NUREG-1437
Supplement 31

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 31

Regarding
James A. FitzPatrick Nuclear Power Plant

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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NUREG-1437
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Regarding James A. FitzPatrick Nuclear Power Plant

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Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51). In the GEIS (and its Addendum 1), the NRC staff identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This draft supplemental environmental impact statement (draft SEIS) has been prepared in response to an application submitted to the NRC by Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) to renew the OL for James A. FitzPatrick Nuclear Power Plant (JAFNPP) for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the NRC staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither Entergy nor the NRC staff has identified information that is both new and significant for any issue that applies to JAFNPP. In addition, the NRC staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the NRC staff concludes that the impacts of renewing the JAFNPP OL would not be greater than impacts identified for these issues in the GEIS. For each of these issues, the NRC staff's conclusion in the GEIS is that the impact is of SMALL[(1)] significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to JAFNPP are addressed in this draft SEIS. For each applicable issue, the NRC staff concludes that the significance of the potential environmental impacts of renewal of the OL would be SMALL. The NRC staff also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The NRC staff determined that information provided during the scoping process did not identify any new issue with a significant environmental impact.

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

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for JAFNPP are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Entergy; (3) consultation with Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

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EXECUTIVE SUMMARY

By letter dated July 31, 2006, Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for the James A. FitzPatrick Nuclear Power Plant (JAFNPP) for an additional 20-year period. If the OL is renewed, State regulatory agencies and Entergy will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OL is not renewed, then the plant must be shut down on or before the expiration date of the current OL, which is October 17, 2014.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA), Title 42, Section 4321, of the *United States Code* (42 USC 4321) in Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51). In 10 CFR 51.20(b)(2), the Commission requires preparation of an Environmental Impact Statement (EIS) or a supplement to an EIS for renewal of a reactor OL. In addition, 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plant*s (GEIS), NUREG-1437, Volumes 1 and 2.[a]

Upon acceptance of the Entergy application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare an EIS and conduct scoping. The NRC staff held public scoping meetings on October 12, 2006, in Oswego, New York, and conducted a site audit at JAFNPP on December 5 and 6, 2006. In the preparation of this draft supplemental environmental impact statement (SEIS) for JAFNPP, the NRC staff reviewed the Entergy Environmental Report (ER) and compared it to the GEIS, consulted with other agencies, conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A of this draft SEIS.

The NRC staff will hold two public meetings in Oswego, New York, in August 2007, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this draft

(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 its Addendum 1.

SEIS. When the comment period ends, the NRC staff will consider and address all of the comments received. These comments will be addressed in Appendix A of the final SEIS.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the NRC staff's preliminary recommendation regarding the proposed action.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

> 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) decision makers.

The evaluation criterion for the NRC staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

> ... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations (10 CFR 51.95[c][2]) contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation–generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS reached the following conclusions:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the NRC staff relied on conclusions in the GEIS for issues designated as Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OL for JAFNPP) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration (DOE/EIA), gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from JAFNPP is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the JAFNPP site or some other unspecified alternate location.

Entergy and the NRC staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Entergy nor the NRC staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the NRC staff has identified any new issue applicable to JAFNPP that has a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to JAFNPP.

Entergy's license renewal application presents an analysis of the Category 2 issues plus environmental justice and chronic effects from electromagnetic fields. The NRC staff has reviewed the Entergy analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at JAFNPP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. Entergy has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of JAFNPP for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1973 *Final Environmental Statement Related to Operation of James A. FitzPatrick Nuclear Power Plant.*

Eleven Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 11 Category 2 issues and environmental justice, the NRC staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the NRC staff determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the NRC staff concludes that a reasonable, comprehensive effort was made to identify and evaluate

SAMAs. Based on its review of the SAMAs for JAFNPP and the plant improvements already made, the NRC staff concludes that none of the candidate SAMAs is cost-beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, where the JAFNPP license renewal impacts are deemed to be SMALL, the NRC staff concluded that these impacts would not result in significant cumulative impacts on potentially affected resources.

If the JAFNPP OL is not renewed and the plant ceases operation on or before the expiration of its current OL, then the adverse impacts of likely alternatives would not necessarily be smaller than those associated with continued operation of JAFNPP. The impacts may be greater in some areas, depending on the alternatives selected.

The preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for JAFNPP are not so great that preserving the option of license renewal for energy planning decision makers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by Entergy; (3) consultation with other Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

ABBREVIATIONS/ACRONYMS

ΔT	temperature difference
°	degree
ac	acre(s)
AC	alternating current
ACC	averted cleanup and decontamination costs
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	averted offsite property damage costs
AOE	averted occupational exposure costs
AOSC	averted onsite costs
ATWS	Anticipated transient without scram
BACT	Best available control technology
BTU	British thermal unit(s)
BWR	boiling-water reactor
BWROG	boiling-water reactor owner group
C	Celsius
CDF	core damage frequency
CEQ	Council on Environmental Quality
CET	containment event tree
CFR	*Code of Federal Regulations*
Ci	curie(s)
CMP	coastal management program
COE	cost of enhancement
CRD	control rod drive
CST	condensate storage tank
CWA	Clean Water Act
CWD	chronic wasting disease
CZMA	Coastal Zone Management Act
DC	direct current
DCH	direct containment heating
DBA	design-basis accident
DSM	demand-side management
DOC	U.S. Department of Commerce

DOE	U.S. Department of Energy
ECCS	emergency core cooling system
EDG	emergency diesel generator
EIA	Energy Information Administration
EIS	environmental impact statement
Entergy	Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc.
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ER	environmental report
ESA	Endangered Species Act
ESW	emergency service water
ETE	evacuation time study
F	Fahrenheit
FDS	fish deterrence system
FES	Final Environmental Statement
FSAR	Final Safety Analysis Report
ft	foot (feet)
ft^3	cubic foot (feet)
ft/m	foot (feet) per minute
ft/s	feet (feet) per second
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GE	General Electric
GEIS	generic environmental impact statement
GLFC	Great Lakes Fishery Commission
GLWQA	Great Lakes Water Quality Agreement
gpd	gallon(s) per day
gpm	gallons per minute
ha	hectare(s)
HCLPF	high confidence low probability of failure
HLW	high-level waste
HPCI	high pressure coolant injection
I&C	instrumentation and control

IJC	International Joint Commission
IGLD	International Great Lakes Datum
in.	inch(es)
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing system loss of coolant accident
ISLRBC	International St. Lawrence River Board of Control
J	Joule
JAFNPP	James A. FitzPatrick Nuclear Power Plant
km	kilometer(s)
Kr	krypton
kt(s)	knot(s)
kV	kilovolt
kWh	kilowatt-hour
L	liter
LAER	Lowest achievable emissions rate
lb	pound(s)
LERF	large early release frequency
LLMW	low-level mixed waste
LOCA	loss of coolant accident
LOSP	loss of offsite power
LPCI	low pressure coolant injection
m	meter(s)
mA	milli-ampere(s)
MAAP	Modular Accident Analysis Program
MACCS2	MELCOR Accident Consequence Code System 2
m/s	meter(s) per second
m^3	cubic meter(s)
mg/L	milligram(s) per liter
mi	mile(s)
min	minute(s)
ml	milliliter
mph	mile(s) per hour
mrem	millirem

m/s	meter per second
MSA	metropolitan statistical area
MSIV	main steam isolation valvue
mSv	milliSievert
MT	metric ton(s)
MTHM	metric ton of heavy metal
MWB	Metropolitan Water Board
MWd/MTU	megawatt days per metric ton of uranium
MWe	megawatts-electric
MWh	megawatt hour
MWt	megawatts-thermal
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969
NESC	National Electrical Safety Code
ng/J	nanogram(s) per Joule
NHPA	National Historic Preservation Act of 1966
NIEHS	National Institute of Environmental Health Sciences
NMPNS	Nine Mile Point Nuclear Station
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NYCRR	*New York State Codes Rules and Regulations*
NYISO	New York Independent System Operator
NYNHP	New York Natural Heritage Program
NYPA	New York Power Authority
NYPSC	New York Public Service Commission
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSERDA	New York State Energy Research and Development Authority
NYSHPO	New York State Office of Parks, Recreation, and Historic Preservation
OCWA	Onondaga County Water Authority
ODCM	*Offsite Dose Calculation Manual*
OL	operating license
OMNR	Ontario Ministry of Natural Resources
OWS	Oswego Water System

