine and marine wetland

Nearby Features: The nearest town is Southport 5 km (3 mi) S. Sunny Point Military Ocean Terminal is about 8 km (5 mi) N.

Population Within an 80 km (50 mi) Radius: 361,872

BYRON STATION

Location: Ogle County, Illinois
27 km (17 mi) SW of Rockford
Latitude 42.0750°N; longitude 89.2811°W
Licensee: Exelon Corporation

Unit Information	Unit 1	Unit 2
Docket Number:	50-454	50-455
Construction Permit:	1975	1975
Operating License:	1985	1987
Commercial Operation:	1985	1987
License Expiration:	2025	2027
Licensed Thermal Power [MW(t)]:	3587	3587
Net Capacity [MW(e)]:	1164	1136
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Natural draft towers
Source: Rock River
Source Temperature Range: Not available
Condenser Flow Rate: 39.9 m^3/s (632,000 gpm)
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: Concrete structure on river bank
Discharge Structure: Discharged to river

Site Information

Total Area: 565.8 ha (1398 ac)
Exclusion Distance: 0.42 km (0.26 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Rockford; 2000 population: 150,115
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Central Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 3.6, mostly lake

Nearby Features: The nearest town is Byron about 5 km (3 mi) NNE. The Chicago Milwaukee and the St. Paul and Pacific Railroads are about 6 km (4 mi) NNE. White Pines State Park is about 18 km (11 mi) WSW.

Population Within an 80 km (50 mi) Radius: 1,300,282

CALLAWAY PLANT

Location: Callaway County, Missouri
16 km (10 mi) SE of Fulton
Latitude 38.7622°N; longitude 91.7817°W
Licensee: Ameren Corporation

Unit Information	Unit 1
Docket Number:	50-483
Construction Permit:	1976
Operating License:	1984
Commercial Operation:	1984
License Expiration:	2024
Licensed Thermal Power [MW(t)]:	3565
Net Capacity [MW(e)]:	1190
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Natural draft cooling tower
Source: Missouri River
Source Temperature Range: Not available
Condenser Flow Rate: 33 m^3/s (530,000 gpm)
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: Intake from river
Discharge Structure: Discharged to river

Site Information

Total Area: 2115.8 ha (5228 ac)
Exclusion Distance: 1.21 km (0.75 mi) radius
Low Population Zone: 4.02 ha (2.50 mi)
Nearest City: Columbia; 2000 population: 84,531
Site Topography: Flat, on a small plateau
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Interior River Valley and Hills
Percent Wetland Within 8 km (5 mi): 4.5, mostly freshwater forested/shrub wetland; riverine

Nearby Features: The nearest town is Portland 8 km (5 mi) SE. The Missouri, Kansas, and Texas Railroad is about 5 km (3 mi) S and the Missouri Pacific Railroad is about 10 km (6 mi) S. U.S. Highway I-70 is about 16 km (10 mi) N.

Population Within an 80 km (50 mi) Radius: 491,072

CALVERT CLIFFS NUCLEAR POWER PLANT

Location:	Calvert County, Maryland
	56 km (35 mi) S of Annapolis
	Latitude 38.4347°N; longitude 76.4419°W
Licensee:	Baltimore Gas and Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-317	50-318
Construction Permit:	1969	1969
Operating License:	1974	1976
Commercial Operation:	1975	1977
License Expiration:	2034	2036
Licensed Thermal Power [MW(t)]:	2700	2700
Net Capacity [MW(e)]:	873	862
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	CE	CE

Cooling Water System

Type: Once-through
Source: Chesapeake Bay
Source Temperature Range: 1–31°C (34–87°F)
Condenser Flow Rate: 76 m^3/s (1,200,000 gpm) each unit
Design Condenser Temperature Rise: 6.7°C (12°F).
Intake Structure: 4500 ft (1372 m) from shore
Discharge Structure: 260 m (850 ft) from shore

Site Information

Total Area: 853 ha (2108 ac)
Exclusion Distance: 1.08 km (0.67 mi) radius
Low Population Zone:
Nearest City: Washington, D.C.; 2000 population: 572,059
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Plains; Middle Atlantic Coastal Plain
Percent Wetland Within 8 km (5 mi): 66, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Long Beach 1.6 km (1 mi) NNW. Calvert Cliffs State Park is about 6 km (4 mi) SSE. A naval ordinance facility is 11 km (7 mi) SSW.

Population Within an 80 km (50 mi) Radius: 3,919,397

CATAWBA NUCLEAR STATION

Location:	York County, South Carolina
	10 km (6 mi) NNW of Rock Hill
	Latitude 35.0514°N; longitude 81.0708°W
Licensee:	Duke Energy Corporation

Unit Information	Unit 1	Unit 2
Docket Number:	50-413	50-414
Construction Permit:	1975	1975
Operating License:	1985	1986
Commercial Operation:	1985	1986
License Expiration:	2045	2046
Licensed Thermal Power [MW(t)]:	3411	3411
Net Capacity [MW(e)]:	1129	1129
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Mechanical draft towers
Source: Lake Wylie
Source Temperature Range: 6–28°C (43–83°F)
Condenser Flow Rate: 42 m^3/s (660,000 gpm) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: Skimmer wall on cove of the lake
Discharge Structure: On another cove of the lake

Site Information

Total Area: 158 ha (391 ac)
Exclusion Distance: 2500 ft (0.76 km; 0.47 mi) radius
Low Population Zone: 6.12 km (3.8 mi) radius
Nearest City: Charlotte, North Carolina; 2000 population: 540,828
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont
Percent Wetland Within 8 km (5 mi): 12.9, mostly lake

Nearby Features: The nearest town is Rock Hill 10 km (6 mi) SSE. U.S. Highway I-77 is about 10 km (6 mi) E and I-85 is about 27 km (17 mi) N. The Southern Railway is 8 km (5 mi) S.

Population Within an 80 km (50 mi) Radius: 2,041,465

CLINTON POWER STATION

Location: DeWitt County, Illinois
10 km (6 mi) E of Clinton
Latitude 40.1731°N; longitude 88.8342°W
Licensee: AmerGen Energy Co.

Unit Information	Unit 1
Docket Number:	50-461
Construction Permit:	1976
Operating License:	1987
Commercial Operation:	1987
License Expiration:	2027
Licensed Thermal Power [MW(t)]:	3473
Net Capacity [MW(e)]:	1043
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through
Source: Salt Creek
Source Temperature Range: 0–28°C (32–83°F)
Condenser Flow Rate: 35.89 m^3/s (568,701 gpm)
Design Condenser Temperature Rise: 13°C (23°F)
Intake Structure: Concrete structure at shoreline of North Fork Salt Creek
Discharge Structure: 5-km (3-mi) flume discharging to Salt Creek

Site Information

Total Area: 5702 ha (14,090 ac)
Exclusion Distance: 0.97 km (0.60 mi) radius
Low Population Zone: 4.02 km (2.5 mi) radius
Nearest City: Decatur; 2000 population: 81,860
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Central Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 9, mostly lake

Nearby Features: The nearest town is DeWitt 3 km (2 mi) ENE. Weldon Springs State Park is 10 km (6 mi) SW. The Illinois Central Gulf Railroad crosses the site. U.S. highway I-74 is 18 km (11 mi) NE. A dam on Salt Creek near the site creates the reservoir Lake Clinton for the cooling water system.

Population Within an 80 km (50 mi) Radius: 789,754

COLUMBIA GENERATING STATION

Location: Benton County, Washington
19 km (12 mi) NW of Richland
Latitude 46.4714°N; longitude 119.3331°W
Licensee: Energy Northwest

Unit Information	Unit 2
Docket Number:	50-397
Construction Permit:	1973
Operating License:	1984
Commercial Operation:	1984
License Expiration:	2024
Licensed Thermal Power [MW(t)]:	3323
Net Capacity [MW(e)]:	1131
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Mechanical draft cooling towers
Source: Columbia River
Source Temperature Range: 3–18°C (38–64°F)
Condenser Flow Rate: 35 m^3/s (550,000 gpm)
Design Condenser Temperature Rise: 15.9°C (28.7°F)
Intake Structure: 2 perforated pipe inlets supported offshore above the river bed 270 m (900 ft) from pump structure on river bank
Discharge Structure: Buried 5 km (3 mi) pipeline, terminating at the river bed 53 m (175 ft) from the shoreline

Site Information

Total Area: 1089 ac (441 ha)
Exclusion Distance: 1.95 km (1.21 mi) radius
Low Population Zone: 4.83 km (3 mi)
Nearest City: Spokane; 2000 population: 195,629
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Shrub/scrub, open water, agriculture
Level 1 Ecoregion Within 8 km (5 mi): North American Desert

Level 3 Ecoregion Within 8 km (5 mi): Columbia Plateau
Percent Wetland Within 8 km (5 mi): 5.6, mostly lake
Nearby Features: The nearest town is Richland 14 km (9 mi) S. The site is in the SE part of the Hanford Reservation.
Population Within an 80 km (50 mi) Radius: 360,573

COMANCHE PEAK STEAM ELECTRIC STATION

Location:	Somervell County, Texas
	64 km (40 mi) SW of Fort Worth
	Latitude 32.2983°N; longitude 97.7856°W
Licensee:	Energy Future Holdings

Unit Information	Unit 1	Unit 2
Docket Number:	50-445	50-446
Construction Permit:	1974	1974
Operating License:	1990	1993
Commercial Operation:	1990	1993
License Expiration:	2030	2033
Licensed Thermal Power [MW(t)]:	3458	3458
Net Capacity [MW(e)]:	1150	1150
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Squaw Creek Reservoir
Source Temperature Range: Not available
Condenser Flow Rate: 65 m^3/s (1,030,000 gpm)
Design Condenser Temperature Rise: 8°C (15°F)
Intake Structure: On shore of reservoir
Discharge Structure: Canal to reservoir

Site Information

Total Area: 3104 ha (7669 ac)
Exclusion Distance: 1.54 km (0.96 mi) minimum
Low Population Zone: 6.44 km (4 mi) radius
Nearest City: Fort Worth; 2000 population: 534,694
Site Topography: Flat, with hills rising from the reservoir
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Herbaceous, forest, open water
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Cross Timbers
Percent Wetland Within 8 km (5 mi): 8.8, mostly lake

Nearby Features: The nearest town is Glen Rose 8 km (5 mi) SSE. Dinosaur Valley State Park is 8 km (5 mi) SW. A 66 cm (26 in) oil pipeline is very near the site and a 91 cm (36 in) natural gas line is about 3 km (2 mi) from the site.

Population Within an 80 km (50 mi) Radius: 1,431,094

COOPER NUCLEAR STATION

Location:	Nemaha County, Nebraska
	37 km (23 mi) S of Nebraska City
	Latitude 40.3619°N; longitude 95.6411°W
Licensee:	Nebraska Public Power District

Unit Information	Unit 1
Docket Number:	50-298
Construction Permit:	1968
Operating License:	1974
Commercial Operation:	1974
License Expiration:	2014
Licensed Thermal Power [MW(t)]:	2381
Net Capacity [MW(e)]:	760
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through
Source: Missouri River
Source Temperature Range: 1–23°C (34–73°F)
Condenser Flow Rate: 39.8 m^3/s (631,000 gpm)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: At shoreline
Discharge Structure: At shoreline

Site Information

Total Area: 441 ha (1090 ac)
Exclusion Distance: 1.09 km (0.68 mi)
Low Population Zone: 1.61 km (1 mi) radius
Nearest City: Lincoln; 2000 population: 225,581
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Agriculture, wetland, forest
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Western Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 6.8, mostly freshwater forested/shrub wetland; riverine

Nearby Features: The nearest town is Nemaha about 1.6 km (1 mi) S. A railroad runs just W of the site. Indian Cave State Park is about 13 km (8 mi) SSE.

Population Within an 80 km (50 mi) Radius: 156,157

CRYSTAL RIVER NUCLEAR POWER PLANT

Location: Citrus County, Florida
11 km (7 mi) NW of Crystal River
Latitude 28.9572°N; longitude 82.6989°W
Licensee: Progress Energy

Unit Information	Unit 3
Docket Number:	50-302
Construction Permit:	1968
Operating License:	1977
Commercial Operation:	1977
License Expiration:	2017
Licensed Thermal Power [MW(t)]:	2609
Net Capacity [MW(e)]:	838
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	B&W

Cooling Water System

Type: Once-through
Source: Gulf of Mexico
Source Temperature Range: 31°C (87°F) maximum
Condenser Flow Rate: 43 m^3/s (680,000 gpm)
Design Condenser Temperature Rise: 9.5°C (17.1°F)
Intake Structure: 4900 m (16,000 ft) from shoreline
Discharge Structure: 4000 m (13,000 ft) canal

Site Information

Total Area: 1917 ha (4738 ac)
Exclusion Distance: 1.34 km (0.83 mi) radius
Low Population Zone: 8.05 km (5 mi)
Nearest City: Gainesville; 2000 population: 95,447
Site Topography: Swamps and marshland
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, wetland, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southern Coastal Plain
Percent Wetland Within 8 km (5 mi): 65.2, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Crystal River about 11 km (7 mi) SE. Units 1 and 2 are coal-fired plants and share a common intake and discharge with the nuclear unit.

Population Within an 80 km (50 mi) Radius: 1,273,146

DAVIS-BESSE NUCLEAR POWER STATION

Location: Ottawa County, Ohio
34 km (21 mi) E of Toledo
Latitude 41.5972°N; longitude 83.0864°W
Licensee: FirstEnergy Nuclear Operating Co.

Unit Information	Unit 1
Docket Number:	50-346
Construction Permit:	1971
Operating License:	1977
Commercial Operation:	1978
License Expiration:	2017
Licensed Thermal Power [MW(t)]:	2772
Net Capacity [MW(e)]:	889
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	B&W

Cooling Water System

Type: Natural draft cooling tower
Source: Lake Erie
Source Temperature Range: 1–23°C (34–73°F)
Condenser Flow Rate: 30 m^3/s (480,000 gpm)
Design Condenser Temperature Rise: 14°C (26°F)
Intake Structure: Submerged intake about 900 m (3000 ft) offshore
Discharge Structure: Submerged discharge about 280 m (930 ft) offshore

Site Information

Total Area: 386 ha (954 ac)
Exclusion Distance: 0.72 km (0.45 mi) radius
Low Population Zone: 3.22 km (2 mi)
Nearest City: Toledo; 2000 population: 313,619
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, agriculture, wetland
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Huron/Erie Lake Plains
Percent Wetland Within 8 km (5 mi): 66.6, mostly lake

Nearby Features: The nearest town is Oak Harbor about 10 km (6 mi) SW. Several wildlife refuge areas are within 8 km (5 mi) of the site.

Population Within an 80 km (50 mi) Radius: 2,617,550

DIABLO CANYON POWER PLANT

Location: San Luis Obispo County, California
19 km (12 mi) W of San Luis Obispo
Latitude 35.2117°N; longitude 120.8544°W
Licensee: Pacific Gas and Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-275	50-323
Construction Permit:	1968	1970
Operating License:	1984	1985
Commercial Operation:	1985	1986
License Expiration:	2024	2025
Licensed Thermal Power [MW(t)]:	3411	3411
Net Capacity [MW(e)]:	1122	1118
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Pacific Ocean
Source Temperature Range: 10–17°C (50–63°F)
Condenser Flow Rate: 54.5 m^3/s (863,000 gpm)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: Reinforced-concrete structure located at shoreline in a cove with artificial breakwater wall
Discharge Structure: Reinforced-concrete structure drops water in stair-step type weir overflow from elevation 21 m (70 ft) to the ocean and discharges on the surface at the shoreline

Site Information

Total Area: 300 ha (750 ac)
Exclusion Distance: 0.80 km (0.50 mi)
Low Population Zone: 9.66 km (6 mi)
Nearest City: Santa Barbara; 2000 population: 92,325
Site Topography: Hilly
Surrounding Area Topography: Hilly to mountainous
Dominant Land Cover Within 8 km (5 mi): Open water, forest, shrub/scrub

Level 1 Ecoregion Within 8 km (5 mi): Mediterranean California
Level 3 Ecoregion Within 8 km (5 mi): Southern and Central California Chaparral and Oak Woodlands
Percent Wetland Within 8 km (5 mi): 54.6, mostly estuarine and marine deepwater
Nearby Features: Site is remote, the nearest town being San Obispo 19 km (12 mi) E. Beaches 11–24 km (7–15 mi) ESE have an influx of summer visitors. Pismo Beach State Park and Morro Bay State Park are within 24 km (15 mi). Vandenberg Air Base is 56 km (35 mi) ESE.
Population Within an 80 km (50 mi) Radius: 836,031

DONALD C. COOK NUCLEAR PLANT

Location:	Berrien County, Michigan
	16 km (10 mi) S of St. Joseph
	Latitude 41.9761°N; longitude 86.5664°W
Licensee:	Indiana Michigan Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-315	50-316
Construction Permit:	1969	1969
Operating License:	1974	1977
Commercial Operation:	1975	1978
License Expiration:	2034	2037
Licensed Thermal Power [MW(t)]:	3304	3468
Net Capacity [MW(e)]:	1029	1077
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Lake Michigan
Source Temperature Range: 1–23°C (34–73°F)
Condenser Flow Rate: 1.6 million gal/min (both units)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: Intake cribs 686 m (2250 ft) from shore
Discharge Structure: 351 m (1150 ft) from shore

Site Information

Total Area: 260 ha (650 ac)
Exclusion Distance: 0.61 km (0.38 mi)
Low Population Zone: 3.22 km (2 mi)
Nearest City: South Bend, Indiana; 2000 population: 107,789
Site Topography: Rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Open water, agriculture, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): S. Michigan/N. Indiana Drift Plains
Percent Wetland Within 8 km (5 mi): 53.6, mostly lake

Nearby Features: The nearest town is Livingston 1.6 km (1 mi) SW. The Chesapeake and Ohio Railroad and U.S. Highway I-94 are just E of the site. Warren Dunes State Park is about 8 km (5 mi) SSW.

Population Within an 80 km (50 mi) Radius: 1,447,303

DRESDEN NUCLEAR POWER STATION

Location: Grundy County, Illinois
14 km (9 mi) E of Morris
Latitude 41.3897°N; longitude 88.2711°W
Licensee: Exelon Generation Company

Unit Information	Unit 2	Unit 3
Docket Number:	50-237	50-249
Construction Permit:	1966	1966
Operating License:	1969	1971
Commercial Operation:	1970	1971
License Expiration:	2029	2031
Licensed Thermal Power [MW(t)]:	2957	2957
Net Capacity [MW(e)]:	867	867
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Cooling lake and spray canal; mechanical draft towers
Source: Kankakee River
Source Temperature Range: 4–29°C (40–85°F)
Condenser Flow Rate: 940,000 gpm (both units)
Design Condenser Temperature Rise: Not available
Intake Structure: Canal from Kankakee River to a crib house
Discharge Structure: A canal carries water to a cooling lake of about 516 ha (1275 ac)

Site Information

Total Area: 1012 ha (2500 ac)
Exclusion Distance: 0.8 km (0.5 mi) radius
Low Population Zone: 8 km (5 mi)
Nearest City: Joliet; 2000 population: 106,221
Site Topography: Flat
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, herbaceous, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Central Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 22, mostly lake

Nearby Features: The nearest town is Channahon 5 km (3 mi) NNE. Braidwood Station (nuclear plant) is about 16 km (10 mi) S and LaSalle County Station (nuclear plant) is about 35 km (22 mi) SW.

Population Within an 80 km (50 mi) Radius: 7,337,564

DUANE ARNOLD ENERGY CENTER

Location:	Linn County, Iowa
	13 km (8 mi) NW of Cedar Rapids
	Latitude 42.1006°N; longitude 91.7772°W
Licensee:	Florida Power & Light Co.

Unit Information	Unit 1
Docket Number:	50-331
Construction Permit:	1970
Operating License:	1974
Commercial Operation:	1975
License Expiration:	2014
Licensed Thermal Power [MW(t)]:	1912
Net Capacity [MW(e)]:	581
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Mechanical draft cooling towers
Source: Cedar River
Source Temperature Range: 0–32°C (32–89°F)
Condenser Flow Rate: 18 m^3/s (290,000 gpm)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: Structure on river shoreline
Discharge Structure: Canal to shoreline

Site Information

Total Area: 200 ha (500 ac)
Exclusion Distance: 0.43 km (0.27 mi)
Low Population Zone: 9.66 km (6 mi)
Nearest City: Cedar Rapids; 2000 population: 120,758
Site Topography: Flat
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, wetland
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Western Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 11.7, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Palo about 3 km (2 mi) SW. Several wildlife refuge areas are within 16 km (10 mi) of the site.
Population Within an 80 km (50 mi) Radius: 613,736

EDWIN I. HATCH NUCLEAR PLANT

Location:	Appling County, Georgia
	18 km (11 mi) N of Baxley
	Latitude 31.9342°N; longitude 82.3444°W
Licensee:	Georgia Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-321	50-366
Construction Permit:	1969	1972
Operating License:	1974	1978
Commercial Operation:	1975	1979
License Expiration:	2034	2038
Licensed Thermal Power [MW(t)]:	2804	2804
Net Capacity [MW(e)]:	876	883
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Mechanical draft towers
Source: Altamaha River
Source Temperature Range: 6–32°C (43–90°F)
Condenser Flow Rate: 35.1 m^3/s (556,000 gpm) each unit
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: At edge of river
Discharge Structure: 37 m (120 ft) from shore

Site Information

Total Area: 908 ha (2244 ac)
Exclusion Distance: 1.26 km (0.78 mi)
Low Population Zone: 1.26 km (0.78 mi)
Nearest City: Savannah; 2000 population: 131,510
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Forest, wetland, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Plains; Southern Coastal Plain
Percent Wetland Within 8 km (5 mi): 23.9, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Cedar Crossing about 11 km (7 mi) NNW. U.S. Highway 1 is just W of the site

Population Within an 80 km (50 mi) Radius: 366,508

ENRICO FERMI ATOMIC POWER PLANT

Location: Monroe County, Michigan
48 km (30 mi) SW of Detroit
Latitude 41.9631°N; longitude 83.2578°W
Licensee: Detroit Edison Co.

Unit Information	Unit 2
Docket Number:	50-341
Construction Permit:	1972
Operating License:	1985
Commercial Operation:	1988
License Expiration:	2025
Licensed Thermal Power [MW(t)]:	3292
Net Capacity [MW(e)]:	1122
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Natural draft cooling towers
Source: Lake Erie
Source Temperature Range: 1–24°C (34–76°F)
Condenser Flow Rate: 52.80 m^3/s (836,000 gpm)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: At edge of lake
Discharge Structure: To the lake via a 20-ha (50-ac) pond

Site Information

Total Area: 453 ha (1120 ac)
Exclusion Distance: 0.92 km (0.57 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Detroit; 2000 population: 951,270
Site Topography: Flat
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Open water, agriculture, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Huron/Erie Lake Plains

Percent Wetland Within 8 km (5 mi): 57.9, mostly lake
Nearby Features: The town of Stony Point is adjacent to the site to the S. Sterling State Park and General Custer Historical Site are about 8 km (5 mi) SW.
Population Within an 80 km (50 mi) Radius: 7,803,464

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

Location:	Oswego County, New York
	10 km (6 mi) NE of Oswego
	Latitude 43.5239°N; longitude 76.3983°W
Licensee:	Entergy Nuclear Operations, Inc.

Unit Information	Unit 1
Docket Number:	50-333
Construction Permit:	1970
Operating License:	1974
Commercial Operation:	1975
License Expiration:	2014
Licensed Thermal Power [MW(t)]:	2536
Net Capacity [MW(e)]:	852
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through
Source: Lake Ontario
Source Temperature Range: 0–20°C (32–68°F)
Condenser Flow Rate: 22.25 m^3/s (352,600 gpm)
Design Condenser Temperature Rise: 18°C (32°F)
Intake Structure: 900 ft. from shore
Discharge Structure: 1400 ft. from shore

Site Information

Total Area: 284 ha (702 ac)
Exclusion Distance: 3000 ft to the east, over 1 mi to the west, and about 1.5 mi to the southern site boundary
Low Population Zone: 5.47 km (3.4 mi)
Nearest City: Syracuse; 2000 population: 147,306
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Eastern Great Lakes and Hudson Lowlands

Percent Wetland Within 8 km (5 mi): 65.4, mostly lake

Nearby Features: The nearest town is Lakeview about 1.6 km (1 mi) WSW. Fort Ontario is about 8 km (5 mi) SW. Nine Mile Point Nuclear Station is about 0.8 km (0.5 mi) W.

Population Within an 80 km (50 mi) Radius: 914,668

JOSEPH M. FARLEY NUCLEAR PLANT

Location:	Houston County, Alabama
	26 km (16 mi) E of Dothan
	Latitude 31.2228°N; longitude 85.1125°W
Licensee:	Alabama Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-348	50-364
Construction Permit:	1972	1972
Operating License:	1977	1981
Commercial Operation:	1977	1981
License Expiration:	2037	2041
Licensed Thermal Power [MW(t)]:	2775	2775
Net Capacity [MW(e)]:	851	860
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Mechanical draft cooling towers
Source: Chattahoochee River
Source Temperature Range: 130°C (86°F) maximum
Condenser Flow Rate: 40.1 m^3/s (635,000 gpm) each unit
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: Intake from river bank via storage pond
Discharge Structure: At river bank

Site Information

Total Area: 749 ha (1850 ac)
Exclusion Distance: 1.26 km (0.78 mi)
Low Population Zone: 3.22 km (2 mi)
Nearest City: Columbus, Georgia; 2000 population: 185,781
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, wetland
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Plains
Percent Wetland Within 8 km (5 mi): 13.1, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Columbia about 6 km (4 mi) N. Chattahoochee State Park is about 19 km (12 mi) S.

Population Within an 80 km (50 mi) Radius: 393,639

FORT CALHOUN STATION

Location:	Washington County, Nebraska
	31 km (19 mi) N of Omaha
	Latitude 41.5208°N; longitude 96.0767°W
Licensee:	Omaha Public Power District

Unit Information	Unit 1
Docket Number:	50-285
Construction Permit:	1968
Operating License:	1973
Commercial Operation:	1974
License Expiration:	2033
Licensed Thermal Power [MW(t)]:	1500
Net Capacity [MW(e)]:	478
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	CE

Cooling Water System

Type: Once-through
Source: Missouri River
Source Temperature Range: 0–27°C (32–80°F)
Condenser Flow Rate: 23 m^3/s (360,000 gpm)
Design Condenser Temperature Rise: 13°C (23°F)
Intake Structure: Concrete structure at river shore
Discharge Structure: At river shore

Site Information

Total Area: 270 ha (660 ac)
Exclusion Distance: 0.92 km (0.57 mi) minimum
Low Population Zone: 8.05 km (5 mi)
Nearest City: Omaha; 2000 population: 390,007
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, herbaceous, wetland
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Western Corn Belt Plains

Percent Wetland Within 8 km (5 mi): 6.3, mostly lake; riverine; freshwater forested/shrub wetland

Nearby Features: The nearest town is De Soto 3 km (2 mi) SSE. De Soto National Wildlife Refuge is about 1.6 km (1 mi) E. Wilson Island State Park is about 6 km (4 mi) SE.

Population Within an 80 km (50 mi) Radius: 852,717

GRAND GULF NUCLEAR STATION

Location: Clairborne County, Mississippi
40 km (25 mi) S of Vicksburg
Latitude 32.0075°N; longitude 91.0475°W
Licensee: System Energy Resources, Inc.

Unit Information	Unit 1
Docket Number:	50-416
Construction Permit:	1974
Operating License:	1984
Commercial Operation:	1985
License Expiration:	2024
Licensed Thermal Power [MW(t)]:	3898
Net Capacity [MW(e)]:	1266
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Natural draft cooling towers
Source: Mississippi River
Source Temperature Range: 1–28°C (34–82°F)
Condenser Flow Rate: 36.1 m^3/s (572,000 gpm)
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: A series of radial-collector wells along the shoreline
Discharge Structure: Discharge to river via a barge slip

Site Information

Total Area: 850 ha (2100 ac)
Exclusion Distance: 0.69 km (0.43 mi) radius
Low Population Zone: 3.22 km (2 mi)
Nearest City: Jackson; 2000 population: 184,256
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Forest, wetland, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Mississippi Valley Loess Plains; Mississippi Alluvial Plain

Percent Wetland Within 8 km (5 mi): 39.4, mostly freshwater forested/shrub wetland
Nearby Features: The nearest town is Grand Gulf 3 km (2 mi) N. The Natchez Trace Parkway is about 10 km (6 mi) SE. The Grand Gulf Military Park is just N of the site.
Population Within an 80 km (50 mi) Radius: 357,525

H.B. ROBINSON STEAM ELECTRIC STATION

Location:	Darlington County, South Carolina
	42 km (26 mi) NE of Florence
	Latitude 34.4025°N; longitude 80.1586°W
Licensee:	Carolina Light and Power Co.

Unit Information	Unit 2
Docket Number:	50-261
Construction Permit:	1967
Operating License:	1970
Commercial Operation:	1971
License Expiration:	2030
Licensed Thermal Power [MW(t)]:	2339
Net Capacity [MW(e)]:	710
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Once-through, cooling pond
Source: Lake Robinson
Source Temperature Range: 8–29°C (46–85°F)
Condenser Flow Rate: 28.7 m^3/s (454,167 gpm)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: Concrete structure on edge of lake
Discharge Structure: 6.8 km (4.2 mi) canal discharging about 6 km (4 mi) upstream from intake

Site Information

Total Area: 2435 ha (6020 ac)
Exclusion Distance: 0.43 km (0.27 mi) radius
Low Population Zone: 7.24 km (4.5 mi)
Nearest City: Columbia; 2000 population: 116,278
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, herbaceous
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Plains
Percent Wetland Within 8 km (5 mi): 13.5, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Hartsville 8 km (5 mi) SE. Unit 1 is an adjacent 185 MW(e) capacity coal-fired plant. Sand Hills State Forest is about 6 km (4 mi) N. The Carolina Sandhills National Wildlife Refuge is about 8 km (5 mi) NNW.

Population Within an 80 km (50 mi) Radius: 809,582

HOPE CREEK GENERATING STATION

Location:	Salem County, New Jersey 13 km (8 mi) SW of Salem Latitude 39.4678°N; longitude 75.5381°W
Licensee:	Public Service Electric and Gas Co.

Unit Information	Unit 1
Docket Number:	50-354
Construction Permit:	1974
Operating License:	1986
Commercial Operation:	1986
License Expiration:	2026
Licensed Thermal Power [MW(t)]:	3339
Net Capacity [MW(e)]:	1061
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Natural draft cooling tower
Source: Delaware River
Source Temperature Range: 1–27°C (34–81°F)
Condenser Flow Rate: 34.8 m^3/s (552,000 gpm)
Design Condenser Temperature Rise: 16°C (28°F)
Intake Structure: At edge of river
Discharge Structure: Pipe 3 m (10 ft) offshore

Site Information

Total Area: 300 ha (740 ac)
Exclusion Distance: 0.90 km (0.56 mi) radius
Low Population Zone: 8.05 km (5 mi) radius
Nearest City: Wilmington, Delaware; 2000 population: 72,664
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, wetland, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Middle Atlantic Coastal Plain

Percent Wetland Within 8 km (5 mi): 82.4, mostly estuarine and marine deepwater; estuarine and marine wetland

Nearby Features: The nearest town is Port Penn about 6 km (4 mi) NW in Delaware. The nearest railroad is 13 km (8 mi) NE. The plant is on the same site as the Salem Nuclear Generating Station.

Population Within an 80 km (50 mi) Radius: 5,999,588

INDIAN POINT ENERGY CENTER

Location:	Westchester County, New York 39 km (24 mi) N of New York City Latitude 41.2714°N; longitude 73.9525°W
Licensee:	Entergy Corporation

Unit Information	Unit 2	Unit 3
Docket Number:	50-247	50-286
Construction Permit:	1966	1969
Operating License:	1973	1976
Commercial Operation:	1974	1976
License Expiration:	2013	2016
Licensed Thermal Power [MW(t)]:	3216	3216
Net Capacity [MW(e)]:	1020	1025
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

<u>Cooling Water System</u>

Type: Once-through
Source: Hudson River
Source Temperature Range: 0–26°C (32–78°F)
Condenser Flow Rate: 53 m^3/s (840,000 gal/min) each unit
Design Condenser Temperature Rise: 9.2°C (16.6°F)
Intake Structure: Concrete structure at river bank
Discharge Structure: Discharge canal to river exiting through 12 ports

<u>Site Information</u>

Total Area: 96.7 ha (239 ac)
Exclusion Distance: 0.32 km (0.20 mi) radius
Low Population Zone: 1.05 km (0.65 mi) radius
Nearest City: White Plains; 2000 population: 53,077
Site Topography: Hilly
Surrounding Area Topography: Hilly to mountainous
Dominant Land Cover Within 8 km (5 mi): Forest, open water, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Northern Forest
Level 3 Ecoregion Within 8 km (5 mi): Northeastern Highlands
Percent Wetland Within 8 km (5 mi): 19.0, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Buchannan 3 km (2 mi) ESE. Camp Smith (military) is 1.6 km (1 mi) N and West Point is 13 km (8mi) N.

Population Within an 80 km (50 mi) Radius: 16,791,654

KEWAUNEE POWER STATION

Location: Kewaunee County, Wisconsin
43 km (27 mi) E of Green Bay
Latitude 44.3431°N; longitude 87.5361°W
Licensee: Dominion Resources

Unit Information	Unit 1
Docket Number:	50-305
Construction Permit:	1968
Operating License:	1973
Commercial Operation:	1974
License Expiration:	2013
Licensed Thermal Power [MW(t)]:	1772
Net Capacity [MW(e)]:	556
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Once-through
Source: Lake Michigan
Source Temperature Range: 1–19°C (34–67°F)
Condenser Flow Rate: 27 m^3/s (420,000 gpm)
Design Condenser Temperature Rise: 11°C (19°F)
Intake Structure: Intake crib 4.6 km (15 ft) deep 533 m (1750 ft) from shore
Discharge Structure: At shoreline

Site Information

Total Area: 367 ha (908 ac)
Exclusion Distance: 1.21 km (0.75 mi)
Low Population Zone: 4.83 km (3 mi) radius
Nearest City: Green Bay; 2000 population: 102,313
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Open Water, Agriculture, Wetland
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Wisconsin Till Plains
Percent Wetland Within 8 km (5 mi): 51.9, mostly lake

Nearby Features: The nearest town is Two Creeks about 5 km (3 mi) S. Point Beach Nuclear Plant is about 8 km (5 mi) S.

Population Within an 80 km (50 mi) Radius: 1,585,415

LASALLE COUNTY STATION

Location: LaSalle County, Illinois
18 km (11 mi) SE of Ottawa
Latitude 41.2439°N; longitude 88.6708°W
Licensee: Exelon Corporation

Unit Information	Unit 1	Unit 2
Docket Number:	50-373	50-374
Construction Permit:	1973	1973
Operating License:	1982	1984
Commercial Operation:	1984	1984
License Expiration:	2022	2024
Licensed Thermal Power [MW(t)]:	3489	3489
Net Capacity [MW(e)]:	1118	1120
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Cooling pond
Source: Illinois River
Source Temperature Range: 8–29°C (47–85°F)
Condenser Flow Rate: 40.7 m^3/s (645,000 gpm) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: Intake from 832.8 ha (2058 ac) cooling pond, makeup from river
Discharge Structure: Discharge to cooling pond

Site Information

Total Area: 1240 ha (3060 ac)
Exclusion Distance: 0.51 km (0.32 mi)
Low Population Zone: 6.41 km (3.98 mi)
Nearest City: Joliet; 2000 population: 106,221
Site Topography: Flat
Surrounding Area Topography: Flat with hills along river
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Central Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 4.9, mostly lake

Nearby Features: The nearest town is Seneca about 8 km (5 mi) NNE. Braidwood Station (nuclear plant) is about 32 km (20 mi) ENE and Dresden Nuclear Power Station is about 35 km (22 mi) NE.

Population Within an 80 km (50 mi) Radius: 1,498,644

LIMERICK GENERATING STATION

Location: Montgomery County, Pennsylvania
34 km (21 mi) NW of Philadelphia
Latitude 40.2200°N; longitude 75.5900°W
Licensee: Exelon Corporation

Unit Information	Unit 1	Unit 2
Docket Number:	50-352	50-353
Construction Permit:	1974	1974
Operating License:	1985	1989
Commercial Operation:	1986	1989
License Expiration:	2025	2029
Licensed Thermal Power [MW(t)]:	3458	3458
Net Capacity [MW(e)]:	1134	1134
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Natural draft cooling towers
Source: Schuylkill River
Source Temperature Range: 6–28°C (42–82°F)
Condenser Flow Rate: 28 m^3/s (450,000 gpm) each unit
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: Intake from river
Discharge Structure: Discharge to river

Site Information

Total Area: 241 ha (595 ac)
Exclusion Distance: 0.76 km (0.47 mi)
Low Population Zone: 2.09 km (1.30 mi)
Nearest City: Reading; 2000 population: 81,207
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Northern Piedmont

Percent Wetland Within 8 km (5 mi): 2, mostly riverine

Nearby Features: The nearest town is Linfield about 1.6 km (1 mi) SE. Valley Forge State Park is 16 km (10 mi) SSE. U.S. Highway I-76 is about 16 km (10 mi) S.

Population Within an 80 km (50 mi) Radius: 7,651,537

MCGUIRE NUCLEAR STATION

Location: Mecklenburg County, North Carolina
27 km (17 mi) NNW of Charlotte
Latitude 35.4322°N; longitude 80.9483°W
Licensee: Duke Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-369	50-370
Construction Permit:	1973	1973
Operating License:	1981	1983
Commercial Operation:	1981	1984
License Expiration:	2041	2043
Licensed Thermal Power [MW(t)]:	3411	3411
Net Capacity [MW(e)]:	1100	1100
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Lake Norman
Source Temperature Range: 3–32°C (38–89°F)
Condenser Flow Rate: 111 m^3/s (1,756,944 gpm) both units
Design Condenser Temperature Rise: 12.3°C (22.1°F)
Intake Structure: Submerged and surface intakes at shoreline
Discharge Structure: 610 m (2000 ft) discharge canal

Site Information

Total Area: 234 ha (577 ac)
Exclusion Distance: 0.76 km (0.47 mi) radius
Low Population Zone: 8.85 km (5.50 mi)
Nearest City: Charlotte; 2000 population: 540,828
Site Topography: Rolling
Surrounding Area Topography: Hilly
Dominant Land Cover Within 8 km (5 mi): Forest, open water, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont
Percent Wetland Within 8 km (5 mi): 21.4, mostly lake

Nearby Features: The nearest town is Lowesville about 5 km (3 mi) W. The dam forming Lake Norman and a hydroelectric power plant are adjacent to the site.
Population Within an 80 km (50 mi) Radius: 2,425,097

MILLSTONE POWER STATION

Location: Millstone Nuclear Power Station
5 km (3 mi) WSW of New London
Latitude 41.3086°N; longitude 72.1681°W
Licensee: Dominion Resources

Unit Information	Unit 2	Unit 3
Docket Number:	50-336	50-423
Construction Permit:	1970	1974
Operating License:	1975	1986
Commercial Operation:	1975	1986
License Expiration:	2035	2046
Licensed Thermal Power [MW(t)]:	2700	3411
Net Capacity [MW(e)]:	882	1155
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	CE	WEST

Cooling Water System

Type: Once-through
Source: Long Island Sound
Source Temperature Range: 2–22°C (36–72°F)
Condenser Flow Rate: 92 m^3/s (1.46 million gpm) both units
Design Condenser Temperature Rise: 13°C (21°F) for Unit 2
9.7°C (17.5°F) for Unit 3
Intake Structure: On shore of Niantic Bay off Long Island Sound
Discharge Structure: Discharge to Niantic Bay via holding pond

Site Information

Total Area: 200 ha (500 ac)
Exclusion Distance: 0.55 km (0.34 mi) minimum
Low Population Zone: 3.86 km (2.40 mi) radius
Nearest City: New Haven; 2000 population: 123,626
Site Topography: Flat
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Northeastern Coastal Zone

Percent Wetland Within 8 km (5 mi): 53.5, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Niantic 3 km (2 mi) NW. U.S. Highway I-95 is about 6 km (4 mi) NNE. Stone Ranch Military Reservation is about 10 km (6 mi) NW. Harkness Memorial State Park, Bluff Point State Park, and Rocky Neck State Park are within 8 km (5 mi) of the site. The U.S. Department of Agriculture Plum Island facility is 16 km (10 mi) S in Long Island Sound. The decommissioned Haddam Neck Plant (nuclear) is 32 km (20 mi) NW.

Population Within an 80 km (50 mi) Radius: 2,868,207

MONTICELLO NUCLEAR GENERATING PLANT

Location:	Wright County, Minnesota
	56 km (35 mi) NW of Minneapolis
	Latitude 45.3333°N; longitude 93.8483°W
Licensee:	Northern States Power Company

Unit Information	Unit 1
Docket Number:	50-263
Construction Permit:	1967
Operating License:	1970
Commercial Operation:	1971
License Expiration:	2030
Licensed Thermal Power [MW(t)]:	1775
Net Capacity [MW(e)]:	572
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through and mechanical draft towers
Source: Mississippi River
Source Temperature Range: 0–29°C (32–85°F)
Condenser Flow Rate: 18 m^3/s (292,000 gpm)
Design Condenser Temperature Rise: 14.9°C (26.8°F)
Intake Structure: Canal
Discharge Structure: Canal

Site Information

Total Area: 860 ha (2150 ac)
Exclusion Distance: 0.48 km (0.30 mi)
Low Population Zone: 1.61 km (1 mi)
Nearest City: Minneapolis; 2000 population: 382,618
Site Topography: Flat terraces
Surrounding Area Topography: Flat to gently sloping
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): North Central Hardwood Forests

Percent Wetland Within 8 km (5 mi): 11.8, mostly freshwater emergent wetland; lake; freshwater forested/shrub wetland

Nearby Features: The business district of Monticello is about 3.2 km (2 mi) SE. Sherburne National Wildlife Refuge is about 14 km (9 mi) N. Lake Maria State Park is about 10 km (6 mi) WSW and Sand Dunes State Forest and campground are 14 km (9 mi) NE.

Population Within an 80 km (50 mi) Radius: 2,740,995

NINE MILE POINT NUCLEAR STATION

Location: Oswego County, New York
10 km (6 mi) NE of Oswego
Latitude 43.5222°N; longitude 76.4100°W
Licensee: Nine Mile Point Nuclear Station, LLC (Constellation Energy Group)

Unit Information	Unit 1	Unit 2
Docket Number:	50-220	50-410
Construction Permit:	1965	1974
Operating License:	1968	1987
Commercial Operation:	1969	1988
License Expiration:	2028	2047
Licensed Thermal Power [MW(t)]:	1850	3467
Net Capacity [MW(e)]:	621	1140
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Unit 1: Once-through
Unit 2: Natural draft tower
Source: Lake Ontario
Source Temperature Range: 1–25°C (33–77°F)
Condenser Flow Rate: Unit 1: 18 m^3/s (290,278 gpm); Unit 2: 36.6 m^3/s (580,000 gpm)
Design Condenser Temperature Rise: Unit 1: 19.4°C (35°F);
Unit 2: 16.7°C (30°F)
Intake Structure: Unit 1: submerged pipeline about 260 m (850 ft) from shore;
Unit 2: submerged pipelines about 300 m (950 ft) and 320 m (1050 ft) from shore
Discharge Structure: Diffuser pipe 169 m (555 ft) long serving both sides

Site Information

Total Area: 360 ha (900 ac)
Exclusion Distance: 1.6 km (1 mi) to the east, 1.4 km (0.87 mi) to the southwest, and 2 km (1.3 mi) to the southern site boundary
Low Population Zone: 6.44 km (4 mi) radius
Nearest City: Syracuse; 2000 population: 147,306
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling

Dominant Land Cover Within 8 km (5 mi): Open water, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Eastern Great Lakes and Hudson Lowlands
Percent Wetland Within 8 km (5 mi): 65.7, mostly lake
Nearby Features: The nearest town is Lakeview about 1.6 km (1 mi) WSW. Fort Ontario is about 10 km (6 mi) SW. James A. Fitzpatrick Nuclear Power Plant is 0.8 km (0.5 mi) E.
Population Within an 80 km (50 mi) Radius: 914,668

NORTH ANNA POWER STATION

Location: Louisa County, Virginia
64 km (40 mi) NW of Richmond
Latitude 38.0608°N; longitude 77.7906°W
Licensee: Dominion Generation Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-338	50-339
Construction Permit:	1971	1971
Operating License:	1978	1980
Commercial Operation:	1978	1980
License Expiration:	2038	2040
Licensed Thermal Power [MW(t)]:	2893	2893
Net Capacity [MW(e)]:	924	910
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Lake Anna
Source Temperature Range: 9–28°C (48–83°F)
Condenser Flow Rate: 120 m^3/s (1,900,000 gpm) both units
Design Condenser Temperature Rise: 8.1°C (14.5°F)
Intake Structure: Intake at lake shore
Discharge Structure: Discharged through lake via a 1400 ha (3400 ac) cooling pond

Site Information

Total Area: 7550 ha (18,643 ac)
Exclusion Distance: 1.35 km (0.84 mi)
Low Population Zone: 9.66 km (6 mi)
Nearest City: Richmond; 2000 population: 197,790
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, agriculture, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont
Percent Wetland Within 8 km (5 mi): 21.1, mostly lake

Nearby Features: The nearest town is Centreville 1.6 km (1 mi) SW. Fredericksburg and Spotsylvania National Military Park is about 24 km (15 mi) NE.

Population Within an 80 km (50 mi) Radius: 1,614,983

OCONEE NUCLEAR STATION

Location:	Oconee County, South Carolina
	42 km (26 mi) W of Greenville
	Latitude 34.7917°N; longitude 82.8986°W
Licensee:	Duke Energy

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number:	50-269	50-270	50-287
Construction Permit:	1967	1967	1967
Operating License:	1973	1973	1974
Commercial Operation:	1973	1974	1974
License Expiration:	2033	2033	2034
Licensed Thermal Power [MW(t)]:	2568	2568	2568
Net Capacity [MW(e)]:	846	846	846
Type of Reactor:	PWR	PWR	PWR
Nuclear Steam Supply System Vendor:	B&W	B&W	B&W

Cooling Water System

Type: Once-through
Source: Lake Keowee
Source Temperature Range: 7–25°C (44–77°F)
Condenser Flow Rate: 96 m^3/s (1,527,778 gpm) all units
Design Condenser Temperature Rise: 9.6°C (17.2°F)
Intake Structure: A skimmer wall draws water from the depths of 223 m (735 ft).
Discharge Structure: All three units discharge through one structure near the Keowee Dam.

Site Information

Total Area: 210 ha (510 acres)
Exclusion Distance: 1.6 km (1 mi) radius
Low Population Zone: 9.66 km (6 mi)
Nearest City: Greenville; 2000 population: 56,002
Site Topography: Flat to rolling
Surrounding Area Topography: Hilly
Dominant Land Cover Within 8 km (5 mi): Forest, open water, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont
Percent Wetland Within 8 km (5 mi): 22.3, mostly lake

Nearby Features: The nearest town is Six Mile 6 km (4 mi) ENE. Keowee Dam is close to the plant. Chattahoochee National Forest is about 24 km (15 mi) W.

Population Within an 80 km (50 mi) Radius: 1,226,479

OYSTER CREEK NUCLEAR GENERATING STATION

Location: Ocean County, New Jersey
14 km (9 mi) S of Toms River
Latitude 39.8142°N; longitude 74.2064°W
Licensee: AmerGen Energy, LLC

Unit Information	Unit 1
Docket Number:	50-219
Construction Permit:	1964
Operating License:	1969
Commercial Operation:	1969
License Expiration:	2009
Licensed Thermal Power [MW(t)]:	1930
Net Capacity [MW(e)]:	619
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through
Source: Barnegat Bay
Source Temperature Range: 2–24°C (35–75°F)
Condenser Flow Rate: 29 m^3/s (460,000 gpm)
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: Forked River serves as a canal for intake and discharge to Barnegat Bay.
Discharge Structure: Forked River serves as a canal for intake and discharge to Barnegat Bay.

Site Information

Total Area: 323.8 ha (800 ac)
Exclusion Distance: 0.40 km (0.25 mi)
Low Population Zone: 3.22 km (2 mi)
Nearest City: Atlantic City; 2000 population: 40,517
Site Topography: Flat
Surrounding Area Topography: Rolling plains to flat lowlands
Dominant Land Cover Within 8 km (5 mi): Forest, open water, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Atlantic Coastal Pine Barrens

Percent Wetland Within 8 km (5 mi): 45, mostly estuarine and marine deepwater; freshwater forested/shrub wetland

Nearby Features: The nearest town is Forked River about 3 km (2 mi) N. The Garden State Parkway is 1.6 km (1 mi) W. There is a large influx of recreationists and tourists in the summer.

Population Within an 80 km (50 mi) Radius: 4,243,462

PALISADES NUCLEAR PLANT

Location:	Van Buren County, Michigan
	56 km (35 mi) W of Kalamazoo
	Latitude 42.3222°N; longitude 86.3153°W
Licensee:	Entergy Corporation

Unit Information	Unit 1
Docket Number:	50-255
Construction Permit:	1967
Operating License:	1972
Commercial Operation:	1973
License Expiration:	2032
Licensed Thermal Power [MW(t)]:	2565
Net Capacity [MW(e)]:	778
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	CE

Cooling Water System

Type: Mechanical draft cooling towers
Source: Lake Michigan
Source Temperature Range: 2–24°C (35–75°F)
Condenser Flow Rate: 6.2 m^3/s (98,000 gpm)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: Intake crib 1000 m (3300 ft) from shore
Discharge Structure: 33 m (108 ft) long canal

Site Information

Total Area: 174.8 ha (432 ac)
Exclusion Distance: 0.71 km (0.44 mi) radius
Low Population Zone: Not available
Nearest City: Kalamazoo; 2000 population: 77,145
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): S. Michigan/N. Indiana Drift Plains
Percent Wetland Within 8 km (5 mi): 58.1, mostly lake

Nearby Features: The nearest town is South Haven about 6 km (4 mi) N. Van Buren State Park joins the plant on the north. Many tourists come to the beaches in the summer. The C&O Railway is about 3 km (2 mi) E. Highway I-196 is about 1.6 km (1 mi) E.

Population Within an 80 km (50 mi) Radius: 1,287,558

PALO VERDE NUCLEAR GENERATING STATION

Location: Maricopa County, Arizona
55 km (34 mi) W of Phoenix
Latitude 33.3881°N; longitude 112.8644°W
Licensee: Arizona Public Service Co.

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number:	50-528	50-529	50-530
Construction Permit:	1976	1976	1976
Operating License:	1985	1986	1987
Commercial Operation:	1986	1986	1988
License Expiration:	2025	2026	2027
Licensed Thermal Power [MW(t)]:	3990	3990	3990
Net Capacity [MW(e)]:	1311	1314	1247
Type of Reactor:	PWR	PWR	PWR
Nuclear Steam Supply System Vendor:	CE	CE	CE

<u>Cooling Water System</u>

Type: Mechanical draft cooling towers treatment plant
Source: Phoenix City Sewage
Source Temperature Range: Not available
Condenser Flow Rate: 35 m^3/s (560,000 gpm) each unit
Design Condenser Temperature Rise: 17.8°C (32.1°F)
Intake Structure: 56 km (35 mi) underground pipeline from Phoenix 91st Avenue Sewage Treatment Plant
Discharge Structure: Blowdown from the circulating water system is directed to onsite evaporation ponds without requiring any offsite discharge

<u>Site Information</u>

Total Area: 1640 ha (4050 ac)
Exclusion Distance: 0.87 km (0.54 mi) minimum
Low Population Zone: 6.44 km (4 mi) radius
Nearest City: Phoenix; 2000 population: 1,321,045
Site Topography: Flat with hills
Surrounding Area Topography: Flat with hills
Dominant Land Cover Within 8 km (5 mi): Shrub/scrub, agriculture, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): North American Desert

Level 3 Ecoregion Within 8 km (5 mi): Sonoran Basin and Range
Percent Wetland Within 8 km (5 mi): 1.2, mostly lake
Nearby Features: The nearest town is Wintersburg about 5 km (3 mi) N. U.S. Highway I-10 is about 11 km (7 mi) N. The Southern Pacific Railroad is about 8 km (5 mi) SE.
Population Within an 80 km (50 mi) Radius: 1,781,095

PEACH BOTTOM ATOMIC POWER STATION

Location:	York County, Pennsylvania
	29 km (18 mi) S of Lancaster
	Latitude 39.7589°N; longitude 76.2692°W
Licensee:	Exelon Co.

Unit Information	Unit 2	Unit 3
Docket Number:	50-277	50-278
Construction Permit:	1968	1968
Operating License:	1973	1974
Commercial Operation:	1974	1974
License Expiration:	2033	2034
Licensed Thermal Power [MW(t)]:	3514	3514
Net Capacity [MW(e)]:	1112	1112
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Once-through, with helper mechanical draft towers
Source: Conowingo Pond
Source Temperature Range: 1–27°C (34–80°F)
Condenser Flow Rate: 95 m^3/s (1.5 million gpm) (both units)
Design Condenser Temperature Rise: 11.5°C (20.8°F)
Intake Structure: Intake from Conowingo Pond through a small intake pond
Discharge Structure: 1520 m (5000 ft) canal to Conowingo Pond

Site Information

Total Area: 248 ha (620 ac)
Exclusion Distance: 0.82 km (0.51 mi)
Low Population Zone: 2.22 km (1.38 mi)
Nearest City: Lancaster; 2000 population: 56,348
Site Topography: Rolling to hilly
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Northern Piedmont
Percent Wetland Within 8 km (5 mi): 14.5, mostly lake

Nearby Features: The nearest town is Slate Hill 3 km (2 mi) SW. Susquehanna State Park is about 5 km (3 mi) N. U.S. Highway I-95 is about 24 km (15 mi) SE. Conowingo Dam, about 13 km (8 mi) SE on the Susquehanna River, forms Conowingo Pond. Unit 1 is a 40 MW(e) nuclear plant on the same site and was retired from service in 1974. Three Mile Island Nuclear Station is 56 km (35 mi) upstream on the Susquehanna River.

Population Within an 80 km (50 mi) Radius: 5,270,600

PERRY NUCLEAR POWER PLANT

Location: Lake County, Ohio
11 km (7 mi) NE of Painesville
Latitude 41.8008°N; longitude 81.1442°W
Licensee: FirstEnergy Corporation

Unit Information	Unit 1
Docket Number:	50-440
Construction Permit:	1977
Operating License:	1986
Commercial Operation:	1987
License Expiration:	2026
Licensed Thermal Power [MW(t)]:	3758
Net Capacity [MW(e)]:	1231
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Natural draft cooling tower
Source: Lake Erie
Source Temperature Range: 0–26°C (32–79°F)
Condenser Flow Rate: 34.41 m^3/s (545,400 gpm)
Design Condenser Temperature Rise: 18°C (32°F)
Intake Structure: Submerged multiport structure 777m (2550 ft) offshore
Discharge Structure: Submerged diffuser 503 m (1650 ft) offshore

Site Information

Total Area: 450 ha (1100 ac)
Exclusion Distance: 0.89 km (0.55 mi) radius
Low Population Zone: 4.02 km (2.50 mi)
Nearest City: Euclid; 2000 population: 52,717
Site Topography: Flat
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Eastern Great Lakes and Hudson Lowlands; Erie Drift Plain
Percent Wetland Within 8 km (5 mi): 49.3, mostly lake
Nearby Features: The nearest town is North Perry 1.6 km (1 mi) SW. The Penn Central Railroad is about 5 km (3 mi) S. U.S. Highway I-90 is about 8 km (5 mi) S.
Population Within an 80 km (50 mi) Radius: 4,923,662

PILGRIM NUCLEAR POWER STATION

Location:	Plymouth County, Massachusetts 6 km (4 mi) SE of Plymouth Latitude 41.9444°N; longitude 70.5794°W
Licensee:	Entergy Corporation

Unit Information	Unit 1
Docket Number:	50-293
Construction Permit:	1968
Operating License:	1972
Commercial Operation:	1972
License Expiration:	2012
Licensed Thermal Power [MW(t)]:	2028
Net Capacity [MW(e)]:	685
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through
Source: Cape Cod Bay
Source Temperature Range: 2–22°C (35.6–71.6°F)
Condenser Flow Rate: 19.6 m^3/s (311,100 gpm)
Design Condenser Temperature Rise: 18°C (32°F)
Intake Structure: Concrete structure at edge of bay protected by a breakwater
Discharge Structure: 260 m (850 ft) long canal

Site Information

Total Area: 57 ha (140 ac)
Exclusion Distance: 0.53 km (0.33 mi)
Low Population Zone: 6.76 km (4.20 mi)
Nearest City: Brockton; 2000 population: 94,304
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Open water, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Atlantic Coastal Pine Barrens; Northeastern Coastal Zone

Percent Wetland Within 8 km (5 mi): 64.4, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Plymouth about 6 km (4 mi) NW. Miles Standish State Forest is about 10 km (6 mi) SW. Plymouth Rock and Plymouth Plantation historical sites are about 8 km (5 mi) W.

Population Within an 80 km (50 mi) Radius: 4,629,116

POINT BEACH NUCLEAR PLANT

Location: Manitowoc County, Wisconsin
21 km (13 mi) NNW of Manitowoc
Latitude 44.2808°N; longitude 87.5361°W
Licensee: Florida Power & Light Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-266	50-301
Construction Permit:	1967	1968
Operating License:	1970	1972
Commercial Operation:	1970	1972
License Expiration:	2030	2033
Licensed Thermal Power [MW(t)]:	1540	1540
Net Capacity [MW(e)]:	512	514
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Lake Michigan
Source Temperature Range: Not available
Condenser Flow Rate: 22 m^3/s (350,000 gpm) each unit
Design Condenser Temperature Rise: 10.7°C (19.3°F)
Intake Structure: Submerged structure 533 m (1750 ft) from shore
Discharge Structure: 2 steel piling troughs, extending 61 m (200 ft) into Lake Michigan

Site Information

Total Area: 510 ha (1260 ac)
Exclusion Distance: 1.19 km (0.74 mi) radius
Low Population Zone: 9.01 km (5.60 mi)
Nearest City: Green Bay; 2000 population: 102,313
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Open water, agriculture, wetland
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Wisconsin Till Plains
Percent Wetland Within 8 km (5 mi): 54, mostly lake

Nearby Features: The nearest town is Two Creeks 1.6 km (1 mi) NNW. Point Beach State Forest is just S of the site. The Kewaunee Nuclear Power Plant is about 8 km (5 mi) N.

Population Within an 80 km (50 mi) Radius: 1,622,052

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Location: Goodhue County, Minnesota
45 km (28 mi) SE of Minneapolis
Latitude 44.6219°N; longitude 92.6331°W
Licensee: Northern States Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-282	50-306
Construction Permit:	1968	1968
Operating License:	1973	1974
Commercial Operation:	1973	1974
License Expiration:	2013	2014
Licensed Thermal Power [MW(t)]:	1650	1650
Net Capacity [MW(e)]:	551	545
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through and/or mechanical draft cooling towers
Source: Mississippi River
Source Temperature Range: 0–28°C (32–82°F)
Condenser Flow Rate: 18.6 m^3/s (294,000 gpm) each unit
Design Condenser Temperature Rise: 15°C (27°F)
Intake Structure: Short canal
Discharge Structure: Discharges to a basin then to towers and/or river

Site Information

Total Area: 230 ha (560 ac)
Exclusion Distance: 0.69 km (0.43 mi) radius
Low Population Zone: 2.41 km (1.50 mi)
Nearest City: Minneapolis; 2000 population: 382,618
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, wetland
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Driftless Area
Percent Wetland Within 8 km (5 mi): 31.9, mostly freshwater forested/shrub wetland; lake

Nearby Features: The business district of the town of Red Wing is 9.6 km (6 mi) SE. A railroad line is just SW of the site.

Population Within an 80 km (50 mi) Radius: 2,731,953

QUAD CITIES NUCLEAR POWER STATION

Location:	Rock Island County, Illinois
	32 km (20 mi) NE of Moline
	Latitude 41.7261°N; longitude 90.3100°W
Licensee:	Exelon Generation Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-254	50-265
Construction Permit:	1967	1967
Operating License:	1972	1972
Commercial Operation:	1973	1973
License Expiration:	2032	2032
Licensed Thermal Power [MW(t)]:	2957	2957
Net Capacity [MW(e)]:	867	867
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Once-through
Source: Mississippi River
Source Temperature Range: 0–29°C (32–85°F)
Condenser Flow Rate: 61 m^3/s (970,000 gpm) both units
Design Condenser Temperature Rise: 15.6°C (28°F)
Intake Structure: Canal at edge of river
Discharge Structure: Two-pipe diffuser system on bottom of river

Site Information

Total Area: 331 ha (817 ac)
Exclusion Distance: 0.80 km (0.50 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Davenport, Iowa; 2000 population: 98,359
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Agriculture, wetland, forest
Level 1 Ecoregion Within 8 km (5 mi):   Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Interior River Valley and Hills; Western Corn Belt Plains
Percent Wetland Within 8 km (5 mi): 22.2, mostly freshwater forested/shrub wetland; lake

Nearby Features: The nearest town is Folletts 5 km (3 mi) NW. The Rock Island Railroad is 3 km (2 mi) W and the Chicago, Milwaukee, and St. Paul Railroad is 1.6 km (1 mi) E. The Rock Island Arsenal is about 24 km (15 mi) SW.

Population Within an 80 km (50 mi) Radius: 656,527

R.E. GINNA NUCLEAR POWER PLANT

Location: Wayne County, New York
32 km (20 mi) NE of Rochester
Latitude 43.2778°N; longitude 77.3089°W
Licensee: Constellation Energy Group

Unit Information	Unit 1
Docket Number:	50-244
Construction Permit:	1966
Operating License:	1969
Commercial Operation:	1970
License Expiration:	2029
Licensed Thermal Power [MW(t)]:	1775
Net Capacity [MW(e)]:	498
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Once-through
Source: Lake Ontario
Source Temperature Range: 0–27°C (32–80°F)
Condenser Flow Rate: 21.4 m^3/s (340,000 gpm)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: 945 m (3100 ft) from shore, at a depth of 10 m (33 ft)
Discharge Structure: Canal discharges to Lake Ontario at shoreline.