PBT	persistent, bioaccumulative, and toxic
PCB	polychlorinated biphenyls
PCS	power conversion system
PDS	plant damage status
PGA	peak ground acceleration
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppm	parts per million
PSA	probabilistic safety assessment
PSD	prevention of significant deterioration
radwaste	radioactive waste
RAI	request for additional information
rem	Roentgen Equivalent Man
RCIC	reactor core isolation cooling
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Environmental Monitoring Program
RHR	residual heat removal
RHRSW	residual heat removal service water
ROW	right-of-way
RPC	replacement cost
RRW	risk reduction worth
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SBO	station blackout
SCOL	Salmonid Communities in Oligotrophic Lakes
SCR	selective catalytic reduction
SEIS	supplemental environmental impact statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SLCS	Standby Liquid Control System
SMA	seismic margin assessment
SO_x	sulfur oxides
SPDES	State Pollutant Discharge Elimination System
SQUG	Seismic Qualification User Group
SRV	safety relief valves
SUNY	State University of New York
Sv	Sievert

TMDL	total maximum daily load
TRC	total residual chlorine
TSCA	Toxic Substance Control Act
TSDF	Treatment, Storage, or Discharge Facility
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
USI	Unresolved Safety Issue
VOC	volatile organic compound
Xe	xenon

1.0 INTRODUCTION

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), which implement the National Environmental Policy Act of 1969 (NEPA), renewal of a nuclear power plant operating license (OL) requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the NRC staff has prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[(1)] The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that need to be addressed by the applicants in plant-by-plant license renewal proceedings. Use of the GEIS guides the preparation of complete plant-specific information related to the OL renewal process.

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) operate the James A. FitzPatrick Nuclear Power Plant (JAFNPP) in northern New York under OL DPR-59, which was issued by the NRC. This OL will expire in October 2014. By letter dated July 31, 2006, Entergy submitted an application to the NRC to renew the JAFNPP OL for an additional 20 years under 10 CFR Part 54. Entergy is a licensee for the purposes of its current OL and an applicant for the renewal of the OL. Pursuant to 10 CFR 54.23 and 51.53(c), Entergy submitted an Environmental Report (ER; Entergy 2006b), in which Entergy analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

This report is the plant-specific supplement to the GEIS (the supplemental EIS [SEIS]) for the Entergy license renewal application. This draft SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The NRC staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

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(1) 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 its Addendum 1.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this draft SEIS, including the development of the GEIS and the process used by the NRC staff to assess the environmental impacts associated with plant operations during license renewal; (2) describe the proposed Federal action to renew the JAFNPP OL; (3) discuss the purpose and need for the proposed action; and (4) present the status of Entergy's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The ensuing chapters of this draft SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible or irretrievable commitment of resources. Chapter 9 also presents the NRC staff's preliminary recommendation with respect to the proposed license renewal action.

Additional information is included in appendixes. Appendix A contains public comments related to the environmental review for license renewal and NRC staff responses to those comments. Appendixes B through G, respectively, list the following:

- The preparers of the supplement,
- The chronology of NRC staff's environmental review correspondence related to this draft SEIS,
- The organizations contacted during the development of this draft SEIS,
- Entergy's compliance status in Table E-1 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process),
- GEIS environmental issues that are not applicable to JAFNPP, and
- Severe accident mitigation alternatives (SAMAs).

1.2 Background

Use of the GEIS, which examines the possible environmental impacts that could occur as a result of renewing individual nuclear power plant OLs under 10 CFR Part 54, and the established license renewal evaluation process support the thorough evaluation of the impacts of renewal of OLs.

1.2.1 Generic Environmental Impact Statement

The NRC initiated a generic assessment of the environmental impacts associated with the license renewal term to improve the efficiency of the license renewal process by documenting the assessment results and codifying the results in the Commission's regulations. This assessment is provided in the GEIS, which serves as the principal reference for all nuclear power plant license renewal EISs.

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse effects, (5) determines whether the results of the analysis apply to all plants, and (6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significantly" (40 CFR 1508.27, which requires consideration of both "context" and "intensity"). Using the CEQ terminology, the NRC established three significance levels—SMALL, MODERATE, or LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this draft SEIS unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required.

In the GEIS, the NRC staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The two uncategorized issues are environmental justice and chronic effects of electromagnetic fields. Environmental justice was not evaluated on a generic basis in the GEIS and must be addressed in the draft SEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

An applicant seeking to renew its OL is required to submit an ER as part of its application. The license renewal evaluation process involves careful review of the applicant's ER and assurance that all new and potentially significant information not already addressed in or available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

In accordance with 10 CFR 51.53(c)(2) and (3), the ER submitted by the applicant must

- Provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, in accordance with 10 CFR 51.53(c)(3)(ii), and

- Discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

In accordance with 10 CFR 51.53(c)(2), the ER does not need to

- Consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered, or (2) relevant to mitigation

- Consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives

- Discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b)

- Contain an analysis of any Category 1 issue unless there is significant new information on a specific issue—this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv)

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its application to renew the JAFNPP OL, Entergy developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for JAFNPP would be properly reviewed before submitting the ER, and to ensure that such new and potentially significant information related to renewal of the license would be identified, reviewed, and assessed during the period of NRC review. Entergy reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to JAFNPP. This review was performed by personnel from Entergy and its support organizations involved in the preparation of a license renewal ER.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*NUREG-1555, Supplement 1 (NRC 2000).

The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information, (2) review of public comments, (3) review of environmental quality standards and regulations, (4) coordination with Federal, State, and local environmental protection and resource agencies, and (5) review of the technical literature. New information discovered by the NRC staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are applicable to JAFNPP. At the beginning of the discussion of each set of issues, a table identifies the issues to be addressed and lists the sections in the GEIS where the issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For Category 1 issues for which there is no new and significant information, the table is followed by a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, followed by the NRC staff's analysis and conclusion. For Category 2 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the draft SEIS sections where the analysis is presented. The draft SEIS sections that discuss the Category 2 issues are presented immediately following the table.

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the Entergy license renewal application began with publication of a Notice of Acceptance for docketing and opportunity for a hearing in the *Federal Register* (FR; 71 FR 55032 [NRC 2006]) on September 20, 2006, which also included a Notice of Intent to prepare an EIS and conduct scoping. Two public scoping meetings were held on October 12, 2006, in Oswego, New York. Comments received during the scoping period were summarized in the *Environmental Scoping Summary Report Associated with the Staff's Review of the Application by Entergy for Renewal of the Operating License for James A. FitzPatrick Nuclear Power* (NRC 2007). Comments that are applicable to this environmental review are presented in Appendix A.

The NRC staff followed the review guidance contained NUREG-1555, Supplement 1 (NRC 2000). The NRC staff and contractors retained to assist the staff conducted a site audit at the JAFNPP site on December 5 and 6, 2006, to gather information and to become familiar with the site and its environs. The NRC staff also reviewed the comments received during scoping and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to JAFNPP were reviewed and are referenced in this draft SEIS.