Site Information

Total Area: 197 ha (488 ac)
Exclusion Distance: 0.47–1.38 km (0.29–0.85 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Rochester; 2000 population: 219,773
Site Topography: Gently rolling to flat
Surrounding Area Topography: Sloping
Dominant Land Cover Within 8 km (5 mi): Open water, agriculture, forest
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Eastern Great Lakes and Hudson Lowlands
Percent Wetland Within 8 km (5 mi): 63.1, mostly lake

Nearby Features: The nearest town is Lakeside 3 km (2 mi) SW. The N.Y. Central Railroad is about 5 km (3 m) S.

Population Within an 80 km (50 mi) Radius: 1,250,000

RIVER BEND STATION

Location: West Feliciana County, Louisiana
39 km (24 mi) NNW of Baton Rouge
Latitude 30.7569°N; longitude 91.3314°W
Licensee: Entergy Nuclear

Unit Information	Unit 1
Docket Number:	50-458
Construction Permit:	1977
Operating License:	1985
Commercial Operation:	1986
License Expiration:	2025
Licensed Thermal Power [MW(t)]:	3091
Net Capacity [MW(e)]:	967
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Mechanical draft cooling towers
Source: Mississippi River
Source Temperature Range: Not available
Condenser Flow Rate: 32.08 m^3/s (508,470 gpm)
Design Condenser Temperature Rise: 15°C (27°F)
Intake Structure: At river bank
Discharge Structure: Pipe extending into the river

Site Information

Total Area: 1352 ha (3342 ac)
Exclusion Distance: 0.92 km (0.57 mi) radius
Low Population Zone: 4.02 km (2.50 mi) radius
Nearest City: Baton Rouge; 2000 population: 227,818
Site Topography: Flat
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Wetland, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Mississippi Valley Loess Plains; Mississippi Alluvial Plain
Percent Wetland Within 8 km (5 mi): 41.6, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is St. Francisville 5 km (3 mi) NW. Audubon Memorial State Park is about 5 km (3 mi) NNE. The Illinois Central Railroad crosses the site.

Population Within an 80 km (50 mi) Radius: 866,314

SAINT LUCIE NUCLEAR PLANT

Location: St. Lucie County, Florida
11 km (7 mi) SE of Fort Pierce
Latitude 27.3486°N; longitude 80.2464°W
Licensee: Florida Power & Light Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-335	50-389
Construction Permit:	1970	1977
Operating License:	1976	1983
Commercial Operation:	1976	1983
License Expiration:	2036	2043
Licensed Thermal Power [MW(t)]:	2700	2700
Net Capacity [MW(e)]:	839	839
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	CE	CE

Cooling Water System

Type: Once-through
Source: Atlantic Ocean
Source Temperature Range: 31°C (87°F)
Condenser Flow Rate: 61 m^3/s (968,000 gpm) both units
Design Condenser Temperature Rise: 13°C (24°F).
Intake Structure: 370 m (1200 ft) offshore
Discharge Structure: Unit 1 is 460 m (1500 ft) offshore; Unit 2 is a multisport discharge 1040 m (3400 ft) offshore

Site Information

Total Area: 457 ha (1130 ac)
Exclusion Distance: 1.56 km (0.97 mi) radius
Low Population Zone: 1.61 km (1 mi)
Nearest City: West Palm Beach; 2000 population: 82,103
Site Topography: Flat land and water
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, wetland, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Southern Coastal Plain

Percent Wetland Within 8 km (5 mi): 77.8, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Ankona 3 km (2 mi) W. The Florida East Coast Railroad is about 3 km (2 mi) W. The plant is on Hutchinson Island, which is separated from the mainland by the Indian River, which is part of the Intracoastal Waterway. A causeway to the mainland is about 10 km (6 mi) SSE.

Population Within an 80 km (50 mi) Radius: 1,180,000

SALEM NUCLEAR GENERATING STATION

Location:	Salem County, New Jersey
	13 km (8 mi) SW of Salem
	Latitude 39.4628°N; longitude 75.5358°W
Licensee:	Public Service Electric and Gas Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-272	50-311
Construction Permit:	1968	1968
Operating License:	1976	1981
Commercial Operation:	1977	1981
License Expiration:	2016	2021
Licensed Thermal Power [MW(t)]:	3459	3459
Net Capacity [MW(e)]:	1174	1130
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: Delaware River
Source Temperature Range: 1–26°C (33–79°F)
Condenser Flow Rate: 69 m^3/s (1,100,000 gpm) each unit
Design Condenser Temperature Rise: 7.6°C (13.6°F)
Intake Structure: 12-bay structure on edge of river
Discharge Structure: Submerged pipes extending 150 m (500 ft) into the river

Site Information

Total Area: 280 ha (700 ac)
Exclusion Distance: 1.29 km (0.80 mi)
Low Population Zone: 8.05 km (5 mi)
Nearest City: Wilmington, Delaware; 2000 population: 72,664
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, wetland, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Middle Atlantic Coastal Plain

Percent Wetland Within 8 km (5 mi): 84, mostly estuarine and marine deepwater; estuarine and marine wetland

Nearby Features: The nearest town is Port Penn about 6 km (4 mi) NW in Delaware. The nearest railroad is 13 km (8 mi) NE. The plant is on the same site as the Hope Creek Generating Station (nuclear).

Population Within an 80 km (50 mi) Radius: 5,975,864

SAN ONOFRE NUCLEAR GENERATING STATION

Location:	San Diego County, California
	8 km (5 mi) SE of San Clemente
	Latitude 33.3703°N; longitude 117.5569°W
Licensee:	Southern California Edison Co.

Unit Information	Unit 2	Unit 3
Docket Number:	50-361	50-362
Construction Permit:	1973	1973
Operating License:	1982	1983
Commercial Operation:	1983	1984
License Expiration:	2022	2023
Licensed Thermal Power [MW(t)]:	3438	3438
Net Capacity [MW(e)]:	1070	1080
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	CE	CE

<u>Cooling Water System</u>

Type: Once-through
Source: Pacific Ocean
Source Temperature Range: 12–23°C (54–73°F)
Condenser Flow Rate: Unit 2: 50.3 m^3/s (797,000 gpm)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: Velocity-cap structure about 1040 m (3400 ft) from shore in water 9 m (30 ft) deep
Discharge Structure: Diffuser port systems extending 1160–2590 m (3800–8500 ft) from shore

<u>Site Information</u>

Total Area: 34 ha (84 ac)
Exclusion Distance: 0.60 km (0.37 mi)
Low Population Zone: 3.14 km (1.95 mi)
Nearest City: Oceanside; 2000 population: 161,029
Site Topography: Narrow, sloping coastal plain and sea cliffs
Surrounding Area Topography: Hilly
Dominant Land Cover Within 8 km (5 mi): Open water, shrub/scrub, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Mediterranean California

Level 3 Ecoregion Within 8 km (5 mi): Southern and Central California Chaparral and Oak Woodlands
Percent Wetland Within 8 km (5 mi): 50.7, mostly estuarine and marine deepwater
Nearby Features: The nearest town is San Clemente 8 km (5 mi) NW. The site is surrounded by Camp Pendleton Marine Base. Camps on the base are 2.4 km (1.5 mi) or more from the site. U.S. Highway I-5 and the Atchison, Topeka, and Santa Fe Railroad are adjacent to the site to the east.
Population Within an 80 km (50 mi) Radius: 12,404,757

SEABROOK STATION

Location:	Rockingham County, New Hampshire
	21 km (13 mi) SSW of Portsmouth
	Latitude 42.8983°N; longitude 70.8497°W
Licensee:	Florida Power & Light Company

Unit Information	Unit 1
Docket Number:	50-443
Construction Permit:	1976
Operating License:	1990
Commercial Operation:	1990
License Expiration:	2032
Licensed Thermal Power [MW(t)]:	3648
Net Capacity [MW(e)]:	1244
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Once-through
Source: Atlantic Ocean
Source Temperature Range: 3–13°C (37–55°F)
Condenser Flow Rate: 25.2 m^3/s (399,000 gpm)
Design Condenser Temperature Rise: 21°C (38°F)
Intake Structure: 3 structures 15 m (50 ft) below sea level with pipeline submerged about 50 m (175 ft) below mean sea level and extending about 2100 m (7000 ft) offshore
Discharge Structure: Submerged pipeline ending in a diffuser located about 1675 m (5500 ft) offshore and about 1525 m (5000 ft) S of intake

Site Information

Total Area: 363 ha (896 ac)
Exclusion Distance: 0.92 km (0.57 mi) minimum
Low Population Zone: 2.01 km (1.25 mi)
Nearest City: Lawrence, Massachusetts; 2000 population: 72,043
Site Topography: Flat
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Open water, forest, developed: high, medium, low density

Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest

Level 3 Ecoregion Within 8 km (5 mi): Northeastern Coastal Zone

Percent Wetland Within 8 km (5 mi): 45.2, mostly estuarine and marine deepwater; estuarine and marine wetland

Nearby Features: The nearest town is Seabrook 1.6 km (1 mi) W. U.S. Highway I-95 is about 1.6 km (1 mi) W. The Boston and Maine Railroad is adjacent to the site. Hampton Beach State Park is 3 km (2 mi) E.

Population Within an 80 km (50 mi) Radius: 6,932,660

SEQUOYAH NUCLEAR PLANT

Location:	Hamilton County, Tennessee
	16 km (10 mi) NE of Chattanooga
	Latitude 35.2233°N; longitude 85.0878°W
Licensee:	Tennessee Valley Authority

Unit Information	Unit 1	Unit 2
Docket Number:	50-327	50-328
Construction Permit:	1970	1970
Operating License:	1980	1981
Commercial Operation:	1981	1982
License Expiration:	2020	2021
Licensed Thermal Power [MW(t)]:	3455	3455
Net Capacity [MW(e)]:	1150	1127
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through and/or natural draft cooling towers
Source: Chickamauga Lake
Source Temperature Range: 6–28°C (42–83°F)
Condenser Flow Rate: 32.9 m^3/s (522,000 gpm) each unit
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: Intake from lake
Discharge Structure: Discharge to lake

Site Information

Total Area: 212 ha (525 ac)
Exclusion Distance: 0.56 km (0.35 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Chattanooga; 2000 population: 155,554
Site Topography: Rolling
Surrounding Area Topography: Hilly
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Ridge and Valley
Percent Wetland Within 8 km (5 mi): 15.1, mostly lake

Nearby Features: The nearest town is Shady Grove about 3 km (2 mi) NW. Harrison Bay State Park is 5 km (3 mi) S. The Volunteer Ordnance Works is about 15 km (9 mi) S. Chickamauga Lake is part of the Tennessee River.

Population Within an 80 km (50 mi) Radius: 954,430

SHEARON HARRIS NUCLEAR POWER PLANT

Location: Wake County, North Carolina
32 km (20 mi) SW of Raleigh
Latitude 35.6336°N; longitude 78.9564°W
Licensee: Progress Energy

Unit Information	Unit 1
Docket Number:	50-400
Construction Permit:	1978
Operating License:	1987
Commercial Operation:	1987
License Expiration:	2027
Licensed Thermal Power [MW(t)]:	2900
Net Capacity [MW(e)]:	900
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Natural draft cooling tower
Source: Buckhorn Creek
Source Temperature Range: 5–27°C (41–81°F)
Condenser Flow Rate: 30.5 m^3/s (483,000 gpm)
Design Condenser Temperature Rise: 14.3°C (25.7°F)
Intake Structure: At shoreline of reservoir on Buckhorn Creek
Discharge Structure: Discharged to reservoir

Site Information

Total Area: 4348 ha (10,744 ac)
Exclusion Distance: 6640 feet (northwest) to 7000 feet (east) to 7200 feet (south)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Raleigh; 2000 population: 276,093
Site Topography: Rolling
Surrounding Area Topography: Rolling
Dominant Land Cover Within 8 km (5 mi): Forest, herbaceous, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont; Southeastern Plains
Percent Wetland Within 8 km (5 mi): 13.2, mostly lake

Nearby Features: The nearest town is Bonsal 3 km (2 mi) NW. The Seaboard Coast Line Railroad is 3 km (2 mi) NW. Buckhorn Creek feeds into the Cape Fear River.

Population Within an 80 km (50 mi) Radius: 2,035,797

SOUTH TEXAS PROJECT NUCLEAR GENERATING STATION

Location:	Matagorda County, Texas
	19 km (12 mi) SSW of Bay City
	Latitude 28.7950°N; longitude 96.0481°W
Licensee:	NRG Energy, Inc.

Unit Information	Unit 1	Unit 2
Docket Number:	50-498	50-499
Construction Permit:	1975	1975
Operating License:	1988	1989
Commercial Operation:	1988	1989
License Expiration:	2028	2029
Licensed Thermal Power [MW(t)]:	3853	3853
Net Capacity [MW(e)]:	1280	1280
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Closed cycle cooling reservoir
Source: Colorado River
Source Temperature Range: 14–29°C (58–84°F)
Condenser Flow Rate: 57.26 m^3/s (907,400 gpm) each unit
Design Condenser Temperature Rise: 11°C (19°F)
Intake Structure: On bank of Colorado River
Discharge Structure: On bank of Colorado River

Site Information

Total Area: 4998 ha (12,350 ac)
Exclusion Distance: 1.43 km (0.89 mi) minimum
Low Population Zone: 4.83 km (3 mi)
Nearest City: Galveston; 2000 population: 57,247
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Agriculture, open water, wetland
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Western Gulf Coastal Plain
Percent Wetland Within 8 km (5 mi): 23.3, mostly lake

Nearby Features: The nearest town is Matagorda 13 km (8 mi) SE. The Missouri Pacific Railroad is about 8 km (5 mi) NNE. A 40-cm (16-in) natural gas pipeline is about 3 km (2 mi) NW.

Population Within an 80 km (50 mi) Radius: 402,902

SURRY POWER STATION

Location: Surry County, Virginia
27 km (17 mi) NW of Newport News
Latitude 37.1656°N; longitude 76.6983°W
Licensee: Dominion Generation

Unit Information	Unit 1	Unit 2
Docket Number:	50-280	20-281
Construction Permit:	1968	1968
Operating License:	1972	1973
Commercial Operation:	1972	1973
License Expiration:	2032	2033
Licensed Thermal Power [MW(t)]:	2546	2546
Net Capacity [MW(e)]:	799	799
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Once-through
Source: James River
Source Temperature Range: 2–29°C (35–84°F)
Condenser Flow Rate: 106 m^3/s (1.68 million gpm) both units
Design Condenser Temperature Rise: 7.8°C (14°F)
Intake Structure: 2.7 km (1.7 mi) concrete canal
Discharge Structure: 880 m (2900 ft) canal

Site Information

Total Area: 340 ha (840 ac)
Exclusion Distance: 500 m (1650 ft) radius or 0.5 km (0.31 mi)
Low Population Zone: 4.83 km (3 mi)
Nearest City: Newport News; 2000 population: 180,150
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Open water, forest, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Middle Atlantic Coastal Plain; Southeastern Plains
Percent Wetland Within 8 km (5 mi): 60.9, mostly estuarine and marine deepwater; riverine

Nearby Features: The nearest town is Scotland 8 km (5 mi) W. Jamestown Island, a Federal park, is 6 km (4 mi) NW. Chippokes Plantation, a state park, is 5 km (3 mi) WSW. Jamestown National Historical Park is 8 km (5 mi) WNW. Colonial Williamsburg is 11 km (7 mi) NNW. Adjacent to the site on the north is Hog Island, a waterfowl refuge. U.S. Highway I-64 is 19 km (12 mi) NW.

Population Within an 80 km (50 mi) Radius: 2,387,353

SUSQUEHANNA STEAM ELECTRIC STATION

Location: Luzerne County, Pennsylvania
11 km (7 mi) NE of Berwick
Latitude 41.0922°N; longitude 76.1467°W
Licensee: PPL

Unit Information	Unit 1	Unit 2
Docket Number:	50-387	50-388
Construction Permit:	1973	1973
Operating License:	1982	1984
Commercial Operation:	1983	1985
License Expiration:	2022	2024
Licensed Thermal Power [MW(t)]:	3952	3952
Net Capacity [MW(e)]:	1135	1140
Type of Reactor:	BWR	BWR
Nuclear Steam Supply System Vendor:	GE	GE

Cooling Water System

Type: Natural draft cooling towers
Source: Susquehanna River
Source Temperature Range: Not available
Condenser Flow Rate: 61 m^3/s (968,000 gpm) both units
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: Intake bays on river bank
Discharge Structure: Diffuser pipe 200 ft (61m) from river bank

Site Information

Total Area: 1173 ac (475 ha)
Exclusion Distance: 0.55 km (0.34 mi) radius
Low Population Zone: 4.83 km (3 mi)
Nearest City: Wilkes-Barre; 2000 population: 43,123
Site Topography: Rolling
Surrounding Area Topography: Hilly with flat river valley
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, developed: open space
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Ridge and Valley
Percent Wetland Within 8 km (5 mi): 4.6, mostly riverine

Nearby Features: The nearest town is Beach Haven about 1.6 km (1 mi) SW. U.S. Highway I-80 is 8 km (5 mi) E and the Delaware and Hudson Railroad is 1.6 km (1 mi) E.

Population Within an 80 km (50 mi) Radius: 1,684,794

THREE MILE ISLAND, UNIT 1

Location:	Dauphin County, Pennsylvania 16 km (10 mi) SE of Harrisburg Latitude 40.1531°N; longitude 76.7250°W
Licensee:	Exelon Corporation

Unit Information	Unit 1
Docket Number:	50-289
Construction Permit:	1968
Operating License:	1974
Commercial Operation:	1974
License Expiration:	2014
Licensed Thermal Power [MW(t)]:	2568
Net Capacity [MW(e)]:	786
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	B&W

Cooling Water System

Type: Natural draft cooling towers
Source: Susquehanna River
Source Temperature Range: 1–29°C (33–84°F)
Condenser Flow Rate: 27 m^3/s (430,000 gpm)
Design Condenser Temperature Rise: Not available
Intake Structure: Concrete structure on river bank
Discharge Structure: Discharged at the shoreline

Site Information

Total Area: 191 ha (472 ac)
Exclusion Distance: 0.61 km (0.38 mi) radius
Low Population Zone: 3.22 km (2 mi)
Nearest City: Harrisburg; 2000 population: 48,950
Site Topography: Flat
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Agriculture, forest, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi):   Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Northern Piedmont

Percent Wetland Within 8 km (5 mi): 11.4, mostly riverine

Nearby Features: The nearest town is Middletown 6 km (4 mi) N. Harrisburg-York Airport is 13 km (8 mi) WNW. Unit 2 ceased operation after an accident in 1979. Peach Bottom Atomic Power Station is 56 km (35 mi) downstream.

Population Within an 80 km (50 mi) Radius: 2,466,679

TURKEY POINT NUCLEAR PLANT

Location:	Dade County, Florida 40 km (25 mi) S of Miami Latitude 25.4350°N; longitude 80.3314°W
Licensee:	Florida Power and Light Co.

Unit Information	Unit 3	Unit 4
Docket Number:	50-250	50-251
Construction Permit:	1967	1967
Operating License:	1972	1973
Commercial Operation:	1972	1973
License Expiration:	2032	2033
Licensed Thermal Power [MW(t)]:	2300	2300
Net Capacity [MW(e)]:	693	693
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Closed-cycle cooling canal
Source: Biscayne Bay
Source Temperature Range: 12–32°C (54–90°F)
Condenser Flow Rate: 82 m^3/s (1.3 million gpm) both units
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: Intake canal and barge canal
Discharge Structure: Canal system covering about 1600 ha (4000 ac)

Site Information

Total Area: 9700 ha (24,000 ac)
Exclusion Distance: 1.27 km (0.79 mi)
Low Population Zone: 8.05 km (5 mi)
Nearest City: Miami; 2000 population: 362,470
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Wetland, open water, agriculture
Level 1 Ecoregion Within 8 km (5 mi): Tropical Wet Forest
Level 3 Ecoregion Within 8 km (5 mi): Southern Florida Coastal Plain
Percent Wetland Within 8 km (5 mi): 91.5, mostly estuarine and marine deepwater

Nearby Features: The nearest town is Florida City about 14 km (9 mi) W. Hawk Missile Base is 1.6 km (1 mi) NW. Homestead Recreation Park is about 3 km (2 mi) NNW. The Florida East Coast Railroad is about 14 km (9 mi) NW. Units 1 and 2 are coal-fired and adjacent to the site.

Population Within an 80 km (50 mi) Radius: 7,490,123

VERMONT YANKEE NUCLEAR POWER STATION

Location: Windham County, Vermont
8 km (5 mi) S of Brattleboro
Latitude 42.7803°N; longitude 72.5158°W
Licensee: Entergy

Unit Information	Unit 1
Docket Number:	50-271
Construction Permit:	1967
Operating License:	1973
Commercial Operation:	1972
License Expiration:	2013
Licensed Thermal Power [MW(t)]:	1912
Net Capacity [MW(e)]:	650
Type of Reactor:	BWR
Nuclear Steam Supply System Vendor:	GE

Cooling Water System

Type: Once-through; closed-cycle mechanical draft towers
Source: Connecticut River
Source Temperature Range: 0–23°F (32–74°C)
Condenser Flow Rate: 22.7 m^3/s (360,000 gpm)
Design Condenser Temperature Rise: 13.4°F (10°C)
Intake Structure: Concrete structure at edge of river
Discharge Structure: Aerating structure discharges at edge of river

Site Information

Total Area: 50.6 ha (125 ac)
Exclusion Distance: 0.27 km (0.17 mi)
Low Population Zone: 8.05 km (5 mi)
Nearest City: Holyoke, Massachusetts; 2000 population: 39,838
Site Topography: Flat
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Northeastern Coastal Zone; Northeastern Highlands

Percent Wetland Within 8 km (5 mi): 6.1, mostly lake

Nearby Features: The nearest town is Vernon about 1.6 km (1 mi) W. Vernon Dam is 1 km (0.7 mi) downstream from the site. The decommissioned Yankee Nuclear Power Station is about 32 km (20 mi) WSW.

Population Within an 80 km (50 mi) Radius: 1,513,282

VIRGIL C. SUMMER NUCLEAR STATION

Location:	Fairfield County, South Carolina 42 km (26 mi) NW of Columbia Latitude 34.2958°N; longitude 81.3203°W
Licensee:	South Carolina Electric and Gas Co.

Unit Information	Unit 1
Docket Number:	50-395
Construction Permit:	1973
Operating License:	1982
Commercial Operation:	1984
License Expiration:	2042
Licensed Thermal Power [MW(t)]:	2900
Net Capacity [MW(e)]:	966
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Once-through
Source: Lake Monticello
Source Temperature Range: 11–33°C (52–91°F)
Condenser Flow Rate: 32 m^3/s (507,000 gpm)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: Intake at shoreline
Discharge Structure: Discharge to lake via a discharge basin and 305-m (1000-ft) canal

Site Information

Total Area: 890 ha (2200 ac)
Exclusion Distance: 1.63 m (1.01 mi) radius
Low Population Zone: 4.83 km (3 mi)
Nearest City: Columbia; 2000 population: 116,278
Site Topography: Rolling
Surrounding Area Topography: Rolling to hilly
Dominant Land Cover Within 8 km (5 mi): Forest, open water, herbaceous
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Piedmont
Percent Wetland Within 8 km (5 mi): 20.2, mostly lake

Nearby Features: The nearest town is Jenkinsville 5 km (3 mi) SE. U.S. Highway I-26 is 11 km (7 mi) SSW. The Southern Railroad is 1.6 km (1 mi) W. The Fairfield pumped storage hydrostation is about 1.6 km (1 mi) NW and uses Lake Monticello as well as the Parr Reservoir.

Population Within an 80 km (50 mi) Radius: 1,032,330

VOGTLE ELECTRIC GENERATING PLANT

Location: Burke County, Georgia
42 km (26 mi) SE of Augusta
Latitude 33.1414°N; longitude 81.7625°W
Licensee: Georgia Power Co.

Unit Information	Unit 1	Unit 2
Docket Number:	50-424	50-425
Construction Permit:	1974	1974
Operating License:	1987	1989
Commercial Operation:	1987	1989
License Expiration:	2027	2029
Licensed Thermal Power [MW(t)]:	3565	3565
Net Capacity [MW(e)]:	1152	1149
Type of Reactor:	PWR	PWR
Nuclear Steam Supply System Vendor:	WEST	WEST

Cooling Water System

Type: Natural draft cooling towers
Source: Savannah River
Source Temperature Range: 4–30°C (39–86°F)
Condenser Flow Rate: 32.16 m^3/s (509,600 gpm) each unit
Design Condenser Temperature Rise: 18°C (33°F)
Intake Structure: At river bank
Discharge Structure: Single-point discharge pipe near the shoreline

Site Information

Total Area: 1282 ha (3169 ac)
Exclusion Distance: 1.09 km (0.68 mi) minimum
Low Population Zone: 3.22 km (2 mi) radius
Nearest City: Augusta-Richmond County; 2000 population: 195,182
Site Topography: Rolling
Surrounding Area Topography: Rolling, river flood plain
Dominant Land Cover Within 8 km (5 mi): Forest, wetland, herbaceous
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Southeastern Plains
Percent Wetland Within 8 km (5 mi): 27.4, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Shell Bluff about 11 km (7 mi) W. The Seaboard Coast Line Railroad is about 6 km (4 mi) NE. The Department of Energy Savannah River Plant is about 16 km (10 mi) NNE.

Population Within an 80 km (50 mi) Radius: 670,000

WATERFORD STEAM ELECTRIC STATION

Location:	St. Charles County, Louisiana
	32 km (20 mi) W of New Orleans
	Latitude 29.9947°N; longitude 90.4711°W
Licensee:	Entergy

Unit Information	Unit 3
Docket Number:	50-382
Construction Permit:	1974
Operating License:	1985
Commercial Operation:	1985
License Expiration:	2025
Licensed Thermal Power [MW(t)]:	3716
Net Capacity [MW(e)]:	1152
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	CE

Cooling Water System

Type: Once-through
Source: Mississippi River
Source Temperature Range: 8–28°C (46–82°F)
Condenser Flow Rate: 61.53 m^3/s (975,000 gpm)
Design Condenser Temperature Rise: 9°C (16°F)
Intake Structure: At river bank
Discharge Structure: At river bank

Site Information

Total Area: 1441 ha (3561 ac)
Exclusion Distance: 0.92 km (90.57 mi) radius
Low Population Zone: 3.22 km (2 mi)
Nearest City: New Orleans; 2000 population: 484,674
Site Topography: Flat
Surrounding Area Topography: Flat
Dominant Land Cover Within 8 km (5 mi): Wetland, agriculture, developed: high, medium, low density
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Mississippi Alluvial Plain

Percent Wetland Within 8 km (5 mi): 67.8, mostly freshwater forested/shrub wetland

Nearby Features: The nearest town is Killona 1.6 km (1 mi) WNW. U.S. Highway I-10 is about 11 km (7 mi) NE and I-90 about 11 km (7 mi) SE. Several active and abandoned gas and oil fields are within 16 km (10 mi). Lake Pontchartrain is about 11 km (7 mi) NE. The Missouri Pacific Railroad is just S of the site and the Southern Pacific Railroad is about 13 km (8mi) SE.

Population Within an 80 km (50 mi) Radius: 2,072,270

WATTS BAR NUCLEAR PLANT

Location:	Rhea County, Tennessee
	11 km (7 mi) SSE of Spring City
	Latitude 35.6022°N; longitude 84.7894°W
Licensee:	Tennessee Valley Authority

Unit Information	Unit 1[(a)]
Docket Number:	50-390
Construction Permit:	1973
Operating License:	1996
Commercial Operation:	1996
License Expiration:	2035
Licensed Thermal Power [MW(t)]:	3459
Net Capacity [MW(e)]:	1121
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Natural draft cooling towers
Source: Chickamauga Lake
Source Temperature Range: 6–28°C (43–82°F)
Condenser Flow Rate: 26 m^3/s (410,000 gpm) each unit
Design Condenser Temperature Rise: 21°C (38°F)
Intake Structure: At lake bank
Discharge Structure: To lake via a holding pond

Site Information

Total Area: 716 ha (1770 ac)
Exclusion Distance: 1.21 km (0.75 mi) radius
Low Population Zone: 4.83 km (3 mi)
Nearest City: Chattanooga; 2000 population: 155,554
Site Topography: Flat to rolling
Surrounding Area Topography: Rolling to hilly

(a) Construction of Unit 1 was halted in 1985, resumed in 1990, and completed in 1995. Construction of Unit 2 was halted in 1985 but was scheduled to resume in 2007.

Dominant Land Cover Within 8 km (5 mi): Forest, agriculture, open water
Level 1 Ecoregion Within 8 km (5 mi): Eastern Temperate Forest
Level 3 Ecoregion Within 8 km (5 mi): Ridge and Valley
Percent Wetland Within 8 km (5 mi): 10.9, mostly lake
Nearby Features: The nearest town is Peakland 3 km (2 mi) NE. Watts Bar Dam is 1.6 km (1 mi) N. A fossil-fired steam plant is just N of the site. U.S. Highway I-75 is about 18 km (11 mi) SE. The New Orleans and Texas Pacific Railroad is 11 km (7 mi) NW. Chickamauga Lake is on the Tennessee River.
Population Within an 80 km (50 mi) Radius: 1,044,454

WOLF CREEK GENERATING STATION

Location: Coffey County, Kansas
6 km (4 mi) NE of Burlington
Latitude 38.2386°N; longitude 95.6894°W
Licensee: Wolf Creek Nuclear Operating Corporation

Unit Information	Unit 1
Docket Number:	50-482
Construction Permit:	1977
Operating License:	1985
Commercial Operation:	1985
License Expiration:	2025
Licensed Thermal Power [MW(t)]:	3565
Net Capacity [MW(e)]:	1166
Type of Reactor:	PWR
Nuclear Steam Supply System Vendor:	WEST

Cooling Water System

Type: Closed-cycle cooling pond
Source: Wolf Creek
Source Temperature Range: 0–31°C (32–87°F)
Condenser Flow Rate: 30m^3/s (500,000 gpm)
Design Condenser Temperature Rise: 1.1°C (30°F)
Intake Structure: On the shore of cooling lake
Discharge Structure: Discharged to 2060 ha (5090 ac) cooling lake, into an embayment separated from the intake

Site Information

Total Area: 3973 ha (9818 ac)
Exclusion Distance: 1.21 km (0.75 mi) radius
Low Population Zone: 4.02 km (2.5 mi) radius
Nearest City: Topeka; 2000 population: 122,377
Site Topography: Flat to rolling
Surrounding Area Topography: Flat to rolling
Dominant Land Cover Within 8 km (5 mi): Herbaceous, agriculture, open water
Level 1 Ecoregion Within 8 km (5 mi): Great Plains
Level 3 Ecoregion Within 8 km (5 mi): Central Irregular Plains

Percent Wetland Within 8 km (5 mi): 14.8, mostly lake

Nearby Features: The nearest town is Sharpe about 3 km (2 mi) N. The Flint Hills National Wildlife Refuge is about 11 km (7 mi) W. The John Redmond Reservoir is about 6 km (4 mi) W. U.S. Highway I-35 is 23 km (14 mi) N. The cooling lake is formed by a dam on Wolf Creek.

Population Within an 80 km (50 mi) Radius: 176,301

REFERENCES

Commission for Environmental Cooperation (CEC). 2006. *Level I Ecological Regions of North America, Commission for Environmental Cooperation*. Available URL: http://www.epa.gov/wed/pages/ecoregions/na_eco.htm#Level%20I (Accessed November 6, 2007).

Energy Information Administration (EIA). 2007. *Nuclear Power Plants Operating in the United States as of September 30, 2005*. Available URL: http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/nuke1.html (Accessed December 5, 2007).

Energy Information Administration (EIA). 2007. *Monthly Nuclear Utility Generation by State and Reactor, 2007 – January through October*. Available URL: http://www.eia.doe.gov/cneaf/nuclear/page/nuc_generation/usreactors.xls (Accessed February 6, 2008).

U.S. Census Bureau (USCB). 2007. *State and County Quickfacts*. Available URL: http://quickfacts.census.gov/qfd/index.html (Accessed December 5, 2007).

U.S. Environmental Protection Agency (EPA). 2007. *Level III Ecoregions of the Conterminous United States*. National and Environmental Effects Research Laboratory. Revised March, 2007. Available URL: http://www.epa.gov/wed/pages/ecoregions/level_iii.htm (Accessed November 6, 2007).

U.S. Geological Survey (USGS). 2003. *National Land Cover Database*. Sioux Falls, South Dakota.

U.S. Fish and Wildlife Service (USFWS). 2007. *National Wetlands Inventory*. Available URL: http://wetlandsfws.er.usgs.gov/NWI/index.html (Accessed November 7, 2007).

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vols. 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2008. *Approved Applications for Power Uprates*. Available URL: http://www.nrc.gov/reactors/operation/licensing/power-uprates/approved-applications.html (Accessed February 6, 2008).

Appendix D

Technical Basis for GEIS Analysis

Appendix D

Technical Basis for GEIS Analysis

D.1. Land Use and Visual Resources

D.1.1 Description of Affected Resources and Region of Influence

Onsite land use resources that would be affected include all of the land and water situated within the plant site property boundaries, whether open to the public or under various levels of access control. For license renewal, current land use patterns would remain unchanged, while additional land areas onsite would be disturbed during refurbishment and decommissioning activities, although these could be areas that had formerly been used for construction or outage purposes. Offsite affected land resources include the host local jurisdictions and taxing authorities where revenue streams, workforce residence distribution, development patterns, and growth management practices have direct and indirect impacts on land use. Land cover types within 5 mi of operating nuclear plants are described in Table D.1-1. Transmission lines affect the land use within the right-of-way (ROW) corridor through a variety of restrictions that were instituted during land or easement acquisition. The region of influence for visual resource impacts can include all areas where plant facilities are visible.

D.1.2 Description of Impact Assessment

Onsite land use impacts were examined through a review of a select number of supplemental environmental impact statements (SEISs) to determine site estimations of disturbances and resources required during license renewal, as well as the information provided in the 1996 GEIS (NRC 1996) and the decommissioning GEIS (NRC 2002). Offsite impacts were assessed based on information provided in the 1996 GEIS that was derived from a survey of professional literature, a survey of newspaper and magazine accounts related to the issues, a survey of all operating nuclear power plants, and experiences at seven selected case study sites. Information provided in the decommissioning GEIS addressed impacts for plants that have undergone decommissioning or are in the process of decommissioning. Additional information for assessing offsite impacts came from a literature search on land use controls and workforce impacts with respect to nuclear power plants, as well as a review of selected SEISs. The evaluation of land use impacts of transmission lines was derived from information provided in the 1996 GEIS and a review of selected SEISs. The assessment of visual resource impacts resulting from the presence of the site, continued operation of plant facilities and transmission lines, or the decommissioning of a facility was derived from the evaluation presented in the

Table D.1-1 Land Cover within 5 Miles of Operating Nuclear Power Plants

	Percent of Land Cover Type									
Site Name	**Barren Land**	**Agriculture**	**Forest**	**Developed – High, Medium, Low Density**	**Developed – Open Space**	**Wetland**	**Herbaceous**	**Open Water**	**Shrub/ Scrub**	**Total Percent**
Region I										
Beaver Valley	0.0	13.1	65.2	4.6	10.0	0.1	1.6	5.5	0.0	100.0
Calvert Cliffs	0.8	9.1	30.5	2.2	2.2	2.9	0.0	52.4	0.0	100.0
Fitzpatrick	0.0	7.2	20.0	0.9	1.5	4.9	0.1	60.5	4.8	100.0
Ginna	0.0	16.4	16.0	1.0	2.4	1.3	0.1	61.8	0.8	100.0
Hope Creek	0.8	14.4	1.9	0.8	0.4	38.0	0.0	43.7	0.0	100.0
Indian Point	0.1	2.2	48.0	12.3	15.9	4.2	0.8	16.3	0.2	100.0
Limerick	0.5	46.0	22.8	16.9	10.9	2.1	0.0	0.9	0.0	100.0
Millstone	0.9	0.9	19.6	13.9	7.5	4.7	0.5	51.3	0.7	100.0
Nine Mile Point	0.0	7.0	19.8	1.0	1.5	4.9	0.1	60.8	4.9	100.0
Oyster Creek	1.3	4.2	37.7	13.8	5.7	12.3	0.0	24.9	0.0	100.0
Peach Bottom	1.0	51.1	30.9	0.6	0.4	2.0	0.0	14.0	0.0	100.0
Pilgrim	3.5	2.5	18.3	7.0	6.3	1.7	0.4	59.7	0.7	100.0
Salem	0.7	13.2	1.6	0.8	0.4	38.7	0.0	44.6	0.0	100.0
Seabrook	1.1	5.1	22.7	19.3	7.5	18.8	0.5	24.2	0.8	100.0
Susquehanna	0.3	26.1	60.5	3.1	5.4	0.9	0.0	3.2	0.5	100.0
Three Mile Island	0.8	37.2	29.5	11.6	7.3	2.4	0.0	11.2	0.0	100.0
Vermont Yankee	0.1	9.4	75.5	4.4	3.1	2.6	0.2	3.9	0.8	100.0
Region II										
Browns Ferry	0.4	43.0	10.8	1.5	3.8	8.3	1.6	26.6	4.1	100.0
Brunswick	1.5	2.9	18.9	5.7	5.3	32.4	5.4	26.2	1.7	100.0
Catawba	0.0	14.0	51.9	5.0	13.5	0.3	3.0	11.7	0.6	100.0

Table D.1-1 (cont.)

Site Name	Percent of Land Cover Type									
	Barren Land	Agriculture	Forest	Developed – High, Medium, Low Density	Developed – Open Space	Wetland	Herbaceous	Open Water	Shrub/ Scrub	Total Percent
Crystal River	0.4	1.9	18.0	3.2	3.5	32.5	1.2	37.9	1.4	100.0
Farley	0.3	29.3	41.1	1.2	3.6	10.1	3.3	2.0	9.0	100.0
Grand Gulf	1.2	6.9	43.7	0.5	3.3	27.5	0.1	12.0	4.9	100.0
Harris	0.3	5.2	67.7	0.9	3.5	2.3	9.5	8.7	2.0	100.0
Hatch	0.5	18.8	41.6	1.5	3.2	19.9	12.2	1.6	0.9	100.0
McGuire	0.1	15.3	35.6	9.1	12.2	1.3	5.2	20.2	0.9	100.0
North Anna	4.0	19.4	55.4	0.6	0.4	3.9	0.0	16.3	0.0	100.0
Oconee	0.8	8.3	52.8	1.4	5.6	0.4	7.9	22.0	0.8	100.0
Robinson	0.0	24.0	31.9	3.3	6.9	8.5	16.5	4.4	4.5	100.0
Sequoyah	0.8	21.7	44.8	3.9	7.5	0.6	3.2	14.2	3.2	100.0
St. Lucie	0.3	0.0	1.9	8.3	7.8	15.6	0.1	65.7	0.1	100.0
Summer	0.6	5.5	60.8	0.6	2.7	2.7	8.6	17.7	0.6	100.0
Surry	1.1	14.8	21.6	1.0	1.2	8.8	0.0	51.6	0.0	100.0
Turkey Point	0.0	2.9	0.0	1.3	1.1	52.5	0.1	41.9	0.2	100.0
Vogtle	0.1	10.1	36.0	1.8	3.1	25.2	19.4	0.8	3.5	100.0
Watts Bar	0.6	26.1	47.0	0.8	4.3	1.7	4.6	9.8	5.2	100.0
Region III										
Arnold	0.0	53.6	13.2	3.5	7.9	9.9	8.8	3.1	0.0	100.0
Braidwood	0.0	47.3	19.2	10.2	6.7	0.3	6.2	10.1	0.0	100.0
Byron	0.1	65.7	19.6	5.4	6.2	0.7	0.2	2.1	0.0	100.0
Callaway	0.2	26.7	64.1	0.8	2.5	2.2	2.1	1.2	0.1	100.0
Clinton	0.0	72.6	11.3	2.7	3.6	0.0	0.9	8.9	0.0	100.0

Table D.1-1 (cont.)

Site Name	Percent of Land Cover Type									
	Barren Land	Agriculture	Forest	Developed – High, Medium, Low Density	Developed – Open Space	Wetland	Herbaceous	Open Water	Shrub/ Scrub	Total Percent
Cook	0.9	20.2	8.8	7.5	7.7	2.8	2.2	49.9	0.1	100.0
Davis Besse	0.1	25.5	0.4	2.5	2.8	13.4	0.6	54.6	0.0	100.0
Dresden	0.1	30.7	15.3	12.3	6.5	4.4	17.0	13.7	0.0	100.0
Fermi	1.6	29.9	2.3	8.0	1.0	4.1	1.3	51.8	0.0	100.0
Kewaunee	0.4	40.9	1.4	2.4	0.6	5.3	2.1	46.6	0.3	100.0
LaSalle	0.1	72.1	11.4	3.6	4.0	0.4	3.4	5.0	0.0	100.0
Monticello	0.0	52.0	18.2	6.0	7.9	4.5	3.8	6.2	1.4	100.0
Palisades	1.1	10.0	16.3	3.2	4.8	9.8	6.1	48.2	0.4	100.0
Perry	0.0	11.8	13.7	12.8	10.7	0.6	1.5	48.8	0.1	100.0
Point Beach	0.5	39.4	1.2	2.0	1.2	8.7	1.5	45.3	0.3	100.0
Prairie Island	0.0	30.3	24.5	2.7	6.5	17.6	3.8	14.3	0.1	100.0
Quad Cities	0.2	57.6	7.3	3.6	4.5	15.8	2.2	8.8	0.0	100.0
Region IV										
Arkansas	0.3	22.8	53.5	3.7	3.8	0.3	3.1	11.4	1.0	100.0
Columbia	0.2	4.8	0.2	2.6	1.1	0.3	3.2	5.0	82.5	100.0
Comanche Peak	0.1	4.4	34.8	2.3	6.3	1.6	43.2	7.2	0.0	100.0
Cooper	0.0	71.1	6.7	1.0	5.2	7.7	4.9	3.5	0.0	100.0
Diablo Canyon	0.1	0.0	19.8	0.5	1.8	0.1	7.9	54.0	15.9	100.0
Fort Calhoun	0.1	44.2	8.3	5.6	4.3	8.4	24.8	4.2	0.0	100.0
Palo Verde	0.0	6.2	0.0	1.3	5.3	0.1	3.5	1.1	82.4	100.0
River Bend	1.4	19.6	24.1	2.3	3.2	34.0	3.0	7.6	4.8	100.0
San Onofre	0.3	1.3	1.4	8.7	3.6	0.6	7.6	48.2	28.4	100.0

Table D.1-1 (cont.)

Site Name	Percent of Land Cover Type									
	Barren Land	Agriculture	Forest	Developed – High, Medium, Low Density	Developed – Open Space	Wetland	Herbaceous	Open Water	Shrub/ Scrub	Total Percent
South Texas	0.8	56.4	3.9	1.7	3.9	14.0	1.0	14.1	4.2	100.0
Waterford	0.1	19.3	0.0	15.2	0.3	55.7	0.1	8.6	0.7	100.0
Wolf Creek	0.3	34.1	6.8	3.5	4.1	0.7	36.3	14.0	0.1	100.0
Averages	**0.5**	**23.2**	**24.8**	**4.7**	**4.8**	**9.6**	**4.7**	**23.5**	**4.3**	**100.0**

Source: USGS 2003

1996 GEIS that included a brief survey of the projected and realized visual resource impacts at nuclear power plants; the decommissioning GEIS, which described the range of options between retention and removal of structures; and a review of selected SEISs.

D.2 Air Quality and Noise

D.2.1 Description of Affected Resources and Region of Influence

Similar to most industrial facilities, nuclear power plants and other fuel-cycle facilities generate air pollutants[a] and propagate noise. The region of influence of the effects on air quality and noise includes the regulated ambient air environment within and outside each plant site property boundaries, whether open to the public or under various levels of access control. For license renewal, current air and noise pollution levels would remain unchanged, while during refurbishment and decommissioning activities, some additional impacts could occur, particularly on plant property. Some offsite areas at a few plants have a limited region of influence of a few kilometers beyond plant boundaries for measurable air quality impacts and a few hundred meters for noticeable noise impacts. The region of air and noise influences for major source activities can conservatively include downwind areas within a 25 to 50 km radius of the plant for air impacts and 500 m to 1 km from the fence line for noise impacts. The air quality nonattainment status maps presented in this section conservatively show a 50-km radius of influence, which is consistent with major new source regulatory reviews for prevention of significant deterioration (PSD) permits.[b] It is not anticipated that construction or refurbishment activities associated with license renewal would involve new major sources of air or noise pollution.

D.2.2 Description of Impact Assessment

Air quality and noise impacts were examined through a review of a select number of SEISs to identify air emission sources that are permitted or have applications for permits during license renewal, as well as the information provided in the 1996 GEIS (NRC 1996) and the decommissioning GEIS (NRC 2002), which addressed impacts for plants that have undergone decommissioning or are in the process of decommissioning. Offsite impacts were assessed based on a survey of all operating nuclear power plants and information in the decommissioning GEIS.

(a) Both radiological and nonradiological (criteria air pollutants) releases are covered in the GEIS. See Appendix F for description of region of influence and the impact assessment for radiological releases.

(b) Any new or modified source with the potential to emit 100 tons per year (TPY) or more of any air pollutant, i.e., particulate matter (PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), or volatile organic compounds (VOCs).

The following, including figures and tables, provide supplemental data and information in support of the air quality impacts provided in Sections 3.3.1, 3.3.2 and 4.1.1.2.

D.2.2.1 Climatology

Continental U.S. maximum and minimum average annual temperatures from 1971 through 2000 are shown in Figures D.2-1 and D.2-2, respectively. The average annual precipitation over the same period is shown in Figure D.2-3. In the period from August 2002 through August 2007, actual precipitation as a percent of the average monthly precipitation is shown in Figure D.2-4. Drought or near-drought conditions are shown in south-central California east of the San Onofre plant and east and north of the Diablo Canyon plant. Similar drought conditions over this recent 5 year period also appear in limited areas near the Palo Verde plant in Arizona. Above normal annual precipitation (10 to 30 percent above historical averages) in the vicinity of licensed commercial power reactors are shown in large areas of southwestern and south Texas and over much of the northeastern United States.

D.2.2.2 Air Quality

Air quality in all geographical regions of the United States is classified as being either in attainment or nonattainment. The U.S. Environmental Protection Agency (EPA) has the authority to formally designate areas as attainment or nonattainment areas and uses the National Ambient Air Quality Standards (NAAQS) to evaluate an area’s attainment status. The pollutants for which the NAAQS have been established are known as criteria pollutants (O_3, PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, and Pb). If the concentration limit of a pollutant is below the NAAQS, the area will be designated as attainment for that pollutant. An area is deemed in attainment by the EPA when the air quality is monitored and the resultant concentrations are found to be consistently below the NAAQS. Table D.2-1 provides primary (public health, including health of “sensitive” populations) and secondary (public welfare, e.g., protection against vegetation and materials damage, decrease in visibility) NAAQS for each criteria air pollutant. However, if the pollution limits are exceeded for several consecutive years, the EPA will designate an area as nonattainment. The area will subsequently be subject to more stringent new or modified source regulatory requirements.

Areas can be in attainment for some pollutants, while designated as nonattainment for others. Some areas are designated as “maintenance” areas. These are regions that were initially designated as nonattainment or unclassifiable and have since attained compliance with the NAAQS. Some designated nonattainment areas for some pollutants include classifications identifying the level of severity or degree on nonattainment. For example, the new 8-hr ozone standard has six separate classification levels, ranging from “marginal” to “extreme,” as

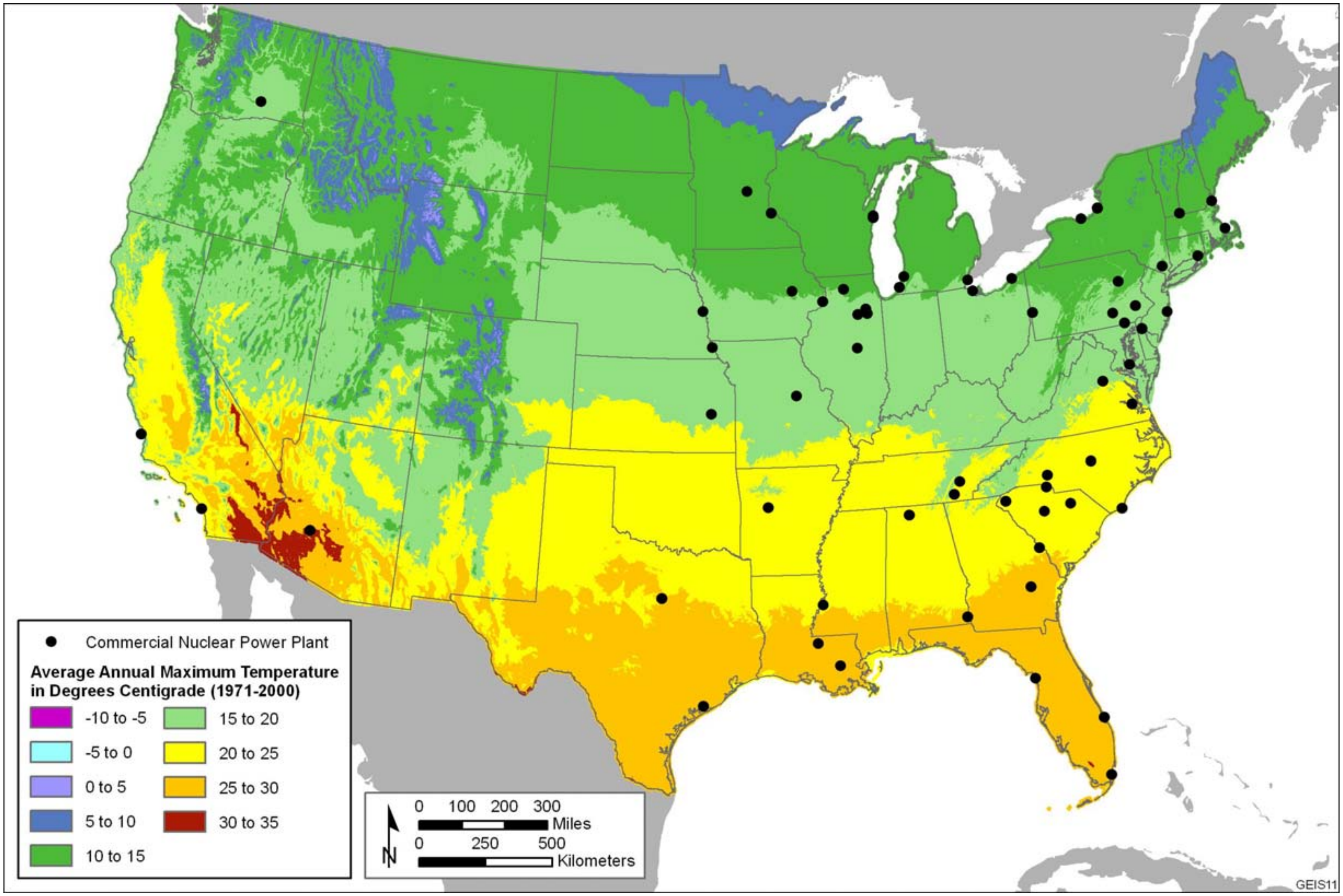


Figure D.2-1. Average Annual Maximum Temperatures over the Continental United States (1971–2000)
(Source: Permission to use this copyrighted material is granted by PRISM Group, Oregon State University)
Copyright (c) 2007, PRISM Climate Group, Oregon State University, http://www.prismclimate.org. Map created December 11, 2007

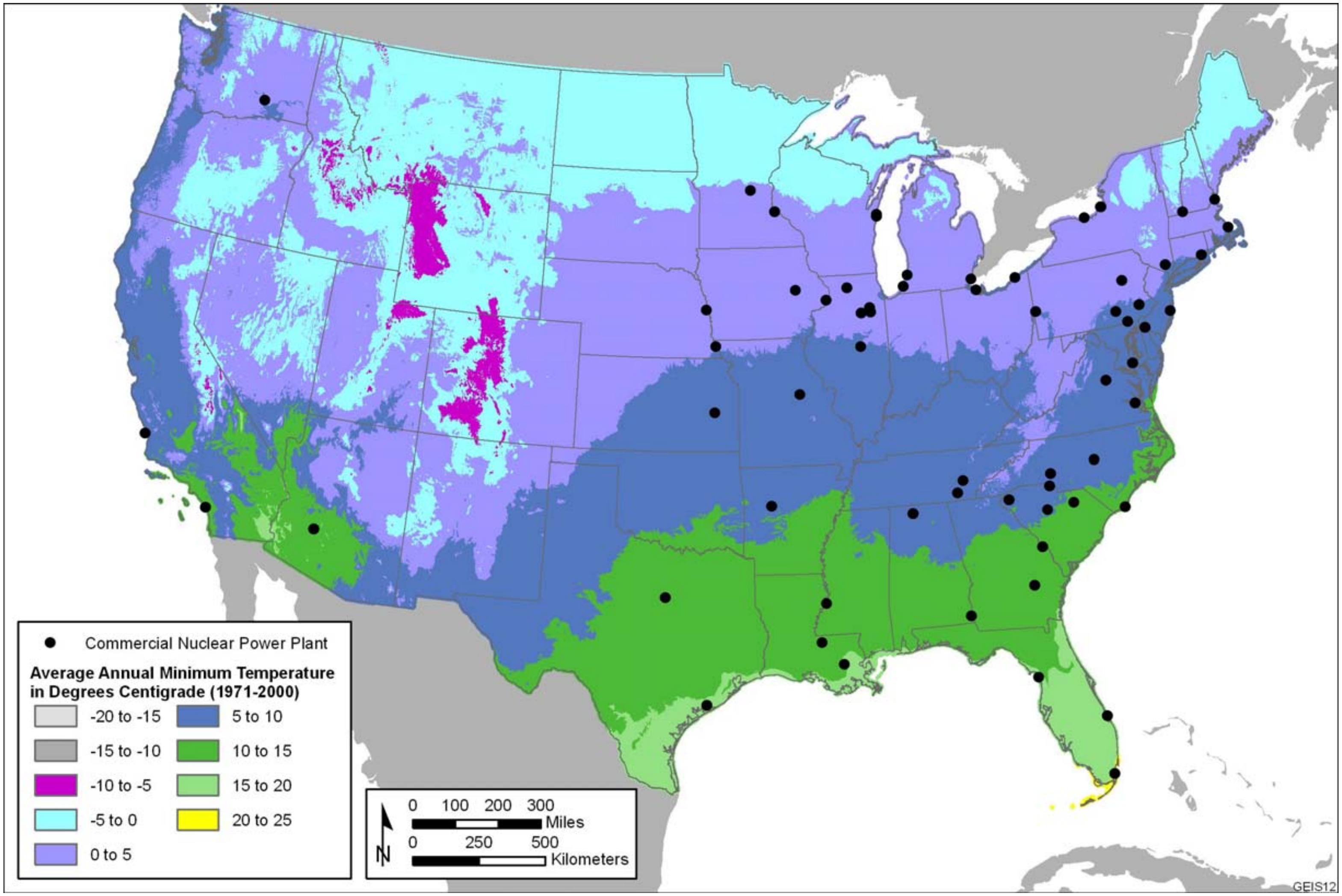


Figure D.2-2. Average Annual Minimum Temperatures over the Continental United States (1971–2000)
(Source: Permission to use this copyrighted material is granted by PRISM Group, Oregon State University)
Copyright (c) 2007, PRISM Climate Group, Oregon State University, http://www.prismclimate.org. Map created December 11, 2007

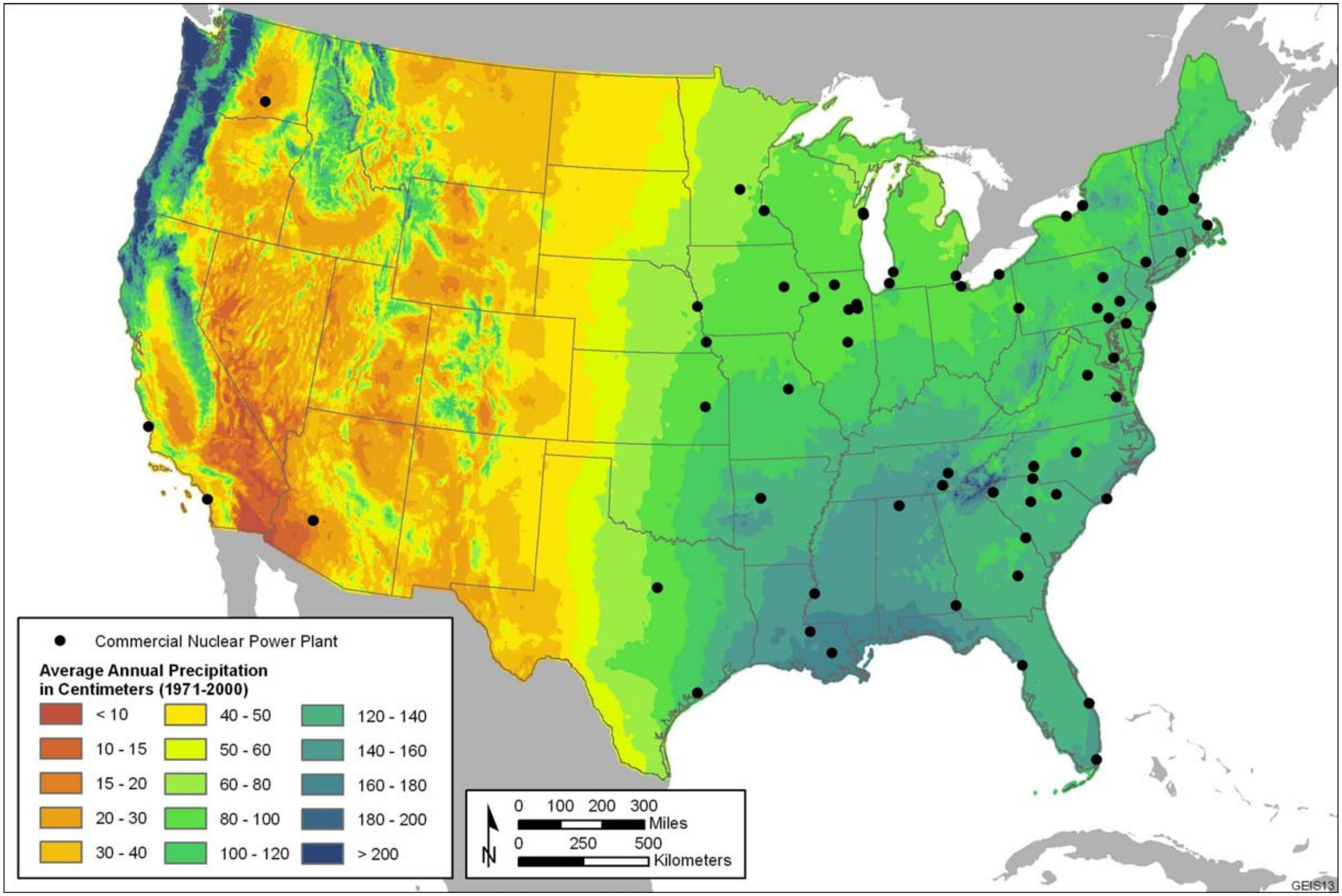


Figure D.2-3. Average Annual Precipitation over the Continental United States (1971–2000)
(Source: Permission to use this copyrighted material is granted by PRISM Group, Oregon State University)
Copyright (c) 2007, PRISM Climate Group, Oregon State University, http://www.prismclimate.org. Map created December 11, 2007

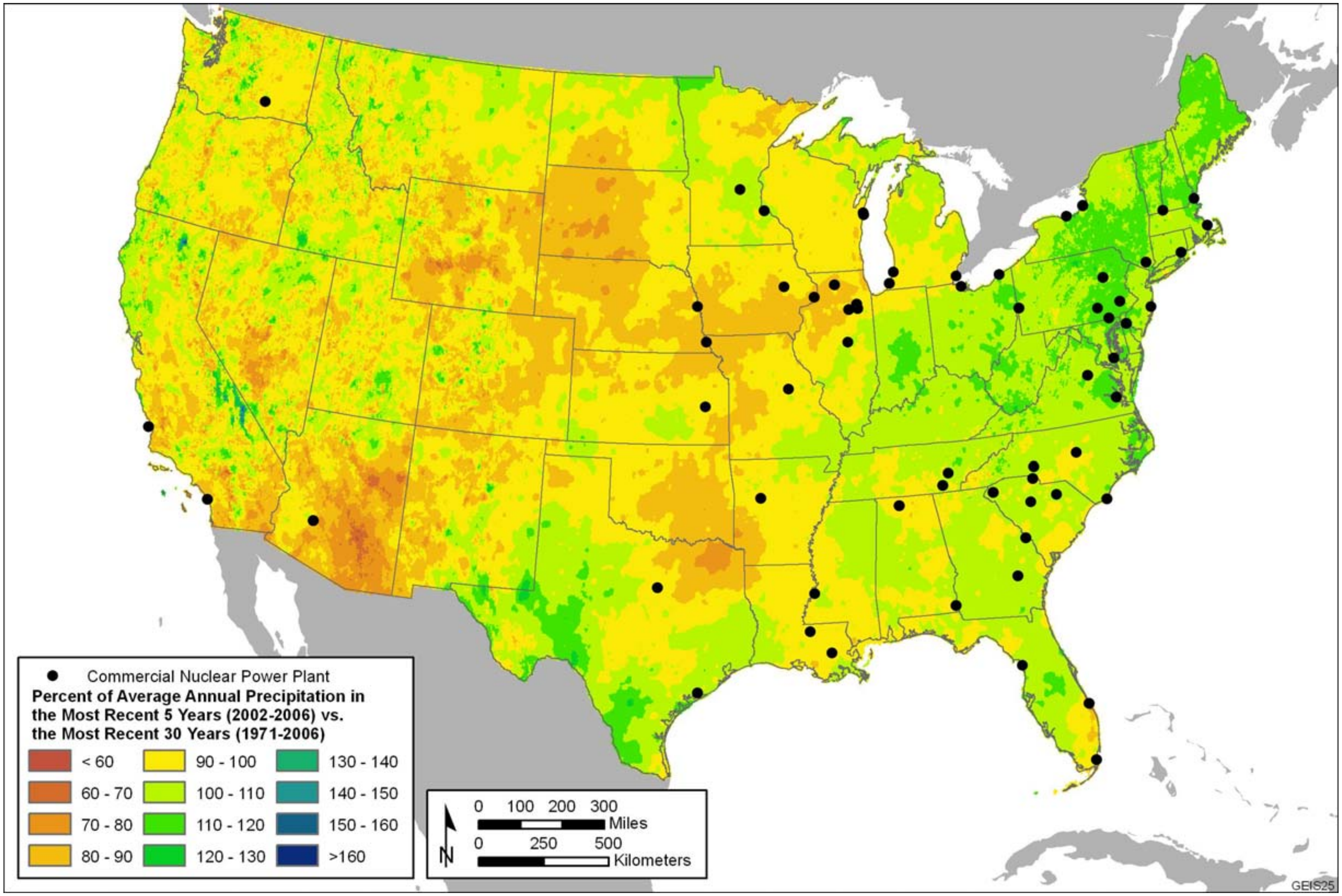


Figure D.2-4. Percent of Average Monthly Precipitation over the Past 5 Years (September 2002–August 2007) vs. the Past 30 Years

(Source: Permission to use this copyrighted material is granted by PRISM Group, Oregon State University)

Table D.2-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Standard Value (ppm)	Standard Value (mg/m^3)	Standard Type
Ozone (O_3)			
Maximum daily 8-hour average[a]	0.08	157	Primary and secondary
Maximum daily 1-hour average[b]	0.12	235	Primary and secondary
Particulate matter <10 micrometers (PM_{10})			
Annual arithmetic mean	Revoked[c]		
24-hour average[d]		150	Primary and secondary
Particulate matter <2.5 micrometers ($PM_{2.5}$)			
Annual arithmetic mean[e]		15	Primary and secondary
24-hour average[f]		65	Primary and secondary
Nitrogen dioxide (NO_2)			
Annual arithmetic mean	0.053	100	Primary and secondary
Sulfur dioxide (SO_2)			
Annual arithmetic mean	0.03	80	Primary
24-hour average[g]	0.14	365	Primary
3-hour average[g]	0.5	1300	Secondary
Carbon monoxide (CO)			
8-hour average[g]	9	10	Primary
1-hour average[g]	35	40	Primary
Lead (Pb)			
Maximum quarterly average		1.5	Primary and secondary

(a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is <1, as determined by Appendix H in 40 CFR Part 50. As of June 15, 2005, EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact Areas.
(c) Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the EPA revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).
(d) Not to be exceeded more than once per year on average over 3 years.
(e) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.
(f) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$ (effective December 17, 2006).
(g) Not to be exceeded more than once per year.

indicated ion the footnote below.[a] The table (Table D.2-1) and figures (Figures D.2-5 through D.2-11) presented in this section cover only the currently designated nonattainment areas and do not show the nonattainment classification levels. Further details on the nonattainment designations, including the classification levels, can be found in EPA's "Green Book" (http://www.epa.gov/airprogm/oar/oaqps/greenbk/index.html).