This draft SEIS presents the NRC staff's analysis that considers and weighs the environmental effects of the proposed renewal of the OL for JAFNPP, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental effects. Chapter 9, “Summary and Conclusions,” provides the NRC staff’s preliminary recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable.

A 75-day comment period on this draft SEIS will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff’s review. During this comment period, two public meetings will be held in Oswego, New York, in August 2007. During these meetings, the NRC staff will describe the preliminary results of the NRC environmental review and answer questions to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OL for JAFNPP. JAFNPP is located in northern New York on the south shore of Lake Ontario, approximately 7 miles (mi) northeast of Oswego, New York, 36 mi north-northeast of Syracuse, New York, and 65 mi east of Rochester, New York. The plant has a single boiling water reactor (BWR) designed by the General Electric Company with a rated power level of 2536 megawatts thermal (MWt) and a gross power output of 881 megawatts electric (MWe). Plant cooling is provided by a once-through cooling system that discharges heated water back to Lake Ontario through a discharge structure. The current OL for JAFNPP expires on October 17, 2014. By letter dated July 31, 2006, Entergy submitted an application to the NRC (Entergy 2006a) to renew this OL for an additional 20 years of operation (i.e., until October 17, 2034).

1.4 The Purpose and Need for the Proposed Action

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing OL, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an OL is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State’s jurisdiction or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (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) decision makers.

This definition of purpose and need 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. From the perspective of the licensee and the State regulatory authority, the purpose of renewing an OL is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's license.

1.5 Compliance and Consultations

Entergy is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, Entergy provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with JAFNPP license renewal. Authorizations and consultations relevant to the proposed OL renewal action are included in Appendix E.

The NRC staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that Entergy is in compliance with applicable environmental standards and requirements for JAFNPP. The NRC staff has not identified any environmental issues that are both new and significant.

1.6 References

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 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR Part 1508. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

Atomic Energy Act of 1954 (AEA). 42 USC 2011, et seq.

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National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2. Office of Nuclear Regulatory Research, Washington, D.C.

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, Volume 1, Addendum 1. Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*. NUREG-1555, Supplement 1. Office of Nuclear Reactor Regulation, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2006. "Notice of Acceptance for Docketing of the Application, Notice of Opportunity for a Hearing and Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Facility Operating License No. DPR-59 for an Additional 20-Year Period, Entergy Nuclear Operations, Inc., James A. Fitzpatrick Nuclear Power Plant." *Federal Register*: Vol. 71, No. 182, pp. 55032-55035. September 20, 2006.

U.S. Nuclear Regulatory Commission (NRC). 2007. *Environmental Scoping Summary Report Associated with the Staff's Review of the Application by Entergy for Renewal of the Operating License for JAFNPP.* Washington, D.C. Accessible at ML070440393.

2.0 DESCRIPTION OF NUCLEAR POWER PLANT AND SITE AND INTERACTION WITH THE ENVIRONMENT

James A. FitzPatrick Nuclear Power Plant (JAFNPP) is located in the town of Scriba, New York. The plant consists of one unit, a boiling water reactor (BWR), which employs a once-through cooling system. JAFNPP is operated by Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy). The plant and its environs are described in Section 2.1, and the environment in which the plant is located is presented in Section 2.2.

2.1 Facility and Site Description and Proposed Facility Operation During the Renewal Term

JAFNPP is located on approximately 702 acres (ac) of land on the south shore of Lake Ontario, at a location known as Nine Mile Point. The plant is in a rural area, approximately seven miles (mi) northeast of Oswego, 36 mi north-northwest of Syracuse, and 65 mi east of Rochester, New York. The largest town within a 50-mi radius is Syracuse. Nine Mile Point Nuclear Station, Units 1 and 2, operated by Nine Mile Point Nuclear Station, LLC, is immediately west of JAFNPP. Figures 2-1 and 2-2 show the site location and features within 50 mi and 6 mi, respectively (Entergy 2006c).

2.1.1 External Appearance and Setting

The area surrounding JAFNPP is generally flat, rising gently from Lake Ontario to the Appalachian Uplands on the south, and bounded on the east by the Tug Hill Upland. The plant is at an elevation of 270 feet (ft) above mean sea level. Elevation rises to 310 ft at the property's southern edge 1 mi away. The JAFNPP site is partially wooded and surrounded primarily by residential and recreational areas except for the Nine Mile Point Nuclear Station. There is no residential, agricultural, or industrial development (other than JAFNPP) on the JAFNPP site. The nearest residence is outside the site boundary approximately 0.7 mi to the east-southeast.

The buildings associated with JAFNPP lie on the northwest part of the site (See Figure 2-3). The plant consists of a reactor building, turbine building with electrical and heater bays, administration building and control room, radioactive waste building, screenwell-pumphouse building with intake and discharge tunnels and structures, diesel generator building, auxiliary boiler building, main stack, independent spent fuel storage installation (ISFSI), sewage treatment plant, interim radioactive waste storage building, switchyard, shooting ranges, and associated transmission lines. The facility is enclosed by a security fence and access to the site is controlled. Although the plant structures can be seen by recreational users on Lake Ontario, JAFNPP is not visible to local communities due to the surrounding forest cover.