To be reclassified from nonattainment to an attainment maintenance area, the Clean Air Act outlines several conditions that must be met, one of which is the development and EPA-approval of a maintenance plan. Other conditions that States must meet before an area may be redesignated by the EPA include: (1) the area has monitored attainment of the air quality standard; (2) the EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions; (3) the State has submitted and EPA has approved, a maintenance plan for the area; and (4) the area has met all other applicable Clean Air Act requirements. The EPA may approve or deny the redesignation request based on air monitoring information, the activities listed in the State Implementation Plan and the comments submitted by the public.

The maintenance plan must demonstrate continued compliance, considering projected growth, for a period of ten years. If outdoor air monitors record a violation of the standard, the maintenance plan must include a commitment to determine appropriate measures to address the cause of the violation. This plan must specify measures that will be used in the area to maintain compliance with the NAAQS. The plan must include controls the area will employ to ensure emissions remain below certain levels and contingency measures to ensure prompt correction of any NAAQS violations. The NRC will ensure coordination of licensee with the appropriate EPA Regional Office and/or State air quality office before any plants begin major construction or refurbishment activities.

(a) Extreme – Area has a design value of 0.187 ppm and above. Severe 17 – Area has a design value of 0.127 up to but not including 0.187 ppm. Severe 15 – Area has a design value of 0.120 up to but not including 0.127 ppm. Serious – Area has a design value of 0.107 up to but not including 0.120 ppm. Moderate – Area has a design value of 0.092 up to but not including 0.107 ppm. Marginal – Area has a design value of 0.085 up to but not including 0.092 ppm.

Figure D.2-5. Map A – Northwest Area NAAQS Attainment Status (no nonattainment areas within region of influence)

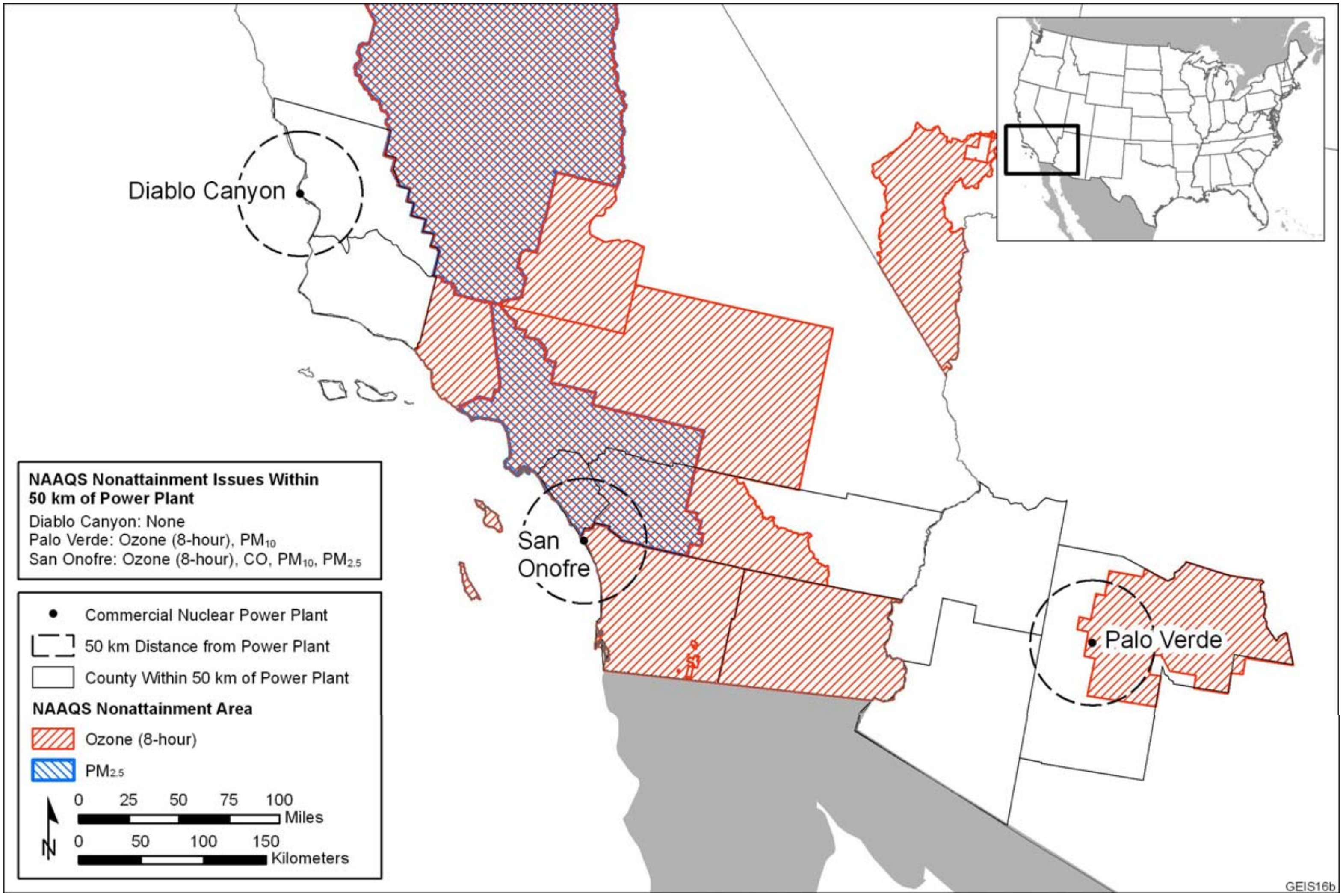


Figure D.2-6. Map B – Southwest Area NAAQS Attainment Status (O_3 and $PM_{2.5}$ designated areas are shown)

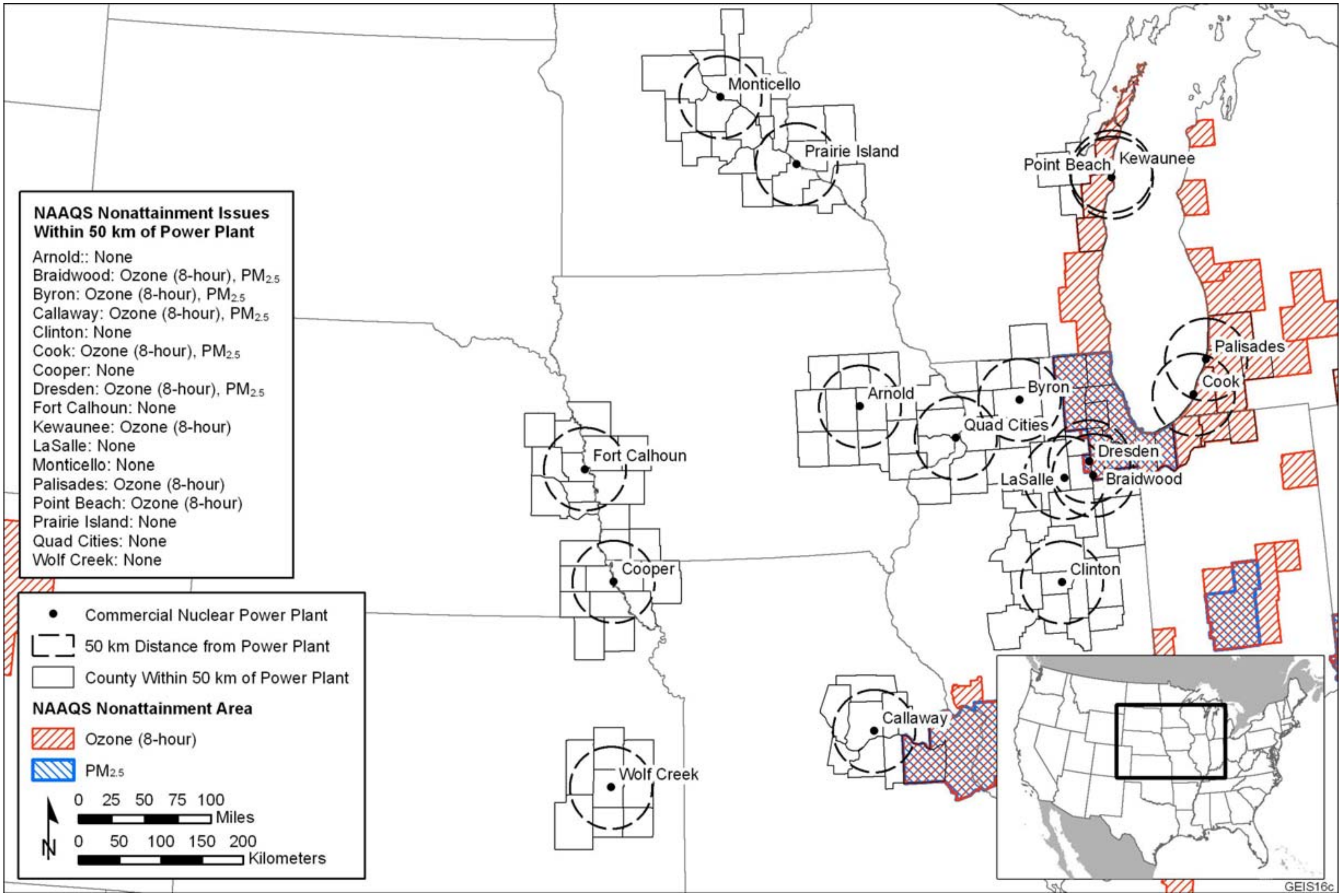


Figure D.2-7. Map C – Midwest Area NAAQS Attainment Status (O_3 and $PM_{2.5}$ designated areas are shown)

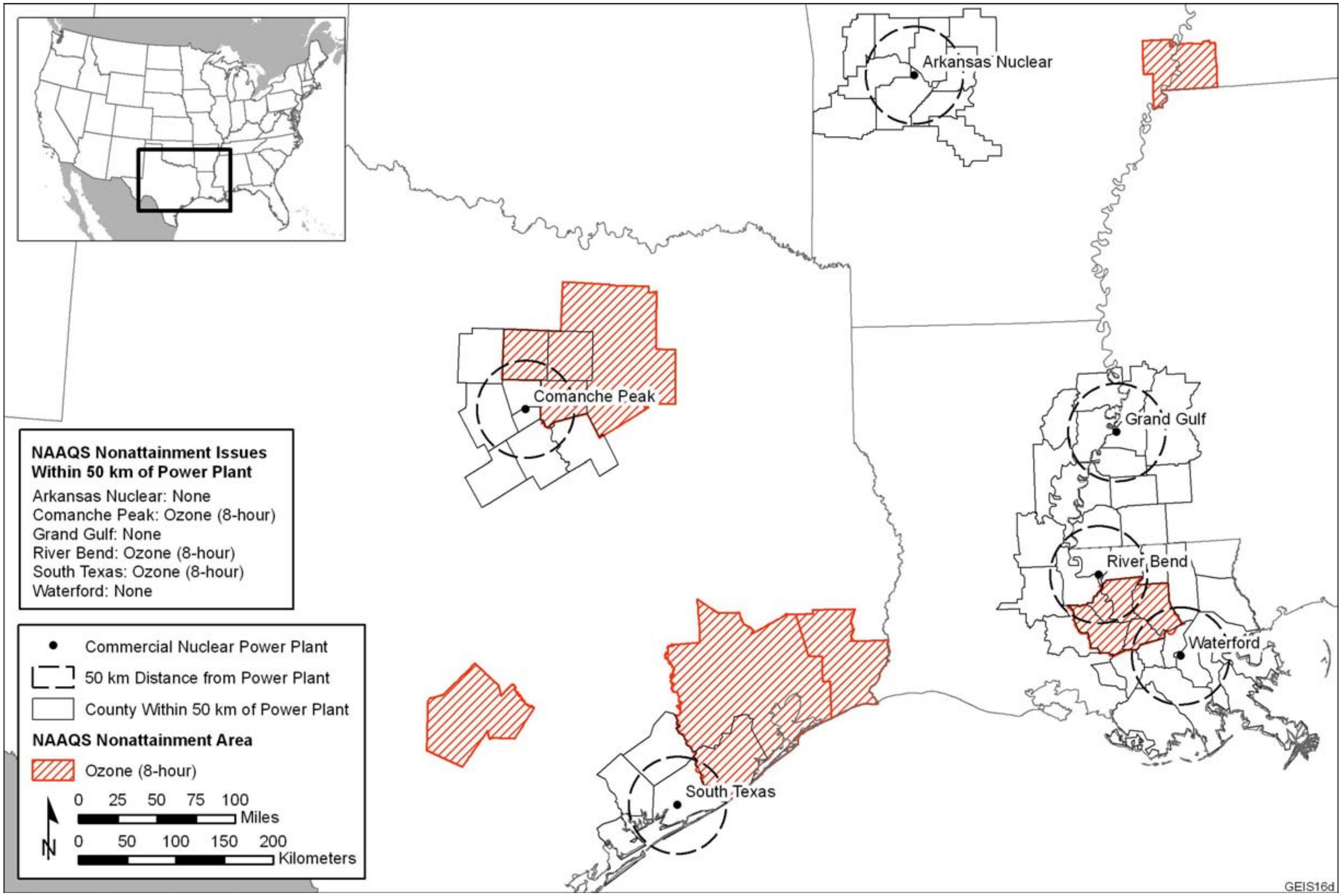


Figure D.2-8. Map D – South Area NAAQS Attainment Status (O_3 designated areas are shown; no $PM_{2.5}$ areas)

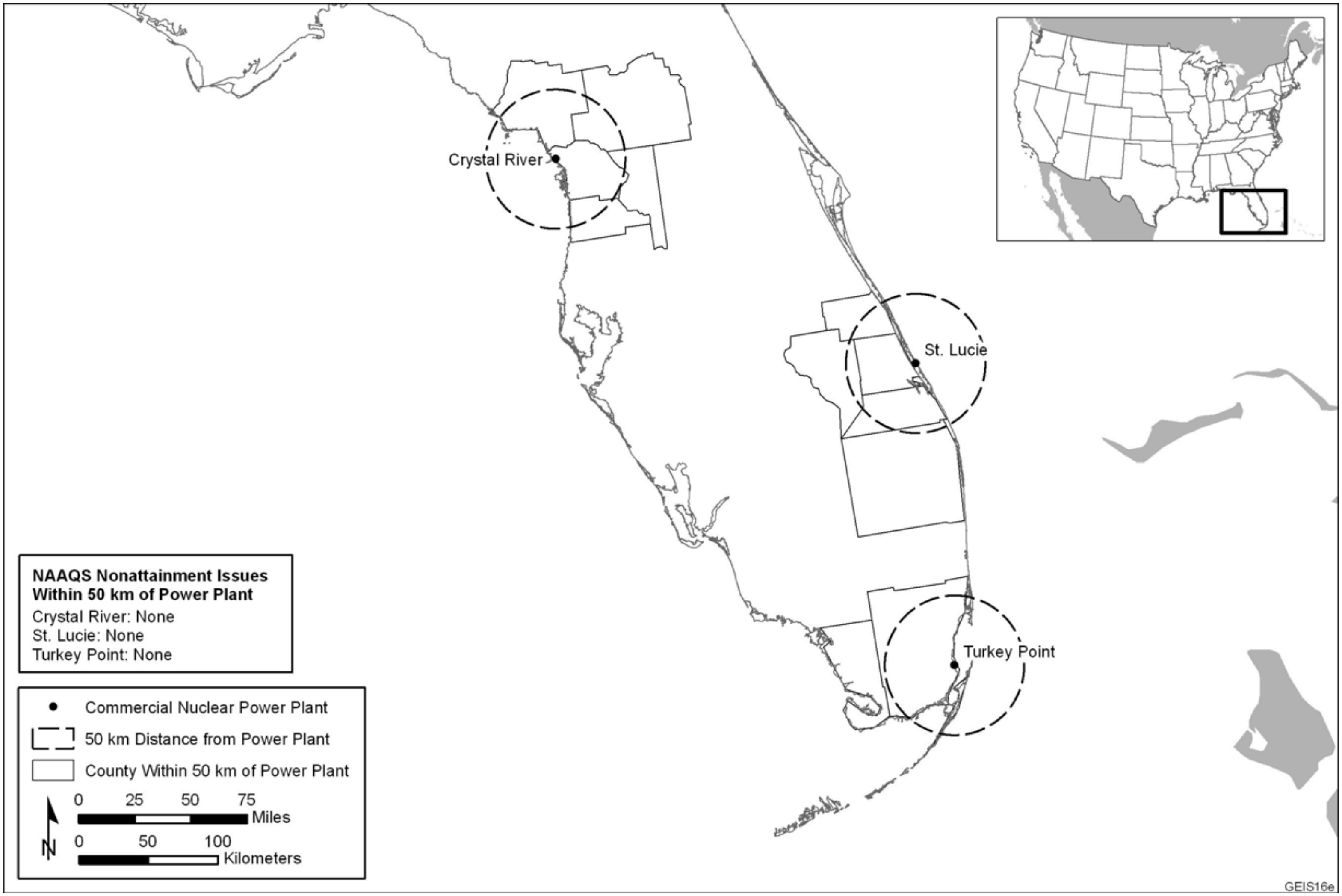


Figure D.2-9. Map E – Florida Area NAAQS Attainment Status (no nonattainment areas within region of influence)

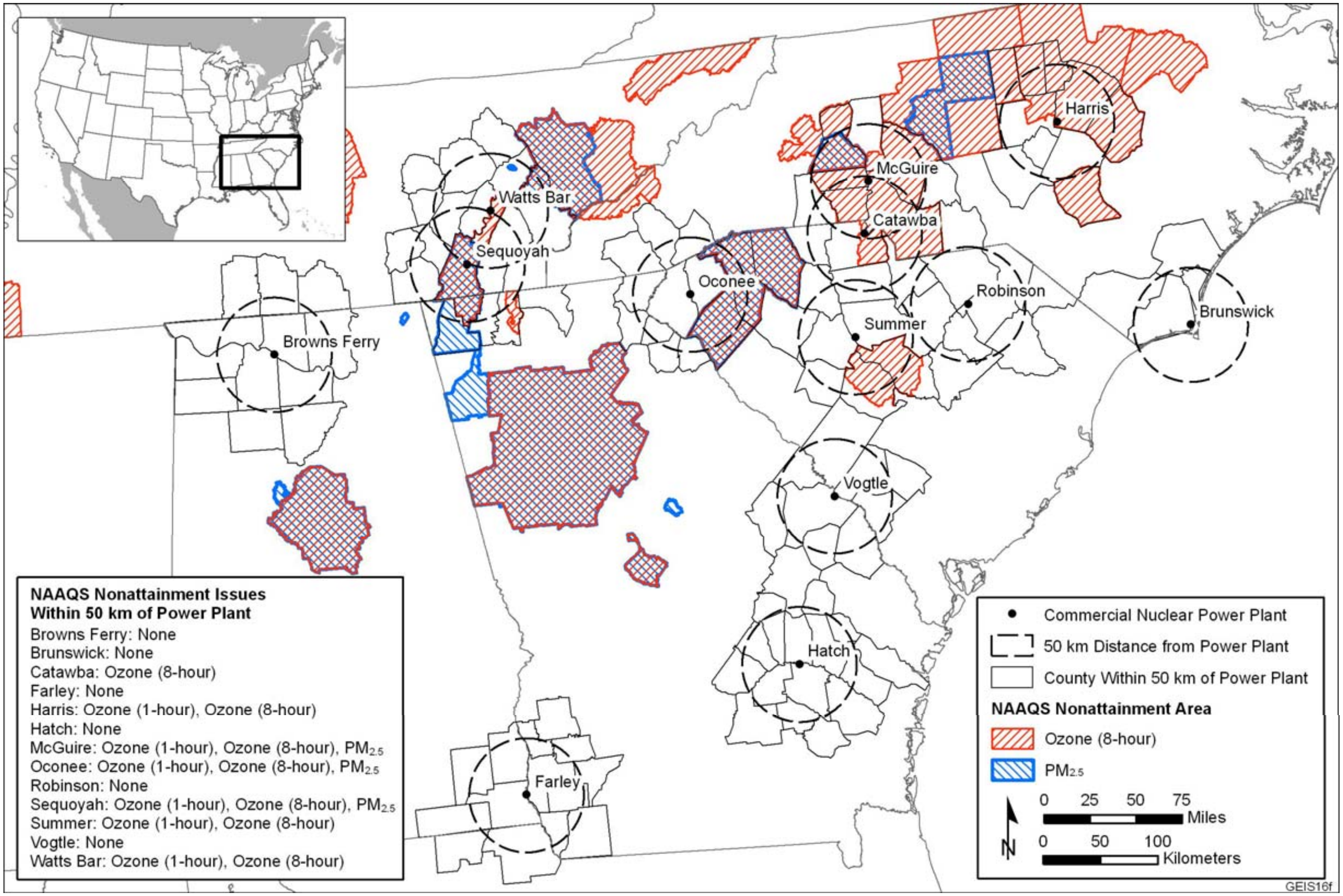


Figure D.2-10. Map F – Southeast Area NAAQS Attainment Status (O_3 and $PM_{2.5}$ designated areas are shown)

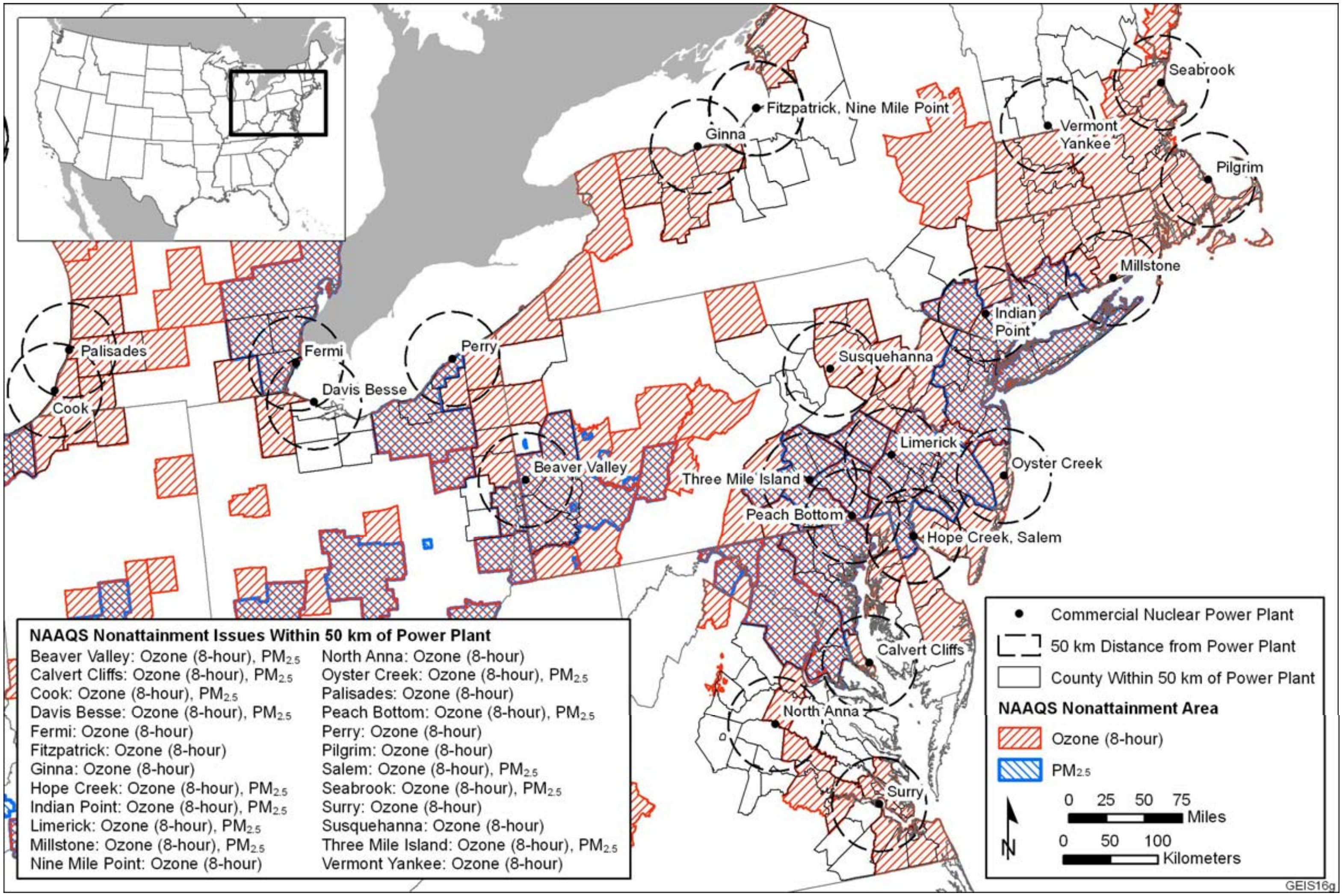


Figure D.2-11. Map G – Northeast Area NAAQS Attainment Status (O_3 and $PM_{2.5}$ designated areas are shown)

Table D.2-2. Summary of Nonattainment Status for Each Operating Commercial Plant

Nuclear Power Plant Name/Map Area	Plant County	State	Pollutants	Nonattainment Status	Distance (km) to Nearest Nonattainment Area (County)
Map A: Northwest[(a)]					
Columbia	Benton	WA	All pollutants	All attainment	NA[(b)]
Map B: Southwest[(a)]					
Diablo Canyon Units 1, 2	San Luis Obispo	CA	All pollutants	All attainment	NA
San Onofre Units 2, 3	San Diego	CA	Ozone 8-hour	Within nonattainment county	San Diego
			CO	Nonattainment	<1, Orange
			PM_{10}	Nonattainment	<1, Orange
			$PM_{2.5}$	Nonattainment	<1, Orange
Palo Verde Units 1, 2, 3	Maricopa	AZ	Ozone 8-hour	Within nonattainment county	0, Maricopa
			PM_{10}	Within nonattainment county	0, Maricopa
Map C: Midwest[(a)]					
Fort Calhoun	Washington	IA	All pollutants	All attainment	NA
Duane Arnold Unit 1	Linn	IA	All pollutants	All attainment	NA
Quad Cities Unit 1, 2	Rock Island	IL	All pollutants	All attainment	NA
Clinton	DeWitt	IL	All pollutants	All attainment	NA
Braidwood Units 1, 2	Will	IL	Ozone 8-hour	Within nonattainment county	0, Will
			$PM_{2.5}$	Within nonattainment county	0, Will
Dresden Units 2, 3	Grundy	IL	Ozone 8-hour	Within nonattainment county	0, Grundy
			$PM_{2.5}$	Within nonattainment county	0, Grundy
LaSalle Units 1, 2	LaSalle	IL	All pollutants	All attainment	NA
Byron Units 1, 2	Ogle	IL	Ozone 8-hour	Nonattainment	<50, McHenry
			$PM_{2.5}$	Nonattainment	<50, McHenry

Table D.2-2. (cont.)

Nuclear Power Plant Name/Map Area	Plant County	State	Pollutants	Nonattainment Status	Distance (km) to Nearest Nonattainment Area (County)
Wolf Creek 1	Coffey	KS	All pollutants	All attainment	NA
Palisades	Van Buren	MI	Ozone 8-hour	Within nonattainment county	0, Van Buren
D.C. Cook Units 1, 2	Cook	MI	Ozone 8-hour	Within nonattainment county	0, Cook
			$PM_{2.5}$	Nonattainment	<45, Porter
Prairie Island Units 1, 2	Goodhue	MN	All pollutants	All attainment	NA
Monticello	Wright	MN	All pollutants	All attainment	NA
Callaway	Callaway	MO	Ozone 8-hour	Nonattainment	<35, Franklin
			$PM_{2.5}$	Nonattainment	<35, Franklin
Cooper	Nemaha	NE	All pollutants	All attainment	NA
Point Beach Units 1, 2	Manitowoc	WI	Ozone 8-hour	Within nonattainment county	0, Manitowoc
Kewaunee	Kewaunee	WI	Ozone 8-hour	Within nonattainment county	0, Kewaunee
Map D: South[(a)]					
Arkansas Nuclear 1, 2	Yell	AR	All pollutants	All attainment	NA
River Bend Unit 1	West Feliciana	LA	Ozone 8-hour	Nonattainment	<12, East Baton Rouge
Waterford Unit 3	St. Charles	LA	All pollutants	All attainment	NA
Grand Gulf Unit 1	Claiborne	MS	All pollutants	All attainment	NA
South Texas 1, 2	Matagorda	TX	Ozone 8-hour	Nonattainment	<36, Brazoria
Comanche Peak 1, 2	Hood and Somervell	TX	Ozone 8-hour	Nonattainment	<36, Johnson
Map E: Florida[(a)]					
Crystal River 3	Citrus	FL	All pollutants	All attainment	NA
St. Lucie Units 1, 2	St. Lucie	FL	All pollutants	All attainment	NA
Turkey Point 3, 4	Dade	FL	All pollutants	All attainment	NA

Table D.2-2. (cont.)

Nuclear Power Plant Name/Map Area	Plant County	State	Pollutants	Nonattainment Status	Distance (km) to Nearest Nonattainment Area (County)
Map F: Southeast[a]					
Browns Ferry 1, 2, 3	Lawrence	AL	All pollutants	All attainment	NA
Farley Units 1, 2	Houston	AL	All pollutants	All attainment	NA
Hatch Units 1, 2	Appling	GA	All pollutants	All attainment	NA
Vogtle Units 1, 2	Burke	GA	All pollutants	All attainment	NA
Brunswick Units 1, 2	Brunswick	NC	All pollutants	All attainment	NA
McGuire Units 1, 2	Mecklenburg	NC	Ozone 1-hour	Nonattainment	<12, Catawba
			Ozone 8-hour	Within nonattainment county	Mecklenburg
			$PM_{2.5}$	Nonattainment	<12, Catawba
Harris Unit 1	Wake	NC	Ozone 1-hour	Nonattainment	<36, Alamance
			Ozone 8-hour	Within nonattainment county	0, Wake
Robinson Unit 2	Darlington/ Chesterfield	SC	All pollutants	All attainment	NA
Summer Unit 1	Fairfield	SC	Ozone 1-hour	Nonattainment	<8, Richland
			Ozone 8-hour	Nonattainment	<8, Richland
Catawba Units 1, 2	York	SC	Ozone 8-hour	Within nonattainment county	0, York
Oconee Units 1, 2, 3	Oconee	SC	Ozone 1-hour	Nonattainment	<19, Anderson
			Ozone 8-hour	Nonattainment	<19, Anderson
			$PM_{2.5}$	Nonattainment	<19, Anderson
Sequoyah Units 1, 2	Hamilton	TN	Ozone 1-hour	Within nonattainment county	0, Hamilton
			Ozone 8-hour	Within nonattainment county	0, Hamilton
			$PM_{2.5}$	Within nonattainment county	0, Hamilton

Table D.2-2. (cont.)

Nuclear Power Plant Name/Map Area	Plant County	State	Pollutants	Nonattainment Status	Distance (km) to Nearest Nonattainment Area (County)
Watts Bar Unit 1	Rhea	TN	Ozone 1-hour	Nonattainment	<1, Meigs
			Ozone 8-hour	Nonattainment	<1, Meigs
Map G: Northeast[(a)]					
Millstone Units 2, 3	New London	CT	Ozone 8-hour	Within nonattainment county	New London
			$PM_{2.5}$	Nonattainment	<36, New Haven
Fermi Unit 2	Monroe	MI	Ozone 8-hour	Within nonattainment county	Monroe
Perry Unit 1	Lake	OH	Ozone 8-hour	Within nonattainment county	Lake
Davis Besse Unit 1	Ottawa	OH	Ozone 8-hour	Nonattainment	<7, Lucas
			$PM_{2.5}$	Nonattainment	<32, Monroe (MI)
Pilgrim Unit 1	Plymouth	MA	Ozone 8-hour	Within nonattainment county	0, Plymouth
Seabrook Unit 1	Rockingham	NH	Ozone 8-hour	Within nonattainment county	0, Rockingham
			$PM_{2.5}$	Within nonattainment county	0, Rockingham
Hope Creek Unit 1	Salem	NJ	Ozone 8-hour	Within nonattainment county	0, Salem
			$PM_{2.5}$	Nonattainment	<3, New Castle (DE)
Salem Units 1, 2	Salem	NJ	Ozone 8-hour	Within nonattainment county	0, Salem
			$PM_{2.5}$	Nonattainment	<3, New Castle(DE)
Oyster Creek	Ocean	NJ	Ozone 8-hour	Within nonattainment county	0, Ocean
			$PM_{2.5}$	Nonattainment	<17, Burlington CO
Calvert Cliffs Units 1, 2	Calvert	MD	Ozone 8-hour	Within nonattainment county	0, Calvert
			$PM_{2.5}$	Nonattainment	<30, Charles (MD)
Nine Mile Point Units 1, 2	Oswego	NY	Ozone -8-hour	Nonattainment	<24, Jefferson
FitzPatrick	Oswego	NY	Ozone 8-hour	Nonattainment	<24, Jefferson

Table D.2-2. (cont.)

Nuclear Power Plant Name/Map Area	Plant County	State	Pollutants	Nonattainment Status	Distance (km) to Nearest Nonattainment Area (County)
Indian Point 2, 3	Westchester	NY	Ozone 8-hour	Within nonattainment county	0, Westchester
			$PM_{2.5}$	Within nonattainment county	0, Westchester
Ginna	Wayne	NY	Ozone 8-hour	Within nonattainment county	0, Wayne
Susquehanna Units 1, 2	Luzerne	PA	Ozone 8-hour	Within nonattainment county	0, Luzerne
Peach Bottom Units 2, 3	York	PA	Ozone 8-hour	Within nonattainment county	0, York
			$PM_{2.5}$	Within nonattainment county	0, York
Beaver Valley 1, 2	Beaver	PA	Ozone 8-hour	Within nonattainment county	0, Beaver
			$PM_{2.5}$	Within nonattainment county	0, Beaver
Three Mile Island	York	PA	Ozone 8-hour	Within nonattainment county	0, York
			$PM_{2.5}$	Within nonattainment county	0, York
Limerick Units 1, 2	Montgomery	PA	Ozone 8-hour	Within nonattainment county	0, Montgomery
			$PM_{2.5}$	Within nonattainment county	0, Montgomery
North Anna Units 1, 2	Louisa	VA	Ozone 8-hour	Nonattainment	<1, Spotsylvania
Surry Units 1, 2	Surry	VA	Ozone 8-hour	Nonattainment	<3, Isle of Wight
Vermont Yankee	Windham/ Vermont	VT, NH	Ozone 8-hour	Nonattainment	<6, Franklin (MA)

(a) Map A – see figure D.2-5; Map B – see Figure D.2-6; Map C – see Figure D.2-7; Map D – see Figure D.2-8; Map E – see Figure D.2-9; Map F – see Figure D.2-10; Map G – see Figure D.2-11.
(b) NA = not applicable.

The air quality attainment status for each licensed nuclear plant is given in Table D.2-2,[(a)] which shows the name of the power plants as well as counties and states where they are located. The nonattainment column indicates the nonattainment status for each criteria air pollutant. In cases when the power plant is located in an attainment area, but within 50 km of a nonattainment area, the nonattainment county name is provided (in the last column) along with the shortest distance between the power plant and the nonattainment boundary.

Figures D.2-5 through D.2-11 show the power plant locations with designated 8-hour ozone and $PM_{2.5}$ nonattainment areas (if present). Nonattainment areas/counties within 50 km of the plants can be identified in each of the figures. Nationally, for new the 8-hour O_3 and $PM_{2.5}$ standards, a total of 81 areas covering 366 counties are designated nonattainment for ozone and 39 areas covering 208 counties are designated nonattainment for $PM_{2.5}$. Total number of areas and counties, respectively, within 50 km of operating plants are 32 and 120 for O_3 and 20 and 51 for $PM_{2.5}$. The maps in Figures D.2-6 through D.2-12 show the power plant locations relative to designated nonattainment areas for each region.

D.3 Geology and Soils

D.3.1 Description of Affected Resources and Region of Influence

Soil and geologic resources of nuclear power plants were not addressed in the 1996 GEIS, but are included in the GEIS update as affected resources for evaluation. The affected soil resources considered in this report are limited to plant site property boundaries. Because soil disturbance during license renewal could occur in undisturbed and undeveloped areas and could affect future onsite soil productivity for sites in farming regions, the locations of power plants relative to areas of prime farmland were determined.

The region of potentially affected geologic resources considered extends to offsite areas, because the presence of a power plant may restrict extraction operations beyond the site boundaries. Seismic settings of the plants were determined and related to historic earthquake information.

(a) The designated nonattainment areas shown for PM_{10}, CO, SO_2, NO_2, O_3 (1-hr), O_3 (8-hr), and $PM_{2.5}$ were prepared from a geographic information system (GIS) database provided by the EPA (2007a). The O_3 (8-hr) and $PM_{2.5}$ designated areas are from the agency's final current status database as of August 2007. The other criteria pollutant maps are drafts being reviewed by EPA Regional Offices as of October 2007. Since nonattainment status designations can change (e.g., nonattainment to attainment, serious to moderate) over time, the EPA "Green Book" Web site (http://www.epa.gov/airprogm/oar/oaqps/greenbk/index.html) and the *Federal Register* links provided on it should be checked to determine the current status.

D.3.2 Description of Impact Assessment

Soils resources onsite could be affected by construction or refurbishment projects during a plant's license renewal phase or during plant decommissioning. These actions would include activities that disturb soil, resulting in erosion, loss of soil resources, and increased suspended solids in nearby surface water bodies.

All published SEISs were reviewed for new and significant information pertaining to soil or geologic impacts, but none was noted. The potential impacts to site soil were addressed generally for possible construction, refurbishment, and decommissioning activities. The impact of license renewal or decommissioning on onsite soils and local geologic resources would depend on site-specific factors such as facility location, construction planning, and site-specific resource mapping. These factors are anticipated to have minimal impact on onsite soils (due to best management practices) or on local geologic resources, so a Category 1 designation was given for this new issue.

D.4 Hydrology

D.4.1 Description of Affected Resources and Region of Influence

Most of the nuclear power plants are located near significant surface water bodies that are either natural or man-made. The surface water assessed as the affected environment is therefore onsite, downstream of the site (in the case of river settings), or throughout some portion of a body of water (in the case of an ocean, lake or Great Lake, bay, reservoir, or pond) adjacent to the site. The region of influence for groundwater impacts included areas both onsite (local water table) and offsite (regional aquifer).

D.4.2 Description of Impact Assessment

Sources of information about surface-water and groundwater issues regarding water use, water conflicts, and water quality included the 1996 GEIS, plant-specific SEISs, and the decommissioning GEIS update (NRC 2002). All published SEISs were reviewed for new and significant information pertaining to water issues.

To analyze the condenser flow rate requirements and consumptive loss associated with specific categories of cooling system technologies (see Section 3.5.1.1), data from the 1996 GEIS and a U.S. Geological Survey report were compiled. The flow rates and consumptive loss rates were normalized to a specific power capacity to allow comparisons.

Permitting requirements related to surface water withdrawal and groundwater use were summarized, and recent information was reviewed to assess water use conflicts and drought effects on rivers.

Several new water issues were considered in this GEIS revision: (1) effects of dredging on water quality, (2) groundwater and soil contamination, and (3) radionuclide releases to groundwater. The impacts of dredging were addressed by reviewing information on dredging operations and permitting requirements in recent SEISs. The effects of general groundwater and soil contamination stemming from spills, leaks, and general industrial practices at power plants were evaluated through review of plant-specific SEISs and supporting documents. The impacts of radionuclide leaks, particularly tritium, were summarized based on a recent NRC summary report of tritium incidents (NRC 2006). A related document by the nuclear industry (NEI 2007) pertaining to assessment and monitoring was also reviewed.

D.5 Ecological Resources

D.5.1 Description of Affected Resources and Region of Influence

Terrestrial resources potentially affected by nuclear power plant operations during the license renewal term were determined at a broad level by obtaining the Level III ecoregion data (EPA 2007b) (Table D.5-1) and land cover data (USGS 2003) for the vicinity of each power plant. An ecoregion describes a broad landscape in which the ecosystems have a general similarity. It can be characterized by the spatial pattern and composition of biotic and abiotic features, such as vegetation, wildlife, physiography, climate, soils, and hydrology (CEC 1997). The Level I ecoregions of the United States in which the nuclear power plants are located are shown in Figure D.5-1. Each ecoregion is subdivided into subregions. Level III ecoregions range from the warm, arid Sonoran Basin and Range ecoregion with cactus-shrub habitats, in which the Palo Verde plant in Arizona is located, to the cool, moist Northeastern Highlands ecoregion with northern hardwood and spruce-fir forests, which contains the Indian Point plant in New York. Level III ecoregions in the vicinity of the operating nuclear plants are presented in Table D.5-2. The region of influence for each power plant was considered to be the area within a radius of 5 mi as well as the transmission line ROWs associated with each power plant.

In the vicinity of the nuclear plants, an average of 25 percent of the land area is forested, 5 percent is grassland, and 4 percent is shrubland, as determined from land cover data. The land area around 10 plants is mostly forested (exceeding 50 percent of the land cover), and around 2 plants, it is mostly shrubland. (For no plants is it mostly grassland.) Agricultural lands are also present in the vicinity of many of the nuclear plants. An average of 23 percent of the area around all plants is used for crop production, and the area around 9 nuclear plants is mostly agricultural (greater than 30 percent land cover). Wetland types within 5 mi of each

Table D.5-1. Level I Ecoregions and Corresponding Level III Ecoregions That Occur in the Vicinity of U.S. Commercial Nuclear Power Plants

Level I Ecoregion	Level III Ecoregion	Level III Description
Eastern Temperate Forests	Arkansas Valley	Forest, pasture, cropland; bottomland deciduous forest on floodplains
	Atlantic Coastal Pine Barrens	Northeastern oak-pine woodland; marsh, swamp, floodplain forest along tidal rivers, freshwater marsh; agriculture; dunes, barrier islands
	Central Corn Belt Plains	Cropland; tallgrass prairie, oak-hickory forest
	Driftless Area	Agriculture; hardwood forest
	Eastern Great Lakes and Hudson Lowlands	Agriculture; northern hardwood forest
	Erie Drift Plain	Agriculture; maple-beech-birch forest; wetlands
	Huron/Erie Lake Plains	Cropland; oak savanna on dunes/beach ridges, elm-ash swamp, beech forest
	Interior Plateau	Oak-hickory forest, cropland, pasture; bluestem prairie, cedar glades
	Interior River Valleys and Hills	Cropland; pasture; forested valley slopes, bottomland deciduous forest, swamp forest, mixed oak forest, oak-hickory forest
	Middle Atlantic Coastal Plain	Pine forest, swamp, marsh, estuaries; oak, gum, cypress near rivers; cropland; dunes, barrier islands
	Mississippi Alluvial Plain	Cropland; bottomland deciduous forest
	Mississippi Valley Loess Plains	Cropland; oak-hickory forest and oak-hickory-pine forest
	North Central Hardwood Forests	Mosaic of coniferous forest and northern hardwood forest, wetlands and lakes, cropland, pasture
	Northeastern Coastal Zone	Northern hardwood forest, spruce-fir forest, lakes
	Northern Piedmont	Appalachian oak forest, cropland

Table D.5-1. (cont.)

Level I Ecoregion	Level III Ecoregion	Level III Description
	Piedmont	Oak-hickory-pine woodland; cropland
	Ridge and Valley	Appalachian oak forest, oak-hickory-pine forest, agriculture
	S. Michigan/N. Indiana Drift Plains	Lakes, marsh; agriculture; oak-hickory forest, northern swamp forest, beech forest
	Southeastern Plains	Mosaic of cropland, pasture, woodland, mixed forest
	Southeastern Wisconsin Till Plains	Agriculture; mosaic of hardwood forest, oak savanna, tallgrass prairie
	Southern Coastal Plain	Coastal lagoons, marsh, swamp, barrier islands; pine, oak-gum-cypress forest; citrus groves, pasture; lakes
	Western Allegheny Plateau	Mixed mesophytic forest, mixed oak forest; pasture, cropland
Great Plains	Central Irregular Plains	Mosaic of grassland, wide riparian forest; cropland
	Cross Timbers	Rangeland, pasture; little bluestem grassland with scattered oaks
	Western Corn Belt Plains	Cropland, pasture; tallgrass prairie; narrow riparian forest
	Western Gulf Coastal Plain	Grassland, cropland
North American Deserts	Columbia Plateau	Arid sagebrush steppe and grassland; agriculture
	Sonoran Basin and Range	Hot climate; creosote bush-bur sage; large areas of palo verde-cactus shrub and giant saguaro cactus
Mediterranean California	Southern and Central California Chaparral and Oak Woodlands	Mediterranean climate: hot dry summers, cool moist winters

Table D.5-1. (cont.)

Level I Ecoregion	Level III Ecoregion	Level III Description
Northern Forests	Northeastern Highlands	Northern hardwood forest, spruce-fir forest; lakes
Tropical Wet Forests	Southern Florida Coastal Plain	Frost-free climate; flat plains with wet soils; marshland, swamp, everglades, palmetto prairie

Source: EPA 2007b

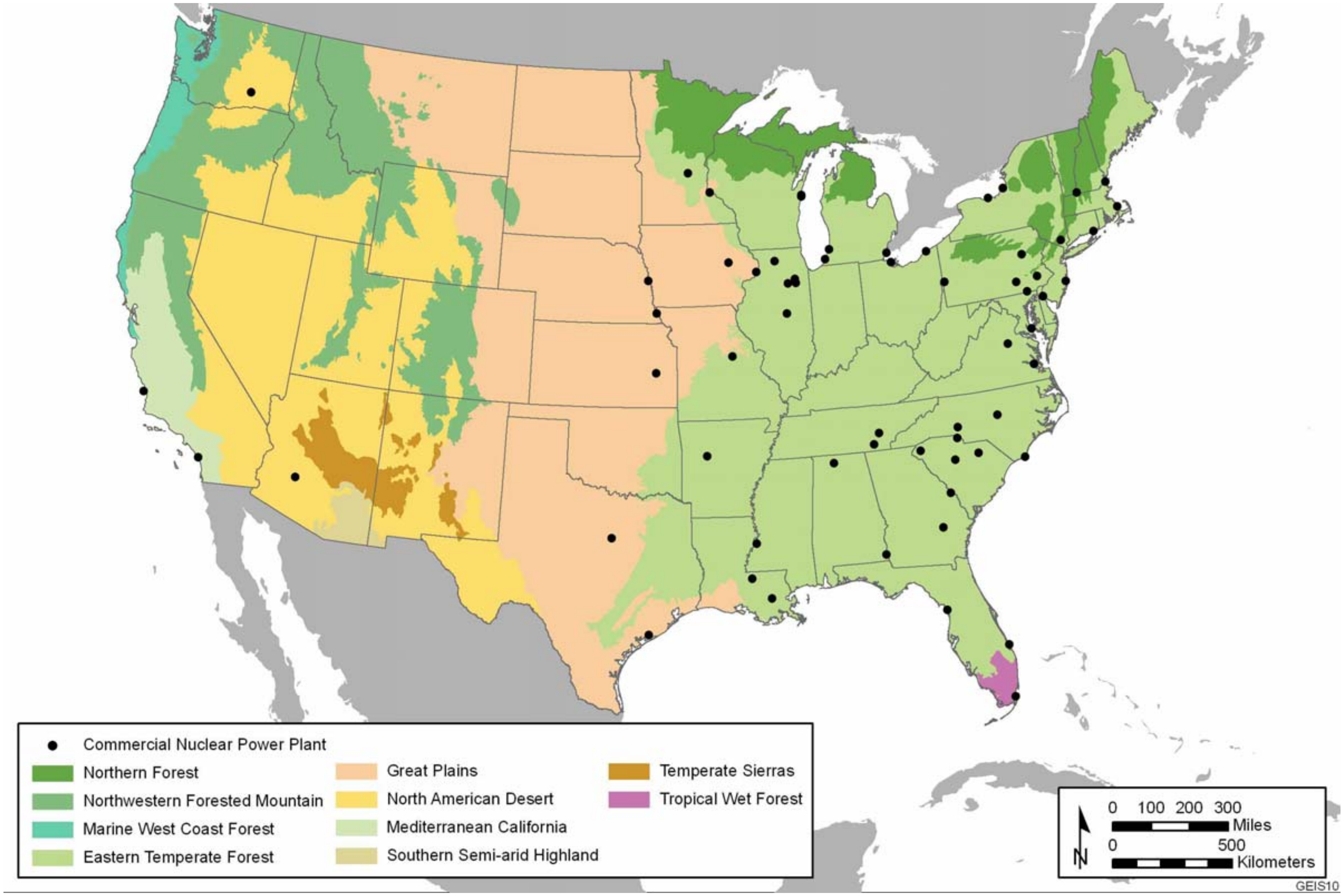


Figure D.5-1. Level I Ecoregions of the United States (CEC 2006)

Table D.5-2. Ecoregions in the Vicinity of Operating Nuclear Power Plants

Site Name	Level I Description	Level III Ecoregion(s)
Arkansas	Eastern Temperate Forests	Arkansas Valley
Beaver Valley	Eastern Temperate Forests	Western Allegheny Plateau
Braidwood	Eastern Temperate Forests	Central Corn Belt Plains
Browns Ferry	Eastern Temperate Forests	Interior Plateau
Brunswick	Eastern Temperate Forests	Middle Atlantic Coastal Plain
Byron	Eastern Temperate Forests	Central Corn Belt Plains
Callaway	Eastern Temperate Forests	Interior River Valleys and Hills
Calvert Cliffs	Eastern Temperate Forests	Southeastern Plains, Middle Atlantic Coastal Plain
Catawba	Eastern Temperate Forests	Piedmont
Clinton	Eastern Temperate Forests	Central Corn Belt Plains
Columbia	North American Deserts	Columbia Plateau
Comanche Peak	Great Plains	Cross Timbers
Cooper	Great Plains	Western Corn Belt Plains
Crystal River	Eastern Temperate Forests	Southern Coastal Plain
D.C. Cook	Eastern Temperate Forests	S. Michigan/N. Indiana Drift Plains
Davis Besse	Eastern Temperate Forests	Huron/Erie Lake Plains
Diablo Canyon	Mediterranean California	Southern and Central California Chaparral and Oak Woodlands
Dresden	Eastern Temperate Forests	Central Corn Belt Plains
Duane Arnold	Great Plains	Western Corn Belt Plains
Farley	Eastern Temperate Forests	Southeastern Plains
Fermi	Eastern Temperate Forests	Huron/Erie Lake Plains
FitzPatrick	Eastern Temperate Forests	Eastern Great Lakes and Hudson Lowlands

Table D.5-2. (cont.)

Site Name	Level I Description	Level III Ecoregion(s)
Fort Calhoun	Great Plains	Western Corn Belt Plains
Ginna	Eastern Temperate Forests	Eastern Great Lakes and Hudson Lowlands
Grand Gulf	Eastern Temperate Forests	Mississippi Valley Loess Plains, Mississippi Alluvial Plain
Harris	Eastern Temperate Forests	Piedmont, Southeastern Plains
Hatch	Eastern Temperate Forests	Southeastern Plains, Southern Coastal Plain
Hope Creek	Eastern Temperate Forests	Middle Atlantic Coastal Plain
Indian Point	Northern Forests	Northeastern Highlands
Kewaunee	Eastern Temperate Forests	Southeastern Wisconsin Till Plains
LaSalle	Eastern Temperate Forests	Central Corn Belt Plains
Limerick	Eastern Temperate Forests	Northern Piedmont
McGuire	Eastern Temperate Forests	Piedmont
Millstone	Eastern Temperate Forests	Northeastern Coastal Zone
Monticello	Eastern Temperate Forests	North Central Hardwood Forests
Nine Mile Point	Eastern Temperate Forests	Eastern Great Lakes and Hudson Lowlands
North Anna	Eastern Temperate Forests	Piedmont
Oconee	Eastern Temperate Forests	Piedmont
Oyster Creek	Eastern Temperate Forests	Atlantic Coastal Pine Barrens
Palisades	Eastern Temperate Forests	S. Michigan/N. Indiana Drift Plains
Palo Verde	North American Deserts	Sonoran Basin and Range
Peach Bottom	Eastern Temperate Forests	Northern Piedmont
Perry	Eastern Temperate Forests	Eastern Great Lakes and Hudson Lowlands, Erie Drift Plain
Pilgrim	Eastern Temperate Forests	Atlantic Coastal Pine Barrens, Northeastern Coastal Zone
Point Beach	Eastern Temperate Forests	Southeastern Wisconsin Till Plains

Table D.5-2. (cont.)

Site Name	Level I Description	Level III Ecoregion(s)
Prairie Island	Eastern Temperate Forests	Driftless Area
Quad Cities	Eastern Temperate Forests and Great Plains	Interior River Valleys and Hills, Western Corn Belt Plains, Central Corn Belt Plains
River Bend	Eastern Temperate Forests	Mississippi Valley Loess Plains, Mississippi Alluvial Plain
Robinson	Eastern Temperate Forests	Southeastern Plains
Salem	Eastern Temperate Forests	Middle Atlantic Coastal Plain
San Onofre	Mediterranean California	Southern and Central California Chaparral and Oak Woodlands
Seabrook	Eastern Temperate Forests	Northeastern Coastal Zone
Sequoyah	Eastern Temperate Forests	Ridge and Valley
South Texas	Great Plains	Western Gulf Coastal Plain
St. Lucie	Eastern Temperate Forests	Southern Coastal Plain
Summer	Eastern Temperate Forests	Piedmont
Surry	Eastern Temperate Forests	Middle Atlantic Coastal Plain, Southeastern Plains
Susquehanna	Eastern Temperate Forests	Ridge and Valley
Three Mile Island	Eastern Temperate Forests	Northern Piedmont
Turkey Point	Tropical Wet Forests	Southern Florida Coastal Plain
Vermont Yankee	Eastern Temperate Forests and Northern Forests	Northeastern Coastal Zone, Northeastern Highlands
Vogtle	Eastern Temperate Forests	Southeastern Plains
Waterford	Eastern Temperate Forests	Mississippi Alluvial Plain
Watts Bar	Eastern Temperate Forests	Ridge and Valley
Wolf Creek	Great Plains	Central Irregular Plains

Source: EPA 2007b

power plant were determined by obtaining National Wetland Inventory (NWI) data (USFWS 2007) (Table D.5-3). When NWI data were not available, the land cover data were used. Open water areas were assigned to NWI classification on the basis of NWI classification methodology.

Aquatic habitats and the types of aquatic organisms (including special status species) that could be affected by nuclear power plant operations during the license renewal term were determined at a broad level on the basis of the location of the plant and the source of cooling water used by the plant. In cases where cooling systems could affect more than one type of system (e.g., freshwater and estuarine), impacts to both systems were considered in the analysis. Similarly, the potential for migratory aquatic species to be affected by a particular plant was based on reported occurrences of such species in waters used to supply cooling water. Plants that use estuarine or marine water sources for cooling or plants that use freshwater cooling water sources with a potential for containing migratory life stages of Federally managed fishery species were assumed to have a potential for affecting essential fish habitat. In general, existing impingement, entrainment, and thermal impacts on aquatic organisms from cooling water systems were considered to be lower for plants with cooling towers when operating in a closed-cycle mode because those plants withdraw smaller volumes of water for cooling and have comparatively smaller thermal plumes.

Additional information regarding terrestrial and aquatic resources in the vicinity of specific nuclear power plants was obtained from scientific articles and reports, from recently completed SEISs, and from environmental reports (ERs) included as part of the applications submitted by applicants for renewal of reactor licenses. Information from these sources was used to describe the general types of nuclear plant interactions with ecological resources and illustrate impact types observed at the nuclear plants. In some cases, information provided in the 1996 GEIS (NRC 1996) was used to describe the affected environment.

D.5.2 Description of Impact Assessment

A wide range of issues (Table 2.4-1) related to potential impacts of license renewal on ecological resources were evaluated by considering how continuation of operations would affect ecological resources compared to the current condition. Although the ecological impacts associated with plant decommissioning have been previously evaluated by the NRC (2002), the ecological impacts associated with delaying decommissioning because of license renewal were considered as part of the proposed action (Section 4.1.3.5). Potential impacts to terrestrial and aquatic resources were evaluated, in part, by a review of published literature related to the impacting factors associated with operations and associated construction and refurbishment actions during the license renewal term. Although some of the impacts identified were specific to nuclear power plant operation (e.g., effects of radionuclides on biota), impacts associated with non-nuclear power plants also were reviewed (e.g., the effects of bird collisions

Table D.5-3. Percent of Area Occupied by Wetland and Deepwater Habitats Within 5 Miles of Operating Nuclear Power Plants

	Percent of Area Occupied by Wetland and Deepwater Habitat Types								
Site	**Estuarine and Marine Deepwater[(b)]**	**Estuarine and Marine Wetland**	**Lacustrine**	**Palustrine Pond[(c)]**	**Riverine**	**Palustrine Emergent Wetland**	**Palustrine Forested/Shrub Wetland**	**Other**	**Total Wetland[(d)]**
Arkansas[(a)]	0.0	0.0	11.4	0.0	0.0	0.1	0.2	0.0	11.7
Beaver Valley	0.0	0.0	1.6	0.2	3.5	0.1	0.1	0.0	5.5
Braidwood	0.0	0.0	7.6	1.6	0.4	1.0	0.8	0.0	11.4
Browns Ferry	0.0	0.0	26.6	0.2	0.0	0.7	14.7	0.0	42.2
Brunswick	23.6	15.3	0.6	0.4	0.2	0.5	19.9	0.1	36.9
Byron	0.0	0.0	1.9	0.1	0.0	0.6	0.9	0.0	3.6
Callaway	0.0	0.0	0.3	0.5	1.1	0.8	1.7	0.0	4.5
Calvert Cliffs	52.8	0.5	0.0	0.1	0.0	0.3	2.3	0.0	3.3
Catawba	0.0	0.0	12.0	0.3	0.2	0.0	0.3	0.0	12.9
Clinton	0.0	0.0	8.3	0.1	0.0	0.1	0.4	0.0	9.0
Columbia	0.0	0.0	5.4	0.0	0.0	0.1	0.1	0.0	5.6
Comanche Peak[(a)]	0.0	0.0	6.6	0.2	0.4	0.0	1.6	0.0	8.8
Cooper	0.0	0.0	0.1	0.3	2.7	0.7	3.1	0.0	6.8
Crystal River	39.1	13.9	0.1	0.3	0.2	2.1	9.6	0.0	26.1
D.C. Cook	0.0	0.0	50.6	0.3	0.0	0.5	2.2	0.0	53.6
Davis Besse	0.0	0.0	53.7	0.8	2.7	7.4	2.0	0.0	66.6
Diablo Canyon	53.8	0.3	0.0	0.0	0.1	0.0	0.5	0.0	0.9
Dresden	0.0	0.0	10.8	1.5	1.2	5.1	3.4	0.0	22.0
Duane Arnold	0.0	0.0	1.0	0.5	1.6	1.2	7.5	0.0	11.7
Farley	0.0	0.0	1.5	0.5	0.0	1.0	10.1	0.0	13.1
Fermi	0.0	0.0	53.3	0.4	0.8	2.0	1.4	0.0	57.9
FitzPatrick[(a)]	0.0	0.0	60.5	0.0	0.0	0.2	4.7	0.0	65.4
Fort Calhoun	0.0	0.0	1.8	0.3	1.7	0.9	1.6	0.0	6.3

Table D.5-3. (cont.)

	Percent of Area Occupied by Wetland and Deepwater Habitat Types								
Site	**Estuarine and Marine Deepwater[b]**	**Estuarine and Marine Wetland**	**Lacustrine**	**Palustrine Pond[c]**	**Riverine**	**Palustrine Emergent Wetland**	**Palustrine Forested/Shrub Wetland**	**Other**	**Total Wetland[d]**
Ginna[a]	0.0	0.0	61.7	0.1	0.0	0.1	1.2	0.0	63.1
Grand Gulf[a]	0.0	0.0	3.1	0.0	8.8	0.7	26.8	0.0	39.4
Harris	0.0	0.0	9.3	0.3	0.0	0.0	3.5	0.0	13.2
Hatch	0.0	0.0	0.0	0.8	2.3	0.5	20.3	0.0	23.9
Hope Creek	44.1	34.6	0.0	0.4	0.0	1.7	1.4	0.1	38.3
Indian Point	14.7	0.6	0.6	0.8	0.2	0.4	1.8	0.0	4.3
Kewaunee[a]	0.0	0.0	46.6	0.0	0.0	1.0	4.3	0.0	51.9
LaSalle	0.0	0.0	4.5	0.3	0.0	0.1	0.1	0.0	4.9
Limerick	0.0	0.0	0.0	0.3	1.2	0.1	0.4	0.0	2.0
McGuire	0.0	0.0	19.5	0.2	0.0	0.1	1.5	0.0	21.4
Millstone	49.1	1.7	0.3	0.2	0.0	0.1	2.1	0.0	4.3
Monticello	0.0	0.0	2.8	0.7	1.4	4.3	2.5	0.0	11.8
Nine Mile Point[a]	0.0	0.0	60.8	0.0	0.0	0.2	4.6	0.0	65.7
North Anna	0.0	0.0	18.3	0.2	0.1	0.1	2.4	0.0	21.1
Oconee[a]	0.0	0.0	21.8	0.2	0.0	0.0	0.4	0.0	22.3
Oyster Creek	27.0	3.9	0.2	0.2	0.0	0.6	13.0	0.0	18.0
Palisades	0.0	0.0	48.9	0.2	0.0	1.1	7.8	0.1	58.1
Palo Verde[a]	0.0	0.0	1.1	0.0	0.0	0.0	0.1	0.0	1.2
Peach Bottom	0.0	0.0	13.8	0.2	0.3	0.1	0.1	0.0	14.5
Perry[a]	0.0	0.0	48.6	0.1	0.1	0.0	0.5	0.0	49.3
Pilgrim	60.8	1.0	0.8	0.3	0.0	0.1	1.4	0.0	3.6
Point Beach[a]	0.0	0.0	45.3	0.0	0.0	1.2	7.5	0.0	54.0
Prairie Island[a]	0.0	0.0	13.2	1.0	0.1	4.4	13.2	0.0	31.9
Quad Cities	0.0	0.0	8.9	0.7	0.2	2.0	10.3	0.0	22.2

Table D.5-3. (cont.)

Site	Estuarine and Marine Deepwater[b]	Estuarine and Marine Wetland	Lacustrine	Palustrine Pond[c]	Riverine	Palustrine Emergent Wetland	Palustrine Forested/Shrub Wetland	Other	Total Wetland[d]
	Percent of Area Occupied by Wetland and Deepwater Habitat Types								
River Bend[a]	0.0	0.0	0.7	0.7	6.2	1.3	32.7	0.0	41.6
Robinson	0.0	0.0	4.4	0.4	0.0	0.3	8.3	0.0	13.5
Salem	45.0	35.6	0.0	0.4	0.0	1.5	1.3	0.1	39.0
San Onofre	48.1	0.5	0.0	0.0	0.7	0.1	1.3	0.0	2.6
Seabrook	24.3	12.8	0.1	0.3	0.0	0.7	6.9	0.0	20.9
Sequoyah	0.0	0.0	14.7	0.4	0.0	0.0	0.1	0.0	15.1
South Texas	0.0	0.0	14.2	0.2	0.8	5.0	3.1	0.0	23.3
St. Lucie	65.8	4.3	0.0	0.5	0.1	7.0	0.1	0.0	11.9
Summer	0.0	0.0	17.1	0.2	0.6	0.3	2.0	0.0	20.2
Surry	33.8	2.6	1.4	0.2	17.3	3.2	2.4	0.0	27.0
Susquehanna	0.0	0.0	0.2	0.3	3.1	0.1	1.0	0.0	4.6
Three Mile Island	0.0	0.0	0.0	0.3	10.6	0.1	0.3	0.0	11.4
Turkey Point	53.7	12.9	0.0	0.0	0.1	15.7	9.1	0.0	37.8
Vermont Yankee	0.0	0.0	2.7	0.3	1.1	0.6	1.4	0.0	6.1
Vogtle	0.0	0.0	0.3	0.3	1.0	1.6	24.3	0.0	27.4
Waterford	0.0	0.0	1.6	0.9	7.6	11.8	45.8	0.2	67.8
Watts Bar	0.0	0.0	9.2	0.2	0.3	0.2	1.1	0.0	10.9
Wolf Creek[a]	0.0	0.0	13.0	0.7	0.4	0.2	0.6	0.0	14.8

(a) Data were derived, at least in part, from the National Land Cover Database (USGS 2003) and were assigned to NWI categories.
(b) Deepwater habitats are permanently flooded and lie below the deepwater/wetland boundary (Cowardin et al 1979).
(c) Includes the Aquatic Bed and Unconsolidated Bottom wetland classes.
(d) Does not include deepwater habitats.
Source: National Wetlands Inventory (USFWS 2007), except where noted.

with natural draft cooling towers or electric transmission lines, or the effects of impingement, entrainment, and thermal stress on fish and other aquatic organisms). In addition, recently completed SEISs were reviewed for impact evaluations and the presentation of new and potentially significant information on the impacts of plant operations during the renewal term.

The potential impacts of radionuclide exposure on terrestrial and aquatic biota at nuclear power plants were evaluated by reviewing Radiological Environmental Monitoring Program reports (primarily Annual Radiological Environmental Operating Reports) for 15 power plants selected to represent a range of radionuclide concentrations in the environmental media, including plants identified as having high annual worker total effective dose equivalent values or public exposures. In instances where a site's sediment or soil concentration for a particular nuclide was below the lower limit of detection (LLD), the LLD was substituted as the concentration for that media type, thereby resulting in a conservative estimate (i.e., more likely to identify a potential for negative impacts to biota) of potential exposure. The radionuclide concentrations in water, sediment, and soil were then input to the RESRAD-BIOTA dose evaluation model (DOE 2004) to estimate the dose rates for terrestrial and aquatic biota.

The RESRAD-BIOTA code was developed at Argonne National Laboratory based on the U.S. Department of Energy's (DOE's) graded approach to biota dose evaluation (DOE 2002). There are three levels provided by the RESRAD-BIOTA code corresponding to the graded approach to biota dose evaluation. The evaluation presented in Section 4.1.1.5.1 was conducted using RESRAD-BIOTA Level 2, which was necessary for dose modeling. Because the LLDs for water samples were relatively high compared to the Biota Concentration Guide, water radionuclide concentrations below the LLD were estimated using the partition coefficient (K_d value) provided in the RESRAD-BIOTA code.

For all ecological receptors, default bioaccumulation factors and dose limits were used. Radionuclides at each site were evaluated by comparing the sum of the total estimated dose to the default dose limits (riparian animal, 0.1 rad/d; terrestrial animal, 0.1 rad/d; terrestrial plant, 1.0 rad/d; aquatic organisms, 1.0 rad/d). Estimated doses that were less than the dose limit were determined to represent an acceptable radiological risk to the receptor, whereas estimated doses above the dose limit were determined to represent an unacceptable radiological risk to the receptor. More information about the RESRAD-BIOTA code, including instructions for using the model, can be found at http://web.ead.anl.gov/resrad/documents/.

The potential impacts of continued operation of the cooling systems on terrestrial biota at nuclear power plants were evaluated by reviewing published site-specific reports to gather information on the types and concentrations of contaminants released from the cooling systems into the environment and comparing those concentrations to regulatory guidelines to determine whether the contaminants associated with cooling system operation posed any risk to terrestrial resources. Specifically, Radiological Effluent Release Reports (RERRs), ERs, and recently prepared SEISs for eight nuclear power plants were reviewed to identify the types and concentrations of contaminants associated with the operation of the cooling systems. The eight nuclear power plants were selected to represent different cooling systems and contaminants. Water concentrations were reported in the RERRs, ERs, or SEISs for only two contaminants: chlorine and tritium. The maximum reported concentrations for both contaminants from the site-specific reports were compared to regulatory guidelines and the results from laboratory experiments. Maximum site-specific concentrations below the lowest observed effects level (LOEL) or below the recommended regulatory guideline were considered to represent an acceptable risk to terrestrial resources. Maximum site-specific concentrations above the LOEL or above the recommended regulatory guideline were considered to represent an unacceptable risk to terrestrial resources. Potential effects of contaminants introduced into aquatic environments from cooling water systems were evaluated by reviewing the SEISs that have been previously completed and scientific literature pertaining to potential and observed effects of contaminants and biocides used for maintenance of cooling water systems.

D.6 Historic and Cultural Resources

D.6.1 Description of Affected Resources and Region of Influence

Historic and cultural resources are the physical remains of past human activity that have historic or cultural meaning. They include archaeological sites (e.g., prehistoric campsites and villages), historic era resources (e.g., farmsteads, forts, and canals), and traditional cultural properties (e.g., resource collection areas and sacred areas). Historic and cultural resources that could be affected by license renewal and that are included in the area of potential effect include both those found in areas within the plant property and areas outside the property that would be affected by plant activities. In most cases, license renewal activities would be confined to the current property boundaries and the transmission line ROW up to the first substation. Continued operations, refurbishment, and decommissioning activities may affect currently undeveloped portions of plant property. While some portions of the current plant property and transmission line ROW were affected during construction, it is expected that some resources remain.

D.6.2 Description of Impact Assessment

Historic and archaeological (cultural) resources were identified as resources to be considered for license renewal in the 1996 GEIS (NRC 1996), where they were identified as a Category 2 issue (NRC 1996). The current assessment is in agreement with this categorization. Only through a site-specific assessment can impacts to historic and cultural resources be determined. The reviews focused on the types of resources that are known at the plants, whether the plants were field examined for the resources prior to construction, and where the plants are located in relation to major water bodies (water being a strong indicator of the presence of historic and cultural resources). Reviews of historic and cultural resources at 27 nuclear plants that have already undergone license renewal indicate that very few archaeological sites had been identified at the power plant locations. Among the plants where field investigations were undertaken, the average number of resources present was 35 per plant. At plants where no field investigations took place, generally no sites were known. While some resources were likely destroyed during construction, there is the potential for some intact resources to remain at most sites. Plant activities that could affect historic and cultural resources during the renewal period include minor construction projects, refurbishment actions, security improvements, landscaping activities, and recreational activities. Procedures are often applied at plants to mitigate the effect of plant activities on historic and cultural resources. Assessment of impacts to historic and cultural resources from these activities can only occur at the plant-specific level.

Transmission lines that would cease operating if a plant shut down are considered within the scope of license renewal. Transmission line ROWs have been developed for many years; however, most ROWs were not examined for historic and cultural resources before construction. Resources likely exist but are unknown to the ROW operator. Danger tree removal and access road maintenance are activities that occur within the transmission line ROW that have the potential to affect historic and cultural resources. Maintenance procedures that consider historic and cultural resources are generally followed to mitigate the effect activities have on the resources. Impacts can only be determined at the plant-specific level.

Potential impacts to historic and archaeological (cultural) resources were considered for decommissioning and were found to be small (NRC 2002). The current assessment evaluates whether continued operations during the license renewal term would affect the conclusions in the decommissioning GEIS for both the plant and transmission lines. The current assessment is based on potential effects of continued operation and refurbishment activities on historic and cultural resources during the license renewal term.

D.7 Socioeconomics and Environmental Justice

D.7.1 Description of Affected Resources and Region of Influence

The impacts of nuclear power plant operations and refurbishment occur at the local level, in the county in which a plant is located, at the regional level, in the counties in which the majority of permanent plant employees reside, and at the State level. The definition of the region around each nuclear plant is based on employee residential location data and the location of vendors providing materials, equipment, and services necessary for operation, maintenance, and any construction that might be required for refurbishment activities. The majority of the economic and tax revenue data used in the GEIS update was derived from a series of reports developed by the Nuclear Energy Institute (NEI 2003, 2004a,b,c,d, 2005a,b, 2006a,b,c), which was used to describe the socioeconomic environment in the region in which a sample of 11 nuclear plants are located, and for the estimation of impacts of each plant at the local and State levels (Table D.7-1).

Table D.7-1. Definition of Local Areas and Regions at 11 Nuclear Plants

Plant	Counties in Local Area	Additional Counties in Region	State
Diablo Canyon	San Luis Obispo	None	California
Grand Gulf	Warren and Claiborne	Hinds, Franklin, Copiah, Adams	Mississippi
Indian Point	Westchester, Duchess, Orange, Putnam and Rockland	None	New York
Limerick	Montgomery	Berks, Chester	Pennsylvania
Millstone	New London	None	Connecticut
Oconee	Anderson, Greenville, Oconee and Pickens	None	South Carolina
Palo Verde	Maricopa	None	California
Peach Bottom	York	Lancaster, Chester	Pennsylvania
Susquehanna	Luzerne	None	Pennsylvania
Three Mile Island	Dauphin	Lancaster, Lebanon, York, Cumberland, Perry	Pennsylvania
Wolf Creek	Coffey	Lyon, Franklin, Anderson, Shawnee	Kansas

Sources: NEI 2003, 2004a,b,c,d, 2005a,b, 2006a,b,c

D.7.2 Estimation of Direct and Indirect Economic Effects

Nuclear power plant operations generate significant employment and expenditures at each plant site. Wage and salary and nonlabor expenditures create demand for a range of durable and nondurable goods provided by wholesalers and retailers, and also create demand for health and professional services and housing. Power plants also provide tax revenues for local and State governmental entities. In addition to employment, wages and salaries, and nonlabor expenditures directly associated with plant operations, power plants also produce indirect employment and income in the local and State economies as direct expenditures associated with wages and salaries, procurement, and tax revenues, which circulate through the economies, producing additional economic activity. The magnitude of the indirect economic impact of labor spending at each plant is determined by the extent to which plant employees live in the local area and region around each plant. The indirect impact of nonlabor expenditures is determined by the extent to which vendors of materials, equipment, and supplies are located in the local area and region.

Estimation of the indirect impact of nuclear power plants on local and State employment and income in NEI data was based on the use of regional economic multipliers in association with plant expenditure data for the construction and operations phases. Multipliers capture the indirect (offsite) effects of onsite activities associated with construction and operation of an activity or event. Expenditure data associated with the construction and operation of nuclear power plants were derived from individual utility sources, which provided the relevant construction and operating cost data for wages and salaries and nonlabor expenditures (procurement of materials, equipment, and services) and tax revenues.

Expenditure data in the NEI reports were mapped into the relevant North American Industry Classification System codes for use with multipliers from an IMPLAN model specified for the local area and State in which each power plant is located. IMPLAN input-output economic models are based on economic accounts showing the flow of commodities to industries from producers and institutional consumers. The accounts also show consumption activities by workers and owners of capital and imports from outside the region. The IMPLAN model contains 528 sectors representing industries in agriculture, mining, construction, manufacturing, wholesale and retail trade, utilities, finance, insurance and real estate, and consumer and business services. The model also includes information for each sector on employee compensation; proprietary and property income; personal consumption expenditures; Federal, State, and local expenditures; inventory and capital formation; and imports and exports. More information on the IMPLAN model and data can be found in each NEI report (NEI 2003, 2004a,b,c,d, 2005a,b, 2006a,b,c).

In addition to NEI data on direct power plant employment, wage and salary spending, materials and equipment expenditures, and local and State tax revenues, NEI estimates of indirect employment and income impacts at the local and State levels associated with power plant labor and nonlabor expenditures and tax revenue spending were reported in the analysis of impacts in the GEIS update.

Impacts of plant operations and refurbishment are likely to vary according to the scale of employment and expenditures at each power plant and the type of economy in which each plant is located. To assess the impact of power plant size and location in the GEIS update, 11 power plants for which direct and indirect impacts were estimated by NEI were classified according to whether the economic structure in the locality and region around each plant is rural or semi-urban. Rural areas often have relatively simple economies, and agriculture is often the primary economic activity. Many of the industries that provide equipment and services important to power plant operations are largely absent in rural areas, which have smaller, less diversified labor markets, with often lower skilled, lower paying occupations. In addition to agriculture and related activities, in some locations there may also be a range of other activities, including resource extraction, manufacturing, and transportation industries that provide employment and income. In semi-urban areas, where economic structures are more complex than in rural areas, there are a wider range of industries and larger and more diverse labor markets. Semi-urban areas may also serve specialized economic functions, including maritime shipping, fishing, boatbuilding, recreation, and tourism and numerous locations featuring residential areas hosting second homes and retirement communities.

D.7.3 Environmental Justice Assessment Methods

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, formally requires Federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations. Additional guidance for undertaking environmental justice reviews is described in Section 3.10.

The analysis of the impacts of nuclear power plant operations and refurbishment during the license renewal term on environmental justice has three parts: (1) a description of the geographic distribution of low-income and minority populations in the affected area; (2) an assessment of whether the impacts of license renewal would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a determination as to whether these impacts disproportionately affect minority and low-income populations.

The analysis considers minority and low-income populations who reside within a 50-mi (80-km) radius of a nuclear plant. Data on low-income and minority individuals are collected and analyzed at the census tract or census block group level.

Minority individuals are those who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African-American, Native Hawaiian or Other Pacific Islander, or two or more races. Beginning with the 2000 census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origin. In addition, persons who classify themselves as being of multiple racial origins may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or Other Race.

Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is “meaningfully greater than” the minority population percentage in the general population or other appropriate unit of geographic analysis. Minority populations may be communities of individuals living in close geographic proximity to one another, or a geographically dispersed or transient set of individuals (e.g., migrant workers or American Indians) where the group experiences common conditions of environmental exposure or effect. The appropriate unit of geographic analysis may be a political jurisdiction, county, region, or State or other similar unit that is chosen so as not to artificially dilute or inflate the affected minority population.

Low-income individuals are those whose annual income falls below the poverty line. The poverty line takes into account family size and the age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau’s Current Population Reports, Series PB60. Low-income populations may be communities of individuals living in close geographic proximity to one another, or a set of individuals (e.g., migrant workers) where the group experiences common conditions of environmental exposure or effect.

Nuclear power plant license renewal could affect environmental justice if any adverse health and environmental impacts are significantly high, and if these impacts would disproportionately affect minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts to minority and low-income populations. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by the Council on Environmental Quality, CEQ) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental impacts that are significant (as defined by CEQ) are impacts or risks of impacts on the natural or physical environment in a low-income or minority community that appreciably exceed the environmental impact on the larger community. Such effects may include ecological, cultural, economic, or social impacts. Adverse environmental impacts are impacts that are determined to be both harmful and significant (as defined by CEQ). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian Tribes are considered (CEQ 1997).

D.8 Human Health

D.8.1 Radiological Effects

Nuclear power plants produce electricity through a heat-generating process known as “fission,” in which neutrons split uranium atoms to produce large amounts of energy. Any material that is capable of undergoing fission by neutrons in a self-sustaining chain reaction is called fissile material. The most common fissile isotopes are uranium-235 and plutonium-239. Neutrons whose energy distribution is in thermal equilibrium with the ambient medium are called thermal neutrons. When a thermal neutron strikes uranium-235, it splits the uranium atom into two isotopes with a smaller atomic weight (called fission products) and several neutrons (the mean number of neutrons per fission of uranium-235 is 2.5) and gamma rays. All fission products are radioactive and decay to form other radioactive isotopes. The amount of energy generated in a fission reaction is about 200 MeV, and this energy is distributed among fission products, neutrons, and fission gamma rays. Most of the energy generated in the nuclear fission process is dissipated as thermal energy and is converted into electrical energy in a nuclear power plant. Nuclear fission differs from other forms of radioactive decay in that it can be harnessed and controlled via a chain reaction in which neutrons released by each fission event trigger yet more events, which, in turn, release more neutrons and cause more fission.

In a nuclear reactor, a controlled sustained chain reaction is produced. The core of a nuclear reactor consists of fuel (containing uranium enriched in uranium-235), a moderator to slow down the neutrons released in fission, a coolant to remove the thermal energy, and control rods for controlling the chain reaction. In enriched uranium, the percent composition of uranium-235 is increased (2 to 5 percent) from its natural composition (about 0.7 percent) in uranium. The nuclear power plants in the United States use water as both a moderator and a coolant. During the fission process, a large inventory of radioactive fission products builds up within the fuel. Virtually all of the fission products are contained within the fuel pellets. The fuel pellets are enclosed in hollow metal rods (cladding), which are hermetically sealed to further prevent the release of fission products. However, a small fraction of the fission products migrate from the fuel rods and contaminate the reactor coolant. The primary system coolant also has radioactive contaminants as a result of neutron activation (a process by which a stable atom becomes radioactive after undergoing a reaction with a neutron). Neutrons also interact with structural materials inside the pressure vessel and with the pressure vessel itself and make those materials radioactive.

D.8.1.1 Background Information on Radiation

Atoms are the basic building blocks of matter. An atom consists of three basic particles: (1) neutrons (neutral particles), (2) protons (positively charged particles), and (3) electrons (negatively charged particles). Neutrons and protons combine to form the positively charged nucleus which is the central part of the atom. The electrons revolve around the nucleus in different orbits. Atoms of different types are known as elements. Elements differ in the number of protons and electrons they have, but they have an equal number of each. When atoms of an element have a different number of neutrons, they are called isotopes of that element. Elements have many isotopes, and some of them may be unstable.

Radiation is energy transmitted in the form of waves or particles. There are two basic types of radiation: particulate radiation and electromagnetic radiation. Particulate radiation (alpha and beta radiation) has both mass and energy associated with it. Electromagnetic radiation is pure energy with no mass, such as x-rays and gamma rays. Radiation is produced when unstable isotopes undergo spontaneous change, known as radioactive disintegration or radioactive decay. The rate of decay is measured by how long it takes for half of the sample to decay. When an unstable isotope changes into a more stable form it may emit either an alpha particle or a beta particle. These reactions may or may not be associated with gamma radiation. The alpha and beta particles are generally referred to as ionizing radiation.

An alpha particle emits positively charged, highly energetic ionizing radiation that consists of two protons and two neutrons. Alpha particles are extremely limited in their ability to penetrate matter, and they can be stopped easily by a sheet of paper or by the outer layer of the skin. In air, they can travel only a few centimeters. Therefore, alpha particles outside the body do not cause any external radiation exposure. However, when the alpha particles are ingested or inhaled they dissipate all their energy in the living tissue, which results in radiation exposure.

A beta particle is an electron that is much lighter than an alpha particle. It can travel a longer distance in air than an alpha particle but can still be stopped by a thin sheet of aluminum foil. Low-energy beta emitters in general do not result in external radiation exposure, but high-energy beta emitters, when stopped by shielding, may generate Bremsstrahlung x-rays that may result in external radiation exposure. The intake of beta particles would result in internal radiation exposure.

X-rays and gamma rays are waves of pure energy that travel with the speed of light and are very penetrating; they require thick concrete or lead shielding to stop them. X-rays and gamma rays can result in both external and internal radiation exposure.

Neutrons lose energy through collisions with the nuclei of the atoms in their environment. They generally slow down to thermal or near thermal energies and are captured by nuclei of the absorbing material. Therefore, neutrons generally travel long distances in air or metallic components before they are absorbed. Radiation exposure occurs from gamma rays and alpha particles that are emitted when a neutron is captured in matter.

D.8.1.2 Conventional Quantities and Units

Following is the list of conventional terms used in the evaluation of radiological human health impacts.

- Absorbed dose: The energy imparted by ionizing radiation per unit mass of the irradiated material. The units of absorbed dose are the rad and the gray (Gy).

- Activity: The rate of disintegration (transformation) or decay of radioactive material. The units of radioactivity are the curie (Ci) and the Becquerel (Bq).

- Collective dose: The sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

- Committed dose equivalent: The dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

- Committed effective dose equivalent: The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

- Deep-dose equivalent: Applies to external whole-body exposure and is the dose equivalent at a tissue depth of 1 cm.

- Dose equivalent: The product of the absorbed dose in tissue, quality factor, and all other modifying factors at the location of interest. The units of dose equivalent are the rem and the sievert (Sv).

- Effective dose equivalent: The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated.

- External dose: That portion of the dose equivalent received from radiation sources outside the body.

- Internal dose: That portion of the dose equivalent received from radioactive material taken into the body.

- Nonstochastic effect: Health effects, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect (also called a deterministic effect).

- Organ dose: Dose received as a result of radiation energy absorbed in a specific organ.

- Occupational dose: Dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material.

- Public dose: The dose received by a member of the public from exposure to radiation or radioactive material.

- Quality factor: The modifying factor (see Table D.8-1) that is used to derive the dose equivalent from the absorbed dose.

- Shallow-dose equivalent: Applies to external exposure of the skin or an extremity and is taken as the dose equivalent at a tissue depth of 0.007 cm averaged over an area of 1 cm^2.

- Stochastic effect: Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effect.

Table D.8-1. Quality Factors and Absorbed Dose Equivalencies

Type of Radiation	**Quality Factor**	**Absorbed Dose Equal to a Unit Dose Equivalent**[(a)]
X-, gamma, or beta radiation	1	1
Alpha particles, multiple-charged particles, fission fragments, and heavy particles of unknown energy.	20	0.05
Neutrons of unknown energy	10	0.1
High energy protons	10	0.1

(a) Absorbed dose in rad equal to 1 rem or the absorbed dose in gray equal to sievert.
Source: 10 CFR Part 20

- Total body dose: Sum of the dose received from external exposure to the total body, gonads, active blood-forming organs, head and trunk, or lens of the eye and the dose due to the intake of radionuclides by inhalation and ingestion where a radioisotope is uniformly distributed throughout the body tissues rather than being concentrated in certain parts.

- Total effective dose equivalent: The sum of the deep-dose equivalent (for external exposure) and the committed effective dose equivalent (for internal exposure).

- Weighting factor: The fraction of the overall health risk, resulting from uniform whole body irradiation, attributable to a specific organ or tissue. Table D.8-2 lists organ dose weighting factors.

- Whole body dose: Same as total body dose.

D.8.1.3 Biological Effects of Radiation

Radiation interacts with the atoms that form the cells. There are two mechanisms by which radiation affects cells: direct action and indirect action. In a direct action, the radiation interacts directly with the atoms of the DNA molecule or some other component critical to the survival of the cell. Since the DNA molecules make up a small part of the cell, the probability of direct action is small. Because most of the cell is made up of water, there is a much higher probability that radiation would interact with water. In an indirect action, radiation interacts with water and breaks the bonds that hold the water molecule together and produces reactive free radicals that are chemically toxic and destroy the cell. The body has mechanisms to repair damage caused by radiation. Consequently, biological effects of radiation on living cells may result in three outcomes: (1) injured or damaged cells repair themselves, resulting in no residual damage; (2) cells die, much like millions of body cells do every day, being replaced through normal biological processes; or (3) cells incorrectly repair themselves, resulting in a biophysical change. Stochastic effects may occur when an irradiated cell is modified rather than killed. A modified

Table D.8-2. Organ Dose Weighting Factors

Organ or Tissue	Weighting Factor
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30[(a)]
Whole body	1.00[(b)]

(a) 0.30 results from 0.06 for each of five "remainder" organs (excluding the skin and the lens of the eye) that receive the highest doses.
(b) For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor of 1 has been specified.
Source: 10 CFR Part 20

cell may, after a prolonged delay, develop into a cancer.

The biological effects on the whole body from exposure to radiation depend on many factors, such as the type of radiation, total dose, time interval over which the dose is received, and part of the body that is exposed. Not all organs are equally sensitive to radiation. The blood-forming organs are most sensitive to radiation; muscle and nerve cells are relatively insensitive to radiation. There could be two types of radiation exposure: (1) a single accidental exposure to high doses of radiation for a short period of time (acute exposure), which may produce biological effects within a short time after exposure, and (2) long-term, low-level overexposure, commonly called continuous or chronic exposure. High doses of radiation can cause death. Other possible effects of a high radiation dose include erythema, dry desquamation, moist desquamation, hair loss, sterility, cataracts, and acute radiation syndromes. Low doses of radiation can cause genetic effects and carcinogenic effects.

D.8.1.4 Human Health Effects of Radiation

Radiation can cause a variety of health effects. The most significant of these are induced cancer fatalities. The National Research Council's Committee on the Biological Effects of Ionizing Radiation (BEIR) has prepared a series of reports on the health consequences of radiation exposure. In the 1996 GEIS (NRC 1996) the NRC staff summarized the risk estimates from different reports including BEIR-I, BEIR-III, and BEIR-V, the 1988 UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation) reports, and International Commission on Radiological Protection (ICRP) Publication 26.

In 1991, the ICRP issued a complete set of new recommendations based on new biological information (ICRP 1991). Table D.8-3 provides the nominal probability coefficients for stochastic effects. ICRP estimated the probability of fatal cancer by using the data on the Japanese survivors of the Hiroshima and Nagasaki atomic bombs and their assessment by

Table D.8-3. Nominal Probability Coefficients for Stochastic Effects

Exposed Population	Probability Coefficients (10^{-4} rem^{-1})[(a)]			
	Fatal Cancer	Nonfatal Cancer	Total Cancer	Severe Hereditary Effects
Adult workers	4.0	0.8	4.8	0.8
Whole population	5.0	1.0	6.0	1.3

(a) Rounded values.
Source: ICRP 1991

BEIR and UNSCEAR committees. ICRP reviewed the available experimental data on dose-response relationships for radiation of low linear energy transfer (LET) and the effect of dose and dose rate on this relationship and concluded that the dose-response relationship is most probably linear quadratic for low LET radiations. The BEIR-V risk estimate (eight cancer fatalities among 10,000 people exposed to 10,000 person-rem) was based on a high dose. ICRP in its 1991 recommendations used a dose and dose rate effectiveness factor (DDREF) of 2 to convert the high-dose or high-dose-rate estimates of risk to low-dose or low-dose-rate estimates of risk. The estimates of severe hereditary effects were also based on the experimental data on genetic effects in animals, which were in assessments done by BEIR and UNSCEAR committees.

In 1993, the National Council on Radiation Protection and Measurement (NCRP) recommended that a lifetime risk of fatal cancer of 4×10^{-4}/(person-rem) be used for a worker population and similarly, a lifetime risk of 5×10^{-4}/(person-rem) be used for the general population. The NCRP also recommended a risk estimate of about 1×10^{-4}/(person-rem) for severe hereditary effects in the total population and a somewhat lower risk estimate for the worker population (NCRP 1993). These recommendations are similar to the ICRP recommendations on the lifetime risk of fatal cancer.

In 1999, the EPA issued Federal Guidance Report No. 13, which provides numerical factors for use in estimating the risk of cancer from low-level exposure to radionuclides. Risk coefficients are provided for the following modes of exposure to a given radionuclide: inhalation of air, ingestion of food, ingestion of tap water, external exposure from submersion in air, external exposure from the ground surface, and external exposure from soil contaminated to an infinite depth (EPA 1999). The risk coefficients are applicable to either chronic or acute exposure to a radionuclide.

In 2006, the National Research Council's Committee on the Biological Effects of Ionizing Radiation (BEIR) published its latest report BEIR-VII, *Health Risks from Exposure to Low Levels of Ionizing Radiation* (BEIR 2006). The committee had published its previous report on the same topic, BEIR-V, in 1990 (BEIR 1990).

Three major changes have occurred after the BEIR V report was published. First, an additional 12 years of follow-up medical data were available. Second, cancer incidence data for the cohort were available (for BEIR V, only mortality data were available). The impact of these two developments has reduced the uncertainty in the assessment of cancer risk among the atomic bomb survivors. Third, the dosimetry system used to assign radiation exposure to the atomic bomb survivors was replaced with an improved dosimetry system. These changes have improved the understanding of the health risks associated with radiation exposure (NRC 2005).

In estimating the cancer risk, the committee used the Hiroshima and Nagasaki atomic bomb survival data for the period 1958-1998 and a dose and dose rate effectiveness factor of 1.5 was used. Table D.8-4 lists the recommended risk coefficients for cancer incidence and fatality. Table D.8-4 shows the estimated cancer cases and deaths in the U.S. population that would be expected to result if each individual in a population of 100,000 was exposed to a single dose of 10 rad. It also shows the number that would be expected in the absence of radiation. The 95 percent confidence intervals are also shown.

The BEIR VII committee's preferred estimate of lifetime attributable risk for solid cancer incidence and mortality (Table D.8-4) suggests that females are more sensitive than males to radiation exposure at 10 rem, a level that is 100 times the NRC's radiation protection standards specified in 10 CFR Part 20. The BEIR VII committee's preferred estimate of lifetime attributable risk for leukemia cancer incidence and mortality (Table D.8-4), moreover, suggests that males are more sensitive than females. The BEIR VII committee uses the 95 percent confidence intervals associated with estimated lifetime cancer risk for males and females that suggest that the apparent gender difference may not be statistically significant.

Table D.8-4. Estimates of Lifetime Attributable Risk of Incidence and Mortality for All Solid Cancers and for Leukemia in the BEIR VII Report[(a)]

	All Solid Cancers		**Leukemia**	
Category	**Males**	**Females**	**Males**	**Females**
Excess cases (including nonfatal cases) from exposure to 10 rad	800 (400–1600)	1300 (690–2500)	100 (30–300)	70 (20–250)
Number of cases in the absence of exposure	45,500	36,900	830	590
Excess deaths from exposure to 10 rad	410 (200–830)	610 (300–1200)	70 (20–220)	50 (10–190)
Number of deaths in the absence of exposure	22,100	17,500	710	530

(a) Number of cases or deaths per 100,000 exposed persons with 95% subjective confidence intervals shown in parentheses.
Source: BEIR 2006

Table D.8-5 compares the BEIR VII risk estimates for whole population with estimates recommended by BEIR V, ICRP, EPA, and UNSCEAR in recent years. The overall difference in the risk estimates recommended by different organizations is statistically insignificant. In this regard, the BEIR VII report states: "in general the magnitude of estimated risks for total cancer mortality or leukemia has not changed greatly from estimates in past reports such as BEIR V and recent reports of the United Nations Scientific Committee on the Effects of Atomic

Table D.8-5. Comparison of BEIR VII Lifetime Cancer Mortality Estimates with Those from Other Reports

Cancer Category	BEIR V[a] (1990)	ICRP[b] (1991)	EPA[b] (1999)	UNSCEAR[c] (2000)	BEIR VII[d] (2006)
Leukemia[e]	50	56	50	-[f]	61
All cancer except leukemia	460	450	520	-	-
All solid cancers (sum)	-	-	-	520	510

NOTE: Excess deaths for population of 100,000 of all ages and both sexes exposed to 10 rad.
(a) Average of estimates for males and females. The values show the results that would be obtained if the DDREF of 1.5, used by the BEIR VII committee, had been employed.
(b) Except for the EPA breast and thyroid cancer estimates, the solid cancer estimates are linear estimates reduced by a DDREF of 2.
(c) Average of estimates for males and females. The estimate is a combined estimate (using the same weights as used by the BEIR VII committee applied on a logarithmic scale) reduced by a DDREF of 1.5.
(d) Average of the committee's preferred estimates for males and females.
(e) Estimates based on a linear-quadratic model.
(f) Not reported.
Source: BEIR VII (2006)

Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP). New data and analyses have reduced sampling uncertainty, but uncertainties related to estimating risk for exposure at low doses and dose rates and transporting risks from Japanese A-bomb survivors to the U.S. population remain large. Uncertainties in estimating risks of site specific cancers are especially large."

If the total fatal cancer risk is the sum of cancer deaths from all solid cancers and leukemia, then the fatal cancer risk coefficient for the general public would be 6×10^{-4}/person-rem (see Table D.8-5). The fatal cancer risk for the general public based on ICRP is 5×10^{-4}/person-rem (Table 3.9-20). There is a difference of approximately 20 percent in the fatal cancer risk coefficient based on the ICRP recommendation and the BEIR-VII report. The difference of 20% is within the margin of uncertainty associated with these estimates.

D.8.1.5 Methodology for Estimating Radiological Impacts

Radiological exposures from nuclear power plants include offsite doses to members of the public and onsite doses to the workforce. Nuclear power plants must be licensed by the NRC and comply with NRC regulations and conditions specified in the license. The licensees are required to comply with 10 CFR Part 20, Subpart C, "Occupational Dose Limits for Adults," and 10 CFR Part 20, Subpart D, "Radiation Dose Limits for Individual Members of the Public" (see Section 3.9.1.1).

D.8.1.5.1 Methodology for Estimating Worker Doses

Plant workers conducting activities involving radioactively contaminated systems or working in radiation areas can be exposed to radiation. Most of the occupational radiation dose to nuclear plant workers results from external radiation exposure rather than internal exposure from inhaled or ingested radioactive materials. Workers also receive radiation exposure during the storage and handling of radioactive waste and during the inspection of stored radioactive waste. However, these sources of exposure are small when compared with other sources of exposure at operating nuclear plants.

Individual occupational doses are measured by NRC licensees as required by the basic NRC radiation protection standard, 10 CFR Part 20 (Section 3.9.1.1). This standard includes requirements for summing internal and external dose equivalents to yield the total effective dose equivalent (TEDE).

Worker doses from external exposure at a nuclear power plant are measured by using either a thermoluminescence dosimeter (TLD) or a film badge. Workers at nuclear plants, in addition to wearing these, wear direct-reading dosimeters (electronic dosimeters) in order to monitor occupational doses related to specific jobs. A TLD may be a Teflon disc impregnated with lithium fluoride sealed in a polyethylene envelope. The TLD is the most widely used personal monitor for gamma radiation and charged particles. Direct-reading dosimeters are useful in situations where there is the potential for sudden or large increases in exposure rate.

The potential external exposure for workers involved in radioactive waste management will likely result from gamma and beta radiation, and the use of the external monitoring devices discussed above is necessary. Internal dosimetry is used when there is a potential that the body may have taken in radioactive material. There are two methods to calculate the committed dose equivalent: 1) measurement of the airborne concentration and the time a worker spends in that area and 2) urinalysis and monitoring of feces or blood. At nuclear power plants, method 1 is generally used. However, for complex situations the mathematical models of the radionuclide's retention and excretion are generally used, as are measurements of the radioactive material content in the excreta, to estimate the doses. Bioassay techniques, such as urinalysis, provide a screening tool to maintain and verify operational radiation protection and control.

For this GEIS revision, worker dose information was obtained from the 38th annual report titled *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2005* (Burrows and Hagemeyers 2006). This report summarizes the occupational exposure data maintained by the NRC's Radiation Exposure Information and Reporting System (REIRS). The licensees submit radiation exposure records for each monitored individual.

D.8.1.5.2 Methodology for Estimating Public Doses

Commercial nuclear power plants, under normal operations, release small amounts of radioactive materials to the environment. The effluent releases (gaseous and liquid) result in radiation doses to humans. Nuclear power plant licensees must comply with Federal regulations (e.g., 10 CFR Part 20, Appendix I to 10 CFR Part 50, 10 CFR Part 50.36a, and 40 CFR Part 190) and conditions specified in the operating license (see Section 3.9.1.1). Appendix I to 10 CFR Part 50 provides numerical values for radioactive effluent design objectives. In addition, each plant license contains technical specification requirements for controlling and limiting the discharge of radioactive gaseous and liquid effluents.

Potential environmental pathways through which persons may be exposed to radiation originating in a nuclear power reactor include atmospheric and aquatic pathways. Radioactive materials released under controlled conditions include fission products and activation products. Fission product releases consist primarily of the noble gases and some of the more volatile materials like tritium, isotopes of iodine, and cesium. These materials are monitored carefully before release to determine whether the limits on releases can be met. Releases into aquatic systems are similarly monitored. When an individual is exposed through one of these pathways, the dose is determined in part by the exposure time, the amount of material ingested or inhaled, and in part by the amount of time that the radioactivity inhaled or ingested is retained in the individual’s body. The major exposure pathways include the following:

- Inhaling contaminated air,
- Drinking milk or eating meat from animals that graze on open pasture on which radioactive contamination may be deposited,
- Eating vegetables grown near the site, and
- Drinking (untreated) water or eating fish caught near the point of discharge of liquid effluents.

Other less important exposure pathways include external irradiation from surface deposition; consumption of animals that drink water that may contain liquid effluents; consumption of crops grown near the site using irrigation water that may contain liquid effluents; shoreline, boating, and swimming activities; and direct offsite irradiation from radiation coming from the plant.

To implement Appendix I of 10 CFR Part 50, the NRC has developed a series of Regulatory Guides that present methods it finds acceptable for calculating effluent releases, the dispersion of effluent in the atmosphere and different water bodies, and the associated radiation doses. In general, licensees follow the guides developed by the NRC staff to calculate public doses.

Liquid effluent from a nuclear power plant may be released into a variety of surface water bodies (e.g., rivers, lakes, reservoirs, cooling ponds, estuaries, and open coastal waters). The released liquid effluent is dispersed by turbulent mixing and by stream flow in rivers, by tidal or nontidal coastal currents in estuaries and coastal waters, and by internal circulation or flow-through in lakes, reservoirs, and cooling ponds. Many parameters (e.g., direction and speed of the flow of currents in the receiving water bodies; size, geometry, and bottom topography of the water body) influence dispersion and dilution. Revision 1 of Regulatory Guide 1.113 (NRC 1977a) describes calculational models for estimating the aquatic dispersion of routine or accidental releases of radioactive material from a nuclear power plant to a surface water body.

Gaseous effluents from nuclear power plants are mostly released through tall stacks or vents near the top of buildings. In some cases, releases could occur near ground level; an example is when auxiliary equipment or a component such as a waste storage tank is housed outside the buildings. Effluent concentrations at downwind locations depend on many parameters (e.g., the initial release height, size and shape of the release point, initial vertical velocity of the effluent, heat content of the effluent, ambient wind speed and temperature, atmospheric stability, and effluent removal mechanisms). Geographic features such as hills, valleys, and large bodies of water greatly influence dispersion and airflow patterns. Revision 1 of Regulatory Guide 1.111 (NRC 1977b) describes basic features of the calculational models and assumptions used to estimate the atmospheric transport and dispersion of gaseous effluents in routine releases from nuclear power plants.

Revision 1 of Regulatory Guide 1.109 (NRC 1977c) provides methods for calculating radiation doses to the public. Appendix A of the regulatory guide describes methods for calculating doses from liquid effluent pathways. The appendix includes the method for calculating doses from potable water, aquatic food, shoreline deposits, and foods grown on land with contaminated water. Appendix B of the regulatory guide describes models and assumptions for calculating doses from noble gases discharged to the atmosphere. It includes the annual gamma and beta air dose calculations and the annual total body and skin dose calculations from noble gas effluents. Appendix C of the regulatory guide provides models and assumptions for calculating doses from radioiodines and other radionuclides released in the atmosphere. It includes the annual external dose calculation from direct exposure to radioactivity deposited on the ground surface, annual dose from inhalation of radionuclides in air, calculation of the radionuclide concentration in food from airborne activity, and calculation of the annual dose from contaminated foods. Appendix D of the regulatory guide provides models for calculating population doses from nuclear power plant effluents.

Radiation doses to the public are calculated in two ways. The first calculation is for dose to the maximally exposed person (that is, the real or hypothetical individual potentially subject to maximum exposure). The second is for doses to the average individual and population. Doses are calculated by using site-specific data when available. For those cases in which site-specific data are not readily available, conservative (overestimating) assumptions are used to estimate doses to the public. For calculating the dose, Regulatory Guide 1.109 divides the population into four age groups: infants (0 to 1 year), children (1 to 11 years), teenagers (11 to 17 years), and adults (17 years and older). Doses are calculated for the maximum exposed individual from these four age groups and compared with the design objectives (Table 3.9-2). Regulatory Guide 1.109 includes the dose factors for these four age groups.

Every year licensees submit two reports to the NRC: an annual radiological environmental monitoring report and an annual radioactive effluent release report. For this GEIS update, public doses from gaseous and liquid effluent releases were obtained from a series of annual radioactive effluent release reports.

D.8.2 Chemical Hazards

In nuclear power plants, chemical effects could result from discharges of chlorine or other biocides, small-volume discharges of sanitary and other liquid wastes, chemical spills, and heavy metals leached from cooling system piping and condenser tubing. Although information was provided about certain types of chemicals used at nuclear power plants, chemical hazards were not specifically addressed in the 1996 GEIS, but the human health impacts of chemicals are included in this GEIS update (Section 3.9.2). Impacts of chemical discharges on human health are considered to be small if the discharges to water bodies are within effluent limits designed to ensure the protection of water quality. The methodology for assessing effects on water quality and aquatic biota are covered in other parts of this appendix. Human health impacts from chemicals were assessed on the basis of information provided in the 1996 GEIS, published literature, available SEISs, and the decommissioning GEIS (NRC 2002).

D.8.3 Microbiological Hazards

Some microorganisms associated with cooling towers and the thermal discharges associated with nuclear power plants can have deleterious impacts on the health of plant workers and the public. The potential for adverse health effects on workers at nuclear power plants as a result of the enhancement of microorganisms is an issue for plants that use cooling towers. The potential for adverse health effects on the public from thermally enhanced microorganisms is an issue for nuclear plants with once-through cooling systems that use cooling ponds, lakes, or canals and that discharge to small rivers. These issues were evaluated by reviewing the information in the 1996 GEIS and published literature on organisms that could be enhanced by plant operation. All published SEISs were also reviewed for new and significant information pertaining to microbiological issues.

D.8.4 Electromagnetic Fields

Nuclear power plants have power transmission systems associated with them that consist of switching stations (or substations) located on the plant site and transmission lines located primarily offsite. Electric and magnetic fields, collectively referred to as the electromagnetic field (EMF), are produced by operating transmission lines. The issue of potential chronic effects from exposure to EMF surrounding transmission lines was evaluated by reviewing the relevant literature.

D.8.5 Other Hazards

Nuclear power plants are industrial facilities that have many of the typical occupational hazards found at any other electric power generation facility. Workers at or around nuclear power plants would be involved in some maintenance activities, electrical work, electric power line maintenance, and repair work and subject to potentially hazardous physical conditions (excessive heat, cold, pressure, etc.). The human health impact from occupational hazards was not discussed in the 1996 GEIS but is considered in this GEIS update (Section 3.9.5). The occupational hazards were evaluated by comparing the rate of fatal injuries and nonfatal occupational injuries and illnesses in the utility sector with the rate in all industries combined.

The workers and general public located at or around nuclear power plants and along the transmission lines are exposed to the potential for acute electrical shock from transmission lines. The shock hazard was evaluated by referral to the National Electric Safety Code (NESC).

D.9 Waste Management and Pollution Prevention

D.9.1 Description of Affected Resources and Region of Influence

Similar to most industrial facilities, nuclear power plants and other fuel-cycle facilities generate waste during their operation. The waste materials are often shipped offsite by truck, train, or in some cases by barge either for disposal or for processing. The wastes that are sent to a processing facility may be reused or recycled or they may be sent to a disposal facility after processing. The processing and handling that occur at the site of generation, including any packaging and loading of the wastes onto conveyance vehicles for shipment offsite, are considered part of the normal operations at that site, and the impacts associated with them are assessed as part of the normal operational impacts. Impacts associated with transportation and offsite processing and disposal are considered under the waste management impacts.

The primary resource that is affected by the disposal of waste materials is the land that is used for disposal. This land is assumed to be an irreversibly and irretrievably committed resource (see Section 4.4.3). The resources that are affected during processing and disposal of the wastes are similar to the resources affected during operation of any nuclear fuel cycle facility, including the nuclear power plants. As discussed in Chapter 4, these resources include land use and visual resources, air quality and noise, geology and soils, hydrology, ecology, cultural resources, socioeconomics, human health and safety, and environmental justice. During transportation, the main resources affected are human health and safety, air quality and noise, and socioeconomics. The impact assessment methodologies and the regions of influence for these resource areas are covered in other parts of this appendix.

D.9.2 Description of Impact Assessment

Historical data and experience were used to estimate the characteristics and quantities of wastes generated at nuclear power plants. These values are discussed in the main body of this document under waste management sections (see for example Sections 3.11, 4.1.1.10, 4.1.3.10, and 4.1.4). Table S-3 in 10 CFR 51.51(b) was the main source for waste generation numbers at other nuclear fuel cycle facilities. The assessment of impacts associated with transportation of waste materials to and from a nuclear power plant relied on the information provided in Table S-4 of 10 CFR 51.52, whereas the impacts of transportation among other fuel-cycle facilities were addressed as part of Table S-3 as discussed Section 4.1.4. The impacts at the offsite processing and disposal facilities are not explicitly evaluated in this document because each of these facilities would be operated pursuant to a permit or license issued by either a Federal or State agency. The impacts at those facilities would be addressed as part of the permitting or licensing process for those facilities. All operations including disposal activities at the disposal facilities would be within the bounds of analyses conducted to obtain the facility's permit or license. For example, the waste shipped to the disposal facility would have to meet that facility's waste acceptance criteria.

The issues associated with the availability of disposal facilities for low-level waste (LLW) are discussed in Section 4.1.1.10. Section 4.1.1.10 also discusses the onsite storage of spent nuclear fuel for up to 30 years beyond the licensing term of a reactor. For all other waste types, it is assumed that permitted processing and/or disposal facilities will be available when needed. Historical evidence suggests that this assumption is valid.

Pollution prevention and waste minimization practices generally employed at the nuclear power plant sites are discussed in Section 3.11. These practices are based on the requirements placed on the licensees by the NRC, EPA, or other Federal or State agencies and the licensee's own efforts to minimize the emissions to the environment and minimize the quantities of wastes generated or sent offsite for treatment or disposal.

D.10 Alternatives

D.10.1 Identification and Evaluation of Alternative Energy Sources

To ensure that the analysis of alternative energy sources focused only on realistic options, data published by the DOE's Energy Information Administration (EIA) were used to identify the current and projected contributions made to the commercial electric power sector by various fossil fuel and renewable energy technologies. Federal and State regulations, as well as the Internet Web sites of Federal and State regulatory agencies and State coalitions were reviewed to identify current and anticipated environmental externalities that would most likely also influence alternative energy technology selections. As a result of these reviews, twelve fossil fuel technologies and eight renewable energy technologies were identified, together with a nuclear energy alternative, as likely replacements for a retiring nuclear reactor. In addition, demand-side management (DSM) and power purchases also were identified for consideration.

The environmental consequence analyses for those fossil fuel, nuclear, and renewable energy technologies selected as likely alternatives were based on data from a variety of sources. Engineering and environmental performance data for fossil fuel technologies were obtained from reports published by DOE's National Energy Technology Laboratory (NETL) and the EPA. Published environmental impact statements (EISs), regulatory guidance, and early site permit applications provided the basis for the environmental consequence analysis of the nuclear energy alternative. Reports and technology overviews published by DOE's Office of Energy Efficiency and Renewable Energy (EERE) and the National Renewable Energy Laboratory (NREL) served as the principal sources of data for environmental impacts of the selected renewable energy technologies. Resource maps developed by NREL were also used to show the geographic relationships between existing commercial nuclear power facilities and readily accessible renewable energy resources of sufficient size and quality to support utility-scale power production. Additional data regarding the environmental consequences of renewable energy technologies were obtained from EISs published by Federal and State agencies and from other sources within the open literature. Impact analyses for DSM and power purchases were supported by data from the EIA and the Federal Energy Regulatory Commission (FERC).

D.10.2 Supporting Information

Schematic diagrams of fossil energy technologies (Figures D.10-1 to D.10-12) and renewable energy technologies (Figures D.10-13 to D.10-15; D.10-20 to D.10-22; and D.10-24 to D.10-26) are presented in this section to aid in an understanding of the operational components of different energy alternatives. Many of the renewable energy technologies are not equally viable in all parts of the country because of the uneven distribution of the underlying energy source. To illustrate availability of renewable energy alternatives, resource distribution maps are also provided (Figures D.10-16 to D.10-19; D.10-23; D.10-27).

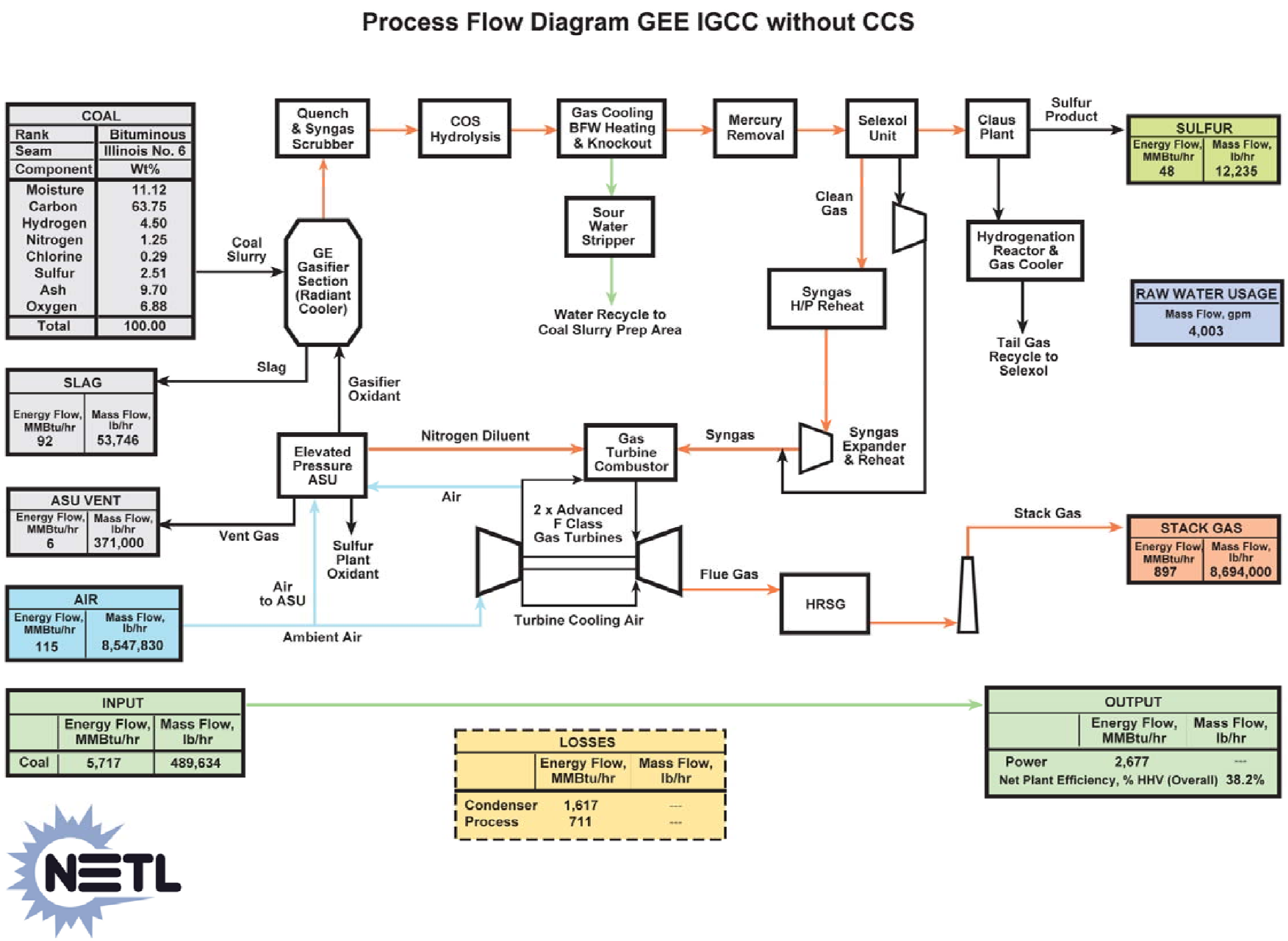


Figure D.10-1. IGCC Coal Power Plant with GE Gasifier Without CO_2 Capture (Source: NETL 2007)

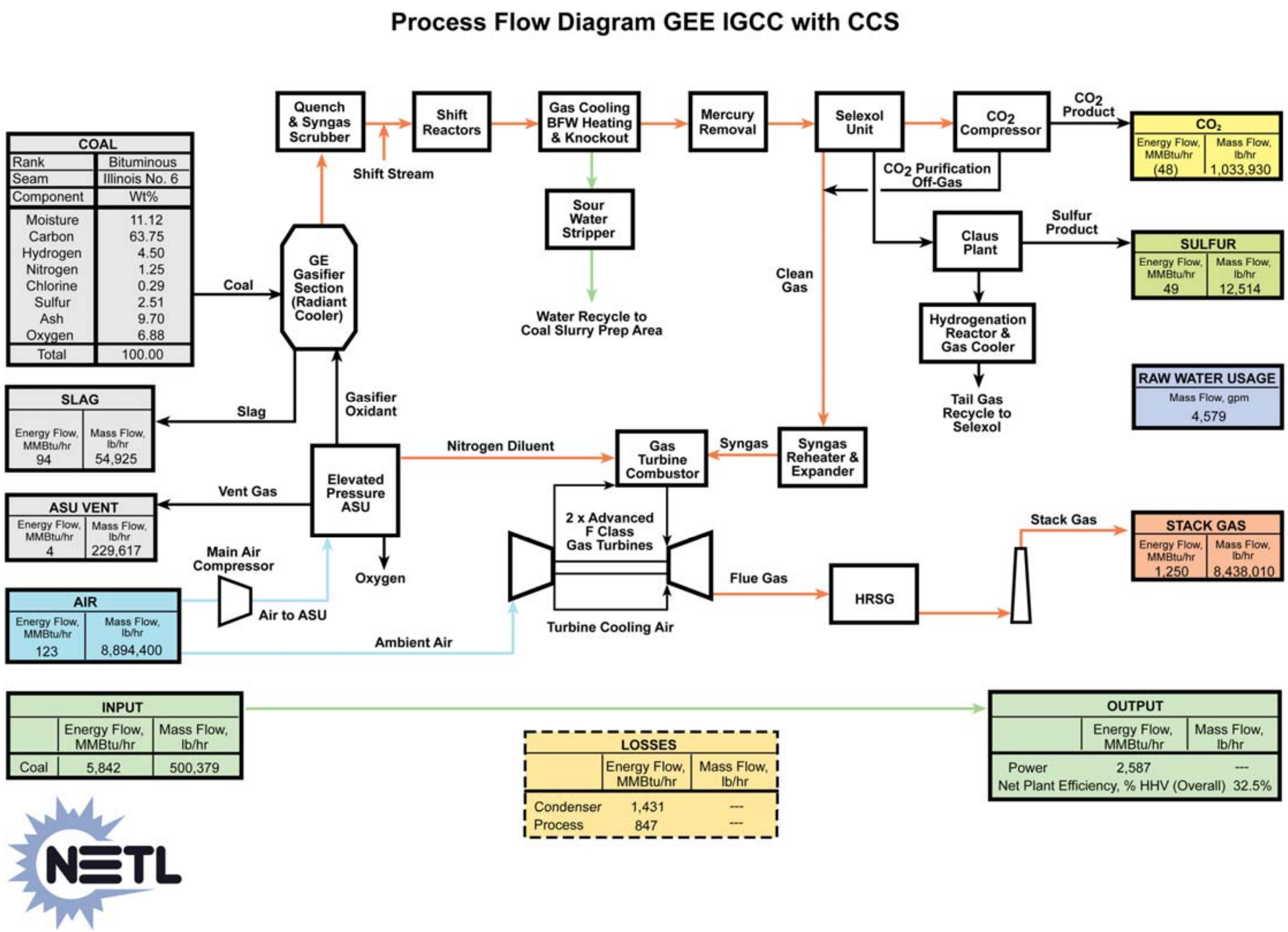
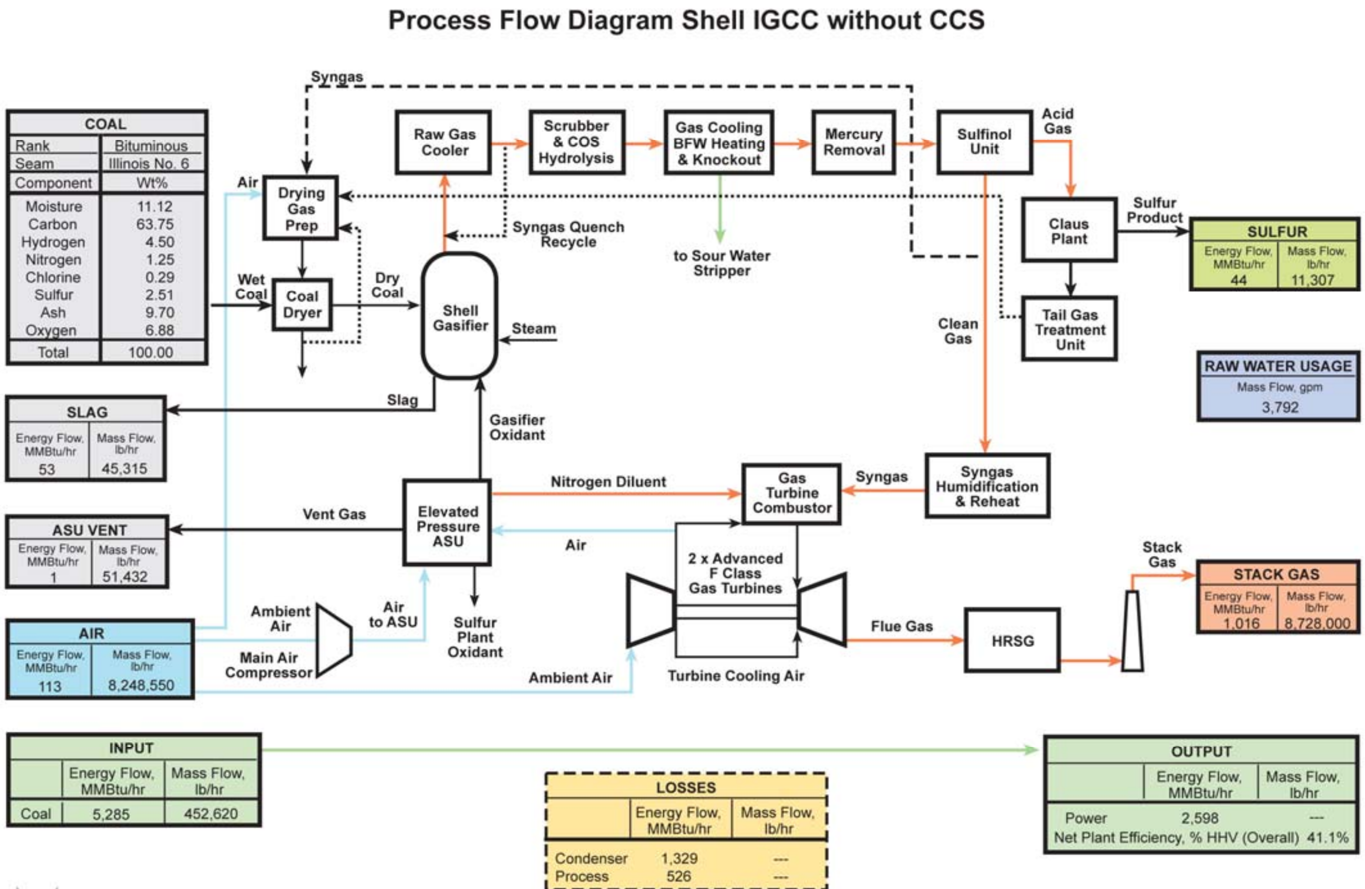