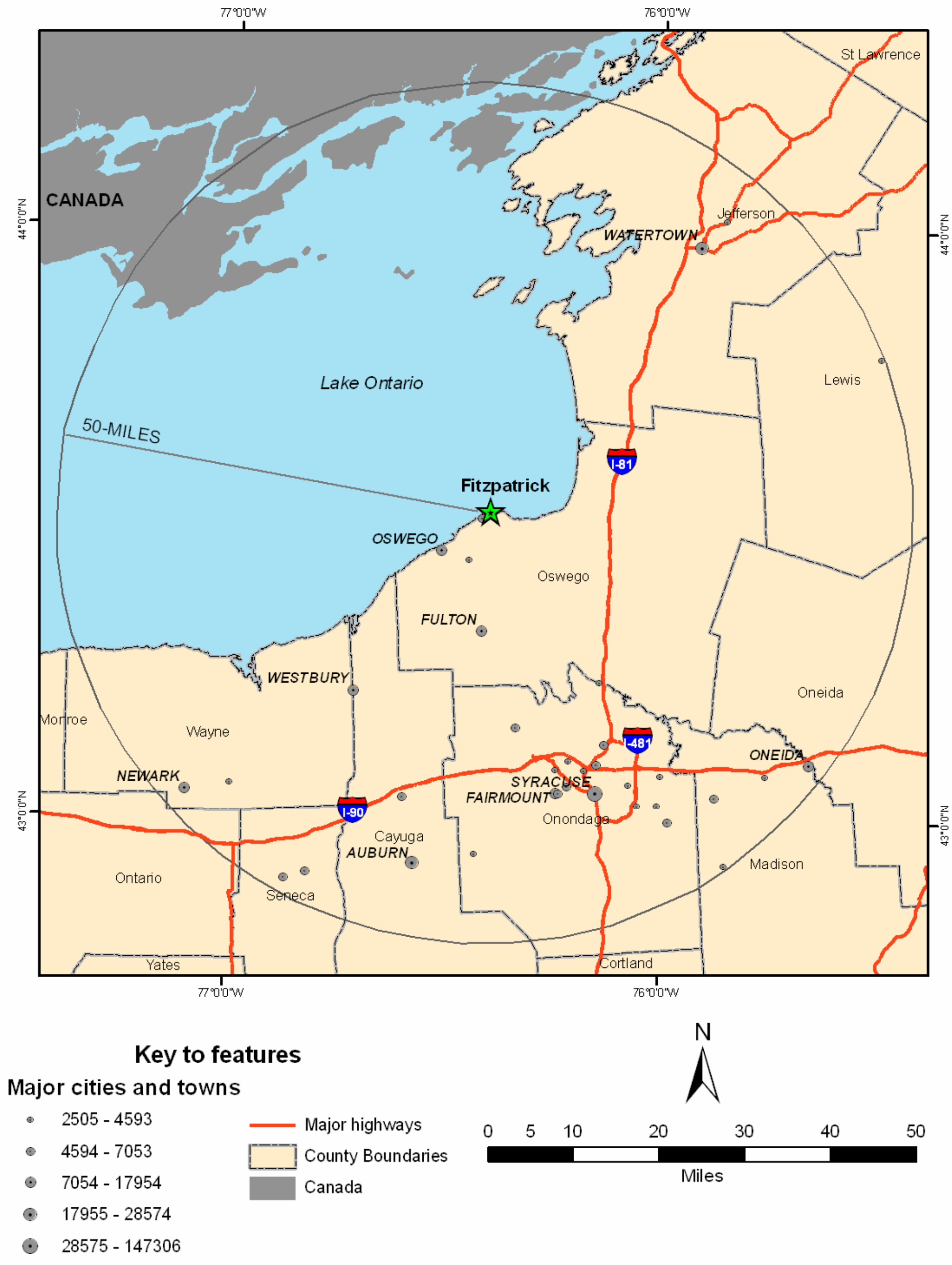

Figure 2-1. Location of JAFNPP, 50-mi Region (Entergy 2006c)

Figure 2-2. Location of JAFNPP**,** 6-mi Region (Entergy 2006c)

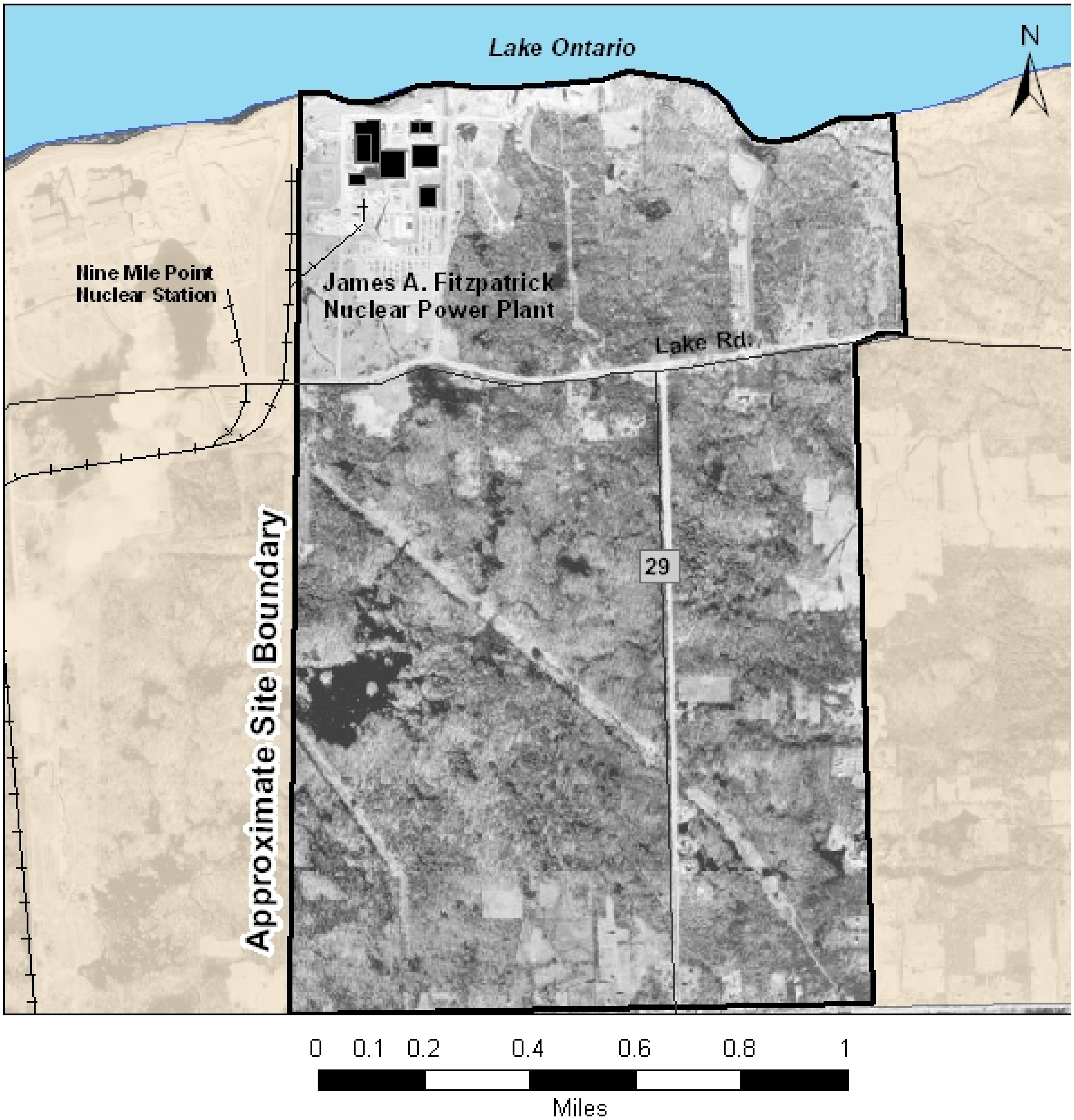

Figure 2-3. JAFNPP Approximate Site Boundary

The plant is accessed by Lake Road, which connects to Oswego County Route 29. A spur of Conrail Railroad is currently blocked for security purposes but could be re-opened to provide rail service to the plant. JAFNPP can also be reached by barge on Lake Ontario.

Within a 50-mi radius of JAFNPP there are 17 state parks, 20 state wildlife management areas, and one national wildlife refuge. The closest public park, Sunset Bay Park, is approximately 1 mi east of JAFNPP on the shore of Lake Ontario. This park has 48 ac of mostly woods and brush land, a boat launch, nature trail, and picnic area. The next closest public park, Independence Park, is approximately 2 mi southwest and also on Lake Ontario. This park has 50 ac of wooded land, walking trails, and an observation deck. Scriba Town Park is 5 mi south of Scriba and includes a picnic area, playground, and swimming facilities.

2.1.2 Reactor Systems

JAFNPP is a single-cycle, forced-circulation BWR that produces steam for direct use in the steam turbine. The rated thermal output of the unit is 2536 megawatts-thermal (MWt), corresponding to an electrical output of approximately 881 megawatts-electric (MWe). JAFNPP achieved commercial operation in 1975 (Entergy 2006c).

The JAFNPP facility is depicted in Figure 2-3. The reactor building is designed as a low in-leakage, elevated release secondary containment system that houses the primary containment system, refueling facilities, and most of the components of the nuclear steam supply system. The secondary containment system provides secondary containment when the primary containment system is closed and in service, and provides primary containment when the primary containment system is open, as in refueling. The secondary containment system consists of the reactor building, standby gas treatment system, reactor building isolation control system, and main stack.

In the event of a postulated pipe break inside the drywell or a fuel handling accident, the reactor building is isolated by the reactor building isolation control system to provide a low leakage barrier. The standby gas treatment system, which is initiated by the same conditions that isolate the reactor building, exhausts air from the reactor building to maintain a reduced pressure within the reactor building relative to the outside atmosphere, treats the air to remove particulates and iodines, and releases the air through the elevated release point, the main stack. These safety features function to localize, control, mitigate, and terminate such events to limit the public’s exposure levels to below applicable dose guidelines.