Figure D.10-2. IGCC Coal Power Plant with GE Gasifier with CO_2 Capture (Source: NETL 2007)



NETL

Figure D.10-3. IGCC Coal Power Plant with Shell Gasifier Without CO_2 Capture (Source: NETL 2007)

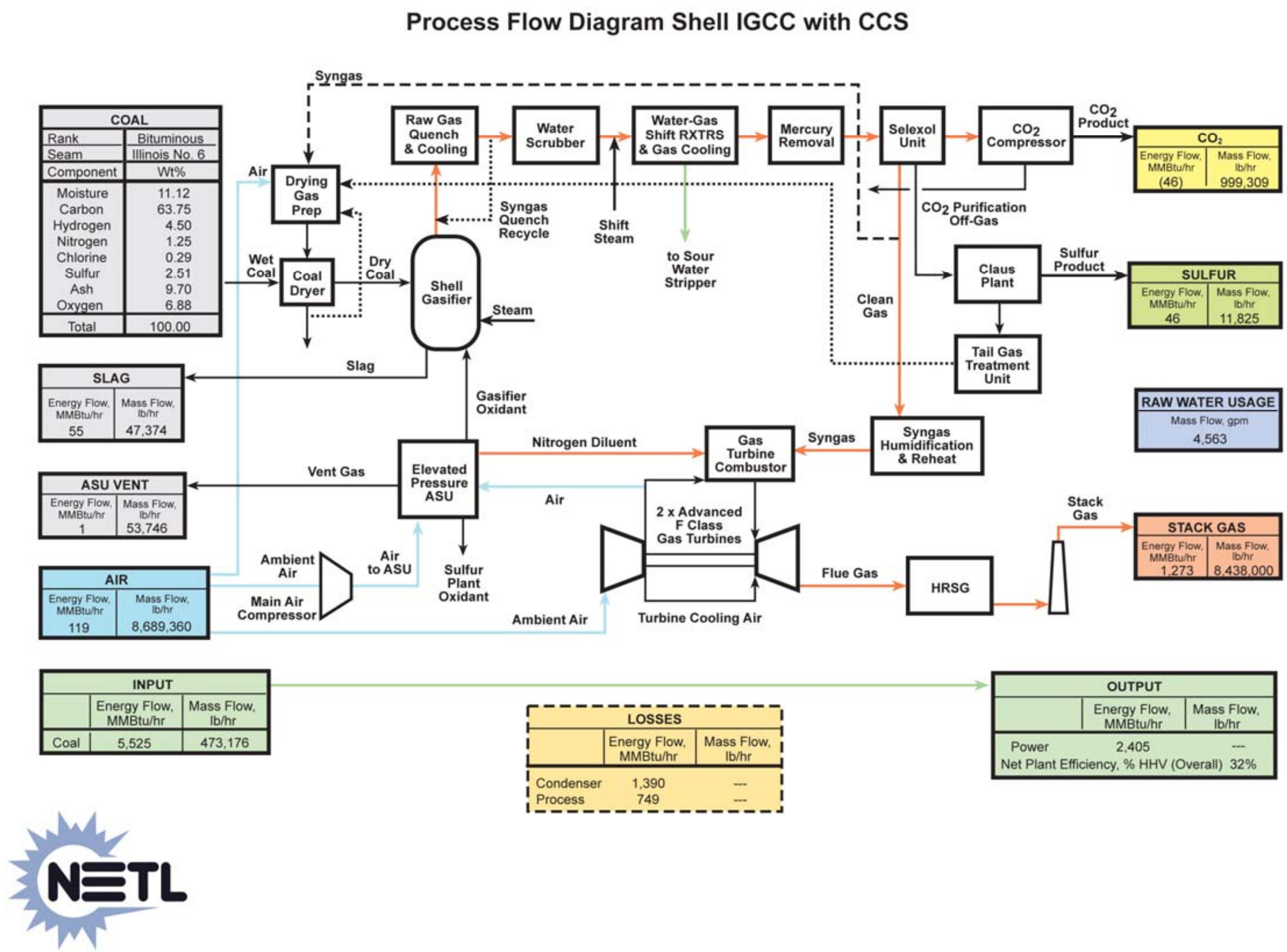


Figure D.10-4. IGCC Coal Power Plant with Shell Gasifier with CO_2 Capture (Source: NETL 2007)

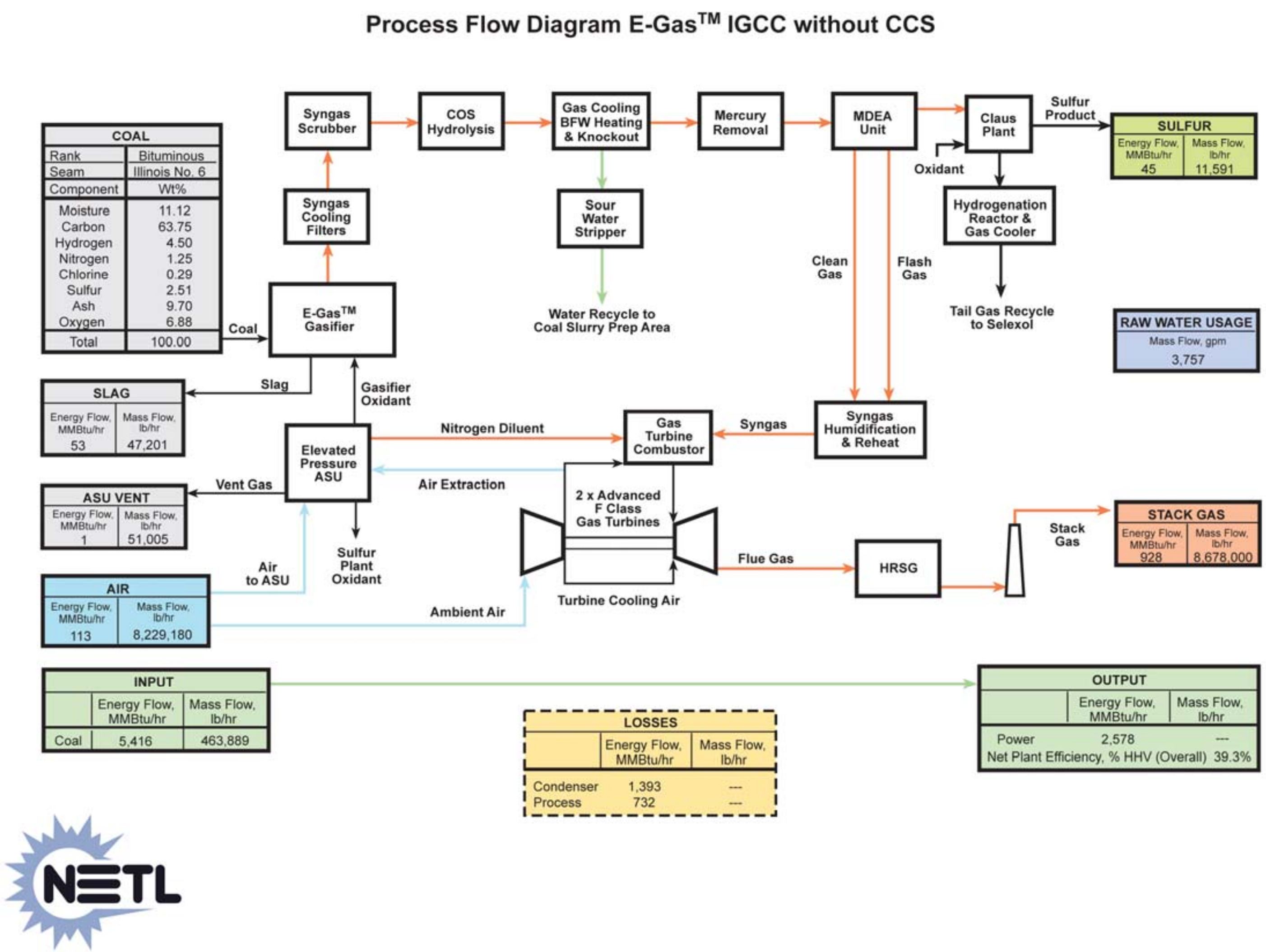


Figure D.10-5. IGCC Coal Power Plant with Conoco-Phillips (E-Gas™) Gasifier Without CO_2 Capture (Source: NETL 2007)

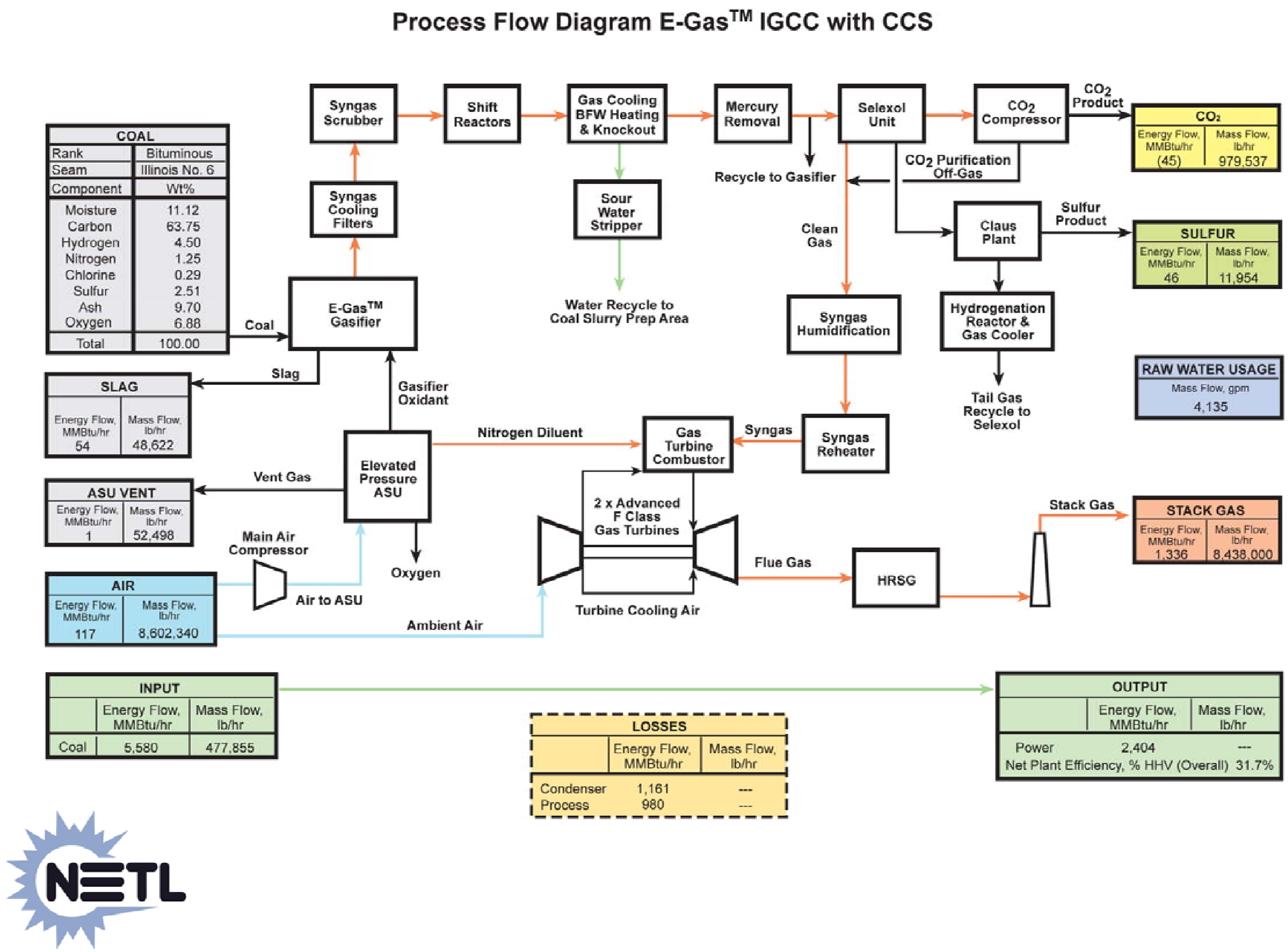


Figure D.10-6. IGCC Coal Power Plant with Conoco-Phillips (E-Gas™) Gasifier with CO_2 Capture (Source: NETL 2007)

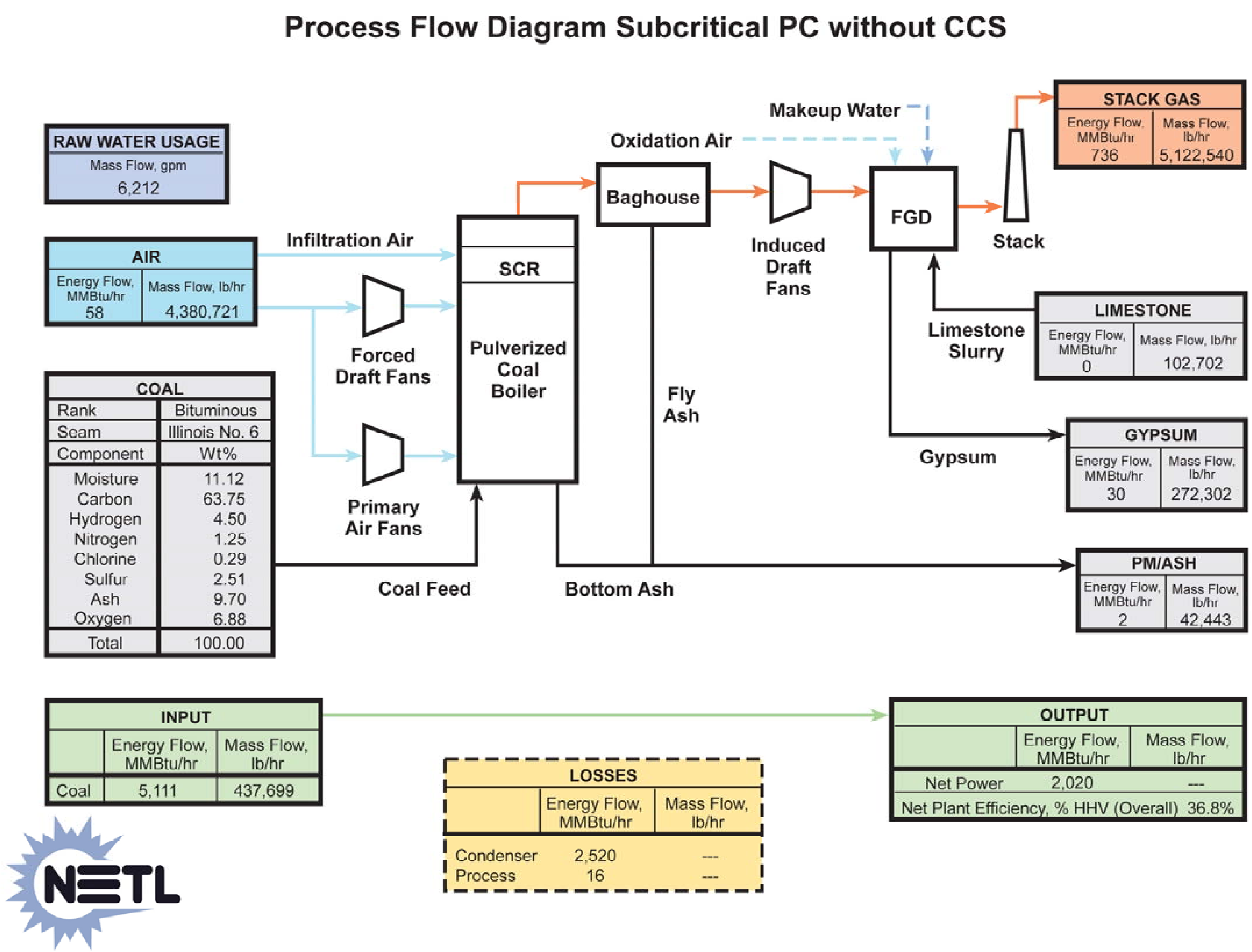


Figure D.10-7. Subcritical Pulverized Coal Power Plant Without CO_2 Capture (Source: NETL 2007)

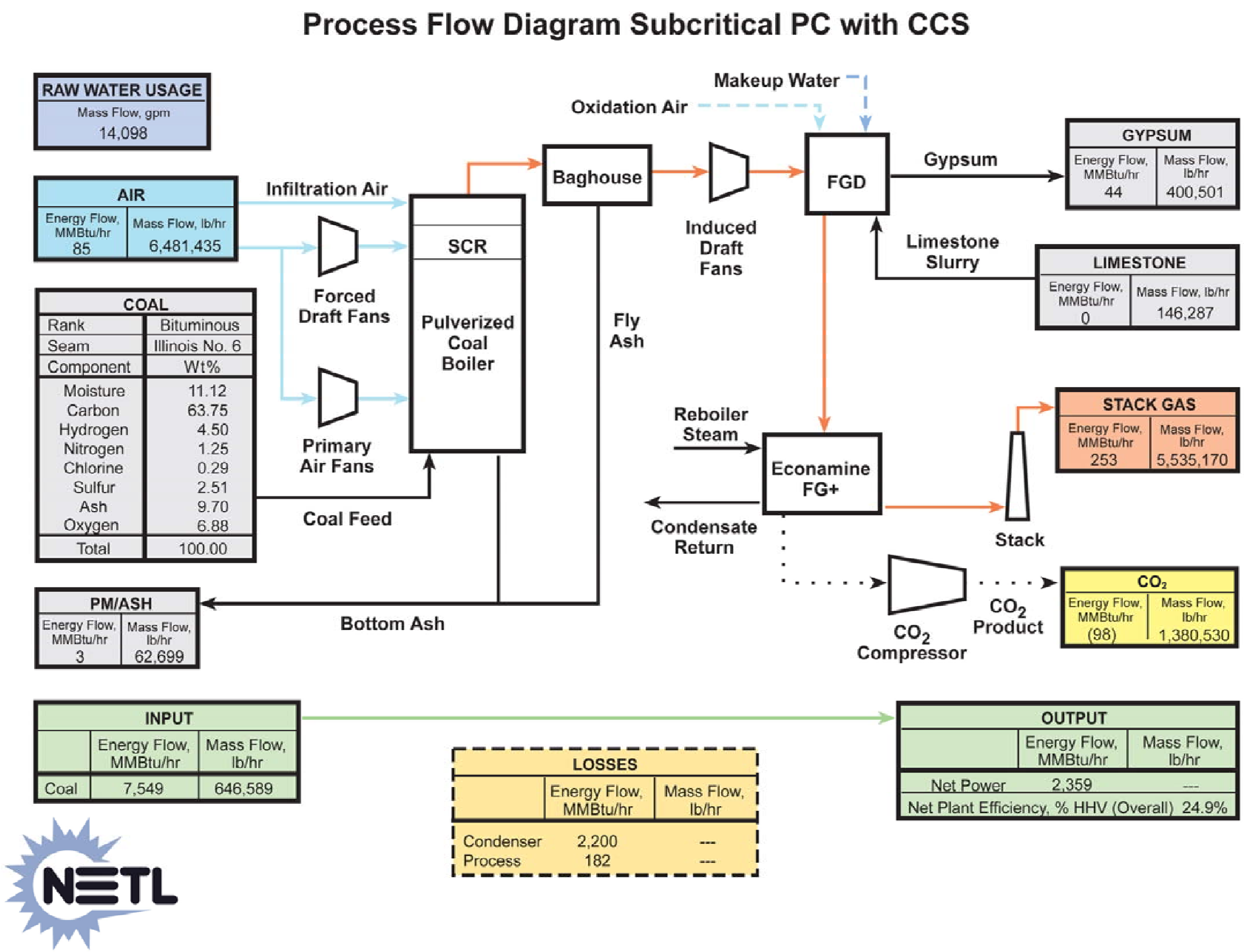


Figure D.10-8. Subcritical Pulverized Coal Power Plant with CO_2 Capture (Source: NETL 2007)

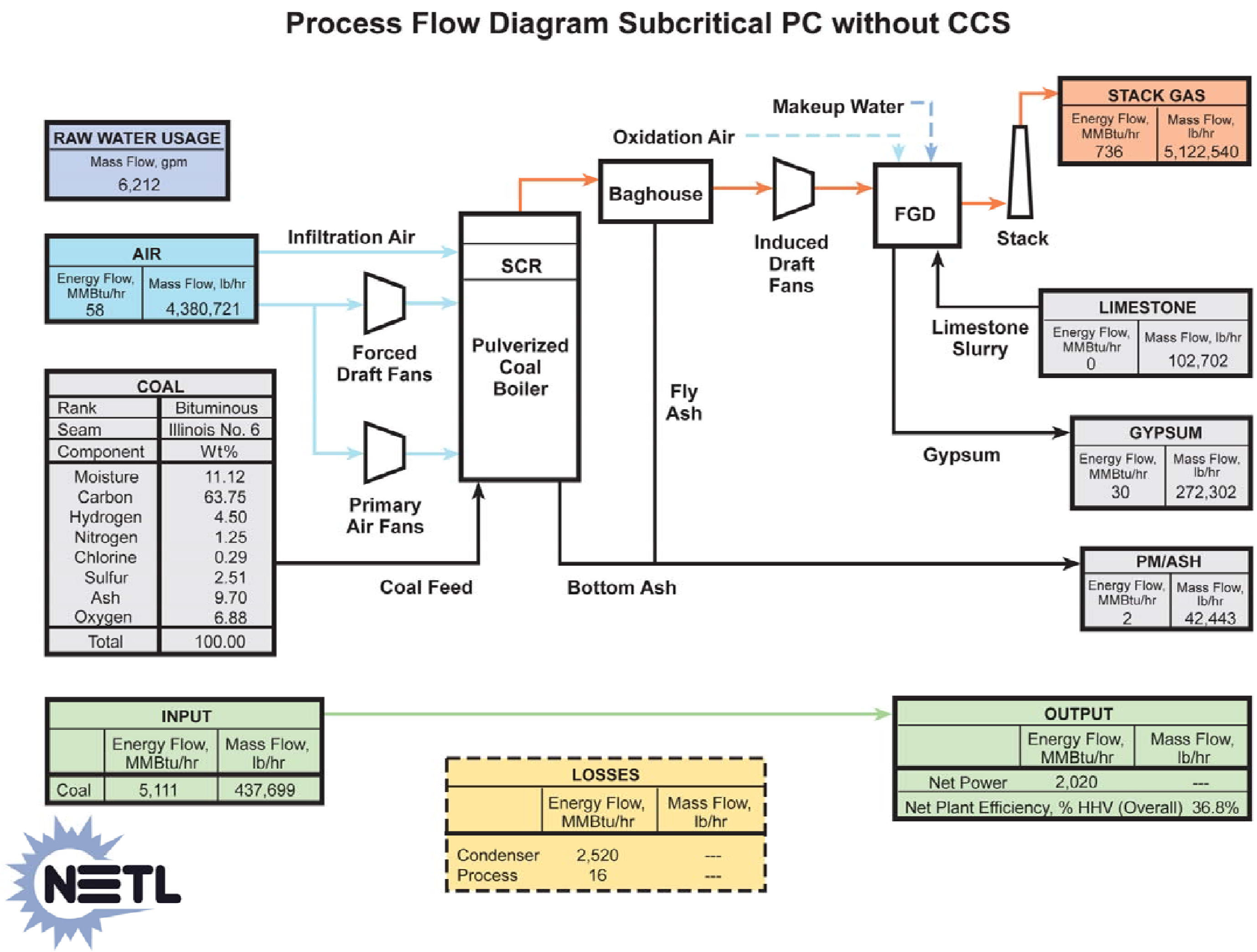


Figure D.10-9. Supercritical Pulverized Coal Power Plant Without CO_2 Capture (Source: NETL 2007)

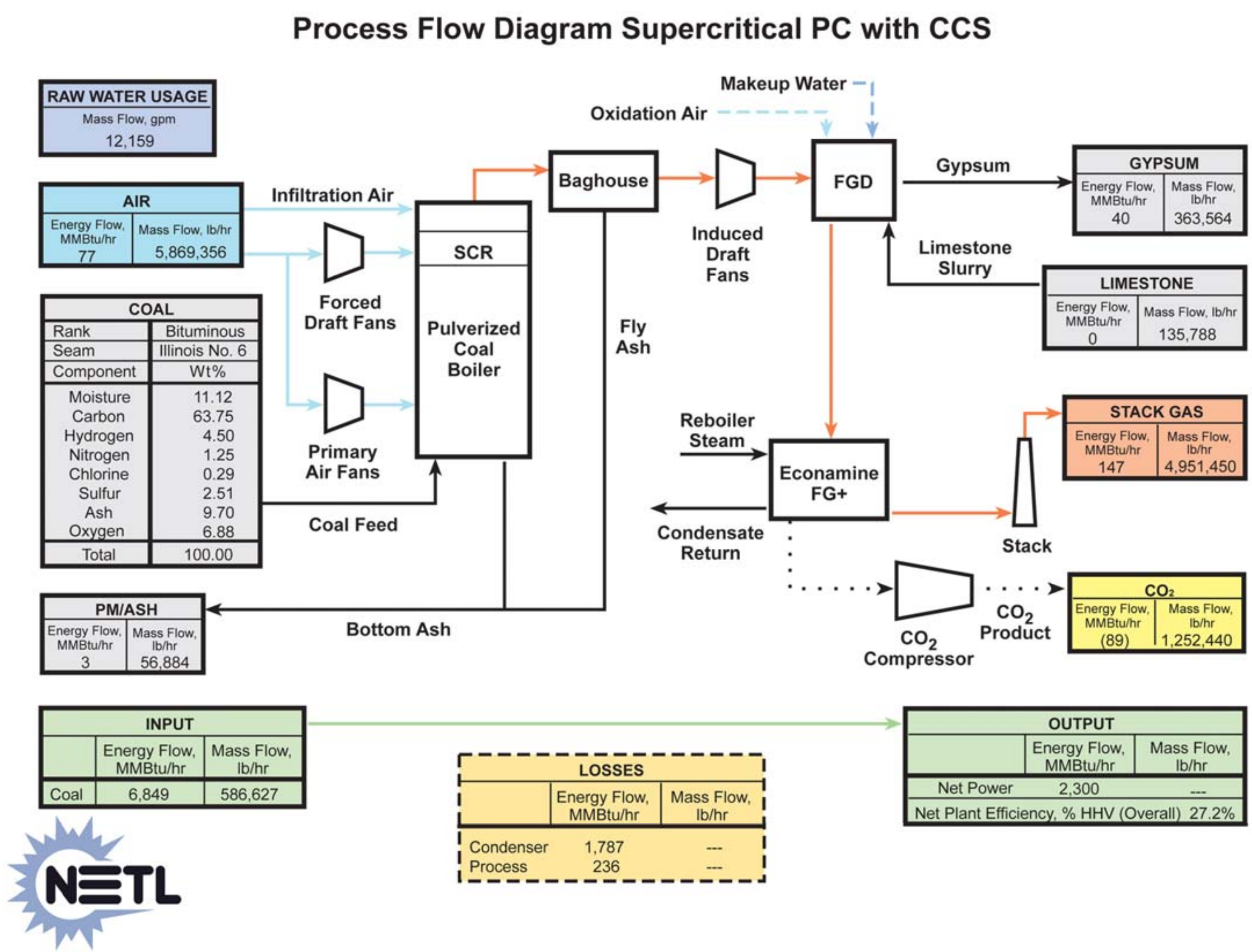


Figure D.10-10. Supercritical Pulverized Coal Power Plant with CO_2 Capture (Source: NETL 2007)

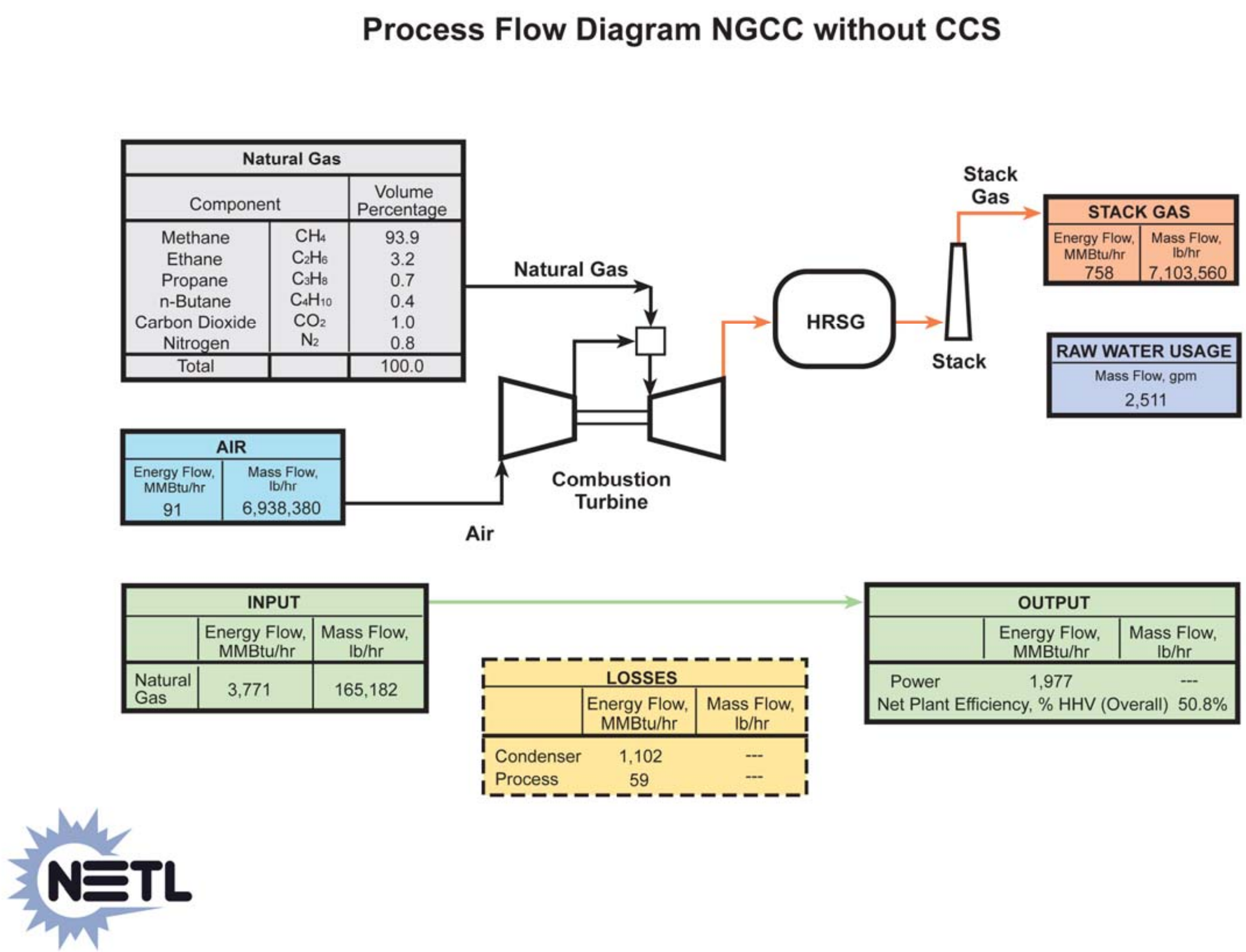


Figure D.10-11. Natural Gas IGCC Power Plant Without CO_2 Capture (Source: NETL 2007)

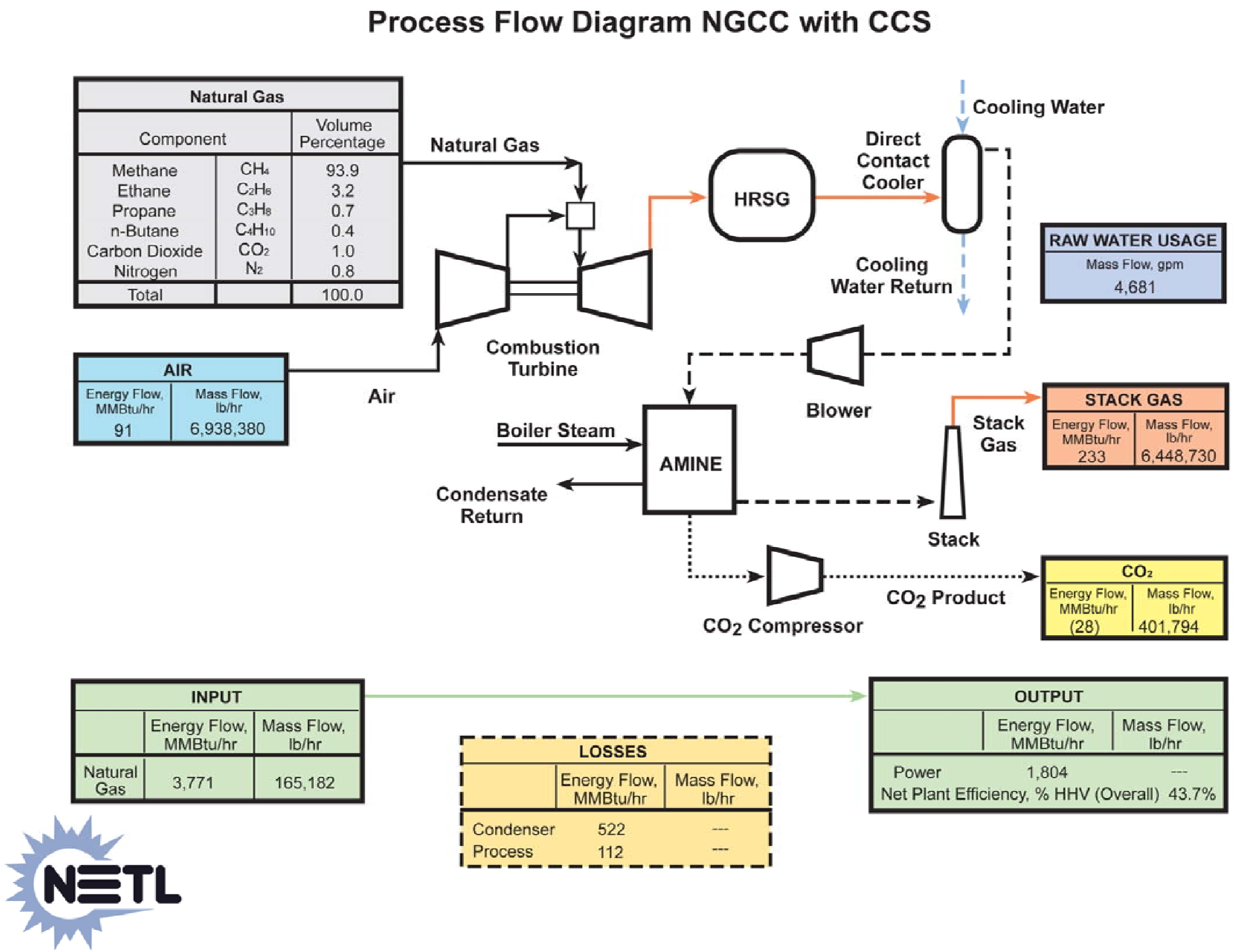


Figure D.10-12. Natural Gas IGCC Power Plant with CO_2 Capture (Source: NETL 2007)

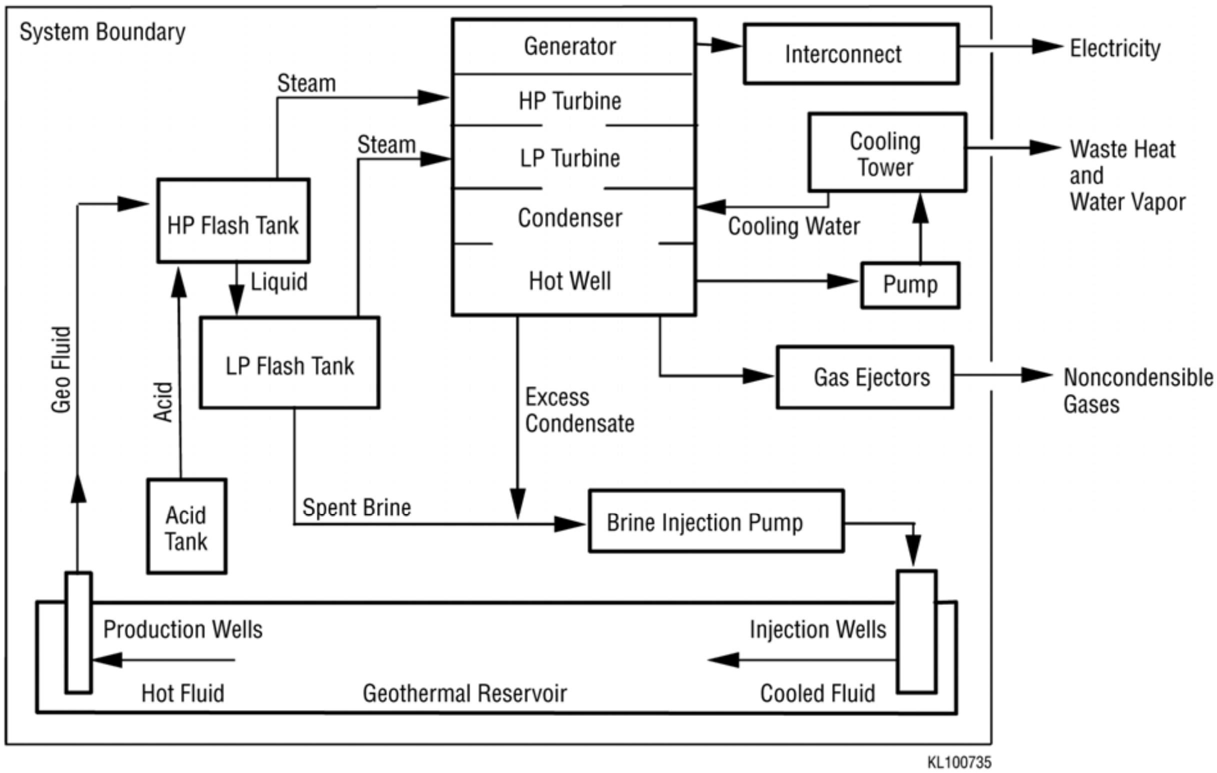


Figure D.10-13. Geothermal Hydrothermal Flashed Steam Power Plant Schematic (Source: EERE 1997)

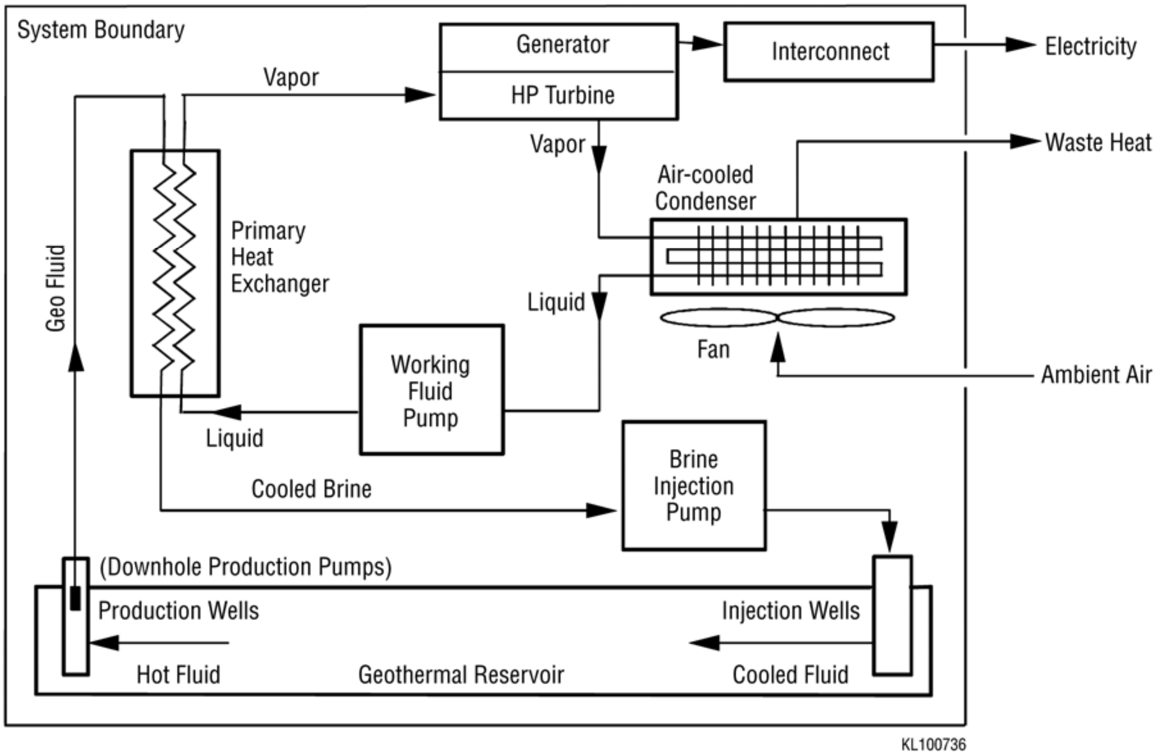


Figure D.10-14. Geothermal Hydrothermal Binary Power Plant Schematic (Source: EERE 1997)

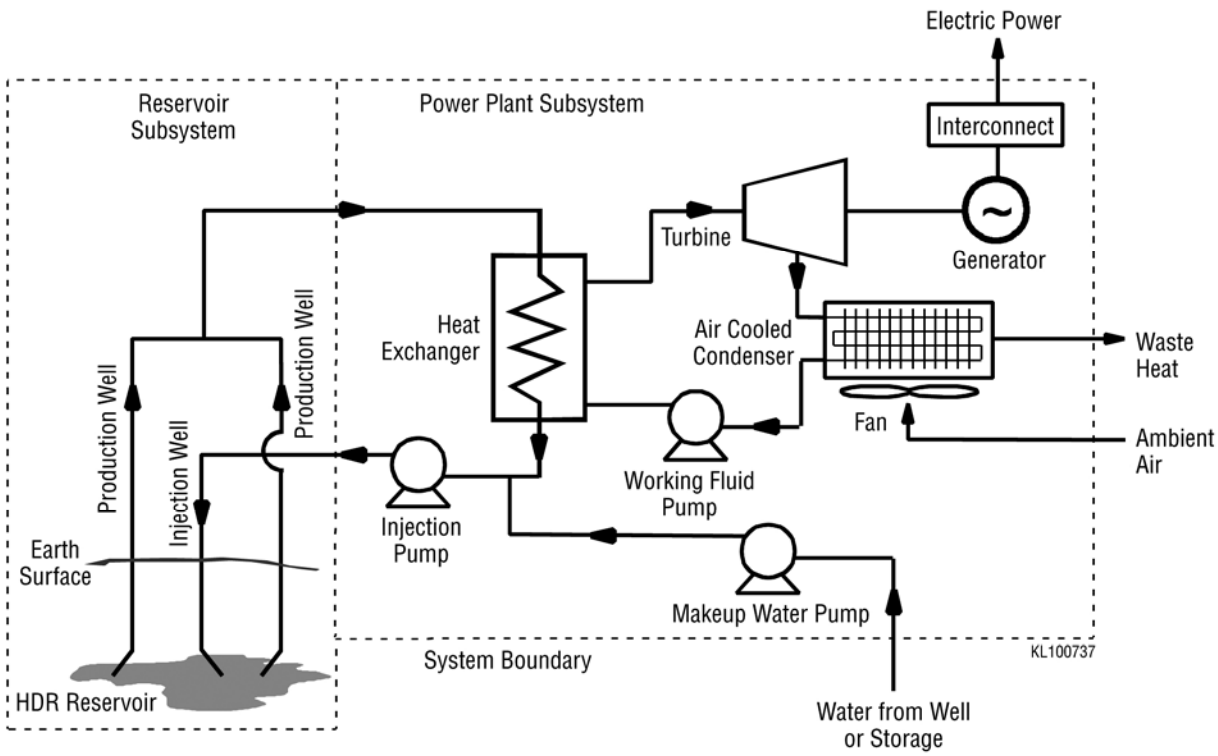


Figure D.10-15. Geothermal Hot Dry Rock Power Plant Schematic (Source: EERE 1997)

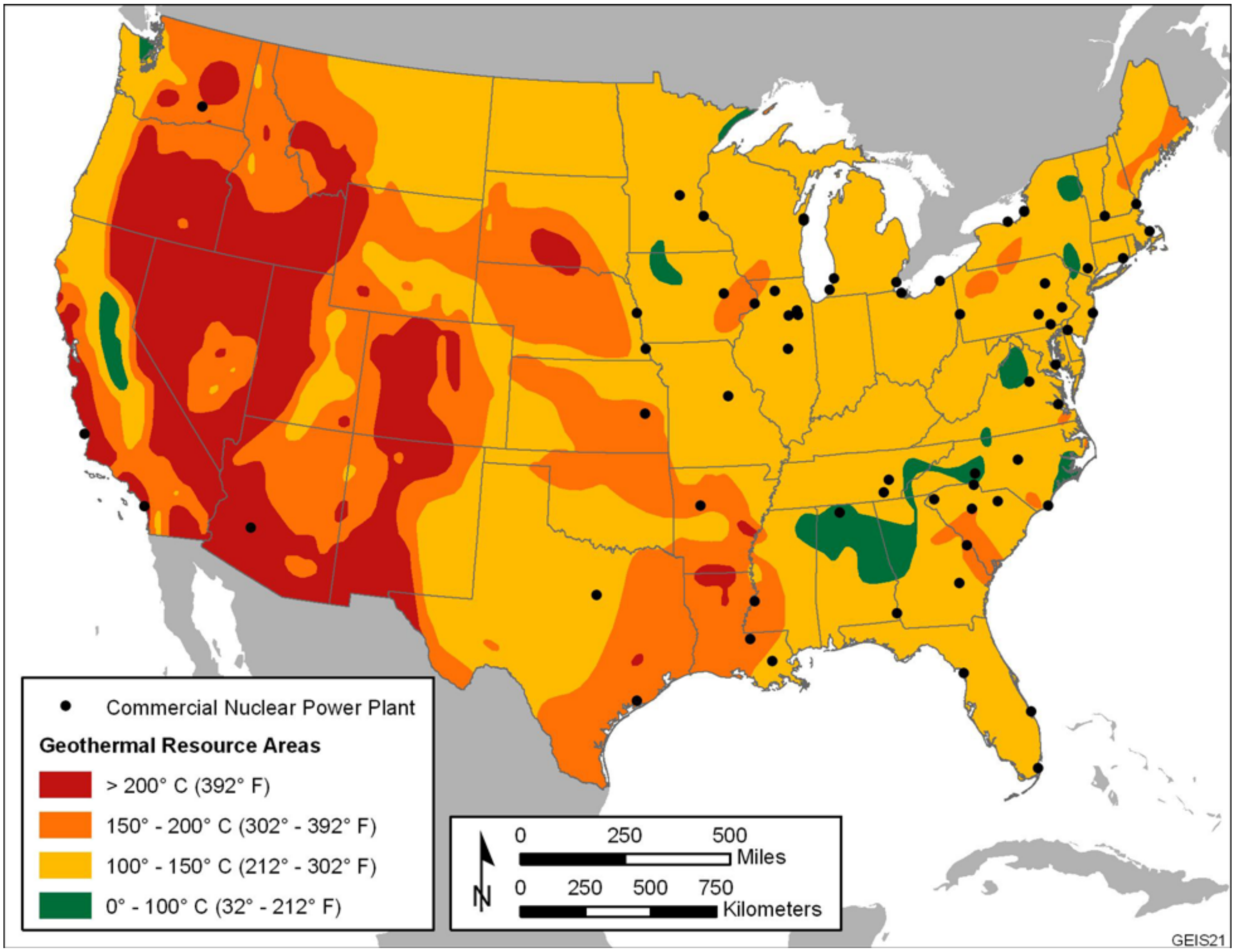


Figure D.10-16. Geothermal Resources in the 48 Contiguous United States (Source: Adapted from NREL 2007)

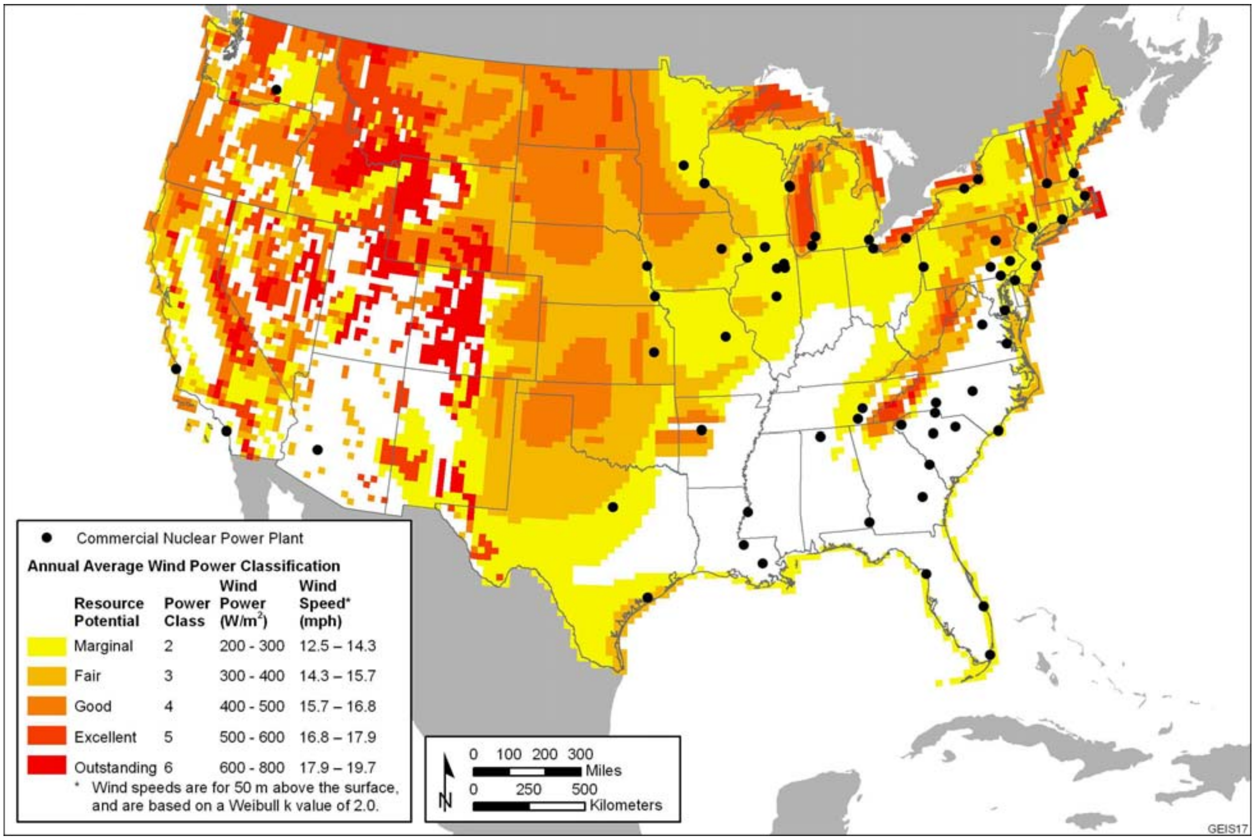


Figure D.10-17. Wind Resources in the 48 Contiguous United States
(Source: Adapted from NREL 2007)

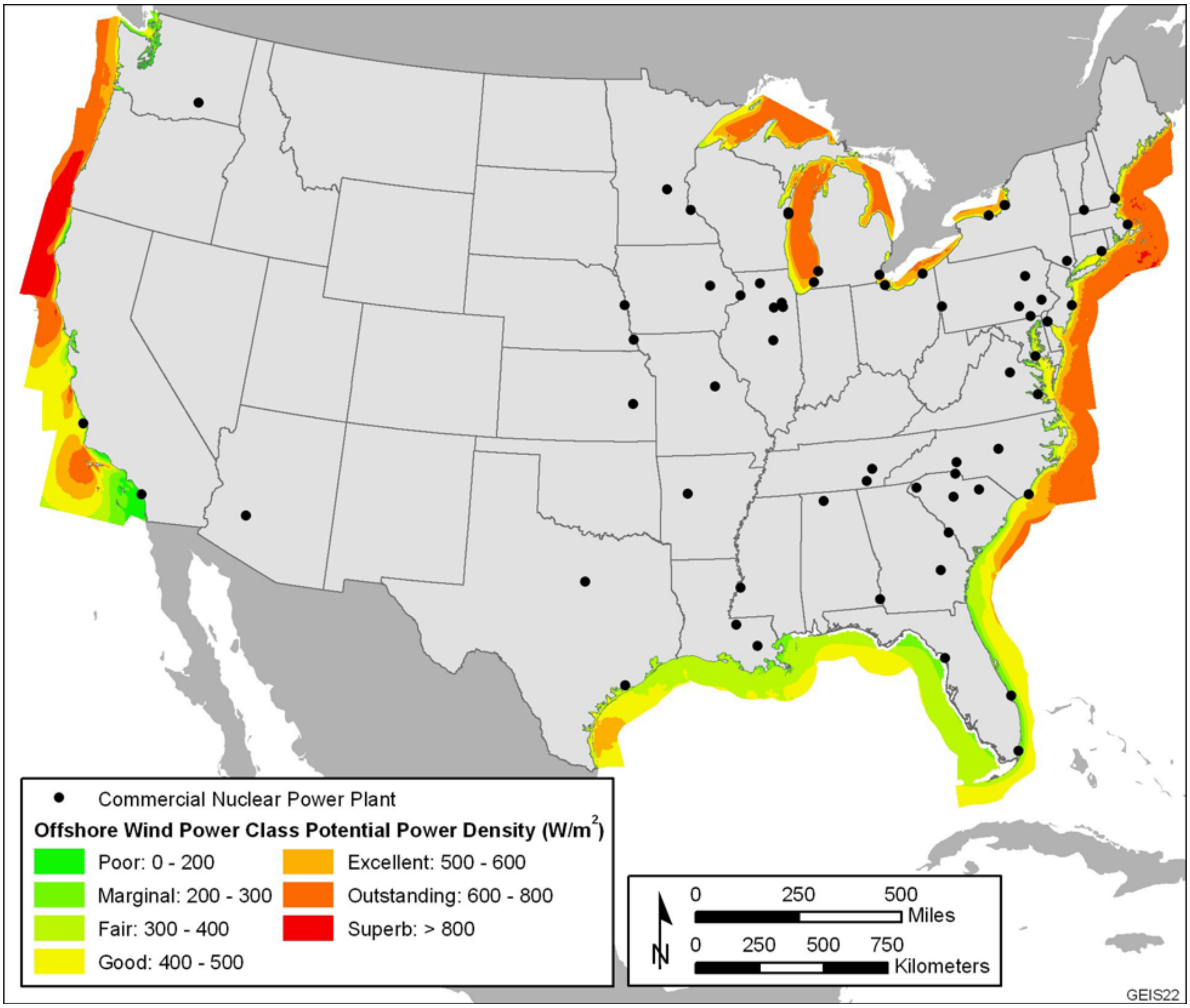


Figure D.10-18. Wind Resources in Offshore Areas of the 48 Contiguous United States (Source: Adapted from NREL 2007)

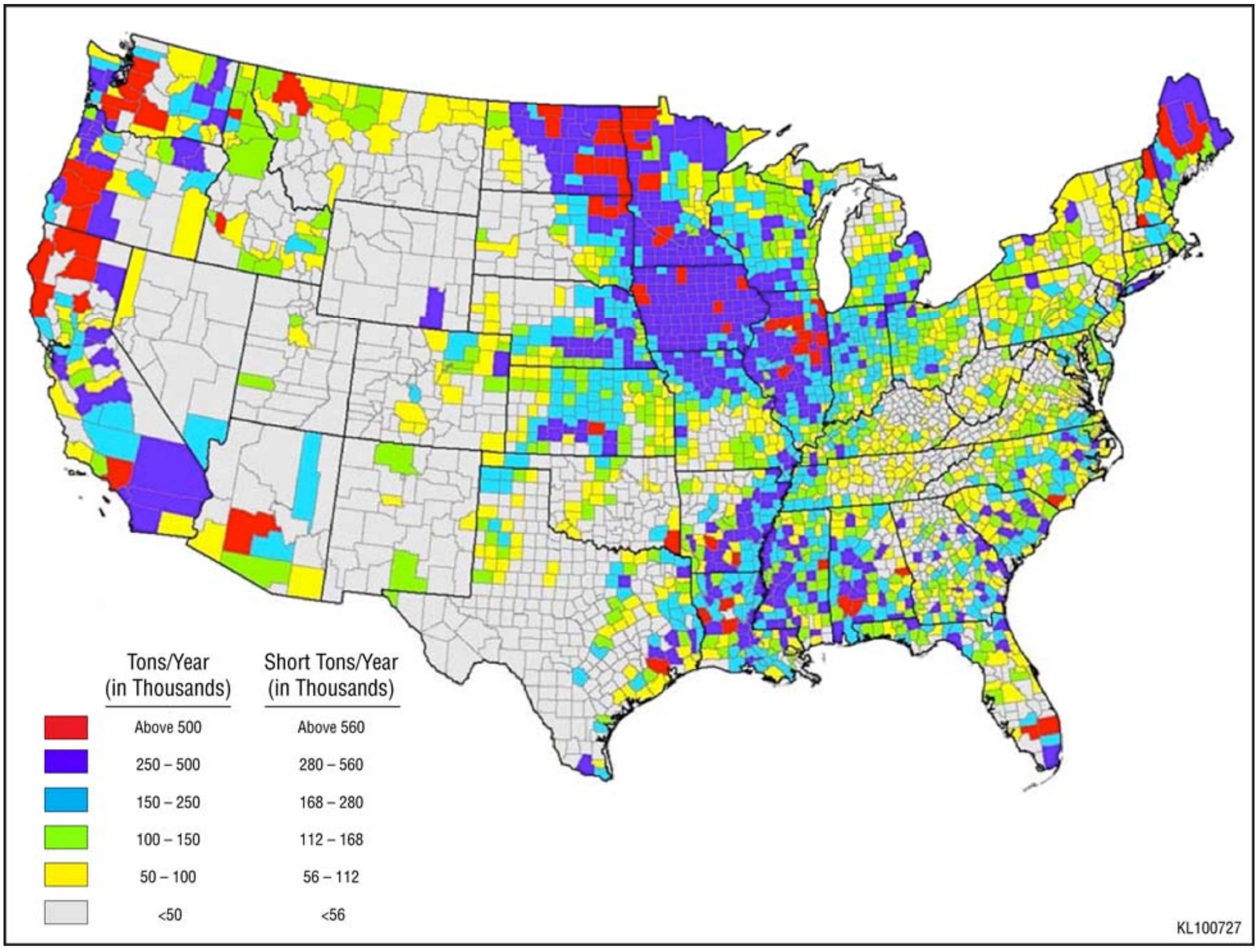


Figure D.10-19. Biomass Resources in the 48 Contiguous United States (Source: Adapted from NREL 2007)

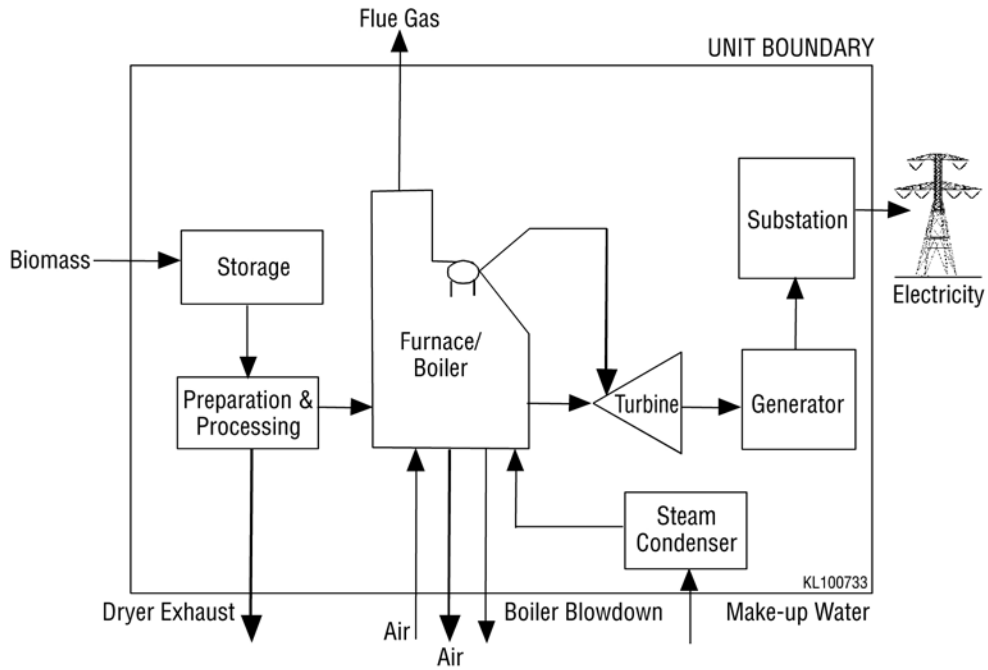


Figure D.10-20. Direct-Fire Biomass Power Plant Schematic
(Source: EERE 1997)