The fuel for the reactor core consists of slightly enriched uranium dioxide pellets contained in sealed Zircaloy-2 tubes that were evacuated, backfilled with helium, and sealed with Zircaloy end plugs welded in each end. The core is designed to permit the energy extraction of 19,000 megawatt-days per metric ton of uranium averaged over the initial core load (Entergy 2006c).

2.1.3 Cooling and Auxiliary Water Systems

JAFNPP uses water from Lake Ontario for station cooling. Approximately 91 percent of the water withdrawn from the lake is used for the circulating water system to cool the station’s main condenser. Approximately 9 percent of the water withdrawn from the lake is used for the station service water system and other plant systems including the emergency service water system, the residual heat removal system, and the fire protection system.

Water is withdrawn from the lake from an offshore submerged intake structure and through the intake tunnel to the screenwell-pumphouse building. Water is eventually returned to the lake by way of a discharge tunnel and an in-lake diffuser system. The cooling and auxiliary water systems for JAFNPP include the intake structure, intake tunnel, screenwell and pumphouse building, discharge tunnel, and diffuser. Neither the intake or discharge diffuser structures are in the shipping lanes of the lake and therefore do not constitute a hazard to commercial shipping.

The offshore intake structure is a reinforced concrete structure located approximately 900 ft from the shoreline in approximately 25 ft of water. Water is drawn from lower levels of the lake to prevent the formation of vortices at the surface and minimize the possibility of interactions with floating ice and the lake fishery. The structure is approximately 14 ft high and the top of the intake structure is approximately 10 ft below the lake surface. The fan-shaped intake is located on the shoreward side of the structure. Water is drawn through four openings with a total intake area of approximately 8 ft by 70 ft. The intake velocity at the intake structure is approximately 1.6 feet per second (ft/s).

The intake opening also includes a bar rack, with bars placed 1 foot apart, to prevent large debris from entering the intake. The bars are heated by induction coils to minimize the probability of frazil ice adhering to the bars and blocking the intake. The heaters are normally kept energized except during maintenance. During maintenance, any frazil ice that is drawn past the intake racks is tempered in the screenwell structure with water from the circulating water discharge chamber. In the unlikely event that the intake is blocked and the volume of water needed for normal shutdown cannot be drawn, the flow in the discharge structure can be reversed using a series of gates, and cooling water can be drawn through the discharge tunnel to the screenwell-pumphouse building.

JAFNPP has installed a high-frequency/high-amplitude acoustic fish deterrence system (FDS) on the intake structure. The JAFNPP FDS consists of nine overlapping, wide-beam, high-frequency transducers mounted on the top of the intake structure. The transducers produce a sound field designed to deter alewifes from entering the intake structure and eventually becoming impinged on the intake screens.

From the intake structure, the lake water drops 60 feet below lake level to a tunnel connecting the intake structure to the onshore screenwell-pumphouse building. The D-shaped tunnel has a flat bottom, vertical sides, and round top; average water velocity in the tunnel is 4.7 ft/s. From the intake tunnel, the water rises into the forebay of the screenwell-pumphouse building.

The screenwell-pumphouse building, which is the structure immediately north of the turbine building, houses the trash racks, traveling screens, pumps for the circulating water, services water, emergency service water, residual heat removal, and fire protection systems. The screenwell-pumphouse also houses the water treatment tanks and associated biofouling control equipment.

From the intake tunnel, water enters the screenwell-pumphouse forebay, travels through vertical trash bars that excludes debris greater than 3 1/8-inches, then through the vertical traveling screens with a 3/8-inch mesh. The screenwell behind the vertical traveling screens houses three circulating water pumps each with a rated flow of 120,000 gpm. The design circulating water flow is 352,600 gpm through the main condenser.

Discharge from the main condenser and service water system is returned to Lake Ontario through the discharge tunnel and diffuser system in the lake. The design effluent flow rate to the discharge tunnel is 388,600 gpm, including the design service water pumps discharge of 36,000 gpm. The discharge tunnel starts from the screenwell-pumphouse building and extends approximately 1400 ft northward into the lake to a junction with the diffuser branch tunnels, which are generally parallel to the shoreline. The discharge diffuser consists of six diffuser heads, three on each diffuser branch and spaced approximately 150 feet apart. On top of each riser is a diffuser head consisting of two horizontal discharge nozzles separated by an included angle of 42 degrees. Each nozzle is 2.5 ft in diameter and discharges water at an exit velocity of 14 ft/s in the offshore direction. The centerline of the nozzles is five to six feet above the lake bottom.

Discharges from the cooling water and service water systems are regulated by the New York State Department of Environmental Conservation (NYSDEC) under State Pollutant Discharge Elimination System (SPDES) Discharge Permit NY-0020109 (Entergy 2006c).

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

JAFNPP radioactive waste (radwaste) systems are designed to collect, treat, and dispose of the radioactive and potentially radioactive wastes that are byproducts of plant operations. The byproducts are activation products resulting from the irradiation of reactor water and impurities therein (principally metallic corrosion products) and fission products resulting from defective fuel cladding or uranium contamination within the reactor coolant system. Operating procedures for radwaste systems ensure that radioactive wastes are safely processed and discharged from the plant within the limits set forth in Part 20 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 20), 10 CFR Part 50, the plant’s technical specifications, and JAFNPP’s *Offsite Dose Calculation Manual* or ODCM (Entergy 2004c, 2006c).

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid. Liquid radioactive wastes are generated from liquids received directly from portions of the reactor coolant system or were contaminated by contact with liquids from the reactor coolant system. Gaseous radioactive wastes are generated from gases or airborne particulates vented from reactor and turbine equipment containing radioactive material. Solid radioactive wastes are solids from the reactor coolant system, solids that came into contact with reactor coolant system liquids or gases, or solids used in the reactor coolant system or steam and power conversion system operation or maintenance (Entergy 2006c).

Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh fuel assemblies during routine refueling outages, typically every 24 months. Spent fuel assemblies are then stored for a period of time in the spent fuel pool in the reactor building and may later be transferred to dry storage at an onsite ISFSI. JAFNPP also provides for onsite storage of mixed wastes, which contain both radioactive and chemically hazardous materials (Entergy 2006c).

JAFNPP's ODCM contains the methodology and parameters used to calculate offsite doses resulting from radioactive gaseous and liquid effluents, and the gaseous and liquid effluent monitoring alarm and trip set points used to verify that the radioactive material being discharged meets regulatory limits (Entergy 2004c). The ODCM also contains the radioactive effluent controls and radiological environmental monitoring activities and descriptions of the information that should be included in the annual Radiological Environmental Operating Report and annual Radioactive Effluent Release Report required by 10 CFR Part 50, Appendix I, and 10 CFR 50.36a, respectively.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The liquid waste processing system collects, holds, treats, processes, and monitors all liquid radioactive wastes for reuse or disposal. The system is divided into several subsystems so that liquid wastes from various sources can be segregated and processed separately. Cross connections between the subsystems provide additional flexibility for processing the wastes by alternate methods. The wastes are collected, treated, and disposed of according to their conductivity and/or radioactivity (Entergy 2006c).

Liquid waste is collected in sumps and drain tanks and transferred to the appropriate subsystem collection tanks for subsequent treatment, disposal, or recycle. The subsystems provide for filtration, demineralizing, dewatering, and resin filtration; and include a modular fluidized transfer demineralization and sluice system. Following treatment and batch sampling, the liquid waste is normally returned to condensate storage tanks for reuse in the plant. Liquid releases to the lake are infrequent, and limited to the maximum extent possible to satisfy the design objectives of 10 CFR Part 50, Appendix I. Liquid discharges to the lake occur only when radioactive material activity concentration in the storage tank is equal to or less than 5×10^{-4} curies per milliliter (Ci/ml) (Entergy 2006c). Liquid discharge concentrations are further reduced by dilution water before any release to the lake. Chemical waste is dewatered and sent offsite to an approved disposal site. Controls for limiting the release of radiological liquid effluents are described in the ODCM (Entergy 2004c).

The NRC staff reviewed the JAFNPP radioactive effluent release reports for 2001 through 2005 for liquid effluents (Entergy 2006a, 2005a, 2004a, 2003, 2002a, 2002b). In 2005, 3 million liters (L) of radiological liquid effluents diluted with 921 million L of water and a total of 1.34×10^{-2} Ci of tritium diluted to concentrations below 2×10^{-6} µCi/ml were released (Entergy 2006a). The releases contained no other fission or activation products, gross alpha radioactivity, or dissolved and entrained gases. In the fourth quarter of 2002, a total of $2.75\ 10^{-3}$ Ci of fission and activation products and 3.62×10^{-7} Ci of gross alpha radioactivity were released.

Based on the liquid waste processing systems and effluent controls and performance from 2001 through 2005, similar small quantities of radioactive liquid effluents are expected from JAFNPP and are not expected to increase during the renewal period. These releases would result in doses to members of the public that are well below the as low as reasonably achievable (ALARA) dose design objectives of 10 CFR Part 50, Appendix I, as discussed in Section 2.2.7.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

The gaseous radwaste processing system processes and disposes of condenser off-gases via the main stack. Non-radioactive gland seal gas and gases from the start-up mechanical pump are also discharged via the stack. During routine reactor operation, condenser off-gas is the major contributor to the activity in the off-gas release. Condenser off-gas entering this system consists of non-condensables from the main condenser, which consist of hydrogen and oxygen formed in the reactor by the radiolytic decomposition of water, air in-leakage to the turbine-condenser, water vapor, and a negligible volume of fission gases. The most important sources of radioactive gases are activation gases in the reactor coolant and fission gases that leak through the fuel cladding (Entergy 2006c).

The gaseous radwaste processing system controls, filters, and removes radioactive particulates and iodine from off-gas stream, recombines radiolytic hydrogen and oxygen, provides adequate holdup time for decay of short-lived radionuclides, and uses charcoal beds for the hold-up and partial decay of xenon (Xe) and krypton (Kr) gases. The stack design ensures prompt mixing of gas inlet streams at its base, thereby providing prompt dilution of hydrogen and allowing the location of sample points as near the base as possible.

JAFNPP maintains gaseous in accordance with the procedures and methodology described in the ODCM. The gaseous radwaste system is used to reduce radioactive materials in gaseous effluents before discharge to meet the ALARA dose design objectives in 10 CFR Part 50, Appendix I. Radioactive effluent gases are released at a typical rate of 24 to 28 cubic feet per minute (ft^3/min). Two air dilution fans are in the base of the stack, both rated at 3000 ft^3/min. One dilution fan operates continuously while the other fan is on standby. The flow from the operating stack dilution fan also ensures that hydrogen is diluted to less than 4 percent by volume. In addition, the limits in the ODCM are designed to prevent members of the public in unrestricted areas from being exposed to radioactive materials in excess of the limits specified in 10 CFR Part 20, Appendix B (Entergy 2006c).

The NRC staff reviewed the JAFNPP radioactive effluent release reports for 2001 through 2005 for gaseous effluents (Entergy 2006a, 2005a, 2004a, 2003, 2002a, 2002b). In 2005, the total fission and activation products released was 4370 Ci; iodine-131 was 9.35 x 10^{-3} Ci; particulates were 3.52 x 10^{-36} Ci; and tritium was 17.1 Ci. These activities are typical of past years and are not expected to increase during the renewal period. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

2.1.4.3 Solid Waste Processing

The solid radwaste processing equipment is located in the radioactive waste building with the exception of the cleanup phase separator tanks, which are located in the reactor building. Both wet and dry radioactive solid wastes are processed. Wet solid wastes include backwash sludge wastes from the reactor water cleanup system, waste from floor drain filters, the fuel pool filter-demineralizers, spent resins from the waste and condensate demineralizers, and spent media from modular fluidized transfer demineralization and sluice system. Dry solid wastes include rags, contaminated clothing, paper, small equipment parts, and solid laboratory wastes (Entergy 2006c).

Contaminated waste such as demolished piping, equipment, and components from facility radiological-controlled areas are first processed at an onsite decontamination unit. If the material is below the acceptable release limits and after additional cleaning shows no further reduction of contamination levels, the material may be returned to use or released from the radiological-controlled area. If the material is not below the release limits and after additional cleaning shows no further reduction of contamination levels, it will be disposed of as radioactive waste. In some instances, the solid material is sent to a vendor for decontamination. This material may be returned for reuse or disposed of as radioactive waste per the vendor's process (Entergy 2006c).

In 2005, JAFNPP made a total of 35 shipments of solid waste to offsite vendors. The solid waste volumes were 623 cubic meters (m^3) of dry compressible waste, contaminated equipment, and spent resins, with an activity of 131 Ci (Entergy 2006a). No irradiated components or control rods were shipped. The solid waste volumes and radioactive material activity levels are typical of annual waste shipments for JAFNPP and are not expected to increase during the renewal period.

2.1.5 Nonradioactive Waste Systems

JAFNPP generates solid waste, hazardous and universal waste, mixed waste, and wastewaters from routine facility operations and maintenance activities.

2.1.5.1 Nonradioactive Waste Streams

Solid waste is waste that is neither radioactive nor hazardous as defined by the Resource Conservation and Recovery Act (RCRA) (40 CFR Part 260). JAFNPP generates solid waste, such as office trash, as part of routine plant maintenance, cleaning activities, and plant operations. A contract service collects office trash and disposes of the waste offsite. JAFNPP has an active recycling program for office paper, aluminum cans, and plastic.

Hazardous waste is nonradioactive waste that is listed by the U.S. Environmental Protection Agency (EPA) as hazardous waste or that exhibits characteristics of ignitability, corrosivity, reactivity, or toxicity (40 CFR Part 261). RCRA regulates the treatment, storage, and/or disposal of hazardous waste and requires a hazardous waste permit for facilities that treat or store large quantities of hazardous waste for more than 90 days and for entities that dispose of hazardous waste at the facility. RCRA regulations are administered in New York State by NYSDEC.

JAFNPP generates a variety of hazardous waste streams including broken fluorescent lamps, mercury, off-specification or expired chemicals, oil lab wastes, oils and solvents, paint waste, photographic waste, and polychlorinated biphenyls (PCBs). JAFNPP is a small-quantity generator of hazardous waste, meaning the plant generates less than 1000 kilograms (kg) of non-acute hazardous waste in a month and stores less than 6000 kg of this waste at any one time. A small-quantity generator can also be classified as generating less than 1 kg of acute hazardous waste in a month and storing less than 1 kg of this waste at one time. In 2004, JAFNPP generated 5266 kg of hazardous waste. Most of the waste was associated with the demolition of buildings. Approximately 318 kg of hazardous waste was generated in 2005 and 626 kg in 2006. During 2004 to 2006, NYSDEC conducted two regulatory compliance inspections of JAFNPP’s RCRA program. No hazardous waste permit violations were noted.