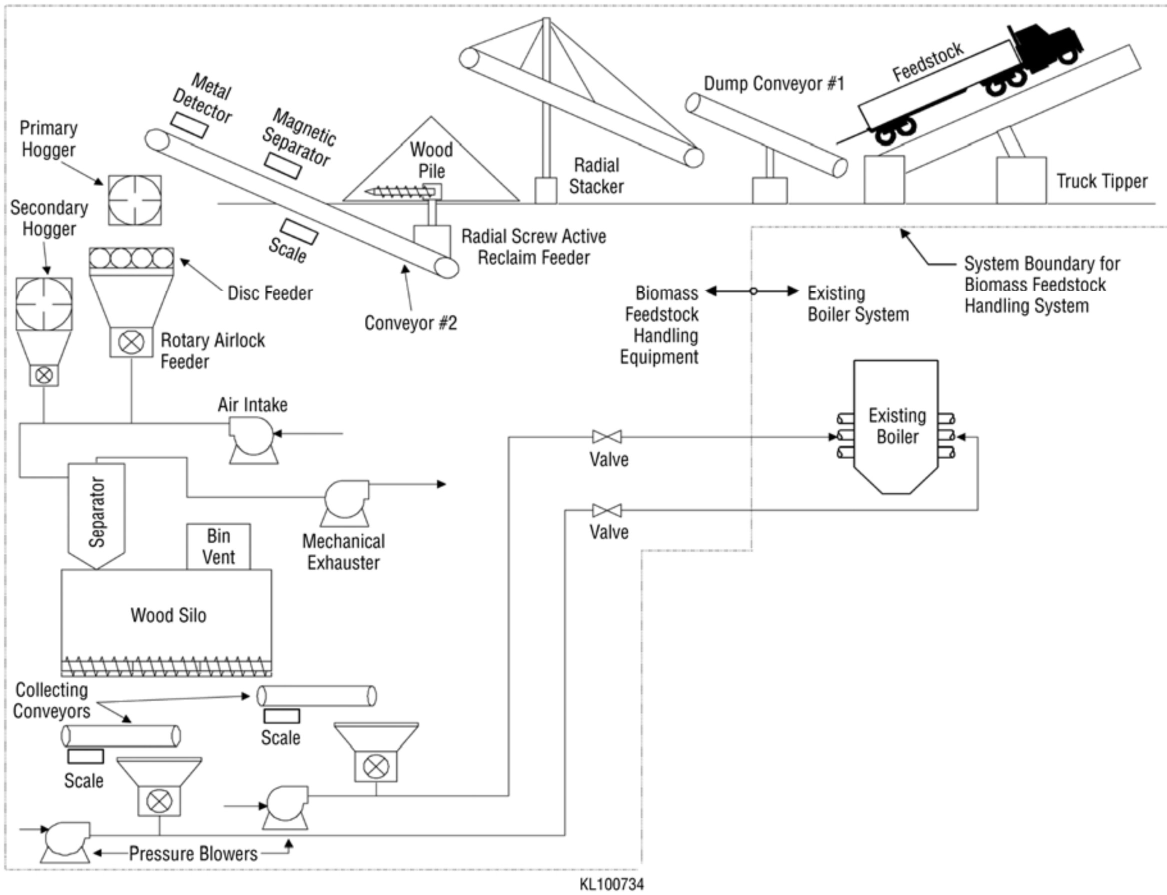


Figure D.10-21. Biomass-Coal Co-Fire Power Plant Schematic (Source: EERE 1997)

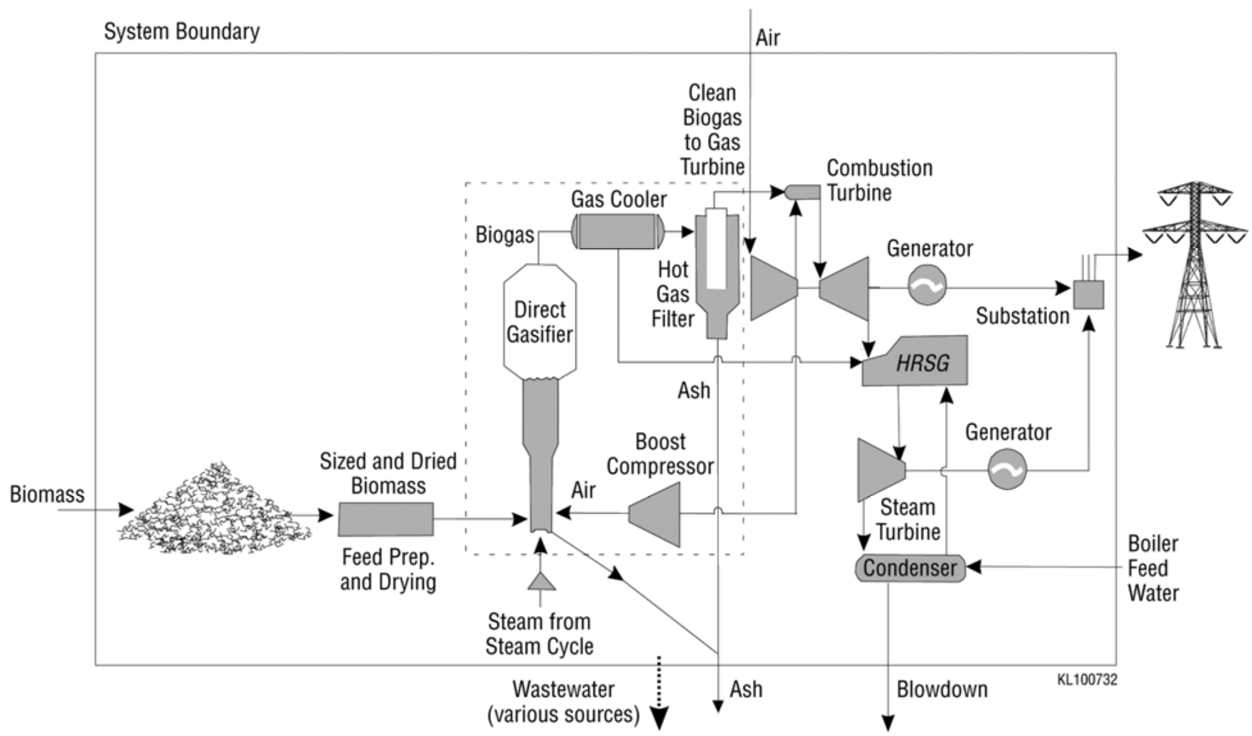


Figure D.10-22. Biomass Gasification Power Plant Schematic (Source: EERE 1997)

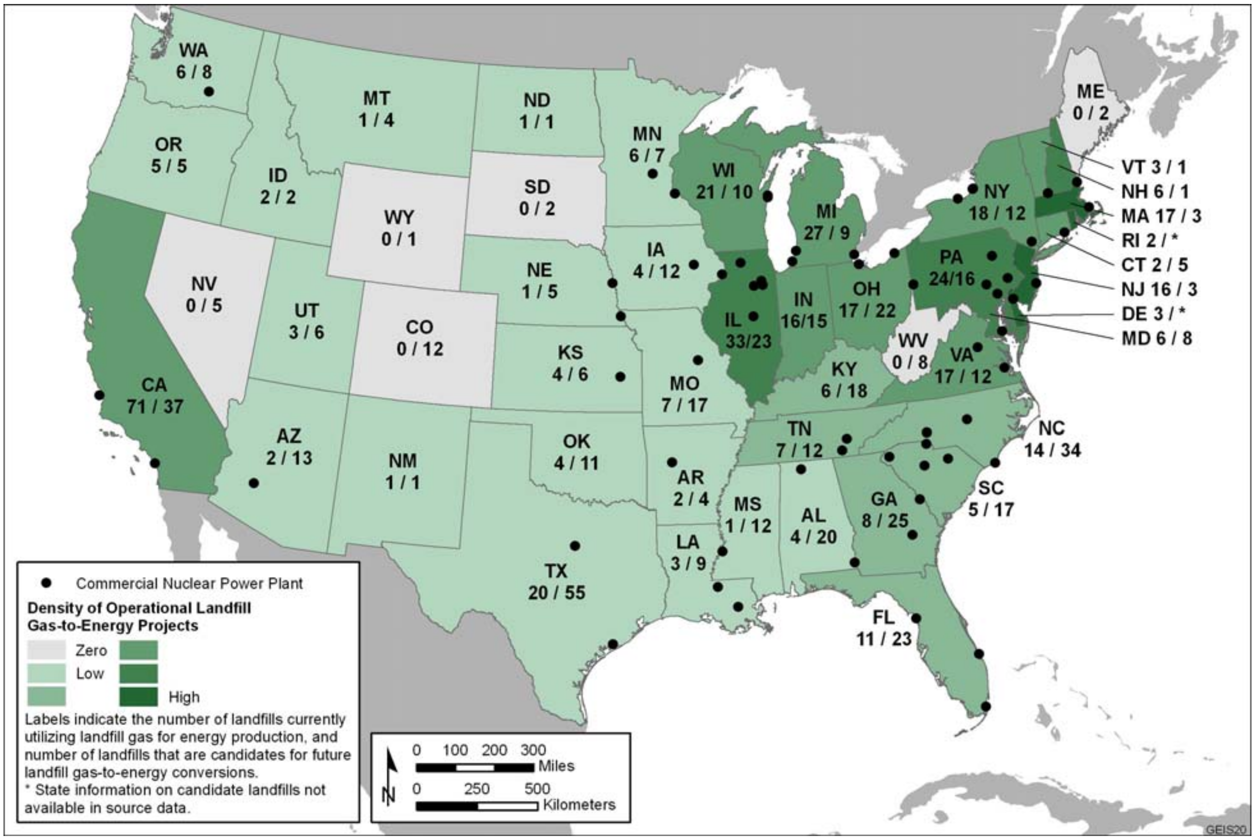


Figure D.10-23. Landfills Currently Enrolled in and Candidate Landfills for Landfill Gas-to-Energy Programs (Source: EPA 2007c)

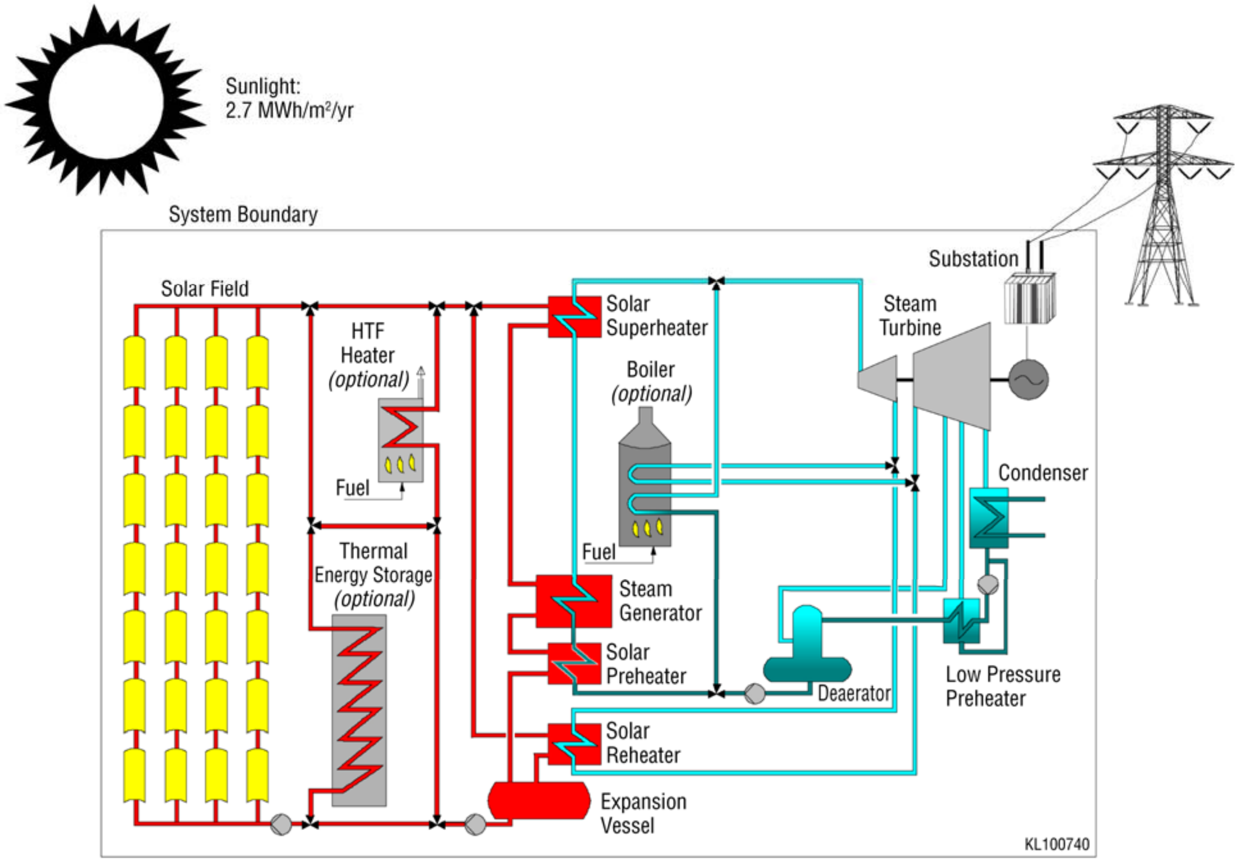


Figure D.10-24. Solar Thermal Power Trough Power Plant Schematic
(Source: EERE 1997)

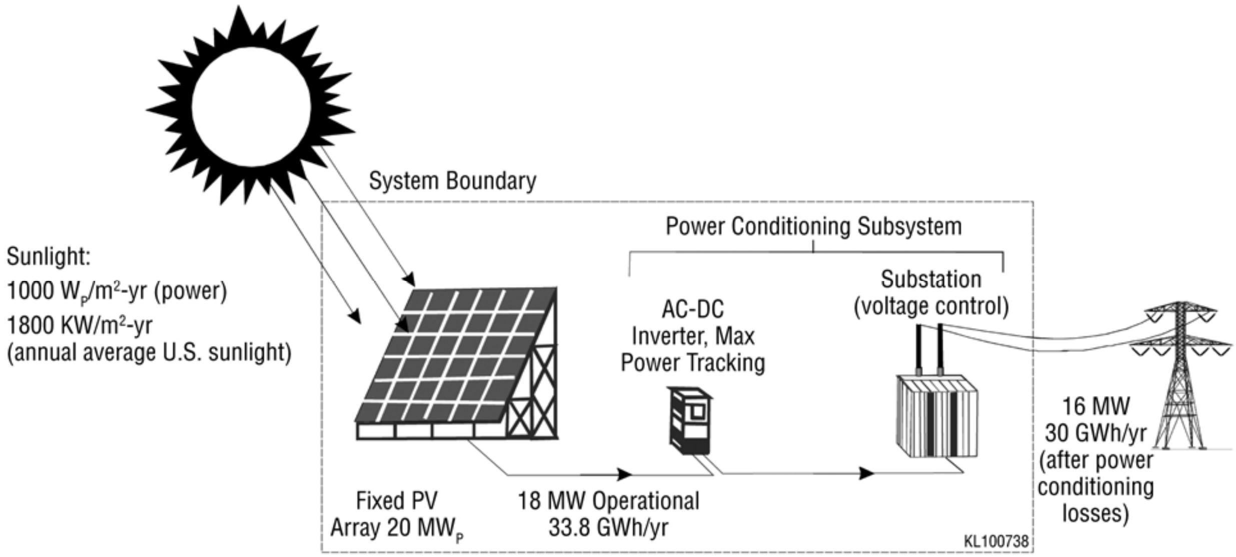


Figure D.10-25. Solar Photovoltaic Fixed Flat Plate Power Plant Schematic (Source: EERE 1997)

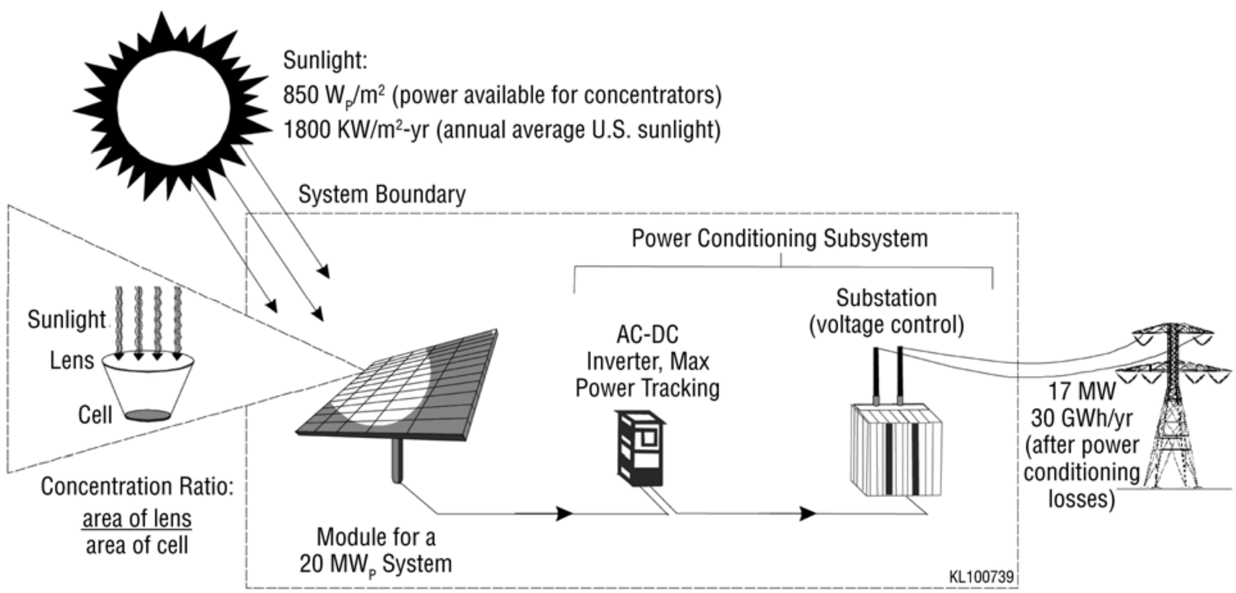


Figure D.10-26. Solar Photovoltaic Flat Plate with Concentrating Mirror Power Plant Schematic (Source: EERE 1997)

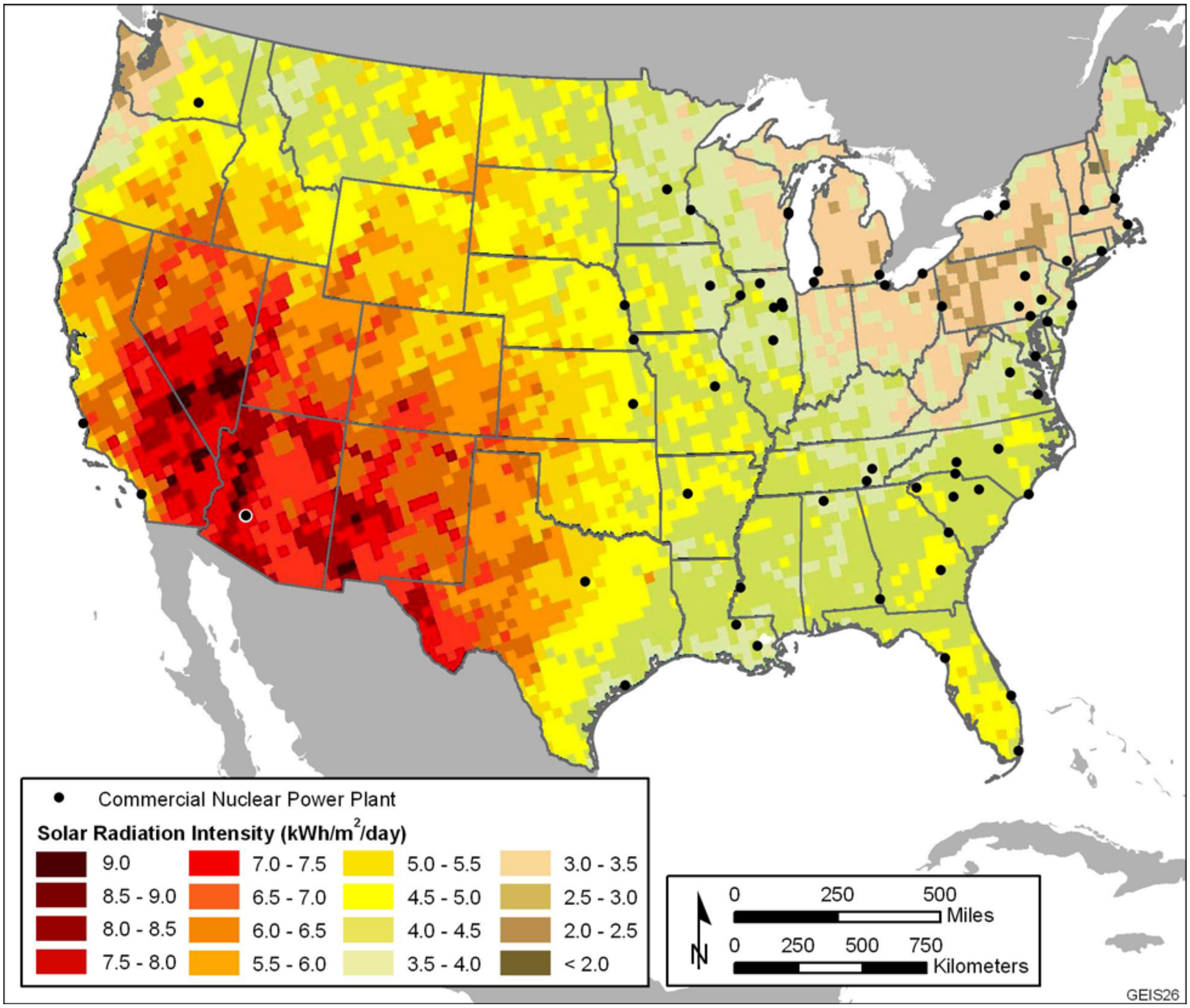


Figure D.10-27. Solar Radiation Intensity in the 48 Contiguous United States (flat plate collectors with two-axis tracking capability) (Source: Adapted from NREL 2007)

D.11 REFERENCES

Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR). 1990. *BEIR-V, Health Effects of Exposure to Low Levels of Ionizing Radiation*, National Research Council, Advisory Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences, Washington, D.C.

Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR). 2006. *Health Risk from Exposure to Low Levels of Ionizing Radiation*. BEIR-VII, National Research Council, National Academy of Sciences, Washington, D.C.

Burrows, S., and D.A. Hagemeyer. 2006. *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2005*. NUREG-0713, U.S. Nuclear Regulatory Commission. (December).

Commission for Environmental Cooperation (CEC). 1997. *Ecological Regions of North America, Toward a Common Perspective*.

Commission for Environmental Cooperation (CEC). 2006. *Ecoregions of North America, Level 1*. U.S. Environmental Protection Agency, Western Ecology Division. Available URL: http://www. epa.gov/wed/pages/ecoregions/na_eco.htm#Level%20I (Accessed November 6, 2007).

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Executive Office of the President, Washington, D.C.

Cowardin, L., V. Carter, F. Golet, and E. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States, Office of Biological Services.* FWS/OBS-79/31, U.S. Fish and Wildlife Service, U.S. Department of the Interior.

Energy Efficiency and Renewable Energy (EERE). 1997. *Renewable Energy Technology Characterizations*. Topical Report TR-109496, U.S. Department of Energy, Office of Utility Technologies, Washington, D.C. (December). Available URL: http://www1.eere.energy.gov/ba/pba/tech_characterizations.html (Accessed November 1, 2007).

Executive Order 12898. 1994. “Federal Actions to Address Environmental Justice in Minority and Low-Income Populations.” *Federal Register* 59(32). (February 16).

International Commission on Radiological Protection (ICRP). 1977. *Recommendations of the International Commission on Radiological Protection.* Publication 26, Pergamon Press, Oxford, U.K.

International Commission on Radiological Protection (ICRP). 1991. *1990 Recommendations of the International Commission on Radiological Protection*. ICRP Publication 60, Pergamon Press, Oxford, England.

National Council on Radiation Protection and Measurement (NCRP). 1993. *Risk Estimates for Radiation Protection*. Report No. 115, Bethesda, Maryland. (December 31).

National Energy Technology Laboratory (NETL). 2007. *Cost and Performance Baseline for Fossil Energy Plants*. DOE/NETL2007/1281, Vol. 1, Final Report, Pittsburgh, Pennsylvania. (May).

National Renewable Energy Laboratory (NREL). 2007. *Renewable Resources Maps & Data*. Available URL: http://www.nrel.gov/renewable_resources (Accessed November 8, 2007).

Nuclear Energy Institute (NEI). 2003. *Economic Benefits of Millstone Power Station: An Economic Impact Study by the Nuclear Energy Institute*. (July).

Nuclear Energy Institute (NEI). 2004a. *Economic Benefits of Diablo Canyon Power Plant: An Economic Impact Study by the Nuclear Energy Institute in Cooperation with Pacific Gas and Electric Company*. (February).

Nuclear Energy Institute (NEI). 2004b. *Economic Benefits of Indian Point Energy Center: An Economic Impact Study by the Nuclear Energy Institute.* (April).

Nuclear Energy Institute (NEI). 2004c. *Economic Benefits of the Duke Power-Operated Nuclear Power Plants: An Economic Impact Study by the Nuclear Energy Institute*. (December).

Nuclear Energy Institute (NEI). 2004d. *Economic Benefits of Palo Verde Nuclear Generating Station: An Economic Impact Study by the Nuclear Energy Institute*. (November).

Nuclear Energy Institute (NEI). 2005a. *Economic Benefits of Three Mile Island Unit 1: An Economic Impact Study by the Nuclear Energy Institute*. (November).

Nuclear Energy Institute (NEI). 2005b. *Economic Benefits of Wolf Creek Generating Station: An Economic Impact Study by the Nuclear Energy Institute*. (July).

Nuclear Energy Institute (NEI). 2006a. *Economic Benefits of Grand Gulf Nuclear Station : An Economic Impact Study by the Nuclear Energy Institute in Cooperation with Entergy*. (December).

Nuclear Energy Institute (NEI). 2006b. *Economic Benefits of the Exelon Pennsylvania Nuclear Fleet: An Economic Impact Study by the Nuclear Energy Institute*. (August).

Nuclear Energy Institute (NEI). 2006c. *Economic Benefits of PPL Susquehanna Nuclear Power Plant: An Economic Impact Study by the Nuclear Energy Institute in Cooperation with PPL Corporation*. (November).

Nuclear Energy Institute (NEI). 2007. *Industry Ground Water Protection Initiative – Final Guidance Document: NEI 07-07 [Final]*. Washington, D.C. Available URL: http://adams websearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=072670589 (Accessed November 5, 2007).

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). 2000. *Sources and Effects of Ionizing Radiation: UNSCEAR 2000 Report to the General Assembly, with Scientific Annexes. Vol. II: Effects*. New York, New York. Available URL: http://www. unscear.org/unscear/en/publications/2000_1.html (Accessed January 31, 2008).

U.S. Department of Energy (DOE). 2002. *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*. DOE Voluntary Consensus Technical Standard DOE-STD-1153-2002, Washington, D.C.

U.S. Department of Energy (DOE). 2004. *RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation, User's Guide, Version 1*. DOE/EH-0676, ISCORS Technical Report 2004-02, Interagency Steering Committee on Radiation Standards, Office of Air, Water and Radiation Protection Policy and Guidance, Washington, D.C. (January). Available URL: http://web.ead.anl.gov/resrad/documents/RESRAD-BIOTA_Manual_Version_1.pdf (Accessed November 26, 2007).

U.S. Environmental Protection Agency (EPA). 1999. *Cancer Risk Coefficients for Environmental Exposure to Radionuclides*. Federal Guidance Report No. 13, EPA 402-R-99-001, Office of Radiation and Indoor Air, Washington, D.C. (September).

U.S. Environmental Protection Agency (EPA). 2007a. *Nonattainment Shape Files*. Personal Communication from T. Rosendahl and J. Cakir, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, to M. Lazaro, Argonne National Laboratory, Argonne, Illinois. (September).

U.S. Environmental Protection Agency (EPA). 2007b. *Level III Ecoregions of the Conterminous United States*. National Health and Environmental Effects Research Laboratory. (Revised March 2007; Updated October 2, 2007). Available URL: http://www.epa.gov/wed/pages/ecoregions/level_iii.htm (Accessed November 6, 2007).

U.S. Environmental Protection Agency (EPA). 2007c. *Basic Information*, *Landfill Methane Outreach Program*. Washington, D.C. Available URL: http://www.epa.gov/landfill/overview.htm (Accessed November 8, 2007).

U.S. Fish and Wildlife Service (USFWS). 2007. *National Wetlands Inventory*. U.S. Department of the Interior. Available URL: http://wetlandsfws.er.usgs.gov/NWI/index.html (Accessed November 7, 2007).

U.S. Geological Survey (USGS). 2003. *National Land Cover Database*. Sioux Falls, South Dakota.

U.S. Nuclear Regulatory Commission (NRC). 1977a. *Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I*. Regulatory Guide 1.113, Revision 1, Office of Standards Development. (April).

U.S. Nuclear Regulatory Commission (NRC). 1977b. *Method of Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*. Regulatory Guide 1.111, Revision 1, Office of Standards Development. (July).

U.S. Nuclear Regulatory Commission (NRC). 1977c. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Revision 1, Office of Standards Development. (October).

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vols. 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Final Generic Environmental Impact Statement on Decommissioning Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Vols. 1 and 2, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2005. *Staff Review of the National Academies Study of the Health Risks from Exposure to Low Levels of Ionizing Radiation (BEIR VII).* Commission Paper SECY-05-0202, ADAMS Accession Number ML052640532 (October 29).

U.S. Nuclear Regulatory Commission (NRC). 2006. *Liquid Radioactive Release Lessons Learned Task Force Final Report*. Available URL: http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=062770207 (Accessed October 17, 2007).

Appendix E

Environmental Impact of Postulated Accidents

Appendix E

Environmental Impact of Postulated Accidents

E.1 Introduction

Chapter 5 of the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (*GEIS), Volumes 1 and 2 (NRC 1996, 1999)[(a)] assessed the impacts of postulated accidents at nuclear power plants on the environment. The postulated accidents included design basis accidents and severe accidents (e.g., those with core melt). The impacts considered included:

- Dose and health effects of accidents (Sections 5.3.3.2 through 5.3.3.4);
- Economic impacts of accidents (Section 5.3.3.5); and
- Impact of uncertainties on results (Section 5.3.4).

The estimated impacts were based upon the analysis of severe accidents at 28 nuclear power plant sites,[(b)] as reported in the environmental impact statements (EISs) and/or final environmental statements (FESs) prepared for each of the 28 plants in support of their operating licenses. With few exceptions, the severe accident analyses were limited to consideration of reactor accidents caused by internal events. The 1996 GEIS addressed the impacts from external events qualitatively.[(c)] The severe accident analysis for the 28 sites was extended to the remainder of plants whose EISs did not consider severe accidents (since such analyses were not required at the time the other plants' EISs were prepared). The estimates of

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and Addendum 1.

(b) The 28 sites are listed in Table 5.1 of the 1996 GEIS. There are a total of 44 units included in this list (at the 28 sites), but 4 of these units never operated (Grand Gulf 2, Harris 2, Perry 2, and Seabrook 2). For the purpose of this appendix, this list will be referred to as containing 28 nuclear power plants, but when mean values are calculated for this subset of nuclear power plants, all 40 units that operated are considered.

(c) See Section 5.3.3.1 of the GEIS, including a brief discussion of the external event risk assessments conducted by the staff prior to 1996, which included assessments for Zion 1 & 2, Indian Point 2 & 3, Limerick 1 & 2, Surry 1, Peach Bottom 2, and Millstone 3.

environmental impact contained in the 1996 GEIS used 95th percentile upper confidence bound (UCB) estimates whenever available. This approach provides conservatism to cover uncertainties, as described in Section 5.3.3.2.2 of the 1996 GEIS. The 1996 GEIS concluded that the probabilistically weighted consequences and impacts were small compared to other risks to which the populations surrounding nuclear power plants are routinely exposed.

The focus of this revision is on severe accidents, since the impacts from design basis accidents are small and, as stated in Section E.3 of this revision, remain unchanged. Since the U.S. Nuclear Regulatory Commission's (NRC's) understanding of severe accident risk has naturally evolved following the issuance of the 1996 GEIS, this appendix assesses more recent information on severe accidents that might alter the conclusions in Chapter 5 of the 1996 GEIS. This revision considers how these developments would affect the conclusions in the original GEIS and provides comparative data where appropriate. This revision does not attempt to provide new quantitative estimates of severe accident impacts. In addition, the revision only covers one initial license renewal period for each plant (as did the 1996 GEIS). Thus, the population projections, meteorology and exposure indices used in the 1996 GEIS are assumed to remain unchanged for purposes of this analysis.

Finally, the format of this appendix follows the same format as used in Chapter 5 of the 1996 GEIS, including a discussion on uncertainties and severe accident mitigation alternatives (SAMAs).

In addition, comments received in response to a notice in the *Federal Register* (NRC 2005c) soliciting feedback on the proposed GEIS revision were also considered in preparing this appendix.

E.2 Plant Accidents

A general description of plant accidents is contained in Section 5.2 of the 1996 GEIS. This description covered:

- The general characteristics of accidents;
- Fission product characteristics;
- Meteorological considerations;
- Exposure pathways;

- Adverse health effects;
- Avoiding adverse health effects;
- Accident experience and observed impacts;
- Mitigation of accident consequences; and
- Emergency preparedness.

This description is still valid and thus remains unchanged. Section 5.2 of the 1996 GEIS also mentions that as of 1990, there have been approximately 1300 reactor-years of experience to support the safety of United States nuclear power plants. As with any technology, experience generally leads to improved plant performance and public safety. As of 2007, there has been approximately an additional 1700 reactor-years of experience in the United States. This additional experience has contributed to improved plant performance (e.g., as measured by trends in plant-specific performance indicators), a reduction in operating events, and lessons learned that improve the safety of all of the operating nuclear power plants. Other examples of items contributing to improved safety include:

- Implementation of plant improvements identified through the Individual Plant Examination and Individual Plant Examination: External Events (IPE/IPEEE) programs (e.g., strengthening of seismic supports; enhanced fire brigade training) (NRC 2003);
- Identification of specific aging mechanisms (e.g., cables; irradiation-assisted stress corrosion cracking) and development of programs to monitor and control these mechanisms (NRC 2001c);
- NRC staff actions on generic safety issues (e.g., Generic Safety Issue 191 on sump performance) (NRC 2008e); and
- Implementation of the NRC's Interim Compensatory Measures (ICMs) Order following the September 2001 terrorist attacks.[a]

Thus, the performance and safety record of nuclear power plants operating in the United States continues to improve. This is also confirmed by analysis which indicates that, in many cases,

(a) The safety evaluations (SEs) for the operating license amendments associated with implementation of Section B.5.b. of Commission Order EA-02-026 provide background related to the implementation of particular portions of the ICMs. As an example, the reader is referred to the SE associated with Brunswick Steam Electric Plant, Units 1 and 2 (NRC 2007b).

improved plant performance and design features have resulted in reductions in initiating event frequency, core damage frequency and containment failure frequency.[a]

E.3 Accident Risk and Impact Assessment

The environmental impacts from design basis accidents and severe accidents are assessed in Sections 5.3.2 and 5.3.3 of the 1996 GEIS, respectively. As stated in Section 5.3.2, the environmental impact from design basis accidents was assessed in the individual plant specific EISs at the time of the initial license application review. Since the licensee is required to maintain the plant within acceptable design and performance criteria, including during any extended life operation, these impacts are not expected to change. Therefore, additional assessment of the environmental impacts from design basis accidents is not necessary, and the bulk of the GEIS evaluation focused on the environmental impact of severe accidents.

To assess the impacts from the airborne pathway, the 1996 GEIS relied on severe accident analyses provided in the EISs for the more recent sites. Table 5-1 in the 1996 GEIS lists the 28 nuclear power plants that included severe accident analyses in their plant-specific EISs. These plant-specific EISs used site-specific meteorology, land topography, population distributions, and offsite emergency response parameters, along with generic or plant-specific source terms, to calculate offsite health and economic impacts. The offsite health effects included those from airborne releases of radioactive material and contamination of surface water and groundwater.

The 1996 GEIS used the environmental impact information from the 28 plant-specific EISs and a metric called the exposure index to (1) scale up the radiological impact of severe accidents on the population due to demographic changes from the time the original EIS was done until the year representing the mid-license renewal period and (2) estimate the severe accident environmental impacts for the earlier plants (whose EISs did not include a quantitative assessment of severe accidents). The exposure index method uses the projected population distribution around each nuclear power plant site at the middle of its license renewal period and meteorology data for each site to provide a measure of the degree to which the population would be exposed to the release of radioactive material resulting from a severe accident (i.e., the exposure index method weights the population in each of 16 sectors around a nuclear power plant by the fraction of time the wind blows in that direction on an annual basis). The exposure index metric was also used to project economic impacts at the mid-year of the license

(a) This statement is based on industry performance data provided in the NRC's *2007-2008 Information Digest* (NRC 2007c) and on the NRC's website (NRC 2008c), as well as information contained in Chapter 5 of the site-specific EISs (the NUREG-1437 series of supplements).

renewal period. A more detailed description of the exposure index method is contained in Appendix G of the 1996 GEIS. The use of the exposure index method remains valid.

Since 1996, developments in plant operation and accident analysis have taken place that could affect the assumptions made in the 1996 GEIS. These changes are grouped into the following areas, and are each covered in the indicated section of this revision:

- Internal event risk (Section E.3.1);
- External event risk (Section E.3.2);
- Updates in the quantification of accident source terms (Section E.3.3);
- Increases in licensed reactor power levels, i.e., power uprates (Section E.3.4);
- Increases in fuel burnup levels (Section E.3.5);
- Consideration of reactor accidents at low power and shutdown conditions (Section E.3.6);
- Consideration of accidents in spent fuel pools (Section E.3.7); and
- The BEIR VII report on the risk of fatal cancers posed by exposure to radiation (Section E.3.8).

Sections discussing uncertainties, SAMAs, and conclusions are also provided.

As discussed in the Section 5.3.3.1 of the 1996 GEIS, the environmental impacts from security-related events were not considered in that document. As stated, these types of events are addressed via deterministic criteria in Title 10, Part 73, of the *Code of Federal Regulations* (10 CFR Part 73), rather than by risk assessments. The regulatory requirements under 10 CFR Part 73 provide reasonable assurance that the risk from sabotage is small. This section goes on to state:

> Although the threat of sabotage events cannot be accurately quantified, the Commission believes that acts of sabotage are not reasonably expected. Nonetheless, if such events were to occur, the Commission would expect that resultant core damage and radiological releases would be no worse than those expected from internally initiated events.

The NRC continues to take this position. As a result of the terrorist attacks of September 11, 2001, the NRC conducted a comprehensive review of the agency's security program and made further enhancements to security at a wide range of NRC-regulated facilities. These enhancements included significant reinforcement of the defense capabilities for nuclear facilities, better control of sensitive information, enhancements in emergency preparedness to further strengthen NRC's nuclear facility security program, and implementation of mitigating strategies to deal with postulated events potentially causing loss of large areas of the plant due to explosions or fires, including those that an aircraft impact might create. These measures are outlined in greater detail in NUREG/BR-0314 (NRC 2004), NUREG-1850 (NRC 2006a), and Sandia National Laboratory's "Mitigation of Spent Fuel Loss-of-Coolant Inventory Accidents and Extension of Reference Plant Analyses to Other Spent Fuel Pools" (NRC 2006b).

The NRC routinely assesses threats and other information provided by a variety of Federal agencies and sources. The NRC also ensures that licensees meet appropriate security-level requirements. The NRC will continue to focus on prevention of terrorist acts for all nuclear facilities and will not focus on site-specific evaluations of speculative environmental impacts resulting from terrorist acts. While these are legitimate matters of concern, the NRC will continue to address them through the ongoing regulatory process as a current and generic regulatory issue that affects all nuclear facilities and many of the activities conducted at nuclear facilities. The issue of security and risk from malevolent acts at nuclear power facilities is not unique to facilities that have requested a renewal of their licenses (NRC 2006a).

As such, malevolent acts remain speculative and beyond the scope of a National Environmental Policy Act (NEPA) review. NEPA requires that there be a "reasonably close causal relationship" between the federal agency action and the environmental consequences. The environmental impact of a terrorist attack is too far removed from the natural, or expected, consequences of a license renewal action to warrant consideration under NEPA. However, as noted above, in the event of a terrorist attack, the consequences of such an attack would be no worse than a severe accident, which has already been analyzed.

In a decision dated June 2, 2006, *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016, 1028 (9th Cir. 2006) the United States Court of Appeals for the Ninth Circuit held that NRC could not categorically refuse to consider the consequences of a terrorist attack under NEPA and remanded the case to NRC. On remand, the Commission adjudicated the intervenors' claim that the NRC Staff had not adequately assessed the environmental consequences of a terrorist attack on the Diablo Canyon Power Plant's proposed facility for storing spent nuclear fuel in dry casks. *See, Pacific Gas & Electric Co.,* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-26, 68 NRC ___ (2009). The Commission ultimately determined that an EIS was not required in order to address land contamination and latent health effect issues (Diablo Canyon, CLI-08-26, slip op. at 8, 15-16). Further, the Commission concluded that the staff's final, supplemental environmental assessment and finding of no significant impact, the adjudicatory record of the case, and its supervisory review of the non-public information underlying portions of the staff's analyses, satisfied the agency's NEPA obligations. *Id.* at 22-23. The staff had found that even the most severe, plausible terrorist attack of those examined would not cause immediate or latent health effects. The staff also found that such an attack was improbable, but if one occurred, the likelihood of significant radioactive release was very low because the nature of the Diablo Canyon casks and site. *Id.* at 22. That case has been challenged in the U.S. Court of Appeals for the Ninth Circuit. See No. 08-75058 (petition for review filed 12/15/08).

The Commission stated that it will adhere to the Ninth Circuit decision when considering licensing actions for facilities subject to the jurisdiction of that Circuit. *See Pacific Gas and Electric Co., (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation*), CLI-07-11, 65 NRC 118 (2007). However, the Commission decided against applying that holding to all licensing proceedings nationwide. In one such proceeding, *Amergen Energy Co. LLC* (Oyster Creek Nuclear Generating Station), CLI-07-8, 65 NRC 124, 128-29 (2007), the New Jersey Department of Environmental Protection contended that NEPA requires an analysis of a terrorist attack. The NRC found that NEPA "'imposes no legal duty on the NRC to consider intentional malevolent acts'" because such acts are "'too far removed from the natural or expected consequences of agency action.'" *Id.* at 129 (quoting the Board decision). The NRC also found that a terrorism review would be redundant because (1) "the NRC has undertaken extensive efforts to enhance security at nuclear facilities," which it characterized as the best mechanism to protect the public; *id.* at 130; (2) the GEIS had addressed the issue and concluded that "the core damage and radiological release from [terrorist] acts would be no worse than the damage and release to be expected from internally initiated events." On appeal, the Third Circuit agreed with the NRC and denied the petition. *See NJDEP v. NRC and Amergen Energy Co, LLC,* (Case No. 07-2271), 561 F.3rd 132 (3rd Cir. 2009). The Court found that, "the NRC correctly concluded that the relicensing of Oyster Creek does not have a 'reasonably close causal relationship' with the environmental effects that would be caused in the event of a terrorist attack." 561 F.3d at 143.

The Third Circuit disagreed with the Ninth Circuit's application of the relevant Supreme Court decisions. Instead, as the Commission had originally held, the Third Circuit concluded that the issuance of a facility license – here, the issuance of the 20-year extension for the Oyster Creek license – would not be the "proximate cause" of a terrorist attack on the facility.

Moreover, the Third Circuit noted that the GEIS for License Renewal had reviewed the possible impacts of a sabotage event, which is a form of terrorism. The GEIS found that the consequences of a sabotage event would be no worse than those expected from [a sever accident]." The Third Circuit noted that the petitioner in the case before it (the State of New Jersey) had failed to demonstrate that the results of a terrorist attack would be any different than those of a severe accident, which had already been analyzed. The Third Circuit also noted that the NRC had prepared a SEIS addressing the mitigation of severe accidents at Oyster Creek. As a result, the Third Circuit found that, even if the Commission were required to analyze the impacts of a terrorist attack, the NRC had prepared both a generic and site-specific analyses of the impacts of a terrorist attack at Oyster Creek and that the Petitioner had not shown that the NRC could evaluate the risks more meaningfully than it had already done.

In sum, the Commission has found that the issuance of a facility license is not the "proximate cause" of a terrorist attack at that facility. Thus, it is not required to prepare an EIS discussion on the potential impacts of a terrorist attack. However, in respect for the decision of the Ninth Circuit, the NRC will prepare an analysis of the environmental impacts of a terrorist attack for licensing actions of facilities within the geographical boundaries of the Ninth circuit. In addition, the Third Circuit has held that the GEIS for License Renewal constitutes such an analysis for license renewals.

E.3.1 Impact of New Information on Accidents Initiated by Internal Events

With few exceptions, the severe accident analyses formulating the basis for the 1996 GEIS were limited to consideration of reactor accidents caused by internal events. The GEIS addressed the impacts from external events qualitatively, and external events are covered in more detail in Section E.3.2 of this revision. The impacts from the 1996 GEIS were based on the original license EISs for the 28 nuclear power plant sites listed in Table 5.1 of the GEIS. The source terms and their likelihood used in the plant-specific original EISs to calculate the airborne pathway environmental impacts of accidents were, in turn, usually based upon information contained in NUREG-0773 (NRC 1982). NUREG-0773 is an update of the original Reactor Safety Study (NRC 1975). These source terms and frequencies were used along with site-specific meteorology, population distributions, and emergency planning characteristics to calculate the airborne pathway environmental impacts. These EISs were issued in the 1981 to 1986 time frame. Thus, while the GEIS was published in 1996, it was primarily based on information from the 1980s.

Since the publication of NUREG-0773, many additional studies have been completed on the likelihood and consequences of reactor accidents initiated by internal events at full power. These studies include NUREG-1150 (NRC 1990c), NUREG/CR-5305 (NRC 1992), and licensee responses to Generic Letter 88-20, Supplement 1 (i.e., the IPE program). Licensees have further developed their IPE-vintage Probabilistic Risk Assessment (PRA) models to support risk-informed licensing actions, including license renewal SAMA analysis. In addition, the NRC has developed standardized plant analysis risk (SPAR) models for all operating plants which can be used to calculate core damage frequencies (CDFs) for internal events.

The purpose of this section is to assess how results from more up-to-date internal event information compare to those on which the 1996 GEIS was based. The evaluation contained in this section compares the CDFs that formed the basis for the 1996 GEIS, and offsite doses directly from the 1996 GEIS, to the newer information. The comparison is done for pressurized water reactors (PWRs) and boiling water reactors (BWRs) and covers each of the plants listed in Table 5.1 of the 1996 GEIS. Changes in source terms (i.e., the quantity, form, and timing of radioactive material released to the environment) are assessed in Section E.3.3.

E.3.1.1 Airborne Pathway Impacts

As a first step in the comparison, the CDFs from the original EISs are compared to the CDFs reported in the plant-specific IPEs for the PWRs and BWRs listed in Table 5.1 of the 1996 GEIS. Tables E-1 and E-2 show these comparisons. As can be seen in Tables E-1 and E-2, for many plants, the IPE CDFs are smaller than those from the original EISs, particularly for BWRs. The mean of the IPE CDFs listed in Tables E-1 and E-2 are lower than the corresponding mean EIS CDF by 30 percent for PWRs and by more than a factor of 3 for BWRs. Accordingly, the likelihood of an accident that leads to core damage would be comparable to or less for PWRs, and significantly less for BWRs, than that used as the basis for the 1996 GEIS.

Additional comparisons can be made using information from NUREG-0773 (NRC 1982), the original EISs, NUREG-1150 (NRC 1990c), the IPEs, NUREG/CR-5305 (NRC 1992), recent analysis using SPAR models, and license renewal applications received to date. These comparisons are shown in Table E-3. In general, the Level 1 (CDF) results are comparable to or less than the corresponding Level 1 information from the GEIS. Furthermore, the newer estimates (license renewal and SPAR) are up to a factor of 2.5 lower than the mean IPE CDFs from Tables E-1 and E-2.

The comparison of Level 3 information is made difficult due to differences in the values reported between older and newer assessments. Older assessments tended to provide mean and/or upper bound population doses for the entire region surrounding the nuclear power plant (as far as 1000 mi). Newer assessments tend to provide mean values within 50 mi. NUREG-1150 provided distributions for both 50 and 1000 mi, and is used as a bridge in this comparison.

The mean of population dose results from the original EISs of the 28 sites that considered severe accidents are a factor of 2 to 4 lower than the mean of the plant-specific upper bound estimates used in the 1996 GEIS for those same 28 sites. The mean population doses from NUREG-1150 (for 1000-mi results) are, in turn, a factor of 10 to 100 less than the original EIS mean value. In actuality, the difference is even larger, because the NUREG-1150 estimate covers a larger area (1000 mi for NUREG-1150 versus 150 mi for the EIS). The NUREG-1150 results for a 50-mi radius are a factor of 4 to 10 lower than the 1000-mi results. The mean of license renewal results (for a 50-mile region) are somewhat higher than the mean results reported in NUREG-1150 for a 50 mile region, but are still well below the population dose values reported in the original environmental impact statements for the 28 sites and used in the 1996 GEIS.

To summarize, the general contribution to decreased estimated doses are a factor of 2 to 4 simply due to the conservatism built into the 1996 GEIS values. An additional decrease in estimated doses of 10 to 100 is seen when comparing the EIS results to the NUREG-1150 results and a factor of 5 to 33 when comparing the EIS results to license renewal SAMA results.

Table E-1. PWR Internal Event (Full Power) Comparison

Plant	Original EIS Estimated CDF [(a)]	IPE CDF [(b)]
Beaver Valley 2	1.0×10^{-4}/yr	1.9×10^{-4}/yr
Braidwood 1, 2	1.0×10^{-4}/yr	2.7×10^{-5}/yr
Byron 1, 2	4.8×10^{-5}/yr	3.1×10^{-5}/yr
Callaway 1	4.8×10^{-5}/yr	5.9×10^{-5}/yr
Catawba 1, 2	4.8×10^{-5}/yr	5.8×10^{-5}/yr
Comanche Peak 1, 2	4.8×10^{-5}/yr	5.7×10^{-5}/yr
Shearon Harris 1	4.8×10^{-5}/yr	7.0×10^{-5}/yr
Indian Point 2, 3	3.5×10^{-4}/yr, 3.4×10^{-4}/yr	3.1×10^{-5}/yr, 4.4×10^{-5}/yr
Millstone 3	2.0×10^{-4}/yr	5.6×10^{-5}/yr
Palo Verde 1, 2, 3	4.8×10^{-5}/yr	9.0×10^{-5}/yr
San Onofre 2, 3	4.8×10^{-5}/yr	3.0×10^{-5}/yr
Seabrook 1	4.8×10^{-5}/yr	6.1×10^{-5}/yr [(c)]
South Texas 1, 2	4.4×10^{-5}/yr	4.3×10^{-5}/yr
St. Lucie 2	4.8×10^{-5}/yr	2.6×10^{-5}/yr
Summer 1	4.9×10^{-5}/yr	2.0×10^{-4}/yr
Vogtle 1, 2	1.0×10^{-4}/yr	4.9×10^{-5}/yr
Waterford 3	4.8×10^{-5}/yr	1.8×10^{-5}/yr
Wolf Creek 1	4.8×10^{-5}/yr	4.2×10^{-5}/yr
Mean value	8.4×10^{-5}/yr	5.9×10^{-5}/yr
Median value	4.8×10^{-5}/yr	4.9×10^{-5}/yr

(a) Obtained by summing individual atmospheric release sequences, including intact containment sequences.
(b) Source: NRC 2003, unless otherwise noted.
(c) Obtained from the licensee's IPEEE submittal.

Table E-2. BWR Internal Event (Full Power) Comparison

Plant	Original EIS Estimated CDF [a]	IPE CDF [b]
Clinton 1	2.4×10^{-5}/yr	2.7×10^{-5}/yr
Fermi 2	2.4×10^{-5}/yr	5.7×10^{-6}/yr
Grand Gulf 1	2.4×10^{-5}/yr	1.7×10^{-5}/yr
Hope Creek	1.0×10^{-4}/yr	4.6×10^{-5}/yr
Limerick 1 ,2	8.9×10^{-5}/yr	4.3×10^{-6}/yr
Nine Mile Point 2	1.1×10^{-4}/yr	3.1×10^{-5}/yr
Perry 1	2.4×10^{-5}/yr	1.3×10^{-5}/yr
River Bend	9.5×10^{-5}/yr	1.6×10^{-5}/yr
Susquehanna 1, 2	2.4×10^{-5}/yr	5.6×10^{-7}/yr [c]
WNP-2 [d]	2.4×10^{-5}/yr	1.8×10^{-5}/yr
Mean value	5.4×10^{-5}/yr	1.5×10^{-5}/yr
Median value	2.4×10^{-5}/yr	1.45×10^{-5}/yr

(a) Obtained by summing individual atmospheric release sequences, including intact containment sequences.
(b) Source: NRC 2003, unless otherwise noted.
(c) Revised 1998 IPE; obtained from NUREG-1437, Supp. 35, Appendix G.
(d) WNP-2 = Washington Nuclear Project 2 (i.e., Columbia).

E.3.1.2 Other Pathway Impacts

Any change in the likelihood of accidents that release substantial amounts of radioactive material to the environment not only affects the airborne pathway, but also the surface water and groundwater pathways and the economic impacts. The information in Tables E-1, E-2, and E-3 indicate that the likelihood and impacts of airborne pathway releases is smaller than that used in the 1996 GEIS. Since this pathway directly affects the surface water pathway and the economic impacts, it is reasonable to conclude that the likelihood of these pathway impacts would also be smaller and would continue to be bounded by the airborne pathway. This assumption is consistent with the results of the 1996 GEIS.

Table E-3. Comparisons with Other Risk Information (Full Power Internal Events)

			CDF (mean/point estimate)	Person-Rem per Year (Mean, except as noted)	
				Region [(a)]	50-mi
PWR	GEIS Basis	• NUREG-0773 [(b)]	6×10^{-5}/yr		
		• Original EIS [(c)]	8.4×10^{-5}/yr	932	
		• 1996 GEIS [(c)]		2200 [(d)]	
	Update	• NUREG-1150 Plants			
		- Surry	4×10^{-5}/yr	~30	~6
		- Sequoyah	5.6×10^{-5}/yr	~80	~10
		• IPE			
		- Catawba	5.8×10^{-5}/yr		15.66
		- McGuire	4×10^{-5}/yr		4.6
		- Surry	1.25×10^{-4}/yr		
		- Sequoyah	1.7×10^{-4}/yr		
		• License Renewal [(e)]	3.9×10^{-5}/yr		18.1
		• SPAR (v3.45) [(c)]	2.3×10^{-5}/yr		
BWR	GEIS Basis	• NUREG-0773 [(b)]	2×10^{-5}/yr		
		• Original EIS [(c)]	5.4×10^{-5}/yr	577	
		• 1996 GEIS [(c)]		2720[(d)]	
	Update	• NUREG-1150 Plants			
		- Grand Gulf	4×10^{-6}/yr	~5	~0.5
		- Peach Bottom	4.4×10^{-6}/yr	~30	~7
		• NUREG/CR-5305			
		- LaSalle	4×10^{-5}/yr	1500 [(f)]	66 [(e)]
		• IPE			
		- Peach Bottom	5.5×10^{-6}/yr		
		- LaSalle	4.7×10^{-5}/yr		
		- Grand Gulf	1.7×10^{-5}/yr		
		• License Renewal [(e)]	1.4×10^{-5}/yr		14.5
		• SPAR (v3.45) [(b)]	8×10^{-6}/yr		

(a) For the EISs and GEIS, the employed distance is 150 mi; for NUREG-1150 and NUREG/CR-5305, the employed distance is 1000 mi.
(b) Based on Table 22 (CDF) of that document; PWR CDF cited is for Surry and BWR corresponds to Peach Bottom.
(c) Values are for those plants listed in Tables E-1 and E-2.
(d) Note that this is the mean of the distribution of 95th percent UCB values.
(e) Mean values for all plants that have applied for license renewal as of August 2008; in a few cases (Beaver Valley, Calvert Cliffs, Ginna, and Nine Mile Point), the site-specific population dose values used included both internal and external events.
(f) Includes both internal and external events.

Furthermore, some information is available regarding basemat melt-through sequences:

- WASH-1400 (NRC 1975) used a frequency of 4×10^{-5}/yr for basemat melt-through sequences;
- NUREG-0773 (NRC 1982) used a generic frequency of 3×10^{-5}/yr and a site-specific frequency of 1.1×10^{-5}/yr for Indian Point Units 2 and 3;
- NUREG-1150 (NRC 1990c) calculated the basemat melt-through frequencies for Surry and Sequoyah to be 2.4×10^{-6}/yr and 1×10^{-5}/yr, respectively;
- A sample of IPE results showed basemat melt-through frequencies ranging from 1×10^{-6}/yr to 4×10^{-6}/yr; and
- A sample of license renewal application results showed basemat melt-through frequencies ranging from 2×10^{-7}/yr to 6×10^{-6}/yr.

For the 1996 GEIS, a conservative value of 1×10^{-4}/yr was used (see Section 5.3.3.4 of the 1996 GEIS), which is higher than any of the values cited above. As such, it is concluded that the basemat melt-through frequencies used in the 1996 GEIS to assess the groundwater pathway are bounding.

For BWRs, no quantitative basemat melt-through information was available. It is expected that for BWRs, containment failure by overpressure would occur before basemat melt-though. In addition, if basemat melt-through sequences do occur, their frequency would be less than that for PWRs due to the lower CDFs for BWRs.

E.3.1.3 Conclusion

The PWR and BWR accident frequencies that form the basis for the environmental impacts shown in the 1996 GEIS are, in most cases, comparable to or higher than the updated accident frequencies shown in Tables E-1, E-2, and E-3. In addition, the population dose estimates presented in Table E-3 demonstrate the conservatism in the 1996 GEIS values, both from the standpoint of reduced risk from more recent estimates and the conservatism built into the GEIS methodology.

E.3.2 Impact of Accidents Initiated by External Events

The 1996 GEIS included a qualitative assessment of the environmental impacts of accidents initiated by external events (see Section 5.3.3.1 of that document). The purpose of this section is to consider updated information regarding potential external event impacts. The sources of information used in this assessment are (1) NUREG-1150 (NRC 1990c) (and the supporting documentation in NUREG/CR-4551 [NRC 1990a]), which assessed seismic and fire events for two plants (Surry and Peach Bottom); (2) NUREG/CR-5305 (NRC 1992), which analyzed the risk from seismic and fire events for one plant (LaSalle); and (3) the results from the IPEEE program, as documented in NUREG-1742 (NRC 2003). The IPEEE program was initiated in the early 1990s and required all operating plants in the United States to do an assessment to identify vulnerabilities to severe accidents initiated by external events and report the results to the NRC, along with any identified improvements and/or corrective actions. NUREG-1742 documents the perspectives derived from the technical reviews of the IPEEE results.

Typically, the external events that contribute the most to plant risk are seismic and fires. In some cases, high winds, floods, and tornados may contribute to plant risk; however, these contributions are generally much lower than those from seismic and fire events. Therefore, the assessment of the environmental impact from external events provided here focuses on seismic and fire events. This is consistent with the results obtained from the IPEEEs and the perspectives articulated in NUREG-1742.

E.3.2.1 Airborne Pathway Impacts

The assessment in this section is based upon a comparison of the risks and environmental impacts from severe accidents initiated by external events to those initiated by internal events, based on the aforementioned information sources.

LEVEL 1 COMPARISON (CDF)

From the IPEEE the following insights can be drawn:

(1) For a majority of plants, fire and/or seismic events are important contributors to risk.

(2) The contributions to CDFs from fire events are comparable to the contribution to CDFs from internal events. The IPEEE CDF values for fire-initiated events are shown in Tables E-4 and E-5 along with the IPE internal event CDFs. For the plants listed in Tables E-4, the PWR fire CDF is about half the internal event CDF. For the BWR plants in Table E-5, the fire CDF is roughly 50 percent higher than the internal events CDF. Section 3.3.1.1 of NUREG-1742 (NRC 2003) provides a comparison of fire and internal events for the entire fleet of plants, and similarly concludes that BWR results are comparable, while PWR results are slightly lower for fire CDF.

However, the IPEEE fire event CDFs are much lower than the internal event CDFs from the original EISs (basis for the 1996 GEIS). The mean value of the PWR fire event CDFs in Table E-4 is one-third the PWR internal event CDF from the EISs (see Table E-1), and the mean value of the BWR fire event CDFs in Table E-5 is less than half the BWR internal event CDF from the original EISs (see Table E-2). It is also worth noting that Table 3.9 in Volume 1 of NUREG-1742 presents some additional information showing that conditional bypass and containment failure probabilities resulting in large early releases is generally small.

(3) The contributions to CDF from seismic events are comparable to the contribution from internal events. For plants listed in Tables E-1 and E-2 that reported seismic CDFs as part of their IPEEE submittals, these CDFs are contained in Tables E-4 and E-5. Although sparse, these values suggest seismic CDFs are lower than or comparable to internal event CDFs. Section 2.6.1 of NUREG-1742 considers all reporting plants, and states that the largest group of reported seismic CDFs were in the range of 1×10^{-5} to 1×10^{-4} (same order of magnitude as the basis for the 1996 GEIS), with the next largest group being 1×10^{-6} to 1×10^{-5} (one order of magnitude lower than the basis for the 1996 GEIS).

(4) As a result of the IPEEE program, most licensees have made improvements to plant hardware, procedures, or training programs. Although not generally quantified as part of the IPEEE, those improvements are, in many cases, considered to have lowered the reported risk estimates.

Table E-6 compares CDFs from NUREG-1150 (NRC 1990c) and NUREG/CR-5305 (NRC 1992) for internal, fire, and seismic events with the internal events from the original EISs (which formed the basis for the 1996 GEIS). As can be seen in this table, the NUREG-1150 and NUREG/CR-5305 fire and seismic CDFs are comparable to those supporting the 1996 GEIS, with a number of both relatively lower and higher comparisons.[a]

In support of early site permits for new reactors, the NRC staff reviewed updates to seismic source and ground motion models provided by applicants. The updates to seismic data and models could result in estimated seismic hazard levels at some current central and eastern United States operating sites that would be higher than seismic hazard values used in design and previous evaluations (such as the IPEEEs). Due to its relevance for other licensing actions, the issue is being pursued as part of the Generic Issues Program, as Generic Issue 199 (GI-199). A preliminary assessment performed for the affected plants as part of GI-199 indicates that the average increase in seismic CDF relative to the IPEEE-era estimates would

(a) The NUREG-1150 values represented best-estimate values at the time they were completed. For Surry, the Lawrence Livermore National Laboratory (LLNL) NUREG-1150 curve is uniformly higher than other seismic hazard estimates (e.g., the Electric Power Research Insitute [EPRI] and LLNL curves used for the IPEEEs, recent United States Geological Survey curves). For Peach Bottom, the EPRI NUREG-1150 curve is uniformly lower.

be about 1E-5 per year. However, this assessment also indicates that on average, the updated seismic CDF remains slightly (approximately 30 percent) less than the internal events CDF. Thus, seismic hazard estimates remain small in an absolute sense, and the new risk estimates are not expected to change the conclusion that the impacts utilized in the 1996 GEIS are bounding.