Universal waste is hazardous waste that has been specified as universal waste by the EPA. Universal waste, including mercury-containing equipment, batteries, lamps, and pesticides, has specific regulations (40 CFR Part 273) to ensure proper collection and recycling or treatment. States may modify the universal waste rule and add additional wastes to their list of universal wastes. New York State classifies batteries, pesticides, mercury-containing thermostats, and lamps as universal wastes, which are therefore subject to specific universal waste regulations (6 NYCRR Subpart 374).

JAFNPP generates pesticides, batteries, and fluorescent lamps as universal wastes from normal facility operations. The batteries and lamps are accumulated in satellite areas and then moved to a locked storage building, in accordance with State universal waste regulations. The wastes are disposed of offsite by a contract service. In 2005, JAFNPP generated approximately 7193 kg of spent batteries and 843 kg of spent fluorescent bulbs. In 2006, 2749 kg of spent batteries and 843 kg of spent bulbs were generated. During the 2004 RCRA inspection, one universal waste program violation related to the management of spent fluorescent bulbs was noted but fixed immediately by site personnel (Entergy 2006g).

The Toxic Substance Control Act (TSCA) of 1976 (15 USC s/s 2601 et seq.) implemented regulations for EPA to track specific toxic chemicals used in the U.S. PCBs, a TSCA chemical is found at JAFNPP in limited quantities in transformer oil, lighting ballasts, and capacitors. In 2005, JAFNPP received a fine from EPA for improperly identifying a drum of used oil as non-hazardous instead of PCB-waste and not disposing of the drum at a TSCA disposal facility. As a result, Entergy created a fleet-wide TSCA management plan that has been implemented at JAFNPP.

Low-level mixed waste (LLMW) is waste that exhibits hazardous characteristics and contains low levels of radioactivity. LLMW has been regulated under multiple authorities. EPA or state agencies regulate the hazardous component of LLMW through RCRA, and either the U.S. Department of Energy (DOE) or NRC regulates the radioactive component. New York State has adopted the EPA rule (6 NYCRR Part 374), which provides for a conditional exemption of LLMW storage, to eliminate dual regulation of LLMW. Storage of LLMW at JAFNPP is permitted under its NYSDEC Treatment, Storage, or Discharge Facility (TSDF) permit (No. NYD000765073). The permit was issued in November 1995 and expired in January 2000. New York Power Authority (NYPA), the owner of JAFNPP at the time, submitted a letter to NYSDEC (NYPA 2000) with its intention to operate under the conditional exemption. Subsequently, NYSDEC allowed the existing permit to continue under the State Administrative Procedures Act (Section 401) until the EPA rule was finalized (NYSDEC 2000a). JAFNPP submitted a letter to NYSDEC in November 2005 stating that JAFNPP qualified for the LLMW exemption and would, therefore, like to terminate its Part 373 Permit (Entergy 2005d). The permit is still pending termination by NYSDEC.

JAFNPP generates oil and solvent wastes, off-specification chemicals, and paint wastes (solids and liquids) from normal facility operation and maintenance. These wastes, when generated, are stored in locked, marked containment buildings specifically for LLMW. JAFNPP last shipped LLMW offsite for disposal in 2005. JAFNPP generates small amounts of LLMW at several accumulation areas in the facility but does not have any stored in the mixed waste storage building (Entergy 2006g).

JAFNPP generates two types of wastewater: sanitary liquid wastes and industrial effluents. Radioactive liquid waste is addressed in Section 2.1.4. Section 2.2.3 provides more information on JAFNPP's SPDES permit.

JAFNPP operates a sewage treatment plant to treat sanitary wastewater generated by the plant. The treated water is discharged into a drainage ditch that flows into Lake Ontario and is regulated as Outfall 012 in the SPDES permit (No. NY-0020109) issued by NYSDEC. Sanitary sludge from the sewage treatment plant is placed in covered sludge drying beds. The sludge is removed by a contractor as needed and disposed of at an offsite treatment facility.

Industrial effluents are typically combined with cooling water discharges in accordance with SPDES permit requirements. There are five SPDES-permitted outfalls (Outfalls 001 through 005). Circulating cooling water, service water, intake screen backwash, clarifier blowdown, filter backwash, clearwell overflow, waste tank discharges, borated water, and emergency diesel generator cooling water are discharged at Outfall 001. Combined storm water and oil-water separator wastewater are discharged at Outfall 002. Storm water runoff is discharged at Outfalls 003, 004, and 005. Overflow from the sedimentation containment pond is also discharged from Outfall 005. JAFNPP's SPDES permit requires specific monitoring and/or sampling at each of the outfalls.

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires applicable facilities to provide information on hazardous and toxic chemicals to emergency planning authorities and the EPA. JAFNPP is subject to EPCRA Section 312 reporting and therefore submits annual reports to local emergency agencies on the following chemicals: carbon dioxide, diesel fuel, electrohydraulic fluid, fuel oil, gasoline, hydrogen, lube oils, nitrogen, oxygen, resins, sodium hypochlorite, and transformer oil (Entergy 2006g).

2.1.5.2 Pollution Prevention and Waste Minimization

Currently, JAFNPP has several waste minimization measures in place. JAFNPP recycles grease from the onsite cafeteria, as well as aluminum, office paper, and used oil. Another waste minimization measure is the use of shock absorbing concrete (SACON) blocks as backstops for firing activities at the firing ranges. The SACON blocks capture expended rounds, preventing potential groundwater or soil lead contamination. The block supplier removes the spent SACON blocks and recycles them into other concrete products (Entergy 2007a).

Entergy has a corporate policy and plan for waste minimization at its nuclear power plants, including JAFNPP (Entergy 2006b). The plan provides a hierarchy of waste minimization options that emphasize source reduction, reuse/recycling, treatment to reduce volume and/or toxicity, and disposal, in that order. A fleet-wide focus group meets to discuss opportunities for waste minimization and information sharing among the Entergy nuclear facilities. There are also fleet-wide programs for Waste Management and Chemical Control. It is expected that Entergy would continue to implement its waste minimization policy and programs during the license renewal period for JAFNPP. The EPA's Office of Pollution Prevention and Toxics has established a clearinghouse that provides information regarding management, technical, and operational approaches to pollution prevention. The EPA's clearinghouse can provide additional opportunities for waste minimization and pollution prevention at JAFNPP.

2.1.6 Facility Operation and Maintenance

Maintenance activities conducted at JAFNPP include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs and activities currently exist at JAFNPP to maintain, inspect, test, and monitor the performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel in-service inspection and testing, maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those implemented to meet technical specification surveillance requirements, those implemented in response to the U.S. Nuclear Regulatory Commission (NRC) generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages. Entergy refuels JAFNPP on a nominal 24-month interval.

2.1.7 Power Transmission System

Two single-circuit, 345-kilovolt (kV) transmission lines, the Edic and Scriba lines, were constructed to connect JAFNPP to the grid. Both of these lines are owned by NYPA. The Edic line (Table 2-1) is approximately 70 mi long and was constructed to connect the JAFNPP to the New York Power Pool transmission grid. This line runs southeasterly from the plant 345-kV switchyard to the Edic Substation located near Utica, New York (Figure 2-4). NYPA has owned and operated the transmission line since it was constructed in the early 1970s. A 400-ft wide right-of-way (ROW) was acquired by NYPA for the Edic 345-kV transmission line although a width of only 150 ft, totaling 1273 ac, was actually cleared for the line. The remaining ROW was acquired for the possible construction of future transmission lines. The Edic transmission line was constructed with steel self-supporting towers spaced about 1200 ft apart. When the ROW was acquired, about 65 percent of the ROW passed through forests, 29 percent through agricultural lands, and 6 percent through wetlands. Most of ROW land remains in private ownership and is used for a variety of compatible purposes.