Table E-4. PWR Internal, Fire, and Seismic Event CDF Comparison (Full Power) [(a)]

Plant	IPE Internal Events CDF	IPEEE Fire CDF	IPEEE Seismic CDF (EPRI/Other/Update)	IPEEE Seismic CDF (LLNL)
Beaver Valley 2	1.9×10^{-4}/yr	1.1×10^{-5}/yr	1×10^{-5}/yr	2.3×10^{-5}/yr
Braidwood 1, 2	2.7×10^{-5}/yr	3.9×10^{-6}/yr 3.8×10^{-6}/yr		
Byron 1, 2	3.1×10^{-5}/yr	4.2×10^{-6}/yr 5.3×10^{-6}/yr		
Callaway 1	5.9×10^{-5}/yr	8.9×10^{-6}/yr		
Catawba 1, 2	5.8×10^{-5}/yr	4.6×10^{-6}/yr	1.6×10^{-5}/yr	
Comanche Peak 1, 2	5.7×10^{-5}/yr	2.1×10^{-5}/yr		
Shearon Harris 1	7.0×10^{-5}/yr	1.3×10^{-5}/yr		
Indian Point 2, 3	3.1×10^{-5}/yr 4.4×10^{-5}/yr	1.8×10^{-5}/yr 5.6×10^{-5}/yr	1.3×10^{-5}/yr 5.9×10^{-5}/yr	1.5×10^{-5}/yr 4.4×10^{-5}/yr
Millstone 3	5.6×10^{-5}/yr	4.8×10^{-6}/yr	9.1×10^{-6}/yr	
Palo Verde 1, 2, 3	9.0×10^{-5}/yr	8.7×10^{-5}/yr		
San Onofre 2, 3	3.0×10^{-5}/yr	1.6×10^{-5}/yr	1.7×10^{-5}/yr	
Seabrook 1	6.1×10^{-5}/yr [(b)]	1.2×10^{-5}/yr	1.2×10^{-5}/yr	1.3×10^{-4}/yr
South Texas 1, 2	4.3×10^{-5}/yr	5.1×10^{-7}/yr	1.9×10^{-7}/yr	2.2×10^{-5}/yr
St. Lucie 2	2.6×10^{-5}/yr	1.9×10^{-4}/yr		
Summer 1	2.0×10^{-4}/yr	8.5×10^{-5}/yr		
Vogtle 1, 2	4.9×10^{-5}/yr	1.0×10^{-5}/yr		
Waterford 3	1.8×10^{-5}/yr	7.0×10^{-6}/yr		
Wolf Creek 1	4.2×10^{-5}/yr	7.6×10^{-6}/yr		
Mean Value	5.9×10^{-5}/yr	2.8×10^{-5}/yr	1.5×10^{-5}/yr	4.3×10^{-5}/yr

(a) Source: NRC 2003, unless otherwise stated.
(b) Obtained from the licensee's IPEEE submittal.

Table E-5. BWR Internal, Fire, and Seismic Event CDF Comparison (Full Power) [(a)]

Plant	IPE Internal Events CDF	IPEEE Fire CDF	IPEEE Seismic CDF (EPRI/Other/Update)	IPEEE Seismic CDF (LLNL)
Clinton 1	2.7×10^{-5}/yr	3.6×10^{-6}/yr		
Fermi 2	5.7×10^{-6}/yr	2.2×10^{-5}/yr		
Grand Gulf 1	1.7×10^{-5}/yr	8.9×10^{-6}/yr		
Hope Creek	4.6×10^{-5}/yr	8.1×10^{-5}/yr	1.1×10^{-6}/yr	3.6×10^{-6}/yr
Limerick 1, 2	4.3×10^{-6}/yr	N/A [(b)]		
Nine Mile Point 2	3.1×10^{-5}/yr	1.4×10^{-6}/yr	2.5×10^{-7}/yr	1.2×10^{-6}/yr
Perry 1	1.3×10^{-5}/yr	3.3×10^{-5}/yr		
River Bend	1.6×10^{-5}/yr	2.3×10^{-5}/yr		
Susquehanna 1, 2	5.6×10^{-7}/yr [(c)]	3.6×10^{-8}/yr		
WNP-2 [(d)]	1.8×10^{-5}/yr	5.5×10^{-5}/yr	2.1×10^{-5}/yr	
Mean Value	1.5×10^{-5}/yr	2.3×10^{-5}/yr	7.5×10^{-6}/yr	2.4×10^{-6}/yr

(a) Source: NRC 2003, unless otherwise stated.
(b) N/A = not available.
(c) Revised 1998 IPE; obtained from NUREG-1437, Supp. 35, Appendix G.
(d) WNP-2 = Washington Nuclear Project 2 (i.e., Columbia).

Table E-6. NUREG-1150 and NUREG/CR-5305 Fire and Seismic CDFs

Plant	Internal Events (mean value)	Fire Events (mean value)	Seismic Events (mean value) [(a)]	1996 GEIS Basis Internal Events (mean value)
Surry (NUREG-1150)	4×10^{-5}/yr	1.1×10^{-5}/yr	1.9×10^{-4}/yr	8.4×10^{-5}/yr [(b)]
Peach Bottom (NUREG-1150)	4.4×10^{-6}/yr	2×10^{-5}/yr	7.5×10^{-5}/yr	5.4×10^{-5}/yr [(c)]
LaSalle (NUREG/CR-5305)	4×10^{-5}/yr	5.5×10^{-5}/yr	8×10^{-7}/yr	5.4×10^{-5}/yr [(c)]

(a) Based on the LLNL seismic hazard distribution results.
(b) This value is the mean of the CDFs of all PWRs listed in Table 5.1 of the 1996 GEIS.
(c) This value is the mean of the CDFs of all BWRs listed in Table 5.1 of the 1996 GEIS.

LEVEL 3 COMPARISON

To obtain quantitative information on the airborne pathway environmental impacts of severe accidents caused by external events, IPEEE, NUREG-1150, and NUREG/CR-5305 results can be used to compare against the internal event airborne pathway impacts contained in the 1996 GEIS. The following discussion summarizes the airborne pathway environmental impact information available.

The IPEEE provided external event environmental impact information (i.e., early fatalities, latent fatalities, and population dose) for Catawba and McGuire. This information showed the impacts of external events to be much less (i.e., one to two orders of magnitude) than those estimated for internally initiated events at full power in the 1996 GEIS for Catawba and McGuire (See Table E-7). Recall that while this is a comparison of mean values versus 95 percent upper confidence bound (UCB) values, the 95 percent UCB values are the ones used for the basis of the 1996 GEIS. Thus, this comparison shows that more realistic estimates are significantly lower than the conservative estimates used in the GEIS.

Fire Events

NUREG-1150 provides quantitative information on the airborne pathway environmental impact from fires for Surry and Peach Bottom. This information is shown in Tables E-8 and E-9 along with the full power, internal event environmental impact information from NUREG-1150 and the 1996 GEIS. NUREG/CR-5305 provides similar information for LaSalle, as presented in Table E-10. Tables E-8 through E-10 present 95th percentile results for all values. As can be seen from these tables, even 95th percentile values from NUREG-1150 and NUREG/CR-5305 are significantly lower (at least by 1 order of magnitude) than the conservative values used in the 1996 GEIS.

Seismic Events

Table E-11 presents mean results from the second-tier NUREG-1150 study documentation (NUREG/CR-4551 [NRC 1990a]) for impacts due to seismic initiators at Surry and Peach Bottom. As can be seen from this table, the mean results from the NUREG-1150 study are, in most cases, significantly smaller than the 95th percentile estimates used in the 1996 GEIS.

E.3.2.2 Other Pathway Impacts

With respect to the other pathways (open bodies of water and groundwater), the IPEEE, NUREG-1150, and NUREG/CR-5305 analysis did not address their impacts on human health. The 1996 GEIS estimated these impacts for reactor accidents from full power (internal events only) using the results from site-specific information on surface water and groundwater areas,

Table E-7. Catawba and McGuire Results for Internal and External Events

Impact	Catawba External Events	Catawba Internal Events	Catawba 1996 GEIS Internal Events - 95 percent UCB	McGuire External Events	McGuire Internal Events	McGuire 1996 GEIS Internal Events - 95 percent UCB
Total person-rem per year	43.6	15.6	1880	10.7	4.6	1806
Total early fatality risk	7.8×10^{-6}/yr	5.9×10^{-6}/yr	1.7×10^{-2}/yr	2.2×10^{-6}/yr	8.2×10^{-7}/yr	1.0×10^{-2}/yr
Total latent fatality risk	2.7×10^{-3}/yr	9.4×10^{-4}/yr	1.4/yr [(a)]	7.4×10^{-4}/yr	3.2×10^{-4}/yr	1.4/yr[(a)]

(a) These values include the factor of 10 adjustment made in the 1996 GEIS (see Section 5.3.3.2.3 of the 1996 GEIS).

Table E-8. Impacts of Accidents Caused by Fire Events (Surry)

Impact	NUREG-1150 Fire Events (95th percentile)	NUREG-1150 Internal Events (95th percentile)	1996 GEIS Internal Events (95th percentile)
Individual risk			
- EF [(a)] (1 mi)	$\sim 1.5 \times 10^{-10}$/yr	$\sim 5 \times 10^{-8}$/yr	Not available
- LF [(b)] (10 mi)	$\sim 1.5 \times 10^{-10}$/yr	$\sim 1 \times 10^{-8}$/yr	Not available
Total person-rem per year (entire region)	~2	~150	1200
Total early fatality risk	$\sim 1 \times 10^{-8}$/yr	$\sim 4 \times 10^{-6}$/yr	1.6×10^{-2}/yr
Total latent fatality risk	$\sim 6 \times 10^{-4}$/yr	$\sim 3 \times 10^{-2}$/yr	0.9/yr

(a) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.

(b) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

Table E-9. Impacts of Accidents Caused by Fire Events (Peach Bottom)

Impact	NUREG-1150 Fire Events (95th percentile)	NUREG-1150 Internal Events (95th percentile)	1996 GEIS Internal Events (95th percentile)
Individual risk			
- EF [(a)] (1 mi)	~1.5×10^{-9}/yr	~2.5×10^{-10}/yr	Not available
- LF [(b)] (10 mi)	~1×10^{-8}/yr	~1.5×10^{-9}/yr	Not available
Total person-rem per year (entire region)	~700	~100	2950
Total early fatality risk	~1.5×10^{-6}/yr	~1×10^{-7}/yr	4.2×10^{-3}/yr
Total latent fatality risk	~0.15/yr	~2×10^{-2}/yr	2.0/yr

(a) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(b) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

volumes, flow-rates, and geology to assess contamination of water by comparing the site-specific information to that used in NUREG-0440 (NRC 1978), which assessed the contamination of surface water and groundwater from reactor accidents.

With the airborne pathway impacts from external events much less than the internal event airborne pathway impacts in the 1996 GEIS, it is reasonable to conclude that the impact of accidents caused by external events on surface water and groundwater contamination will also be much less than the impacts contained in the 1996 GEIS. Due to the longer time before the population is exposed and the effects of interdiction of contaminated food, only latent fatalities are expected to result from these pathways. Therefore, the environmental impacts of surface and groundwater contamination caused by accidents initiated by external events are bounded by the impacts stated in the 1996 GEIS. This same conclusion can also be drawn with respect to the economic impacts.

E.3.2.3 Conclusion

In summary, it is concluded that the CDFs from severe accidents initiated by external events, as quantified in NUREG-1150 (NRC 1990c) and the other sources cited above, can be comparable to those from accidents initiated by internal events, but lower than the CDFs that formed the basis for the 1996 GEIS. The environmental impacts from externally initiated events are generally significantly lower (one or more orders of magnitude) than those used in the 1996 GEIS.

Table E-10. Impacts of Accidents Caused by Fire Events (LaSalle)

Impact	NUREG/CR-5305 Fire Events (95th percentile)	NUREG/CR-5305 Internal Events (95th percentile)	1996 GEIS Internal Events (95th percentile)
Individual risk			
- EF [(a)] (1 mi)	~1.1 × 10^{-10}/yr	~1.5 × 10^{-10}/yr	Not available
- LF [(b)] (10 mi)	~1.0 × 10^{-8}/yr	~1.3 × 10^{-8}/yr	Not available
Total person-rem per year	~1920	~2600	2898
Total early fatality risk	~9 × 10^{-9}/yr	~1.2 × 10^{-8}/yr	3.6 × 10^{-3}/yr
Total latent fatality risk	~0.3/yr	~0.4/yr	2.0/yr

(a) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(b) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

Table E-11. Impacts of Accidents Caused by Seismic Events

Impact	Surry		Peach Bottom	
	NUREG/CR-4551 Surry [(a)] LLNL (*EPRI*) Hazard Curve	1996 GEIS (95th percentile)	NUREG/CR-4551 Peach Bottom [(a)] LLNL (*EPRI*) Hazard Curve	1996 GEIS (95th percentile)
Individual risk				
- EF [(b)] (1 mi)	1.8 × 10^{-7}/yr (*1.8 × 10^{-8}/yr*)		1.6 × 10^{-6}/yr (*5.3 × 10^{-8}/yr*)	
- LF [(c)] (10 mi)	3.1 × 10^{-8}/yr (*3.8 × 10^{-9}/yr*)		3.4 × 10^{-7}/yr (*1.1 × 10^{-8}/yr*)	
Total person-rem per year	45 (*6.7*)	1200	460 (*17*)	2950
Total early fatality risk	9.3 × 10^{-5}/yr (*1.4 × 10^{-5}/yr*)	1.6 × 10^{-2}/yr	3.0 × 10^{-3}/yr (*8.8 × 10^{-5}/yr*)	4.2 × 10^{-3}/yr
Total latent fatality risk	3.9 × 10^{-2}/yr (*5.6 × 10^{-3}/yr*)	0.9/yr	2.5 × 10^{-1}/yr (*9.9 × 10^{-3}/yr*)	2.0/yr

(a) Mean values.
(b) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(c) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

E.3.3 Impact of New Source Term Information

The 1996 GEIS used information from 28 plant-specific EISs to project the environmental impact from all 118 plants analyzed (see Table 5.5 in the 1996 GEIS). The 28 sites chosen were those for which the impacts from severe accidents were analyzed in their plant-specific EISs. As stated in Section 5.3.3.1 of the 1996 GEIS, the source terms (i.e., the magnitude, timing, and characteristics of the radioactive material released to the environment) used in the EIS analyses for the 28 sites (and subsequently used to estimate the environmental impacts from all plants) were generally based on those documented in NUREG-0773 (NRC 1982). The NUREG-0773 source terms represented an update (rebaseline) of the source terms used in WASH-1400 (NRC 1975). The source terms in NUREG-0773 were developed for PWRs and BWRs and are shown in Tables 13 and 14A of that document. NUREG-0773 states that the provided source terms are based on models that have "known deficiencies which would tend to give overestimates of the magnitude of the releases."

Since completion of NUREG-0773, additional information on source terms has been developed through experimental and analytical programs. The purpose of this section is to assess the impact of new source term information on the environmental impacts described in the 1996 GEIS. The new source term information assessed is that used in NUREG-1150 (NRC 1990c) as updated and simplified in NUREG/CR-6295 (NRC 1997b).

E.3.3.1 Airborne Pathway Impact

Tables E-12 and E-13 present a comparison of the results for large release sequences from NUREG-0773 (NRC 1982) and NUREG/CR-6295 (NRC 1997b). These sequences typically dominate the total risk from all severe accidents. In this case, large release sequences have been culled from the full set of sequences in each study based on a total Iodine release fraction of 10% or higher. These tables present release frequencies, timings, and release fractions for iodine and cesium, which are the elements that contribute the most to early (iodine) and latent (cesium) fatalities. Only limited comparisons between the studies are possible due to differences in the sequences analyzed in each study and their associated release modes. Nevertheless the following observations can be made:

- The sum of the release frequencies from NUREG/CR-6295 are lower than those from NUREG-0773 for all containment types, with the exception of the NUREG/CR-6295 LaSalle sequences. However, the higher release frequency for LaSalle is offset by lower release fractions at LaSalle.

- Where direct comparisons can be made (i.e., for bypass sequences in PWRs and containment failures before vessel breach in BWRs) the release fractions from NUREG/CR-6295 are significantly lower than those from NUREG-0773.

- For several sequences in NUREG/CR-6295, the release fractions appear to be comparable to or slightly greater than those from NUREG-0773 (e.g., PWR sequence RSEQ1 and BWR sequence RPB6 which have a release magnitude comparable to the largest PWR release and BWR release from NUREG-0773, respectively. However, the release frequencies reported in NUREG/CR-6295 for these sequences are one to two orders of magnitude lower than those from NUREG-0773, resulting in a lower risk impact.

- The release times and the difference in time between core uncovery and release to the atmosphere are generally comparable between the two studies.

Based on the comparisons provided above, the expected impacts, i.e., the frequency-weighted consequences, from the airborne pathway using the updated source term information would be much lower than previously predicted.

Table E-12. NUREG-0773 and NUREG/CR-6295 Large Source Terms (PWRs)

Source		Sequence	Frequency	Release Time (hr)	Release Duration (hr)	Post Core Uncovery Delta (hr) [(a)]	Iodine Release Fraction	Cesium Release Fraction
NUREG-0773	Surry	Event V (Bypass)	4×10^{-6}/yr	1	1	0.5	0.64	0.82
		TMLB'-δ (CF during CD)	3×10^{-6}/yr	2.5	0.5	1	0.31	0.39
		PWR-3 (CR during CD)	3×10^{-6}/yr	5	1.5	2	0.2	0.2
		Sum	1×10^{-5}/yr					
NUREG/CR-6295	Surry	RSUR1 [(b)] (CF at VB)	2.9×10^{-7}/yr	6	2	1	0.35	0.31
		RSUR4 [(b)] (Bypass)	1.6×10^{-6}/yr	1	2.5	0.7	0.12	0.12
		Sum	1.9×10^{-6}/yr					
	Sequoyah	RSEQ1 [(b)] (CF during CD)	2.8×10^{-7}/yr	5.5	2	0.5	0.59	0.62
		RSEQ2 [(b)] (CF at VB)	3.6×10^{-6}/yr	6	2	1	0.18	0.19
		RSEQ5 [(b)] (Bypass)	3.1×10^{-6}/yr	1	2.5	0.7	0.12	0.12
		Sum	7×10^{-6}/yr					

(a) For NUREG-0773, this represents the interval of time between the decision to take protective measures and the start of the release; for NUREG/CR-6295, this represents the time between core uncovery and the start of the release.
(b) These source terms have multiple plumes, which have been summed here for ease of comparison.
Bypass = fission product released from the reactor bypass the containment.
CF = containment failure.
CD = core damage.
VB = reactor vessel branch.

Table E-13. NUREG-0773 and NUREG/CR-6295 Large Source Terms (BWRs)

Source		Sequence	Frequency	Release Time (hr)	Release Duration (hr) [a]	Post Core Uncovery Delta (hr) [a]	Iodine Release Fraction	Cesium Release Fraction
NUREG-0773	Peach Bottom	AEα' (CF before VB)	2×10^{-9}/yr	0.8	0.5	0.5	0.3	0.6
		AEα (CF before VB, scrub)	1×10^{-9}/yr	0.8	0.5	0.5	0.2	0.4
		TCγ' (CF before CD)	2×10^{-6}/yr	1.5	2.0	1.0	0.5	0.6
		TW γ' (CF before CD)	3×10^{-6}/yr	50	2.0	40	0.1	0.3
		Sum	5×10^{-6}/yr					
NUREG/CR-6295	Peach Bottom	RPB1 [b] (CF at VB)	1.2×10^{-6}/yr	11.5	4.3	3.5	0.11	0.1
		RPB2 [b] (CF at VB)	1.0×10^{-6}/yr	7.3	4.3	2.5	0.11	0.1
		RPB6 [b] (CF at VB)	3×10^{-8}/yr	11.5	4.3	3.5	0.44	0.4
		Sum	2.2×10^{-6}/yr					
	LaSalle	RLAS1 [b] (CF before VB)	6.3×10^{-6}/yr	58	13.5	4.8	0.16	0.17
		RLAS2 [b] (CF at VB)	6.2×10^{-6}/yr	3.8	7.3	2.5	0.15	0.03
		RLAS3 [b] (CF at VB)	1.2×10^{-6}/yr	16.9	6.3	5.8	0.11	0.07
		RLAS4 [b] (CF before VB)	2.4×10^{-6}/yr	23.7	1.8	0.5	0.18	0.12
		Sum	1.6×10^{-5}/yr					
	Grand Gulf	RGG1 [b] (CF at VB)	8.4×10^{-7}/yr	3.6	4	2.6	0.23	0.11
		RGG3 [b] (Late CF)	1.2×10^{-6}/yr	14	4	13	0.15	0.01
		Sum	2×10^{-6}/yr					

(a) For NUREG-0773, this represents the interval of time between the decision to take protective measures and the start of the release; for NUREG/CR-6295, this represents the time between when the water level reaches 2 feet above the bottom of the active fuel and the start of the release.
(b) These source terms have multiple plumes, which have been summed here for ease of comparison.
CF = containment failure.
CD = core damage.
VB = reactor vessel branch.

E.3.3.2 Other Pathway Impacts

Since the comparison of the new source term information to that used in the 1996 GEIS environmental impact projection shows that the amount of release of radioactive material in a severe accident is estimated to be less than estimated in the 1996 GEIS, the environmental impacts from the other pathways (contamination of open bodies of water, groundwater contamination, and economic impacts) will also be less than estimated in the 1996 GEIS.

E.3.3.3 Conclusion

More recent source term information indicates that the timing from dominant severe accident sequences, as quantified in NUREG/CR-6295 (NRC 1997b), is comparable to the analysis forming the basis of the 1996 GEIS. In most cases, the release frequencies and release fractions are significantly lower for the more recent estimate. Thus, the environmental impacts used as the basis for the 1996 GEIS (i.e., the frequency-weighted consequences) are higher than the impacts that would be estimated using the more recent source term information.

It is worth noting that a significant effort is ongoing to re-quantify realistic severe accident source terms under the State-of-the Art Reactor Consequence Analysis (SOARCA) Project. Preliminary results indicate that source term timing and magnitude may be significantly lower than quantified in previous studies (NRC 2008a). This information will be incorporated, as appropriate, in future revisions of this document.

E.3.4 Impact of Power Uprates

Power uprates are defined as the process of increasing the maximum power level at which a nuclear power plant may operate. Although power uprates have been approved by the NRC since 1977, the effects of power uprates since 1996 were not taken into account for the GEIS. Extended power uprates began to be approved in 1998. For BWRs, it became common for a power uprate to be between 10 and 20 percent, and for PWRs, up to 5 percent. The purpose of this section is to provide an assessment of the impacts of power uprates on severe accident scenarios and their environmental impacts.

The process of license amendments for power uprates requires licensees to evaluate the effects of the uprate on the safety of the plant. Design basis accidents were analyzed to determine the change in possible dose, should an accident occur. Most commonly, loss of coolant accidents, control rod drop accidents and fuel handling accidents were assessed. Whole body and thyroid doses were determined for the exclusion area boundary, the outer edge of the low population zone, and the main control room. These values must meet 10 CFR Part 100 and 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 19 dose limits. The effects of power uprates on CDF and large early release frequency (LERF) are also assessed.

E.3.4.1 Airborne Pathway Impacts

Power uprates require using fuel with a higher percentage of uranium-235 or additional fresh fuel in order to derive more energy from the operation of the reactor. This results in a larger radionuclide inventory (particularly short-lived isotopes, assuming no change in burnup limits) in the core, than the same core at a lower power level. The larger radionuclide inventory represents a larger source term for accidents and can result in higher doses to offsite populations in the event of a severe accident. Typically, short-lived isotopes are the main contributor to early fatalities. As stated in NUREG-1449 (NRC 1993), short-lived isotopes make up 80 percent of the dose following early release.

LERF represents the frequency of sequences that result in early fatalities. Thus, the impact of a power uprate on early fatalities can be gauged by considering the impact of the uprate on the LERF metric. To this end, Table E-14 presents the change in LERF calculated by each licensee who has been granted a power uprate of greater than 10 percent. As can be seen, the increase in LERFs range from a minimal impact to an increase of 30 percent (with a mean of 8.8 percent). This change is judged to be small to moderate.

Table E-14. Changes in LERF for Extended Power Uprates >10 Percent

Plant	Percent Increase in Power	Percent Increase in Internal Event LERF
Brunswick 1, 2	15	4.5
Clinton	20	5.5
Dresden 2, 3	17	10
Duane Arnold	15.3	16
Ginna	16.8	19
Hope Creek	15	30
Quad Cities 1, 2	17.8	4
Susquehanna 1, 2	13	<1
Vermont Yankee	20	5
Mean	16.4	8.8

E.3.4.2 Other Pathway Impacts

As discussed in previous sections, the change in impacts due to other pathways is viewed to be bounded by the change in the airborne pathway, consistent with the results obtained in the 1996 GEIS.

E.3.4.3 Conclusion

Power uprates would result in a small to (in some cases) moderate increase in the environmental impacts from a postulated accident. However, taken in combination with the other information presented in this appendix, the increases would be bounded by the 95 percent UCB values in Tables 5.10 and 5.11 of the 1996 GEIS.

E.3.5 Impact of Higher Fuel Burnup

There has been continued movement toward higher fuel burnup, to allow for more efficient utilization of the fuel and longer operating cycles. An environmental assessment (EA) was published by the NRC in 1988 on the effects of increased peak burnup (to 60 GWd/MT, 5 percent by weight uranium-235). NUREG/CR-5009 (NRC 1988) is the basis for the EA. NUREG/CR-6703 (NRC 2001a) is a more current analysis using updated designs and data, and peak burnup to 75 GWd/MT.

The purpose of this section is to include the updated information from NUREG/CR-6703 into the GEIS to account for the effect of current and possible future increased fuel burnup on postulated accidents. Future peak burnups being considered are 62 GWd/MT for PWRs and 70 GWd/MT for BWRs.

E.3.5.1 Airborne Pathway Impacts

The environmental impacts of accidents where high burnup fuel is being used (assuming no change in plant power level) are due to the effects of an increased inventory of long-lived fission products. Long-lived fission products contribute primarily to latent health effects, and thus latent fatalities are used here as a measure of the impact of higher burnup fuel. Since latent fatalities are directly scalable to dose, the assessment is based upon the increase in population dose due to the use of high burnup fuel.

NUREG/CR-6703 (NRC 2001a) analyzed design basis accidents from full power for PWR and BWR reactors at different levels of fuel burnup. A PWR steam generator tube rupture and a BWR main steam line break were analyzed. Burnup was analyzed to 75 GWd/MT, at which point, fuel with more than 5 percent by weight uranium-235 would be required. As described on page 25 of that document, the models used do not account for natural processes and engineered safety features, so "more attention should be paid to trends in doses than to absolute values."

Table E-15 shows doses at the Exclusion Area Boundary (EAB) and the total population dose stated in NUREG/CR-6703. The EAB dose includes contributions from inhalation, and external dose. The total population dose also includes contributions from contaminated foods as well. The increase in population dose is moderate (~38 percent) from 42 to 75 GWd/MT for PWRs. For BWRs, the net increase in population dose is small (~8 percent). Although the analysis in NUREG/CR-6703 is for design basis accidents, the percentage increase in impacts would be generally similar for severe accidents.

E.3.5.2 Other Pathway Impacts

As discussed in previous sections, the change in impacts due to other pathways is viewed to be bounded by the change in the airborne pathway, consistent with the results obtained in the 1996 GEIS.

Table E-15. LOCA Consequences as a Function of Fuel Burnup

Reactor Type	Peak-Rod Burnup (GWd/MT)	Individual Dose at 0.8 km [(a)] (rem) [(b)]	Mean Total Population Dose (person-rem) [(b)]
PWR	42	10	940,000
	50	10	1,100,000
	60	10	1,200,000
	62	10	1,200,000
	65	11	1,200,000
	70	11	1,300,000
	75	11	1,300,000
BWR	60	10	1,300,000
	62	10	1,300,000
	65	10	1,300,000
	70	11	1,400,000
	75	11	1,400,000

(a) 0.8 km = 0.5 mi.
(b) Note that these doses are on a per event basis, not a frequency (per year) basis.

E.3.5.3 Conclusion

Increased peak fuel burnup from 42 to 75 GWd/MT for PWRs, and 60 to 75 GWd/MT for BWRs, results in small to moderate increases (up to 38 percent) in the environmental impacts in the event of a severe accident. However, taken in combination with the other information presented in this appendix, the increases would be bounded by the 95 percent UCB values in Tables 5.10 and 5.11 of the 1996 GEIS.

E.3.6 Impact from Accidents at Low Power and Shutdown Conditions

The 1996 GEIS did not include an assessment of the environmental impacts of accidents initiated at low power or shutdown conditions. These conditions include power levels less than 5 percent, shutdown (with or without maintenance or plant modifications under way), and fuel handling. The safety concern under these conditions is that plant configurations may be established where not all plant safety systems and features would be operable (e.g., containment integrity may not be required), and activities (e.g., plant modification) could be under way that could not be done while at full power. Accordingly, accidents initiated at such conditions may have different initiators, progress differently, and have different consequences than those initiated at full power conditions. In addition, operating experience has shown that events affecting fuel cooling do occur during shutdown operation. Accordingly, the industry implemented a number of voluntary measures in response to NRC generic letters and bulletins, and in 1991 developed guidelines for the assessment of shutdown management and implementation of safety improvements (NUMARC 1991). As discussed in SECY-97-168 (NRC 1997c), these voluntary industry initiatives resulted in improved safety.

The purpose of this section is to provide an assessment of the risk from postulated severe accidents at low power and shutdown conditions relative to the risk from postulated severe accidents at full power conditions, including a comparison against the findings in the 1996 GEIS.

The conditions assessed are:

- Plant operation at power levels between 0 and 5 percent;

- Shutdown with containment open; and

- Fuel handling inside the containment structure.

Several sources of information are available to support this assessment. These include studies that have been done assessing actual events and the risk from accidents at low power and shutdown conditions. These studies are: (1) NUREG-1449 (NRC 1993); (2) NUREG/CR-6143 (NRC 1995b); and (3) NUREG/CR-6144 (NRC 1995a). In addition, in 1997, the NRC staff recommended a proposed rule be considered to address shutdown conditions. Although the Commission did not approve going forward with the proposed rule (see SRM-97-168, NRC 1997d), the technical basis for the proposed rule provides additional useful information.

E.3.6.1 Airborne Pathway Impacts

NUREG-1449 (NRC 1993) presents an analysis of actual events that have occurred at low power and shutdown conditions. This analysis includes an estimate of the conditional core damage frequency associated with each event and an overall assessment of the range of total core damage frequencies (mean value) that could result from events at low power and shutdown conditions. This range was from 10^{-5}/yr to 10^{-4}/yr.

NUREG/CR-6143 (NRC 1995b) and NUREG/CR-6144 (NRC 1995a) provide low power and shutdown risk assessments for two plants (Grand Gulf and Surry). For Grand Gulf, the mean core damage frequency stated in NUREG/CR-6143 is approximately 2×10^{-6}/yr and for Surry (NUREG/CR-6144) it is 4×10^{-6}/yr. However, such core damage frequencies need to be considered with respect to their consequences. Due to the decay time associated with low power and shutdown conditions (i.e., decay of short-lived isotopes and lower decay heat) and, in most cases, longer times available to take mitigative action, the offsite consequences would be less than for accidents from full power. However, in certain plant operating states, the containment in those states may be open. Thus, a higher conditional probability for containment bypass might exist.

NUREG/CR-6143 and NUREG/CR-6144 also provide estimates of the offsite airborne pathway consequences on human health from accidents (internal events only) at low power and shutdown conditions. Tables E-16 and E-17 list these estimates for Grand Gulf and Surry, respectively. Also shown for each plant are the airborne pathway offsite consequence results for accidents from full power from NUREG-1150 (NRC 1990c) (for internal events) and from the 1996 GEIS. As can be seen, the airborne pathway risk and consequences from accidents at low power and shutdown are comparable to those from full power, as quantified in these studies. Although the impacts for low power and shutdown conditions are somewhat greater (by about a factor of 2 to 5) for certain metrics, these differences are small in an absolute sense. Moreover, the consequences of accidents from low power and shutdown are significantly less than those stated in the 1996 GEIS (by more than an order of magnitude). Thus, even though the 1996 GEIS estimates regarding the airborne pathway environmental impact are for internal events only, their conservatism causes them to bound the impacts from accidents at low power and shutdown.

Table E-16. Impacts of Low Power and Shutdown Accidents (Grand Gulf)

Impact	Low Power/Shutdown Accidents NUREG/CR-6143 (95th percentile values)	Full Power Accidents Internal Events NUREG-1150 (95th percentile values)	Full Power Accidents Internal Events 1996 GEIS (95th percentile values)
Individual risk			
- EF [(a)] (1 mi)	$\sim 3 \times 10^{-10}$/yr	$\sim 1.5 \times 10^{-10}$/yr	
- LF [(b)] (10 mi)	$\sim 5 \times 10^{-9}$/yr	$\sim 1 \times 10^{-9}$/yr	
Total person-rem per year (entire region)	~28	~15	1441
Total early fatality risk	$\sim 4 \times 10^{-8}$/yr	$\sim 2.5 \times 10^{-8}$/yr	2.8×10^{-3}/yr
Total latent fatality risk	$\sim 1 \times 10^{-2}$/yr	$\sim 2.5 \times 10^{-3}$/yr	1.0/yr
CDF	5.6×10^{-6}/yr	1.2×0^{-5}/yr	2.4×10^{-5}/yr [(c)]

(a) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(b) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.
(c) This is the CDF from the Grand Gulf original EIS.

Table E-17. Impacts of Low Power and Shutdown Accidents (Surry)

Impact	Low Power/Shutdown Accidents (NUREG/CR-6144) (95th percentile values)	Full Power Accidents Internal Events NUREG-1150 (95th percentile values)	Full Power Accidents Internal Events 1996 GEIS (95th percentile values)
Individual risk			
- EF [(a)] (1 mi)	$\sim 7 \times 10^{-9}$/yr	$\sim 4 \times 10^{-8}$/yr	
- LF [(b)] (10 mi)	$\sim 7 \times 10^{-9}$/yr	$\sim 1 \times 10^{-8}$/yr	
Total person-rem per year (entire region)	~1.3	~150	1200
Total early fatality risk	$\sim 2 \times 10^{-7}$/yr	$\sim 4 \times 10^{-6}$/yr	1.6×10^{-2}/yr
Total latent fatality risk	$\sim 5 \times 10^{-2}$/yr	$\sim 2.5 \times 10^{-2}$/yr	0.9/yr
CDF	1.9×10^{-5}/yr	1.3×10^{-4}/yr	

(a) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(b) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

E.3.6.2 Other Pathway Impacts

For the impacts from surface water and groundwater contamination from accidents at low power and shutdown, the estimates for accidents from full power (internal events only) in the 1996 GEIS can be used for comparison. With the airborne impacts from accidents at low power and shutdown (i.e., person-rem/yr) estimated to be less than the impacts from accidents at full power, the surface water contamination should likewise be less.

Section 5.3.3.4 of the 1996 GEIS concluded that the contribution of risk from the groundwater pathway for at-power accidents "generally contributes only a small fraction of that risk attributable to the atmospheric pathway but in a few cases may contribute a comparable risk." Groundwater contamination due to basemat melt-through would be less likely than for accidents at full power, due to the lower decay heat associated with low power and shutdown events. Thus, the risks portrayed in the 1996 GEIS are considered to be bounding.

With respect to the economic impacts, the lower estimated person-rem/yr from accidents at low power and shutdown should also result in lower economic impacts than from accidents at full power. This conclusion is consistent with the regulatory analysis supporting the proposed rule on shutdown conditions. In that analysis, the offsite property damage estimate for a severe accident at the Surry Plant was $800 million. Considering the frequency of such an event at low power and shutdown conditions where containment is either open or fails (approximately 3×10^{-6}/yr from NUREG/CR-6144), the annualized economic impact would be approximately $2400 per year. This is much less than the $1,146,600 per year stated in Table 5.31 of the 1996 GEIS for the economic impact at Surry of an accident from full power.

E.3.6.3 Conclusion

In summary, it is concluded that the environmental impacts from accidents at low power and shutdown conditions are generally comparable to those from accidents at full power when comparing the NUREG/CR-6143 (NRC 1995b) and NUREG/CR-6144 (NRC 1995a) values to NUREG-1150 (NRC 1990c) values. Although the impacts for low power and shutdown conditions could be somewhat greater than for full power (for certain metrics), the 1996 GEIS estimates of the environmental impact of severe accidents bound the potential impacts from accidents at low power and shutdown with margin. Finally, as cited above and discussed in SECY-97-168 (NRC 1997c), industry initiatives taken during the early 1990s have also contributed to the improved safety of low power and shutdown operation.

E.3.7 Impact from Accidents at Spent Fuel Pools

The 1996 GEIS did not include an explicit assessment of the environmental impacts of accidents at the spent fuel pools (SFPs) located at each reactor site. The 1996 GEIS did, however, discuss qualitatively (see Section 5.2.3.1) the reasons why the impact of accidents at SFPs would be much less than that from reactor accidents. Thus, in Table B-1 of 10 CFR Part 51, it was concluded that accidents at SFPs could be classified as Category 1 and not require further analysis in support of license renewal. This was primarily due to the fact that the resolution of Generic Safety Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools," concluded that the risk from accidents at SFPs was low and, accordingly, no additional regulatory action was necessary. The analysis supporting this conclusion is contained in NUREG-1353 (NRC 1989).

Since issuance of the 1996 GEIS, additional analysis of the risk from spent fuel pool accidents has been performed and documented. The key document in this regard is NUREG-1738 (NRC 2001b). As a result of the September 11, 2001, terrorist attacks, additional analysis has been performed on SFP security, although much of this work is security-related information and not publically available. In addition, there are two other major activities of note: (1) a 2004 to 2005 study performed by the National Academies (National Research Council 2006b), and (2) a 2006 Petition for Rulemaking (see NRC 2008d).

The purpose of this section is to consider the risk from severe accidents in SFPs relative to the risk from severe accidents in reactors, including a comparison against the findings in the 1996 GEIS. The impacts considered are only those from spent fuel in the pool. Spent fuel assembly dry cask safety is not included, since cask safety is addressed under 10 CFR Part 72.

E.3.7.1 Airborne Pathway Impacts

The analysis contained in NUREG-1738 (NRC 2001b) assesses the impacts from accidents at a typical SFP at decommissioning nuclear power plants. The impacts assessed are those associated with the airborne pathway impact on human health. The analysis covers a range of decay times for the fuel stored in the pool, a number of initiating events, and some variations in emergency evacuation times, fission product releases, and seismic hazard. The initiating events included in the analysis are listed below.

- Seismic (for central and eastern United States sites)[a]

- Cask drop

- Loss of offsite power

- Internal fire

(a) Excludes Diablo Canyon, San Onofre, and WNP-2 (Columbia).

- Loss of pool cooling

- Loss of pool coolant inventory

- Accidental aircraft impact (although not deliberate impacts)

- Tornado missile

The SFP inventory assumed was 3½ core loads with an average fuel burnup of 60 GWd/MT. Although intended to be representative of the SFP in a typical decommissioning PWR or BWR, the assumed core inventory, burnup, and decay time range is also reasonably representative of that for operating PWRs and BWRs while at power. In addition to the above results, NUREG-1738 also assessed the risk from recriticality in the SFP and concluded that, given licensee surveillance and monitoring programs, the potential risk of such events is small.

The analysis conducted in NUREG-1738 assumed the plant was in its decommissioning phase and, thus, has fewer protective features for the prevention or mitigation of SFP accidents. Therefore, the impact analysis contained in NUREG-1738 is considered conservative. In addition, the NUREG-1738 impact analysis assumed that the zirconium fuel cladding would start to burn and the event would be nonrecoverable when the water level in the pool falls to within 3 feet above the top of the assemblies' active fuel region. This is also conservative and does not credit potential operator actions to prevent or mitigate SFP accidents beyond that point, or the fact that for a wide range of conditions spent fuel can be air-cooled. Table E-18 summarizes the airborne pathway impact on human health from a severe accident in a SFP (from the NUREG-1738 analysis) for a time period of 1 month to 2 years (i.e., a typical operating reactor fuel cycle). Ranges are given to account for differences in emergency planning and seismic hazard assumptions. The site characteristics used in NUREG-1738 were those from the Surry plant. Thus Table E-18 also presents Surry's site-specific results from NUREG-1150 (NRC 1990c) and the 1996 GEIS.

As can be seen in Table E-18, the impacts from SFP accidents at Surry (as calculated in NUREG-1738) are generally comparable to or smaller than the analogous NUREG-1150 internal event reactor accidents when using the low ruthenium release source term. For the high ruthenium release source term, the NUREG-1738 results are generally higher than the accompanying reactor results from NUREG-1150. For either source term, the NUREG-1738 impacts are much less than the conservative estimates of full power reactor accidents at Surry as estimated in the 1996 GEIS.

The impacts stated in NUREG-1738 are also similar to those calculated for the resolution of Generic Safety Issue 82, in which NUREG-1353 (NRC 1989) calculated a best-estimate population dose of 16 person-rem per year.[(a)] While the NUREG-1738 results are for the Surry

Table E-18. Impacts of Accidents at SFPs from NUREG-1738 [(a)]

	Spent Fuel Pools [(b)] (1 month to 2 years decay time)		Reactors		
	NUREG-1738 Low Ru Release (range of means)	NUREG-1738 High Ru Release (range of means)	NUREG-1150 Surry (mean)	NUREG-1150 Surry (95th percentile)	1996 GEIS Surry (95th percentile)
Individual risk					
- EF [(c)] (1 mi)	2×10^{-9} to 7×10^{-9}/yr	6×10^{-8} to 1×10^{-7}/yr	1.5×10^{-8}/yr	4×10^{-8}/yr	
- LF [(d)] (10 mi)	1×10^{-8}/yr	2×10^{-7}/yr	1.5×10^{-9}/yr	1×10^{-8}/yr	
Total person-rem per year	2.5 to 12 (50 mi)	8 to 60 (50 mi)	6 (50 mi) 30 (entire region)	30 (50 mi) 150 (150 mi)	1200 (150 mi)
Total early fatality risk	2×10^{-7} to 6×10^{6}/yr	1×10^{-5} to 5×10^{-4}/yr	1×10^{-6}/yr	3×10^{-6}/yr	1.6×10^{-2}/yr

(a) All values are approximate.
(b) Values are obtained from Figures 3.7-3, 3.7-4, 3.7-7, and 3.7-8 of NUREG-1738.
(c) EF = early fatality risk. The individual early fatality risk within one mile is the frequency (per year) that a person living within one mile of the site boundary will die within a year due to the accident. The entire population within one mile is considered to obtain an average value.
(d) LF = latent fatality risk. The individual latent cancer fatality risk within 10 miles is the frequency (per year) that a person living within 10 miles of the plant will die many years later from cancer due to radiation exposure received from the accident. The entire population within 10 miles is considered to obtain an average value.

site, individual risk metrics for early fatalities and latent fatalities should be relatively insensitive to the site-specific population (see pg. 3-28 of NUREG-1738) because these metrics reflect doses to the close-in population. In addition, while results are presented for both the low and high ruthenium source term, the low ruthenium source term is still viewed as the more accurate representation. Therefore, the risk and environmental impact from fires in SFPs as analyzed in NUREG-1738 are expected to be comparable to or lower than those from reactor accidents and are bounded by the 1996 GEIS.

Since the issuance of NUREG-1738 (NRC 2001b), and subsequent to the terrorist attacks of September 11, 2001, significant additional analyses have been performed that support the view that the risk of a successful terrorist attack (i.e., one that results in a zirconium fire) is very low. These analyses were conducted by the Sandia National Laboratories and are collectively referred to herein as the “Sandia studies.” The Sandia studies are sensitive security-related information and are not available to the public. The Sandia studies considered spent fuel

(a) Taken from the Executive Summary of that report: total dose = 8×10^{6} person-rem; event frequency = 2×10^{-6} per year.

loading patterns and other aspects of a pressurized-water reactor SFP and a boiling-water reactor SFP, including the role that the circulation of air plays in the cooling of spent fuel. The Sandia studies indicated that there may be a significant amount of time between the initiating event (i.e., the event that causes the SFP water level to drop) and the spent fuel assemblies becoming partially or completely uncovered. In addition, the Sandia studies indicated that for conditions where air cooling may not be effective in preventing a zirconium fire, there is a significant amount of time between the spent fuel becoming uncovered and the possible onset of such a zirconium fire, thereby providing a substantial opportunity for both operator and system event mitigation.

The Sandia studies, which more fully account for relevant heat transfer and fluid flow mechanisms, also indicated that air cooling of spent fuel would be sufficient to prevent SFP zirconium fires at a point much earlier following fuel offload from the reactor than previously considered (e.g., in NUREG-1738). Thus, the fuel is more easily cooled, and the likelihood of a zirconium fire is therefore reduced.

Furthermore, additional mitigation strategies implemented subsequent to September 11, 2001, enhance spent fuel coolability and the potential to recover SFP water level and cooling prior to a potential zirconium fire. The Sandia studies also confirmed the effectiveness of these additional mitigation strategies to maintain spent fuel cooling in the event the pool is drained and its initial water inventory is reduced or lost entirely. Based on the more rigorous accident progression analyses, the recent mitigation enhancements, and NRC site evaluations of every SFP in the United States, the risk of an SFP zirconium fire initiation is expected to be less than reported in NUREG-1738 (NRC 2001b) and previous studies. For additional information on SFP safety and security, the reader is referred to the NRC's response to a National Academy of Sciences study on the topic (NRC 2005a) and the NRC's response to a recent Petition for Rulemaking (NRC 2008d).

E.3.7.2 Other Pathway Impacts

The NUREG-1738 (NRC 2001b) analysis did not address the impacts with respect to the other pathways (open bodies of water and groundwater). The 1996 GEIS estimated these impacts for reactor accidents from full power (internal events only) using the results from plant-specific reactor accident analysis to assess contamination of open bodies of water and from the Liquid Pathway Generic Study (NUREG-0440, NRC 1978) to assess the contamination of groundwater from basemat melt-through accidents.

In both cases, the impacts on human health from surface water and groundwater contamination are only a small fraction of those impacts from the airborne pathway, except in a few cases where the impacts are comparable. With the impacts from the airborne pathway associated with spent fuel pool accidents (as stated in NUREG-1738) being comparable to the impacts from reactor accidents, as stated in NUREG-1150 (NRC 1990c), the impacts from SFP-related surface water and groundwater contamination may also be comparable, even though the SFP fuel inventory is several times that of the reactor. This is due to the lower probability of occurrence of SFP accidents, the effects of decay of the fission products on the radionuclide inventory, and the lower energy density of the fuel inventory, which makes basemat melt-through more unlikely.

The same conclusion can also be drawn with respect to the economic impacts. These impacts are related to the likelihood of the accidents and the cost of cleanup and food interdiction. Even with higher fuel inventories, the lower likelihood of accidents in the SFP reduces the economic impacts. For example, the UCB economic impact identified in Table 5.31 in the 1996 GEIS from full power reactor accidents at Surry is approximately 1.1×10^6 dollars/yr. The worst-case economic impacts estimated in past studies for SFP accidents ranged from approximately 1.8×10^4 dollars/yr to 1.2×10^5 dollars/yr.[(a)]

An issue related to the groundwater pathway that has received significant attention since the issuance of the 1996 GEIS is leakage of water from SFPs (or related systems) at Salem Unit 1, Indian Point Units 1 and 2, and Seabrook. Instances of this kind are adequately monitored and addressed via existing regulatory programs, and do not fall within the scope of this section. For more information on this topic, the reader is referred to NUREG-0933, Supplement 31, Section 3, Issue 202 (NRC 2007d) and NRC 2008b.

E.3.7.3 Conclusion

In summary, it is concluded that the environmental impacts from accidents at SFPs (as quantified in NUREG-1738 [NRC 2001b]) can be comparable to those from reactor accidents at full power (as estimated in NUREG-1150 [NRC 1990c]). Subsequent analyses performed, and mitigative measures employed, since 2001 have further lowered the risk of this class of accidents. In addition, even the conservative estimates from NUREG-1738 are much less than the impacts from full power reactor accidents as estimated in the 1996 GEIS. Therefore, the environmental impacts stated in the 1996 GEIS bound the impact from SFP accidents.

E.3.8 Impact of the Use of BEIR VII Risk Coefficients

Section 5.3.3.2.2 from the 1996 GEIS discussed adverse health effects from exposure to radiation and referenced several National Academy of Sciences reports (BEIR I, III, and V) (National Research Council 1972, 1980, 1990) as sources of risk coefficients for fatal cancers

(a) The former estimate uses information from Tables C.95 and C.101 of NUREG/BR-0184 (NRC 1997a), while the latter uses information from Tables 5.1.1 and 5.1.2 of NUREG-1353 (NRC 1989).

(i.e., latent fatalities) associated with radiation exposure. Benchmark evaluations of the exposure index methodology employed by the 1996 GEIS were conducted using the MELCOR Accident Consequence Code System (MACCS), as described in Section 5.3.3.2.3 of the original GEIS. MACCS is the predecessor of the currently used MACCS2 code, and represented the state-of-the-art for assessing risks associated with postulated severe reactor accidents at the time of the original GEIS. That study used a linear cancer model based on the BEIR V report (National Research Council 1990). The code-to-code comparisons suggest that latent fatality values in the FESs are an order of magnitude too low. Therefore, to account for this, the latent fatality results predicted from the FES values were multiplied by a factor of 10 to obtain the final predicted latent fatality results in the 1996 GEIS. This adjustment in combination with the use of 95th percentile UCB values ensured that the basis for health effects would be conservative.

In 2006, the National Research Council's Committee on the Biological Effects of Ionizing Radiation (BEIR) published BEIR VII, entitled *Health Risks from Exposure to Low Levels of Ionizing Radiation* (National Research Council 2006a). BEIR VII provides estimates of the risk of incidence and mortality for males and females (see Section 3.9.1.4 and Appendix D of this report for more information). There is a difference of approximately 20 percent in the fatal cancer risk coefficient based on International Commission on Radiological Protection (ICRP) recommendation (as described in ICRP 1991) and the BEIR VII report. The difference of 20 percent is within the margin of uncertainty associated with these estimates (see Appendix D.8.1.4 for a detailed discussion of the BEIR VII report).

The NRC staff completed a review of the BEIR VII report and documented its findings in NRC 2005c. In this paper, the NRC staff concluded that the findings presented in the BEIR VII report agree with the NRC's current understanding of the health risks from exposure to ionizing radiation. The NRC staff agreed with the BEIR VII report's major conclusion 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 process the NRC uses to develop its standards of radiological protection. Therefore, the NRC's regulations continue to be adequately protective of public health and safety and the environment. This general topic is discussed further in a 2007 denial of a Petition for Rulemaking, as discussed in NRC 2007e.

E.3.9 Uncertainties

Section 5.3.5 in the 1996 GEIS provides a discussion of the uncertainties associated with the analysis in the GEIS and in the individual plant EISs used to estimate the environmental impacts of severe accidents. The uncertainties discussed covered:

- The probability of an accident.

- The quantity and chemical form of radioactivity released.
- Atmospheric dispersion modeling for the radioactive plume transport, including:
  - Duration, energy release, and in-plant radionuclide decay time;
  - Meteorological sampling scheme used;
  - Emergency response effectiveness and warming time;
  - Dose conversion factors and dose-response relationships for early health consequences;
  - Dose conversion factors and dose-response relationships for latent health consequences;
  - Chronic exposure pathways; and
  - Economic data and modeling.
- Assumption of normality for random error components.
- The exposure-index method, and
  - Selection of exposure index parameters;
  - Selection of distances;
  - Regressing early fatalities for only large plants; and
  - Normalization of plants for latent fatalities, costs, and dose.

The 1996 GEIS recognized that the uncertainties in the estimated impacts could be large (i.e., from a factor of 10 to 1000). Reference was made to NUREG-1150 (NRC 1990c) as providing more state-of-the-art risk analysis that also considered uncertainties and that the cumulative effect of this analysis shows a reduction in risk.

In an attempt to help compensate for uncertainties, the 1996 GEIS used very conservative estimates of environmental impacts. These included:

- Use of the 95th percentile confidence values in estimating airborne pathway and economic impacts;
- Use of site-specific analysis for estimating surface water pathway impacts; and
- Use of NUREG-0440 (NRC 1978) results to bound the estimated groundwater pathway impacts.

It was generally concluded that even with uncertainties, the environmental impacts estimated in the 1996 GEIS were adequate for use.

Many of these same uncertainties also apply to the analysis used in this update. However, as discussed in Sections E.3.1 through E.3.8 of this revision, more recent information is used to supplement the estimate of the environmental impacts contained in the 1996 GEIS. In effect, the assessments contained in Sections E.3.1 through E.3.8 of this revision provide additional information and insights into items that could be considered areas of uncertainty associated with the 1996 GEIS.

This more recent information also provides insights on additional sources of uncertainty from those discussed in the 1996 GEIS. Each of these insights on additional sources of uncertainty is discussed below.

E.3.9.1 Emergency Planning (EP)

The 1996 GEIS (in Section 5.3.5.3) included a discussion on uncertainties associated with EP. However, no quantitative information on the magnitude of these uncertainties was presented. To provide a perspective on the magnitude of the uncertainty, the following information is provided.

NUREG-1150 (NRC 1990c) and the SFP accident analysis in NUREG-1738 (NRC 2001b) specifically assessed the effect of different EP assumptions on the airborne pathway impacts. NUREG-1150 assessed four alternative emergency response modes in addition to its base case (99.5 percent of the population within 10 mi was evacuated in 4.5 hours with no sheltering). These alternatives were assessed for reactor accidents from full power, with the Surry and Peach Bottom analyses including seismic and fire initiated events as well as internal events. For the worst case (no evacuation, no sheltering, and early relocation), the estimated early fatalities per year were approximately a factor of 10 higher than the base case.

The SFP accident analysis in NUREG-1738 also specifically assessed the effect of variations in emergency evacuation. The variations were assessed against the base case used in the NUREG-1150 risk analysis. Doses beyond 20 mi were not calculated. Cases where the evacuation was faster, slower, and where fewer people were evacuated were assessed. As can be expected, improved evacuation scenarios resulted in smaller impacts, and relaxed evacuation scenarios resulted in additional impacts. The impacts associated with relaxed evacuation scenarios did go up, but only a few percent in societal dose (i.e., person-rem) and up to a factor of 10 in early fatalities. However, these impacts are still far below the conservative characterization of the impacts for reactor accidents contained in the original GEIS.

E.3.9.2 Population Increase

The assessments of environmental impacts contained in NUREG-1150 (NRC 1990c), NUREG-1738 (NRC 2001b), NUREG-1449 (NRC 1993), NUREG/CR-5305 (NRC 1992), NUREG/CR-6143 (NRC 1995b) and NUREG/CR-6144 (NRC 1995a) are all based on populations that existed in the mid-1980s to mid-1990s. The 1996 GEIS estimated impacts at the mid-year of each plant’s license renewal period (i.e., 2030 to 2050). To adjust the impacts estimated in the NUREGs and NUREG/CRs to the mid-year of the assessed plant's license renewal period, the information (i.e., exposure indexes [EIs]) in the 1996 GEIS can be used. The EIs adjust a plant's airborne and economic impacts from the year 2000 to its mid-year license renewal period based on population increases. These adjustments result in anywhere from a 5 to a 30 percent increase in impacts, depending upon the plant being assessed. Therefore, the effect of increased population around the plant does not generally result in significant increases in impacts.

E.4 Severe Accident Mitigation Alternatives (SAMAs)

In Section 5.4 of the 1996 GEIS, the purpose and role of severe accident mitigation design alternatives (SAMDAs) in the license renewal process are discussed. Severe accident mitigation alternatives (SAMAs) include design alternatives (SAMDAs) and alternatives that involve changes in procedures and training. With respect to this revision, the purpose and objectives of SAMAs remain unchanged.

The purpose of this section is to discuss the impacts on SAMA analysis of the assessments presented in this revision. By way of an introduction, it should be noted that since publication of this 1996 GEIS, many improvements have occurred that have enhanced reactor safety. These are discussed in Section E.2 of this revision and, as can be seen in improved plant performance measures, have been effective. Even so, the SAMA analyses that have been performed to date have found SAMAs that were cost-beneficial, or at least possibly cost-beneficial subject to further analysis, in approximately half of the plants. However, none of the SAMAs identified related to managing the effects of aging during the period of extended operation. Therefore, they did not need to be implemented as part of license renewal, pursuant to the regulations in 10 CFR Part 54. In general, the cost-beneficial SAMAs were identified for further evaluation by the licensee under the current operating license. In several cases, the applicant has decided to implement the modifications even though they were not related to license renewal (NRC 2006a).

The SAMA analysis performed in support of license renewal has focused on those areas of greatest risk (accidents initiated by internal and external events) and on measures that could result in the greatest risk reduction in a cost-beneficial fashion. Even though the 1996 GEIS did not explicitly consider accidents initiated by external events in estimating the environmental impacts from severe accidents, the environmental impacts from external events have been included in an applicant's SAMA analysis for license renewal, by following the guidance contained in NEI 05-01, Rev. A (NEI 2005). This guidance (which was endorsed by the NRC in Interim Staff Guidance LR-ISG-2006-03, [NRC 2007a]) calls for the consideration of external events in assessing SAMAs. External events are considered by multiplying the internal event risk to account for any increase in risk caused by external events. The multiplication factor is determined on a plant-specific basis considering previous and current external event analysis (e.g., IPEEE). Given the existing information on the contribution to risk from external events, the approach described in NEI 05-01, Rev. A continues to be a reasonable approach to address the external event risk contribution.

This revision has assessed other potential contributors to risk. Therefore, it is reasonable to assess whether those contributors should be included in the SAMA analysis. Specifically, these contributors are:

- Power uprates;
- The use of higher burnup fuel;
- Accidents from low power and shutdown conditions; and
- Accidents at SFPs.

With respect to power uprates and the use of higher burnup fuel, the increased impacts are small compared to the impacts in the 1996 GEIS, and these factors are included in any severe accident assessment for license renewal. Therefore, no additional SAMA analysis is required.

With respect to accidents from low power and shutdown conditions (which are not currently included in SAMA analysis), the likelihood and risks are generally lower than those of accidents from full power. In addition, there have been industry initiatives to improve low power and shutdown safety. It is also likely that some SAMAs identified as a result of assessing risks from accidents at full power would provide benefits to accidents from low power. Therefore, the potential for cost-effective SAMAs related to low power and shutdown accidents is substantially less than for accidents at full power. Accordingly, it is reasonable to continue to exclude low power and shutdown conditions from SAMA consideration.

With respect to accidents in SFPs, the additional mitigative measures implemented following the attacks of September 11, 2001, make the potential for cost-effective SAMAs related to SFP accidents substantially less than for reactor accidents. Therefore, it is reasonable to conclude that accidents at SFPs do not need to be considered in the SAMA analysis, and no change is warranted from its current Category 1 designation in Table B-1 of 10 CFR Part 51. Accordingly, the current SAMA process is considered adequate for use in future SAMA analyses.

E.5 Summary and Conclusion

The 1996 GEIS estimated the environmental impacts on human health and economic factors from full power severe reactor accidents initiated by internal events. Sections E.3.1 through E.3.8 of this revision assessed the impacts of new information and additional accident considerations on the environmental impact of severe accidents contained in the 1996 GEIS. In addition, the impact of uncertainties associated with the new information is assessed in Section E.3.9. The purpose of this section is to discuss the cumulative effects of the new information on the environmental impacts and uncertainties stated in the 1996 GEIS and to state what conclusions can be drawn.

The different sources of new information can be generally categorized by their effect of either decreasing, not affecting, or increasing the best-estimate environmental impacts associated with postulated severe accidents. Those areas where a decrease in best-estimate impacts would be expected are:

- New internal events information (decreases by an order of magnitude)
- New source term information (significant decreases)

Areas likely leading to either a small change or no change include:

- Use of BEIR VII risk coefficients

Lastly, those areas leading to an increase in best-estimate impacts would consist of:

- Consideration of external events (comparable to internal event impacts)
- Power uprates (small to moderate increase)
- Higher fuel burnup (small to moderate increases)
- Low power and shutdown events (could be comparable to internal event impacts)
- Spent fuel pool accidents (could be comparable to internal event impacts)

Given the difficulty in conducting a rigorous aggregation of these results (due to the differences in the information sources utilized), a fairly simple approach is taken. The latter group contains three areas where the increase could be comparable to the current risk and two areas where the increase could approach 30 to 40 percent. The net increase from these five areas would therefore be approximately 470 percent[a] (increase by a factor of 4.7). The reduction in risk due to newer internal event information would account for a decrease by a factor of 5 to 100. Some of the reduction in internal event risk is due to newer source term information, so this area will not be double-counted here. The net effect of an increase on the order of 500 percent and a decrease on the order of 500 percent to 10,000 percent would be a reduction in estimated impacts.

Furthermore, even if one assumed that the net effect of the new information was no change in risk, the information provided throughout this appendix has demonstrated that the level of conservatism in the upper bound estimates utilized in the 1996 GEIS is much larger than the individual (or cumulative) deltas from the updated information. In particular, Section E.3.1 demonstrated that the GEIS values were a factor of 2 to 4 higher than the underlying EIS values.

With respect to uncertainties, the 1996 GEIS contained an assessment of uncertainties in the information used to estimate the environmental impacts. Section 5.3.5 of the 1996 GEIS discusses the uncertainties and concludes that they could cause the impacts to vary anywhere from a factor of 10 to a factor of 1000. This range of uncertainties bounds the uncertainties discussed in Section E.3.9 above, which ranged from a factor of 3 to 10, as well as the uncertainties brought out by the other sources of new information.

Given the discussion in Sections E.3.1 through E.3.8, it is concluded that the reduction in environmental impacts from the use of new information outweighs any increases resulting from new considerations. As a result, the findings in the 1996 GEIS remain valid. In addition, it is reasonable that in license renewal applications, the impacts from reactor accidents at full power, including internal and external events, should continue to be considered in assessing SAMAs. The impacts of all other new information do not contribute sufficiently to the environmental impacts to warrant their inclusion in the SAMA analysis, since the likelihood of finding cost-effective plant improvements is small. Table E-19 provides a summary of the conclusions discussed above.

(a) This approximation simply assumes that each comparable area results in an increase of 100 percent and the other two areas (uprates and burnup) each result in an increase of 35 percent.

Table E-19. Summary of Conclusions

Topic (Section)	Conclusions
New Internal Events Information (Section E.3.1)	New information on the risk and environmental impacts of severe accidents caused by internal events indicates that PWR and BWR CDFs are generally comparable to or less than those forming the basis of the 1996 GEIS. In some cases, these differences are significant (approaching one order of magnitude). Comparison of population dose from newer assessments illustrates a reduction in impact by a factor of 5 to 100 when compared to older assessments, and an additional factor of 2 to 4 due to the conservatism built into the 1996 GEIS values. This would also mean that contamination of open bodies of water and economic impacts would, in most cases, be significantly less. Additionally, the likelihood of basemat melt-through accidents is significantly less than that used in the analysis supporting the 1996 GEIS.
Consideration of External Events (Section E.3.2)	The 1996 GEIS did not explicitly consider severe accidents initiated by external events in assessing environmental impacts. When the environmental impacts of external events are considered, they can be comparable to those from internal events; however, they are generally significantly lower than the estimates used in the 1996 GEIS. This conclusion would also apply to the contamination of open bodies of water and groundwater and economic impacts.
New Source Term Information (Section E.3.3)	More recent source term information indicates that the timing from dominant severe accident sequences, as quantified in NUREG/CR-6295, is comparable to the analysis forming the basis of the 1996 GEIS. In most cases, the release frequencies and release fractions are significantly lower for the more recent estimate. Thus, the environmental impacts used as the basis for the 1996 GEIS are higher than the impacts that would be estimated using the more recent source term information.
Power Uprates (Section E.3.4)	Based on a comparison of the change in LERF for extended power uprates, a small to moderate increase in environmental impacts results from the increase in operating power level.
Higher Fuel Burnup (Section E.3.5)	Increased peak fuel burnup from 42 to 75 GWd/MT for PWRs, and 60 to 75 GWd/MT for BWRs, is estimated to result in small to moderate increases (up to 38 percent) in the environmental impacts in the event of a severe accident.
Consideration of Low Power and Shutdown Events (Section E.3.6)	The environmental impacts from accidents at low power and shutdown conditions are generally comparable to those from accidents at full power when comparing the NUREG/CR-6143 and NUREG/CR-6144 values to NUREG-1150 values. Even so, the 1996 GEIS estimates of the environmental impact of severe accidents bound the potential impacts from accidents at low power and shutdown. Finally, as cited above and discussed in SECY-97-168, industry initiatives taken during the early 1990s have also contributed to the improved safety of low power and shutdown operation.

Table E-19. Summary of Conclusions

Topic (Section)	Conclusions
Consideration of Spent Fuel Pool Accidents (Section E.3.7)	The environmental impacts from accidents at SFPs (as quantified in NUREG-1738) can be comparable to those from reactor accidents at full power (as estimated in NUREG-1150). Subsequent analyses performed, and mitigative measures employed, since 2001 have further lowered the risk of this class of accidents. In addition, even the conservative estimates from NUREG-1738 are much less than the impacts from full power reactor accidents as estimated in the 1996 GEIS.
Use of BEIR VII Risk Coefficient (Section E.3.8)	Use of newer risk coefficients such as in BEIR VII is expected to have a small impact on the results presented in the 1996 GEIS.
Uncertainties (Section E.3.9)	The impact and magnitude of uncertainties, as estimated in the 1996 GEIS, bound the uncertainties introduced by the new information and considerations.
SAMAs (Section E.4)	The current process and scope of SAMA analysis are sufficient for determining the need for additional mitigative measures.
Summary and Conclusion (Section E.5)	Given the new and updated information, the reduction in estimated environmental impacts from the use of new internal event and source term information outweighs any increases from the consideration of external events, power uprates, higher fuel burnup, low power and shutdown risk, and SFP risk.

E.6 References

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 71. *Code of Federal Regulations*, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

10 CFR Part 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

10 CFR Part 73. *Code of Federal Regulations*, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials."

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

International Commission on Radiological Protection (ICRP). 1991. *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Pergamon Press, Oxford, United Kingdom.

National Research Council. 1972. *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation (BEIR I)*. National Academies Press, Washington, D.C.

National Research Council. 1980. *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation (BEIR III)*. National Academies Press, Washington, D.C.

National Research Council. 1990. *Health Effects of Exposure to Low Levels of Ionizing Radiation (BEIR V)*. National Academies Press, Washington, D.C.

National Research Council. 2006a. Committee on the Biological Effects of Ionizing Radiation (BEIR), BEIR VII, *Health Risks from Exposure to Low Levels of Ionizing Radiation*. The National Academies Press, Washington, D.C.

National Research Council. 2006b. *Safety and Security of Commercial Spent Nuclear Fuel Storage*. The National Academies Press, Washington, D.C.

Nuclear Energy Institute (NEI). 2005. *SAMA Analysis Guidance Document,* Revision A, NEI-05-01. (November 2005).

Nuclear Management and Resources Council (NUMARC). 1991. *Guidelines for Industry Actions to Assess Shutdown Management*, NUMARC 91-06. (December 1991).

U.S. Nuclear Regulatory Commission (NRC). 1975. *Reactor Safety Study – An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants,* WASH-1400, NUREG-75/014. (October 1975).

U.S. Nuclear Regulatory Commission (NRC). 1978. *Liquid Pathway Generic Study*, NUREG-0440. (February 1978).

U.S. Nuclear Regulatory Commission (NRC). 1982. *The Development of Severe Reactor Accident Source Terms: 1957–1981,* NUREG-0773. (November 1982).

U.S. Nuclear Regulatory Commission (NRC). 1988. *Assessment of the Use of Extended Burn-up Fuel in Light Water Power Reactors*, NUREG/CR-5009. (February 1988).

U.S. Nuclear Regulatory Commission (NRC). 1989. *Regulatory Analysis for the Resolution of Generic Issue 82*, NUREG-1353. (April 1989).

U.S. Nuclear Regulatory Commission (NRC). 1990a. *Evaluation of Severe Accident Risks: Surry Unit 1*, NUREG/CR-4551 Volume 3, Revision 1. (October 1990).

U.S. Nuclear Regulatory Commission (NRC). 1990b. *Evaluation of Severe Accident Risks: Peach Bottom, Unit 2*, NUREG/CR-4551 Volume 4, Revision 1. (December 1990).

U.S. Nuclear Regulatory Commission (NRC). 1990c. *Severe Accident Risk: An Assessment for Five U.S. Nuclear Power Plants*, NUREG-1150. (December 1990).

U.S. Nuclear Regulatory Commission (NRC). 1992. *Integrated Risk Assessment for the LaSalle Unit 2 Nuclear Power Plant*, NUREG/CR-5305. (August 1992).

U.S. Nuclear Regulatory Commission (NRC). 1993. *Shutdown and Low Power Operation at Commercial NPPs in the United States*, NUREG-1449. (September 1993).

U.S. Nuclear Regulatory Commission (NRC). 1995a. *Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Surry, Unit 1*, NUREG/CR-6144. (May 1995).

U.S. Nuclear Regulatory Commission (NRC). 1995b. *Evaluation of Potential Severe Accidents During Low Power Shutdown Operation at Grand Gulf, Unit 1*, NUREG/CR-6143. (July 1995).

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vols. 1 and 2. Office of Nuclear Reactor Regulation, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997a. *Regulatory Analysis Technical Evaluation Handbook*, NUREG/BR-0184. (January 1997).

U.S. Nuclear Regulatory Commission (NRC). 1997b. *Reassessment of Selected Factors Affecting Siting of Nuclear Power Plants*, NUREG/CR-6295. (February 1997).

U.S. Nuclear Regulatory Commission (NRC). 1997c. *Issuance for Public Comment of Proposed Rulemaking Package for Shutdown and Fuel Storage Pool Operation*, SECY-97-168. (July 30, 1997).

U.S. Nuclear Regulatory Commission (NRC). 1997d. *Issuance for Public Comment of Proposed Rulemaking Package for Shutdown and Fuel Storage Pool Operation*, SRM-SECY-97-168. (December 11, 1997).

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Vol. 1, Addendum 1. Office of Nuclear Reactor Regulation, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2001a. *Environmental Impact of Extending Fuel Burn-up Above 60 GWd/MT*, NUREG/CR-6703. (January 2001).

U.S. Nuclear Regulatory Commission (NRC). 2001b. *Technical Study of Spent Fuel Pool Accident Risk and Decommissioning Nuclear Power Plants*, NUREG-1738. (February 2001).

U.S. Nuclear Regulatory Commission (NRC). 2001c. *Generic Aging Lessons Learned Report*, NUREG-1801. (July 2001).

U.S. Nuclear Regulatory Commission (NRC). 2003. *Perspectives Gained from the Individual Plant Examination of External Events (IPEEE)*, NUREG-1742. (April 2003).

U.S. Nuclear Regulatory Commission (NRC). 2004. *Protecting Our Nation – Since 9-11-01*, NUREG/BR-0314. (September 2004).

U.S. Nuclear Regulatory Commission (NRC). 2005a. Letter from Nils J. Diaz (NRC Chairman) to Senator Pete V. Domenici (Chairman, Subcommittee on Energy and Water Development). (March 14, 2005).

U.S. Nuclear Regulatory Commission (NRC). 2005b. *Notice of Extension of the Public Comment Period for Scoping Process to Prepare an Environmental Impact Statement for the License Renewal of Nuclear Power Plants*, *Federal Register*, Vol. 70, No. 190, p. 57628. (October 3, 2005).

U.S. Nuclear Regulatory Commission (NRC). 2005c. *Staff Review of the National Academies Study of the Health Risks from Exposure to Low Levels of Ionizing Radiation (BEIR VII)*, SECY-05-0202. (October 29, 2005).

U.S. Nuclear Regulatory Commission (NRC). 2006a. *Frequently Asked Questions on License Renewal of Nuclear Power Reactors*, NUREG-1850. (March 2006).

U.S. Nuclear Regulatory Commission (NRC). 2006b. *Mitigation of Spent Fuel Loss-of-Coolant Inventory Accidents and Extension of Reference Plant Analyses to Other Spent Fuel Pools*, Sandia Letter Report, Revision, (November 2, 2006).

U.S. Nuclear Regulatory Commission (NRC). 2007a. Memorandum from Pao-Tsin Kuo (NRC) to James Riley (NEI) entitled, “Final License Renewal Interim Staff Guidance LR-ISG-2006-003: Staff Guidance for Preparing Severe Accident Mitigation Alternatives Analyses.” (August 2, 2007).

U.S. Nuclear Regulatory Commission (NRC). 2007b. Memorandum from Stewart Bailey (NRC) to James Scarola (Brunswick Steam Electric Plant) entitled, “Brunswick Steam Electric Plant, Units 1 and 2 – Conforming License Amendments to Incorporate the Mitigation Strategies Required by Section B.5.b. of Commission Order EA-02-026 and the Radiological Protection Mitigation Strategies Required by Commission Order EA-06-137 (TAC Nos. MD4516 and MD 4517).” (August 9, 2007).

U.S. Nuclear Regulatory Commission (NRC). 2007c. *2007–2008 Information Digest*, NUREG-1350, Vol. 19. (August 2007).

U.S. Nuclear Regulatory Commission (NRC). 2007d. *A Prioritization of Generic Safety Issues*, NUREG-0933, Supplement 31. (September 2007).

U.S. Nuclear Regulatory Commission (NRC). 2007e. Denial of Petition for Rulemaking PRM-51-11. *Federal Register*, Vol. 72, No. 240, p. 71083. (December 14, 2007).

U.S. Nuclear Regulatory Commission (NRC). 2008a. “State-of-the-Art Reactor Consequence Analyses (SOARCA) Project Accident Analysis,” Randall Gauntt and Charles Tinkler, presented at the 2007 Regulatory Information Conference (RIC), Rockville, MD. (March 11, 2008).

U.S. Nuclear Regulatory Commission (NRC). 2008b. Letter from M. Gamberoni (NRC) to J. Pollock (Entergy Nuclear Operations) entitled, “Indian Point Nuclear Generating Units 1 & 2 – NRC Inspection Report Nos. 05000003/2007010 and 05000247/2007010.” (May 13, 2008).

U.S. Nuclear Regulatory Commission (NRC). 2008c. *Industry Performance Data*. Available URL: http://nrcoe.inel.gov/results/index.cfm?fuseaction=IndustryPerf.showMenu (Accessed August 4, 2008).

U.S. Nuclear Regulatory Commission (NRC). 2008d. “Denial of Petition for Rulemaking PRM-51-10 and PRM-51-12,” *Federal Register*, Vol. 73, No. 154, p. 46204. (August 8, 2008).

U.S. Nuclear Regulatory Commission (NRC). 2008e. *Resolution of Generic Safety Issues*, NUREG-0933, Main Report and Supplements 1–32 (August).

Appendix F

Applicable Laws, Regulations, and Other Requirements

Appendix F

Applicable Laws, Regulations, and Other Requirements

F.1 Introduction

This appendix presents a brief discussion of Federal and State laws, regulations, and other requirements that may be affected by the renewal and continued operation of U.S. Nuclear Regulatory Commission (NRC)-licensed nuclear power plants. It provides additional information about environmental laws and regulations applicable to license renewal that were first introduced in Chapter 3, “Affected Environment.” These include Federal and State laws, regulations, and other requirements designed to protect the environment, including land and water use, air quality, aquatic resources, terrestrial resources, radiological impacts, solid waste, chemical impacts, and socioeconomic conditions.

Applicable Federal and State laws and regulations presented in this part include

(1) laws and regulations that could require the NRC or the applicant to undergo a *new* authorization or consultation process with Federal or State agencies outside the NRC or

(2) laws and executive orders that could require the NRC or the applicant to *renew* authorizations currently granted or hold additional consultations with Federal or State agencies outside the NRC.

This appendix is provided as a general overview to assist the applicant in identifying environmental and natural resources laws that may affect the license renewal process. This is not intended as a complete and final list, and the applicant is reminded that a variety of additional local and regional requirements may exist for the specific plant site.

Section F.3 identifies Federal laws and regulations applicable to license renewal. Section F.4 discusses Executive Orders. Section F.5 identifies the applicable NRC regulations. Section F.6 discusses applicable State laws, regulations, agreements, and requirements that are applicable to license renewal. Section F.7 discusses emergency management and response laws, regulations, and executive orders. Section F.8 discusses consultations with agencies and Federally recognized American Indian Nations. These regulatory requirements address issues such as protection of public health and the environment, worker safety, historic and cultural resources, and emergency planning.

F.2 Background

NRC is required to ensure that licensed nuclear power plants are operated in a manner that ensures the protection of public health, safety, and the environment. As part of the National Environmental Policy Act (NEPA) process, an agency must consider whether an action could threaten a violation of any Federal, State, or local law or requirement (40 *Code of Federal Regulations* [CFR] 1508.27(b)10) or require a permit, license, or other entitlement (40 CFR 1502.25). This appendix identifies and summarizes all applicable Federal, State, and local laws and regulations, requirements, agreements, and permits that relate to the continued operation of NRC-licensed nuclear power plants.

There are a number of Federal environmental laws that affect environmental protection, health, safety, compliance, and/or consultation at every NRC-licensed nuclear power plant location. In addition, certain environmental requirements have been delegated to State authorities for enforcement and implementation. Furthermore, State legislatures have adopted laws to protect health and safety and the environment. It is NRC's policy to make sure nuclear power plants are operated in a manner that ensures the protection of public health, safety, and the environment through compliance with all applicable Federal and State laws, regulations, and other requirements.

F.3 Applicable Federal Laws and Regulations

The regulations applicable to the operation of NRC-licensed nuclear power plants encompass a broad range of Federal and State laws, requirements, Executive Orders, and agreements addressing cultural, environmental, health and safety, transportation, and other issues. Generally, these regulations are relevant to how the work involved in performing a Proposed Action would be conducted to protect workers, the public, and cultural and environmental resources. Some of these require permits or consultation with other agencies or governing bodies. The Federal laws applicable to the review of NRC license renewal applications are identified and briefly discussed in this section, and are presented in alphabetical order.

American Indian Religious Freedom Act (AIRFA) of 1978 (42 United States Code [USC] 1996) – The *American Indian Religious Freedom Act* protects Native Americans' rights of freedom to believe, express, and exercise traditional religions.

Antiquities Act of 1906, as amended (16 USC 431–433) – The *Antiquities Act* protects historic and prehistoric ruins, monuments, and antiquities, including paleontological resources, on Federally controlled lands from appropriation, excavation, injury, and destruction without permission.

Archaeological and Historic Preservation Act of 1960, as amended (16 USC 469 et seq.) – The *Archaeological and Historic Preservation Act* establishes procedures for preserving historical and archeological resources. Analysis of environmental compliance included assessing the energy alternatives for possible impacts on prehistoric, historic, and traditional cultural resources.

Archaeological Resources Protection Act of 1979, as amended (16 USC 470aa et seq.) – The *Archaeological Resources Protection Act* requires a permit for any excavation or removal of archaeological resources from Federal or American Indian lands. Excavations must be undertaken for the purpose of furthering archaeological knowledge in the public interest, and resources removed are to remain the property of the United States. Consent must be obtained from the American Indian Tribe or the Federal agency having authority over the land on which a resource is located before issuance of a permit. The permit must contain terms and conditions requested by the Tribe or Federal agency.

Atomic Energy Act of 1954 (42 USC 2011 et seq.) – The 1954 *Atomic Energy Act* (AEA), as amended, and the *Energy Reorganization Act of 1974* (42 USC §5801 et seq.) give the NRC the licensing and regulatory authority for nuclear energy uses within the commercial sector. It gives NRC responsibility for licensing and regulating commercial uses of atomic energy and allows the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. NRC implements its responsibilities under the AEA through regulations set forth in Title 10 CFR.

Bald and Golden Eagle Protection Act of 1940, as amended (16 USC 668–668d) – The *Bald and Golden Eagle Protection Act* makes it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States. The U.S. Fish and Wildlife Service (USFWS) reviews NRC environmental impact statements to determine whether the activities analyzed would comply with the *Bald and Golden Eagle Protection Act*.

Clean Air Act of 1970, as amended (42 USC 7401 et seq.) – The *Clean Air Act* (CAA) is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." The CAA establishes regulations to ensure air quality and authorizes individual States to manage permits. Section 118 of the CAA requires each Federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants, to comply with all Federal, State, inter-State, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for criteria pollutants. The EPA has identified and set NAAQS for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated prior to permit approval in order to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each State and approved by the EPA. The CAA requires sources to meet standards and obtain permits to satisfy those standards. Nuclear power plants may be required to comply with the CAA Title V, Sections 501–507, for sources subject to new source performance standards or sources subject to National Emission Standards for Hazardous Air Pollutants. Emissions of air pollutants are regulated by the EPA in 40 CFR Parts 50 to 99.

Clean Water Act (33 USC 1251 et seq.) – The *Clean Water Act* (CWA; formerly the *Federal Water Pollution Control Act*) was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The Act requires all branches of the Federal Government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters, to comply with Federal, State, inter-State, and local requirements.

The CWA requires the EPA to set national effluent limitations and water-quality standards, and establishes a regulatory program for enforcement. Specifically, Section 402(a) of the Act establishes water-quality standards for contaminants in surface waters. The CWA imposes limitations on wastewater and storm water pollutant discharges through the National Pollutant Discharge Elimination System (NPDES) permitting program. The Act requires an NPDES permit before discharging any point source pollutant into U.S. waters. The NPDES General Permit for Industrial Storm Water is required for point source discharge of storm water runoff from industrial or commercial facilities to State waters. The EPA can delegate primary NPDES enforcement authority to States under the State Pollutant Discharge Elimination System (SPDES). Section 401(a)(1) of the CWA requires States to certify that the permitted discharge would comply with all limitations necessary to meet established State water-quality standards, treatment standards, or schedule of compliance.

The U.S. Army Corps of Engineers (USACE) is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320). Under Section 401 of the CWA, the EPA or a delegated State agency has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge to waters of the State, including wetlands.

A Section 404 permit would need to be obtained from the USACE before implementing any action, such as earthmoving activities and certain erosion controls that could disturb wetlands. Federal and State permits/certification are obtained using the same form, and permit applications for activities affecting waterways and wetlands are reviewed by the USACE in consultation with the USFWS, the Soil Conservation Service, the EPA, and the delegated State agency.

Coastal Zone Management Act of 1972, as amended (16 USC 1451 et seq.) – Congress enacted the *Coastal Zone Management Act* (CZMA) in 1972 to address the increasing pressures of over-development upon the nation's coastal resources. The National Oceanic and Atmospheric Administration (NOAA) administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary. To encourage States to participate, the CZMA makes Federal financial assistance available to any coastal State or territory, including those on the Great Lakes that are willing to develop and implement a comprehensive coastal management program.

Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act (42 USC 9601 et seq.) – The *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) includes an emergency response program to respond to a release of a hazardous substance to the environment. Releases of source, byproduct, or special nuclear material from a nuclear incident are excluded from CERCLA requirements if the releases are subject to the financial protection requirements of the AEA. CERCLA is intended to provide a response to, and cleanup of, environmental problems that are not covered adequately by the permit programs of the many other environmental laws, including the CAA, CWA, *Safe Drinking Water Act*, *Marine Protection, Research, and Sanctuaries Act*, *Resource Conservation and Recovery Act*, and AEA. Under Section 120 of CERCLA, each department, agency, and instrumentality of the United States is subject to, and must comply with, CERCLA in the same manner as any nongovernmental entity (except for requirements for bonding, insurance, financial responsibility, or applicable time period). Under CERCLA, the EPA would have the authority to regulate hazardous substances at a facility in the event of a release or a "substantial threat of a release" of those materials. Releases greater than reportable quantities would be reported to the National Response Center. Assessment of alternatives for environmental compliance included consideration of whether hazardous substances in reportable quantity amounts could be present at power plants during the license renewal term.

Emergency Planning and Community Right-to-Know Act of 1986 (42 USC 11001 et seq.) (also known as "SARA Title III") – The *Emergency Planning and Community Right-to-Know Act of 1986* (EPCRA), which is the major amendment to CERCLA (42 USC §9601*)*, establishes the requirements for Federal, State, and local governments, Indian Tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The "Community Right-to-Know" provisions increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities working with facilities can use the information to improve chemical safety and protect public health and the environment. This Act requires emergency planning and notice to communities and government agencies concerning the presence and release of specific chemicals. The EPA implements this Act under regulations found in 40 CFR Parts 355, 370, and 372.

Endangered Species Act of 1973 (16 USC 1531–1544) – The *Endangered Species Act* (ESA) was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the Act requires consultation with the USFWS of the U.S. Department of the Interior or the National Marine Fisheries Service (NMFS) of the U.S. Department of Commerce to determine whether endangered and threatened species or their critical habitats are known to be in the vicinity of the proposed action, and to determine whether the proposed Federal action may affect listed species or critical habitat.

Environmental Standards for Uranium Fuel Cycle (40 CFR Part 190, Subpart B) – These regulations establish maximum doses to the body or organs of members of the public, as a result of operational normal releases from uranium fuel cycle activities, including uranium enrichment. These regulations were promulgated by the EPA under the authority of the AEA, as amended, and have been incorporated by reference in the NRC regulations in 10 CFR §20.1301(e).

Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 USC 135 et seq.) – The *Federal Insecticide, Fungicide, and Rodenticide Act* as amended by the Federal Environmental Pesticide Control Act and subsequent amendments, requires the registration of all new pesticides with the EPA before they are used in the United States. Manufacturers are required to develop toxicity data for their pesticide products. Toxicity data may be used to determine permissible discharge concentrations for an NPDES permit.

Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) – The *Fish and Wildlife Conservation Act* provides Federal technical and financial assistance to States for the development of conservation plans and programs for nongame fish and wildlife. The Act also encourages Federal agencies to conserve and promote the conservation of nongame fish and wildlife and their habitats. Conservation plans are required to identify appropriate nongame fish and wildlife species and significant problems that may adversely affect these species and their habitats. The conservation plan must also determine the actions that should be taken to conserve the nongame fish and wildlife species. The designated State agencies are expected to consult with the appropriate Federal agencies during the development, revision, and implementation of the plan.

Fish and Wildlife Coordination Act of 1934, as amended (16 USC 661–666e) – The *Fish and Wildlife Coordination Act* requires Federal agencies to consult with the USFWS and the head of the State agency that administers wildlife resources in the affected State for an activity involving the impoundment, diversion, deepening, control, or modification of a stream or body of water. The agency would then produce a *Fish and Wildlife Coordination Act Report*.

Hazardous Materials Transportation Act of 1975, as amended (49 USC 1801 et seq.) – The *Hazardous Materials Transportation Act* regulates transportation of hazardous material (including radioactive material) in and between States. According to the Act, States may regulate the transport of hazardous material as long as their regulation is consistent with the Act or the U.S. Department of Transportation regulations provided in 49 CFR Parts 171 through 177. Other regulations regarding packaging for transportation of radionuclides are contained in 49 CFR Part 173, Subpart I.

Low-Level Radioactive Waste Policy Act of 1980, as amended (42 USC §2021 et seq.) – The *Low-Level Radioactive Waste Policy Act* amended the AEA to improve the procedures for the implementation of compacts providing for the establishment and operation of regional low-level radioactive waste disposal facilities. It also allows for Congress to grant consent for certain inter-State compacts. The amended act sets forth the responsibilities for disposal of low-level waste by States or inter-State compacts. The act states the amount of waste that certain low-level waste recipients can receive over a set time period. The amount of low-level radioactive waste generated from both pressurized and boiling water reactor types is allocated over a transition period until a local waste facility is operational.

Marine Mammal Protection Act of 1972 (16 USC §1361 et seq.) – The *Marine Mammal Protection Act* (MMPA) was enacted to protect and manage marine mammals and their products (e.g., the use of hides and meat). The primary authority for implementing the Act belongs to the USFWS and NMFS. The USFWS manages walruses, polar bears, sea otters, dugongs, marine otters, and West Indian, Amazonian, and West African manatees. The NMFS manages whales, porpoises, seals, and sea lions. The two agencies may issue permits under MMPA Section 104 (16 USC 1374) to persons, including Federal agencies, that authorize the taking or importing of specific species of marine mammals.

After the Secretary of the Interior or the Secretary of Commerce approves a State's program, the State can take over responsibility for managing one or more marine mammals. The MMPA also established a Marine Mammal Commission whose duties include reviewing laws and international conventions relating to marine mammals, studying the condition of these mammals, and recommending steps to Federal officials (e.g., listing a species as endangered) that should be taken to protect marine mammals. Federal agencies are directed by MMPA Section 205 (16 USC 1405) to cooperate with the commission by permitting it to use their facilities or services.

Migratory Bird Treaty Act of 1918, as amended (16 USC 703 et seq.) – The *Migratory Bird Treaty Act* is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. The Act stipulates that, except as permitted by regulations, it is unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, or kill any migratory bird.

National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.) – The *National Environmental Policy Act* (NEPA) requires Federal agencies to integrate environmental values into their decision-making process by considering the environmental impacts of proposed Federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the Policy. Section 102(2) contains action-forcing provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information. This generic environmental impact statement (GEIS) has been prepared in accordance with NEPA requirements and NRC regulations (10 CFR Part 51) for implementing NEPA to ensure compliance with Section 102(2).

National Historic Preservation Act of 1966, as amended (16 USC 470aa et seq.) – The *National Historic Preservation Act* (NHPA) was enacted to create a national historic preservation program, including the *National Register of Historic Places* and the Advisory Council on Historic Preservation. Section 106 of the Act requires Federal agencies to take into account the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800. These regulations were revised on July 6, 2004 (69 FR 40544) and became effective on August 5, 2004. The regulations call for public involvement in the Section 106 consultation process, including Indian tribes and other interested members of the public, as applicable.

Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) – The *Native American Graves Protection and Repatriation Act* establishes provisions for the treatment of inadvertent discoveries of American Indian remains and cultural objects. When discoveries are made during ground-disturbing activities, activity in the area must immediately stop, and reasonable protective efforts, proper notifications, and appropriate disposition of the discovered items must be pursued.

Noise Control Act of 1972 (42 USC 4901 et seq.) – The *Noise Control Act* delegates the responsibility of noise control to State and local governments. Commercial facilities are required to comply with Federal, State, inter-State, and local requirements regarding noise control. Section 4 of the Noise Control Act directs Federal agencies to carry out programs in their jurisdictions "to the fullest extent within their authority" and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.

Nuclear Regulatory Commission License Termination Rule (10 CFR Part 20, Subpart E) – The AEA assigns NRC the responsibility for licensing and regulating commercial uses of atomic energy. When a licensed facility has completed its mission, the facility must meet standards for cleanup in order to terminate its license. The License Termination Rule establishes that NRC will consider a site acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirem per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). The critical group is the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

The License Termination Rule also provides for land use restrictions or other types of institutional controls to allow terminating NRC licenses and releasing sites under restricted conditions if decommissioning criteria for unrestricted use cannot be met. Plus, the License Termination Rule establishes alternate criteria for license termination if the licensee provides assurance that public health and safety would continue to be protected, and that it is unlikely that the dose from all manmade sources combined, other than medical, would be more than 100 millirem per year.

Nuclear Waste Policy Act of 1982 (42 USC 10101, et seq.) – The *Nuclear Waste Policy Act* provides for the research and development of repositories for the disposal of high-level radioactive waste, spent nuclear fuel, and low-level radioactive waste. The act consists of three titles and several subtitles. Title I includes the provisions for the disposal and storage of high-level radioactive waste and spent nuclear fuel. Subtitle A of Title I delineates the requirements for site characterization and construction of the repository and the participation of States and other local governments in the selection process. Subtitles B, C, and D of Title I deal with the specific issues for interim storage, monitored retrievable storage, and low-level radioactive waste.

Occupational Safety and Health Act of 1970 (29 USC 651 et seq.) – The *Occupational Safety and Health Act* establishes standards to enhance safe and healthy working conditions in places of employment throughout the United States. The Act is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. Employers who fail to comply with OSHA standards can be penalized by the Federal government. The Act allows States to develop and enforce OSHA standards if such programs have been approved by the Secretary of Labor.

Pollution Prevention Act of 1990 (42 USC 13101 et seq.) – The *Pollution Prevention Act* establishes a national policy for waste management and pollution control that focuses first on source reduction, then on environmental, safe recycling, treatment, and disposal.

Resource Conservation and Recovery Act as amended by the Hazardous and Solid Waste Amendments (42 USC 6901 et seq.) – The *Resource Conservation and Recovery Act* (RCRA) requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006 (42 USC §6926) allows States to establish and administer these permit programs with EPA approval. EPA regulations implementing the RCRA are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.

Safe Drinking Water Act of 1974 (42 USC 300(f) et seq.) – The *Safe Drinking Water Act* (SDWA) was enacted to protect the quality of public water supplies and sources of drinking water and establishes minimum national standards for public water supply systems in the form of maximum contaminant levels (MCLs) for pollutants, including radionuclides. Other programs established by the SDWA include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control Program. In addition, the Act provides underground sources of drinking water with protection from contaminated releases and spills.

Sole Source Aquifer – If a nuclear power plant is located within an area designated as a sole source aquifer pursuant to Section 1424(e) of the SDWA, the Supplemental EIS would be subject to EPA review. If the EPA review raises concerns that plant operations are not protective of groundwater quality, specific mitigation recommendations or additional pollution prevention requirements may be required.

Toxic Substances Control Act (15 USC 2601 et seq.) – The *Toxic Substances Control Act* (TSCA) regulates the manufacture, processing, distribution, and use of certain chemicals not regulated by RCRA or other statutes including asbestos-containing material and polychlorinated biphenyls. Any TSCA-regulated waste removed from structures (e.g., polychlorinated biphenyls-contaminated capacitors or asbestos) or discovered during the implementation phase (e.g., contaminated media), would be managed in compliance with TSCA requirements in 40 CFR Part 761. The evaluation for all alternatives considers compliance with TSCA.

F.4 Applicable Executive Orders

Executive Orders establish policies and requirements for Federal agencies. Executive Orders are applicable to Executive branch agencies but do not have the force of law or regulation.

Executive Order 11514, Protection and Enhancement of Environmental Quality – This Order (regulated by 40 CFR Parts 1500 through 1508) requires Federal agencies to continually monitor and control their activities to: (1) protect and enhance the quality of the environment, and (2) develop procedures to ensure the fullest practicable provision of timely public information and understanding of the Federal plans and programs that may have potential environmental impact so that views of interested parties can be obtained.

Executive Order 11593, Protection and Enhancement of the Cultural Environment – This Order directs Federal agencies to locate, inventory, and nominate qualified properties under their jurisdiction or control to the *National Register of Historic Places*.

Executive Order 11988, Floodplain Management – This Order requires Federal agencies to avoid direct or indirect support of floodplain development whenever there is a practicable alternative. A Federal agency is required to evaluate the potential effects of any actions it may take in a floodplain. Federal agencies are also required to encourage and provide appropriate guidance to applicants to evaluate the effects of their proposals on floodplains prior to submitting applications for Federal licenses, permits, loans, or grants.

Executive Order 11990, Protection of Wetlands – This Order requires Federal agencies to avoid any short or long-term adverse impacts on wetlands wherever there is a practicable alternative, and to provide opportunity for early public review of any plans or proposals for new construction in wetlands. Federal agencies are required to evaluate the potential effects of any actions they may take on wetlands when carrying out their responsibilities (e.g., planning, regulating, and licensing activities). However, this executive order does not apply to the issuance by Federal agencies of permits, licenses, or allocations to private parties for activities involving wetlands on non-Federal property.

Executive Order 12088, Federal Compliance with Pollution Control Standards, October 13, 1978, as amended by Executive Order 12580, Superfund Implementation – This Order directs Federal agencies to comply with applicable administrative and procedural pollution controls standards established by, but not limited to, the CAA, the *Noise Control Act*, the CWA, the SDWA, the TSCA, and the RCRA.

Executive Order 12148 (Federal Emergency Management, July 20, 1979) – This Order transfers functions and responsibilities associated with Federal emergency management to the

Director of the Federal Emergency Management Agency. The Order assigns the Director the responsibility to establish Federal policies for, and to coordinate all civil defense and civil emergency planning, management, mitigation, and assistance functions of, Executive agencies.

Executive Order 12580, Superfund Implementation, as amended by Executive Order 13308 (June 20, 2003) – This Order delegates to the heads of Executive Departments and agencies the responsibility of undertaking remedial actions for releases or threatened releases that are not on the National Priorities List, and removal actions, other than emergencies, where the release is from any facility under the jurisdiction or control of Executive Departments and agencies.

Executive Order 12656 (Assignment of Emergency Preparedness Responsibilities, November 18, 1988) – This Order assigns emergency preparedness responsibilities to Federal departments and agencies.

Executive Order 12856, Right to Know Laws and Pollution Prevention Requirements – Executive Order 12856 directs Federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response, and accident notification; and to meet the requirements of EPCRA.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations – This calls for Federal agencies to address environmental justice in minority populations and low-income populations (59 FR 7629), and directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. In response to this Executive Order, the NRC has issued a final policy statement on the "Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040; August 24, 2004) and environmental justice procedures to be followed in NEPA documents prepared by the NRC's Office of Nuclear Reactor Regulation.

Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities – This Order requires Federal agencies to develop and implement a program for conservation of energy and water resources. As part of this program, agencies are required to conduct comprehensive facility audits of their energy and water use.

Executive Order 13007, Indian Sacred Sites – This Order directs Federal agencies, to the extent permitted by law and not inconsistent with agency missions, to avoid adverse effects to sacred sites and to provide access to those sites to Native Americans for religious practices. The Order directs agencies to plan projects to provide protection of and access to sacred sites to the extent compatible with the project.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Order 13229 (October 9, 2001) and amended by Executive Order 13296 (April 18, 2003) – This Order requires Federal Executive branch agencies to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health or safety risks.

Executive Order 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition – This Order requires each Federal agency to incorporate waste prevention and recycling in its daily operations and work to increase and expand markets for recovered materials. This Order states that it is national policy to prefer pollution prevention whenever feasible. Pollution that cannot be prevented should be recycled; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner. Disposal should be employed only as a last resort.

Executive Order 13112, Invasive Species – This Order directs Federal agencies to act to prevent the introduction of or to monitor and control invasive (non-native) species, to provide for restoration of native species, to conduct research, to promote educational activities, and to exercise care in taking actions that could promote the introduction or spread of invasive species. During the implementation phase, rehabilitation of disturbed areas would be accomplished by reseeding or revegetating areas with native plants and trees.

Executive Order 13123, Greening the Government through Efficient Energy Management (June 8, 1999) – This Order sets goals for agencies for reducing greenhouse gas emissions from facility energy use, reducing energy consumption per gross square foot of facilities, reducing energy consumption per gross square foot or unit of production, expanding use of renewable energy, reducing the use of petroleum within facilities, reducing source energy use, and reducing water consumption and associated energy use.

Executive Order 13148, Greening the Government through Leadership in Environmental Management – This Order requires agencies to develop strategies and goals for environmental compliance, right-to-know, and pollution prevention. It requires all Federal facilities to have an environmental management system, requires compliance or environmental management system audits, and requires that Federal Executive Branch agencies comply with the requirements for toxic chemical release reporting in Section 313 of EPCRA.

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments – This Order directs Federal agencies to establish regular and meaningful consultation and collaboration with Tribal governments in the development of Federal policies that have Tribal implications, to strengthen U.S. government-to-government relationships with American Indian tribes, and to reduce the imposition of unfunded mandates on Tribal governments.

F.5 Applicable U.S. Nuclear Regulatory Commission Regulations

The AEA, as amended, allows the NRC to issue licenses for commercial power reactors to operate up to 40 years. This license is based on adherence of the licensee to regulations outlined in CFR, Title 10. The NRC regulations allow for the renewal of the licenses for up to an additional 20 years beyond the initial licensing period. The renewal of the license depends on the outcome of safety and environmental assessments of the commercial power reactor. There are no specific limitations in the AEA or NRC regulations restricting the number of times a license may be renewed. The license renewal process includes a set of requirements, which are designed to assure the safe operation and protection of the environment.

The license renewal process includes two reviews: an environmental review and a safety review. The reviews are based on the regulations published in the *Code of Federal Regulations* (10 CFR Parts 51 for the environmental review and 54 for the safety review). These regulations describe the NRC's expectation for the format and content of license renewal applications as well as the methods used by NRC staff in evaluating these applications.

The license renewal environmental review consists of the following regulations and guidance:

- *Code of Federal Regulations* – The scope of the environmental review is based on the regulations provided in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

- *Preparation of Environmental Reports for License Renewal Applications* (Supplement 1 to Regulatory Guide 4.2, Revision 1) – This document outlines the format and content to be used by the applicant to discuss the environmental aspects of its license renewal application. It defines the information the applicant must include in the application, which the NRC staff then reviews.

- *Standard Review Plan for Environmental Reviews for Nuclear Power Plants – Supplement 1: Operating License Renewal* (NUREG-1555, Supplement 1, Revision 1) – This is the outline for the NRC's review of the environmental issues. After considering ways to evaluate the environmental consequences of license renewal, the NRC chose to develop the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437 (GEIS), which covered impacts that were common to all or most nuclear power facilities. The GEIS that was published in 1996 allows the applicant and

NRC to focus on those important environmental issues specific to each site being re-licensed. The review results in a site-specific supplement to the GEIS.

F.6 Applicable State Laws, Regulations and Agreements

The AEA authorizes States to establish programs to assume NRC regulatory authority for certain activities. For example, the New York State Department of Labor (NYSDOL) and Department of Environmental Conservation NYSDEC have established requirements under this Agreement State Program. NYSDOL has jurisdiction in New York over commercial and industrial uses of radioactive material. Under the New York Agreement State Program, NYSDEC has jurisdiction over discharges of radioactive material to the environment, including releases to the air and water, and the disposal of radioactive wastes in the ground. In addition to implementing 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.

In addition, the CWA allows for primary enforcement and administration through State agencies, provided the State program (1) is at least as stringent as the Federal program, (2) conforms to the CWA, and (3) delegates authority for the Federal NPDES program from the EPA to the State. The primary mechanism to control water pollution is the requirement that direct dischargers to obtain an NPDES permit or, in the case of States where the authority has been delegated from the EPA, an SPDES permit, pursuant to the CWA.

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 only regulates surface waters. For example, an SPDES permit is required under New York State law for all discharges to both surface waters and groundwater.

F.6.1 State Environmental Requirements

Certain environmental requirements, including some discussed earlier, may have been delegated to State authorities for implementation, enforcement, or oversight. Table F.6-1 provides a list of representative State environmental requirements that may affect license renewal applications for nuclear power plants.

Table F.6–1. State Environmental Requirements

Law/Regulation	Requirements
Air Quality Protection	
Title V Permit Rules	Establishes the policies and procedures by which a State will administer the Title V permit program under the CAA. Requires Title V sources to apply for and obtain a Title V permit prior to operation of the source facility.
Permits to Install New Sources of Pollution	Requires a permit prior to the installation of a new source of air pollutants, or the modification of an air contaminant source. Discusses exemptions and conditions under which approval will be granted. Also requires an impact analysis to determine if the air contaminant source will cause or contribute to violations of the NAAQS.
Air Permits to Operate and Variances	Requires a permit prior to the operation or use of any air contaminant source in violation of any applicable air pollution control law, unless a variance has been applied for and obtained from the State agency.
Accidental Release Prevention Program	Requires the owner or operator of a stationary source that has more than a threshold quantity of a regulated substance to comply with all the provisions of the rule, including creating a hazard assessment, risk management plan, a prevention program, and an emergency response program.
General Conformity Rules	Rules on “general conformity” are mandated by the CAA to ensure that Federal actions do not contribute to air quality violations within the State. Discusses which Federal actions are subject to the conformity requirements, the procedures for conformity analysis, public participation/consultation, and the final conformity determination.
Water Resources Protection	
National Pollutant Discharge Elimination System Permits	Initiates plans and programs for the prevention, control, and abatement of new or existing pollution of State waters. Requires an individual or general permit prior to any discharge of sewage, industrial waste, or other waste as defined by State code. Requires that each point source comply with authorized discharge levels, monitoring requirements, and other appropriate requirements.
Permits to Install New Sources of Pollution	Requires a permit prior to the installation of a new source of water pollutants, or the modification of any pollutant discharge source.
Water Quality Standards	Establishes water quality standards for surface waters in the State, including beneficial use designations, numeric water quality criteria, and the anti-degradation water body classification system.
Section 401 Water Quality Certifications	Requires a Section 401 water quality certification and payment of applicable fees before the issuance of any Federal permit or license to conduct any activity that may result in any discharge to waters of the State.
Public Water Systems Licenses to Operate	Requires a public water systems license prior to operating or maintaining a public water system.

Table F.6–1. (cont.)

Law/Regulation	Requirements
Design, Construction, Installation, and Upgrading for Underground Storage Tank systems	Establishes performance standards and upgrading requirements for underground storage tanks containing petroleum (e.g., diesel fuel) or other regulated substances. Requires an installation or upgrading permit for each location where such installation or upgrading is to occur prior to beginning either an installation or upgrading of a tank or piping comprising an underground storage tank system.
Registration of Underground Storage Tank System	Establishes annual registration requirements for underground storage tanks containing petroleum or other regulated substances.
Flammable and Combustible Liquids	Requires a permit to install, remove, repair, or alter a stationary tank for the storage of flammable or combustible liquids or modify or replace any line or dispensing device.
Waste Management and Pollution Prevention	
Generator Standards	Requires any person who generates a waste to determine if that waste is hazardous. Requires a generator identification number from EPA or State agency prior to treatment, storage, disposal, transport, or offer for transport of hazardous waste.
Licensing Requirements for Solid Waste, Construction, and Demolition Debris Facilities	Requires an annual license for any municipal solid waste landfill, industrial solid waste landfill, residual solid waste landfill, compost facility, transfer facility, infectious waste treatment facility, or solid waste incineration facility prior to operation. New facilities must obtain a permit to install prior to construction. Also, requires a license to establish, modify, operate, or maintain a construction and demolition debris facility.
Radiation Generator and Broker Reporting Requirements	Requires completion of a low-level radioactive waste generator report within 60 days of beginning to generate low-level waste. Additionally, requires each generator to submit an annual report on the state of low-level waste activities in their facility and pay applicable fees.
Hazardous Waste Management System, Permits	Requires operation permits for any new or existing hazardous waste facility.
Emergency Planning and Response	
Hazardous Chemical Reporting	Requires the submission of Material Safety Data Sheets and an annual Emergency and Hazardous Chemical Inventory to local emergency response officials for any hazardous chemicals that are produced, used, or stored at the facility in an amount that equals or exceeds the threshold quantity.

Table F.6–1. (cont.)

Law/Regulation	Requirements
Emergency Planning Requirements of Subject Facilities	Requires any facility having an extremely hazardous substance present in an amount equal to or exceeding the threshold planning quantity to notify the emergency response commission and the local emergency planning committee within 60 days after onsite storage begins. Also, requires the designation of a facility representative who will participate in the local emergency planning process as a facility emergency coordinator.
Toxic Chemical Release Reporting	Establishes reporting requirements and schedule for each toxic chemical known to be manufactured (including imported), processed, or otherwise used in excess of an applicable threshold quantity. Applies only to facilities of a certain classification.
Biotic Resources Protection	
State Endangered Plant Species Protection	Establishes criteria for identifying threatened or endangered species of native plants and prohibits injuring or removing endangered species without permission.
State Endangered Fish and Wildlife Species Protection	Establishes and requires periodic update to a State list of endangered fish and wildlife species.
Permits for Impacts to Isolated Wetlands	Requires a general or individual isolated wetland permit prior to engaging in an activity that involves the filling of an isolated wetland.
Cultural Resources Protection	
State Registry of Archaeological Landmarks	Establishes a State registry of archaeological landmarks. Prohibits any person from excavating or destroying such land, or from removing skeletal remains or artifacts from any land placed on the registry without first notifying the State Historic Preservation Office.
Survey and Salvage; Discoveries; Preservation	Directs State departments, agencies, and political subdivisions to cooperate in the preservation of archaeological and historic sites and the recovery of scientific information from such sites. Also, requires State agencies and contractors performing work on public improvements to cooperate with archaeological and historic survey and salvage efforts and to notify the State historic preservation office about archaeological discoveries.

F.6.2 Operating Permits and Other Requirements

Several operating permit applications may be prepared and submitted, and regulator approval and/or permits would be received prior to license renewal approval by the NRC. Table F.6-2 lists representative Federal, State, and local permits.

F.6.3 Cooperating Agencies

During the scoping process, no Federal, State, or local agencies were identified as potential cooperating agencies in the preparation of this GEIS.

Table F.6–2. Federal, State, and Local Permits and Other Requirements

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Air Quality Protection			
Title V Operating Permit: Required for sources that are not exempt and are major sources, affected sources subject to the Acid Rain Program, sources subject to new source performance standards, or sources subject to National Emission Standards for Hazardous Air Pollutants.	EPA or State agency	CAA, Title V, Sections 501–507 (USC, Title 42, Sections 7661-7661f [42 USC 7661-7661f])	Nuclear Power plants are subject to 40 CFR Part 61, Subpart H (40 CFR Part 61, Subpart H), “National Emissions Standards for Emissions of Radionuclides,” which is included in the terms and conditions of the Title V Operating Permit.
Risk Management Plan: Required for any stationary source that has a regulated substance (e.g., chlorine, hydrogen fluoride, nitric acid) in any process (including storage) in a quantity that is over the threshold level.	EPA or State agency	CAA, Title 1, Section 112(R)(7) (42 USC 7412)	These regulated substances stored in quantities that exceed the threshold levels would require a Risk Management Plan.
CAA Conformity Determination: Required for each criteria pollutant (i.e., sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead) where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a Federal action would equal or exceed threshold rates.	EPA or State agency	CAA, Title 1, Section 176(c) (42 USC 7506)	CAA conformity determination would be required at nuclear power plants located in nonattainment areas with NAAQS for criteria pollutants or maintenance areas for any criteria pollutant that would be emitted as a result of license renewal.
Water Resources Protection			
NPDES Permit: Construction Site Storm Water: Required before making point source discharges of storm water from a construction project that disturbs more than 2 hectares (5 acres) of land.	EPA or State agency	CWA (33 USC 1251 et seq.); 40 CFR Part 122	Any plant refurbishment involving construction of more than 2 hectares (5 acres) of land would require a Storm Water Pollution Prevention Plan and construction site storm water discharge permit.
NPDES Permit: Industrial Facility Storm Water: Required before making point source discharges of storm water from an industrial site.	EPA or State agency	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.

Table F.6–2. (cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
NPDES Permit: Process Water Discharge: Required before making point source discharges of industrial process wastewater.	EPA or State agency	CWA (33 USC 1251 et seq.); 40 CFR Part 122	Process industrial wastewater would be discharged through existing outfalls covered by the permit.
Spill Prevention Control and Countermeasures Plan: Required for any facility that could discharge diesel fuel in harmful quantities into navigable waters or onto adjoining shorelines.	EPA or State agency	CWA (33 USC 1251 et seq.); 40 CFR Part 112	A Spill Prevention Control and Countermeasures Plan is required at nuclear power plants storing large volumes of diesel fuel and/or other petroleum products.
CWA Section 401 Water Quality Certification: Required to be submitted to the agency responsible for issuing any Federal license or permit to conduct an activity that may result in a discharge of pollutants into waters of a State.	EPA or State agency	CWA, Section 401 (33 USC 1341); ORC Chapters 119 and 6111	Certification for operation of a nuclear power plant may require a Federal license or permit (e.g., a CWA Section 404 Permit), a CWA Section 401 Water Quality Certification.
New Underground Storage Tanks System Registration: Required within 30 days of bringing a new underground storage tank system into service.	EPA or State agency	RCRA, as amended, Subtitle I (42 USC 6991a–6991i); 40 CFR §280.22	Required if new underground storage tank systems would be installed during refurbishment at a nuclear power plant.
Above Ground Storage Tank: A permit is required to install, remove, repair, or alter any stationary tank for the storage of flammable or combustible liquids.	State Fire Marshal		Required if new aboveground diesel fuel storage tanks would be installed during refurbishment at a nuclear power plant.
Waste Management and Pollution Prevention			
Registration and Hazardous Waste Generator Identification Number: Required before a person who generates over 100 kg (220 lb) per calendar month of hazardous waste ships the hazardous waste offsite.	EPA or State agency	RCRA, as amended (42 USC 6901 et seq.), Subtitle C	Generators of hazardous waste must notify the EPA that the wastes exist and require management in compliance with RCRA.

Table F.6–2. (cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Hazardous Waste Facility Permit: Required if hazardous waste will undergo nonexempt treatment by the generator, be stored onsite for longer than 90 days by the generator of 1,000 kg (2,205 lb) or more of hazardous waste per month, be stored onsite for longer than 180 days by the generator of between 100 and 1,000 kg (220 and 2,205 lb) of hazardous waste per month, disposed of onsite, or be received from offsite for treatment or disposal.	EPA or State agency	RCRA, as amended (42 USC 6901 et seq.), Subtitle C	Hazardous wastes are usually not disposed of onsite at nuclear power plants. Hazardous wastes generated onsite are not generally stored for more than 90 days. However, should a nuclear power plant store wastes onsite for greater then 90 days for characterization, profiling, or scheduling for treatment or disposal, a Hazardous Waste Facility Permit would be required.
Emergency Planning and Response			
List of Material Safety Data Sheets: Submission of a list of material Safety Data Sheets is required for hazardous chemicals (as defined in 29 CFR Part 1910) that are stored onsite in excess of their threshold quantities.	State and local emergency planning agencies	EPCRA, Section 311 (42 USC 11021); 40 CFR §370.20	Nuclear power plant operators are required to submit a List of Material Safety Data Sheets to State and local emergency planning agencies.
Annual Hazardous Chemical Inventory Report: The report must be submitted when hazardous chemicals have been stored at a facility during the preceding year in amounts that exceed threshold quantities.	State and local emergency response agencies; local fire department	EPCRA, Section 312 (42 USC 11022); 40 CFR §370.25	If hazardous chemicals have been stored at a nuclear power plant during the preceding year in amounts that exceed threshold quantities plant operators would be required to submit an Annual Hazardous Chemical Inventory Report.
Notification of Onsite Storage of an Extremely Hazardous Substance: Submission of the notification is required within 60 days after onsite storage begins of an extremely hazardous substance in a quantity greater than the threshold planning quantity.	State and local emergency response agencies	EPCRA, Section 304 (42 USC 11004); 40 CFR §355.30	If an extremely hazardous substance will stored at a nuclear power plant in a quantity greater than the threshold planning quantity, plant operators would prepare and submit the Notification of Onsite Storage of an Extremely Hazardous Substance.

Table F.6–2. (cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Annual Toxics Release Inventory Report: Required for facilities that have 10 or more full-time employees and are assigned certain Standard Industrial Classification codes.	EPA or State agency	EPCRA, Section 313 (42 USC 11023); 40 CFR Part 372	If required, nuclear power plant operators would prepare and submit a Toxics Release Inventory Report to the EPA.
Transportation of Radioactive Wastes and Conversion Products Packaging, Labeling, and Routing Requirements for Radioactive Materials: Required for packages containing radioactive materials that will be shipped by truck or rail.	U.S. Department of Transportation	Hazardous Materials Transportation Act (49 USC 1501 et seq.); AEA, as amended (42 USC 2011 et seq.); 49 CFR Parts 172, 173, 174, 177, and 397	When shipments of radioactive materials are made, nuclear power plant operators would comply with U.S. Department of Transportation packaging, labeling, and routing requirements.
Biotic Resource Protection			
Threatened and Endangered Species Consultation: Required between the responsible Federal agencies and affected States to ensure that the project is not likely to: (1) jeopardize the continued existence of any species listed at the Federal or State level as endangered or threatened; or (2) result in destruction of critical habitat of such species.	USFWS and State agencies	ESA of 1973, as amended (16 USC 1531 et seq.)	The NRC would consult with the USFWS and State agencies regarding the impact of license renewal on threatened or endangered species or their critical habitat.
CWA Section 404 (Dredge and Fill) Permit: Required to place dredged or fill material into waters of the United States, including areas designated as wetlands, unless such placement is exempt or authorized by a nationwide permit or a regional permit; a notice must be filed if a nationwide or regional permit applies.	USACE	CWA (33 USC 1251 et seq.); 33 CFR Parts 323 and 330	Any dredging or placement of fill material into wetlands within the jurisdiction of the USACE at a nuclear power plant would require a Section 404 permit.

Table F.6–2. (cont.)

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Cultural Resources Protection			
Archaeological and Historical Resources Consultation: Required before a Federal agency approves a project in an area where archaeological or historic resources might be located.	State Historic Preservation Officer and/or Tribal Historic Preservation Officer	NHPA of 1966, as amended (16 USC 470 et seq.); *Archaeological and Historical Preservation Act* of 1974 (16 USC 469-469c-2); Antiquities Act of 1906 (16 USC 431 et seq.); *Archaeological Resources Protection Act* of 1979, as amended (16 USC 470aa–mm)	The NRC would consult with the State and/or Tribal Historic Preservation Officers and representative Indian Tribes regarding the impacts of license renewal and the results of archaeological and architectural surveys of nuclear power plant sites.

F.7 Emergency Management and Response Laws, Regulations, and Executive Orders

This section discusses the laws, regulations, and Executive Orders that address the protection of public health and worker safety and require the establishment of emergency plans. These laws, regulations, and Executive Orders relate to the operation of nuclear power plants.

F.7.1 Federal Emergency Management Response Laws

Emergency Planning and Community Right-to-Know Act of 1986 (USC 11001 et seq.) (also known as "SARA Title III") – This act requires emergency planning and notice to communities and government agencies concerning the presence and release of specific chemicals. The EPA implements this act under regulations found in 40 CFR Parts 355, 370, and 372. Under Subtitle A of this act, facilities are required to provide various information (such as inventories of specific chemicals used or stored and releases that occur from these sites) to the State emergency response commission and to the local emergency planning committee to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. Implementation of the provisions of this act began voluntarily in 1987, and inventory and annual emissions reporting began in 1988.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC 9604(I) (also know as "Superfund") – This act provides authority for Federal and State governments to respond directly to hazardous substance incidents. The act requires reporting of spills, including radioactive spills, to the National Response Center.

Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (42 USC 5121) – This act, as amended, provides an orderly, continuing means of providing Federal Government assistance to State and local governments in managing their responsibilities to alleviate suffering and damage resulting from disasters. The President, in response to a State governor's request, may declare an "emergency" or "major disaster" to provide Federal assistance under this act. The President, in Executive Order 12148, delegated all functions except those in Sections 301, 401, and 409 to the Director of the Federal Emergency Management Agency. The act provides for the appointment of a Federal coordinating officer who will operate in the designated area with a State coordinating officer for the purpose of coordinating State and local disaster assistance efforts with those of the Federal Government.

Justice Assistance Act of 1984 (42 USC 3701–3799) – This act establishes Emergency Federal law enforcement assistance to State and local governments in responding to a law enforcement emergency. The act defines the term "law enforcement emergency" as an uncommon situation which requires law enforcement, which is or threatens to become of serious or epidemic proportions, and with respect to which State and local resources are inadequate to protect the lives and property of citizens or to enforce the criminal law. Emergencies that are not of an ongoing or chronic nature (for example, the Mount Saint Helens volcanic eruption) are eligible for Federal law enforcement assistance including funds, equipment, training, intelligence information, and personnel.

Price-Anderson Nuclear Industries Indemnity Act (42 USC 2210) – The *Price-Anderson Act* provides insurance protection to victims of a nuclear accident. The main purpose of the Act is to partially indemnify the nuclear industry against liability claims arising from nuclear incidents while still ensuring compensation coverage for the general public. The Act establishes a no-fault insurance-type system in which the first $10 billion is industry-funded as described in the Act (any claims above the $10 billion would be covered by the Federal Government).

The Act requires NRC licensees and U.S. Department of Energy contractors to enter into agreements of indemnification to cover personal injury and property damage to those harmed by a nuclear or radiological incident, including the costs of incident response or precautionary evacuation and the costs of investigating and defending claims and settling suits for such damages.

F.7.2 Federal Emergency Management and Response Regulations

Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release (10 CFR 30.72, Schedule C) – This Section of the regulations provides a list that is the basis for both the public and private sector to determine whether the radiological materials they handle must have an emergency response plan for unscheduled releases. The "Federal Radiological Emergency Response Plan," dated November 1995, primarily discusses offsite Federal response in support of State and local governments with jurisdiction during a peacetime radiological emergency.

Occupational Safety and Health Administration Emergency Response, Hazardous Waste Operations, and Worker Right to Know (29 CFR Part 1910) – This regulation establishes OSHA requirements for employee safety in a variety of working environments. It addresses employee emergency and fire prevention plans (Section 1910.38), hazardous waste operations and emergency response (Section 1920.120), and hazards communication (Section 1910.1200) to make employees aware of the dangers they face from hazardous materials in their workplace. These regulations do not directly apply to Federal agencies. However, Section 19 of the Occupational Safety and Health Act (29 U.S.C. 668) requires all Federal agencies to have occupational safety programs "consistent" with Occupational Safety and Health Act standards.

Emergency Management and Assistance (44 CFR Section 1.1) – This regulation contains the policies and procedures for the Federal Emergency Management Act, National Flood Insurance Program, Federal Crime Insurance Program, Fire Prevention and Control Program, Disaster Assistance Program, and Preparedness Program, including radiological planning and preparedness.

Hazardous Materials Tables and Communications, Emergency Response Information Requirements (49 CFR Part 172) – This regulation defines the regulatory requirements for marking, labeling, placarding, and documenting hazardous material shipments. The regulation also specifies the requirements for providing hazardous material information and training.

F.7.3 Emergency Management and Response Executive Orders

Executive Order 12148 (Federal Emergency Management, July 20, 1979) – This Order transfers functions and responsibilities associated with Federal emergency management to the Director of the Federal Emergency Management Agency. The Order assigns the Director the responsibility to establish Federal policies for, and to coordinate all civil defense and civil emergency planning, management, mitigation, and assistance functions of, Executive agencies.

Executive Order 12656 (Assignment of Emergency Preparedness Responsibilities, November 18, 1988) – This Order assigns emergency preparedness responsibilities to Federal Departments and agencies.

Executive Order 12938 (Proliferation of Weapons of Mass Destruction, November 14, 1994) – This Order states that the proliferation of nuclear, biological, and chemical weapons ("weapons of mass destruction") and the means of delivering such weapons constitutes an unusual and extraordinary threat to the national security, foreign policy, and economy of the United States, and that a national emergency would be declared to deal with that threat.

F.8 Consultations with Agencies and Federally Recognized American Indian Nations

Certain laws, such as the ESA, the Fish and Wildlife Coordination Act, and the NHPA, require consultation and coordination by the NRC with other governmental entities including other Federal agencies, State and local agencies, and Federally recognized American Indian governments. These consultations must occur on a timely basis and are generally required before any land disturbance can begin. Most of these consultations are related to biotic resources, cultural resources, and American Indian rights. The biotic resource consultations generally pertain to the potential for activities to disturb sensitive species or habitats. Cultural resource consultations relate to the potential for disruption of important cultural resources and archaeological sites. American Indian consultations are concerned with the potential for disturbance of ancestral American Indian sites, the traditional practices of American Indians and natural resources of importance to American Indians.

NRC FORM 335
(9-2004)
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, Volume 2, Revision 1

2. TITLE AND SUBTITLE

Generic Environmental Impact Statement for License Renewal of Nuclear Plants
Appendices
Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH	YEAR
July	2009

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT

Technical

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as 8 above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

U.S. Nuclear Regulatory Commission (NRC) regulations allow for the renewal of commercial nuclear power plant operating licenses, depending on the outcome of an assessment to determine whether the nuclear plant can continue to operate safely and protect the environment during the 20-year period of extended operation. Renewal of a nuclear power plant operating license requires the preparation of an environmental impact statement (EIS). To support the preparation of these EISs, the NRC published the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) in 1996.

The NRC committed to review and revise the GEIS on a 10-year cycle, if necessary. This GEIS revision reviews and reevaluates the issues and findings of the 1996 GEIS. Lessons learned and knowledge gained during previous license renewal reviews provides a significant source of new information for this assessment. In addition, new research, findings, and other information were considered in evaluating the significance of impacts associated with license renewal. The intent of the GEIS is to determine which issues would result in the same impact at all nuclear power plants, and which issues require a plant-specific analysis for impact determinations. The GEIS is intended to improve the efficiency of the license renewal process by (1) providing an evaluation of the types of environmental impacts that may occur as a result of renewing the license of a nuclear power plant, (2) identifying and assessing the impacts that are expected to be generic (the same or similar), and (3) defining the number and scope of impacts that need to be addressed in plant-specific EISs. The GEIS revision identifies 78 environmental impact issues for consideration in plant-specific supplements to the GEIS.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

Generic Environmental Impact Statement for License Renewal of Nuclear Plants
GEIS
NUREG-1437, Revision 1
National Environmental Policy Act
NEPA
License Renewal

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)
unclassified

(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

Printed on recycled paper

Federal Recycling Program