A second single circuit, 345-kV transmission line was also constructed to connect JAFNPP to the grid. The Scriba line (Table 2-1) is approximately 4900 ft (0.9 mi) in length and runs southward from the plant's 345-kV switchyard to the National Grid Scriba Substation where it connects to the 345-kV transmission system.

The two 345-kV lines for JAFNPP have transmission capacity in excess of the JAFNPP generating unit, so either line can be out of service without curtailing the output from the plant. Both lines exceed the requirements of the National Electric Safety Code for heavy loading districts, Grade B (Entergy 2006c).

Table 2-1. JAFNPP Transmission Lines, Substations, and Corridors

Substation	Owner	Number of Lines	kV	Approximate Distance in miles	Corridor Width in feet	Corridor Area in acres	Within Scope of License Renewal
Edic	NYPA	1	345	70	150	1273	Yes
Scriba	NYPA	1	345	0.9	NA	NA	Yes
Lighthouse Hill	National Grid	1	115	26	NA	NA	No
Nine Mile Point Nuclear Station	Constellation	1	115	0.7	NA	NA	No

Source: Entergy 2006c

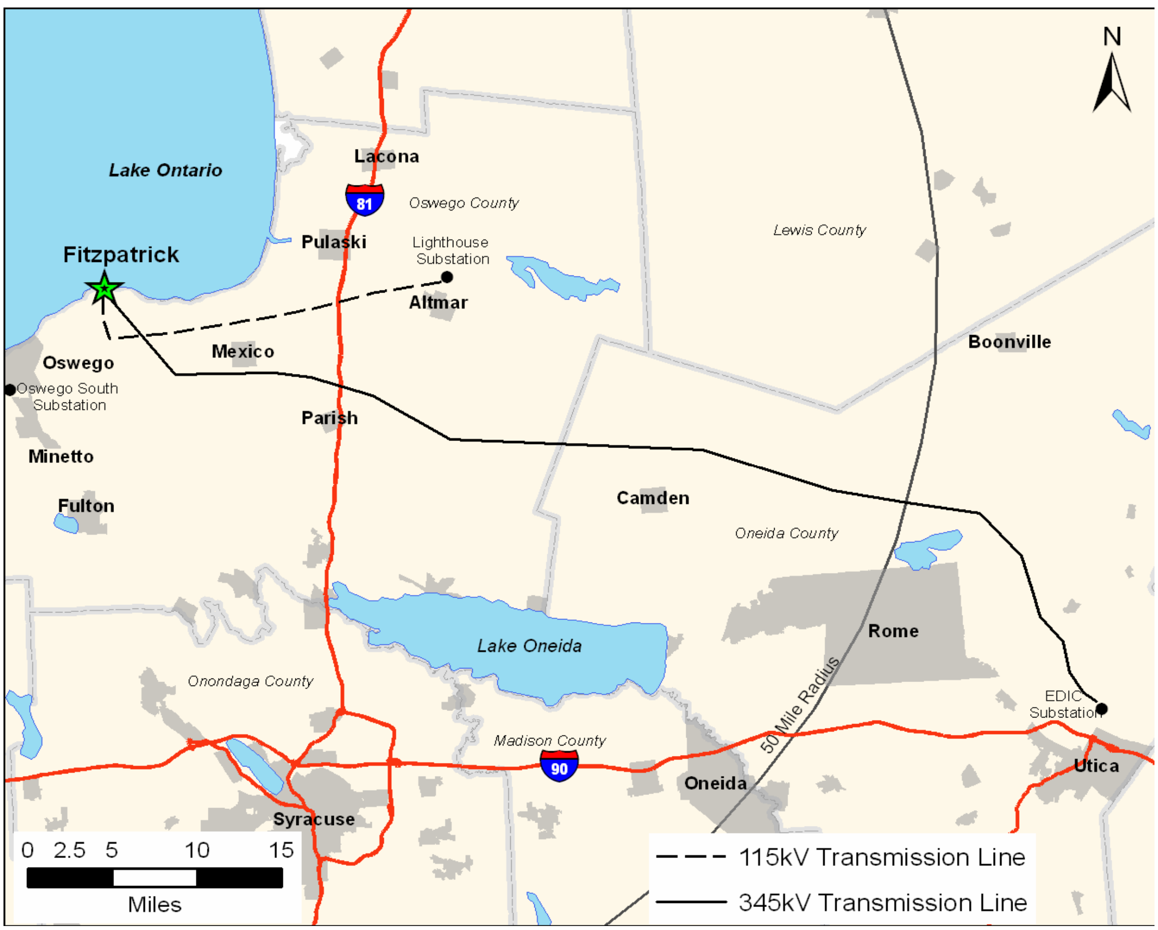

Figure 2-4. JAFNPP Transmission Lines

In addition to the two 345-kV transmission lines for power distribution, offsite power is provided to JAFNPP by two single-circuit 115-kV transmission lines connected to the plant's 115-kV bus. One 115-kV line (Table 2-1) runs southward from the site and connects to the National Grid 115-kV transmission line that extends to the Lighthouse Hill Hydroelectric Station located about 26 mi east of JAFNPP. In addition to being a hydroelectric generating station and an integral part of the National Grid 115-kV system, the Lighthouse Hill facility also serves as the switchyard for several other hydroelectric facilities in the area. The other JAFNPP 115-kV line (Table 2-1) is approximately 3700 ft in length and is connected to the 115-kV bus at Constellation Nuclear Nine Mile Point Nuclear Station. The 115-kV bus at Constellation Nuclear Nine Mile Point Nuclear Station Unit 1 is also connected via a 115-kV transmission line to the South Oswego Substation (Entergy 2006c).

Ownership of the four JAFNPP transmission lines is as follows: (1) Edic Substation 345-kV transmission line: from 345-kV switchyard to approximately the site property line, JAFNPP owns the line; from the JAFNPP property line to the Edic Substation, NYPA owns the line; (2) Scriba Substation 345-kV transmission line: from 345-kV switchyard to approximately the site property line, JAFNPP owns the line; from the JAFNPP property line to the Scriba Substation, NYPA owns the line; (3) Lighthouse Hill Hydroelectric Station 115-kV transmission line: from 115-kV Switchyard to approximately the site property line, JAFNPP owns the line; from the JAFNPP property line to the Lighthouse Hill Hydroelectric Station, National Grid owns the line; and (4) Constellation Nuclear Nine Mile Point Nuclear Station 115-kV transmission line: from 115-kV switchyard to approximately the site property line, JAFNPP owns the line; from the JAFNPP property line to the Constellation Nuclear Nine Mile Point Nuclear Station 115-kV bus, Constellation Nuclear Nine Mile Point Nuclear Station owns the line.

For the two 345-kV transmission line ROWs, NYPA uses a vegetation management plan approved by the New York State Public Service Commission. NYPA uses an integrated vegetation management computer application, which employs geographic information system technology. The vegetation management program is designed to control tall-growing tree species and to enhance the abundance of lower-growing desirable vegetation. Field inventories are conducted annually for the ROW scheduled for clearing the following year. Inventories and treatment recommendations are reviewed and approved by the NYPA forestry staff. The majority of clearing is performed using mechanical methods. Herbicide applications are applied to selected plant species by licensed contractors, and a safe buffer is maintained around wetlands, and stream and river crossings. A safe buffer is also used around wells and springs that are used for residential water supplies. Areas where herbicides are used are posted with information regarding the chemicals that were used and when they were applied. Herbicides are not applied on NYPA ROWs using aerial application methods (Entergy 2006c).

2.2 Facility Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near JAFNPP as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts associated with other Federal project activities.

2.2.1 Land Use

JAFNPP is located in an unincorporated and primarily rural area approximately seven mi northeast of Oswego, New York. Syracuse is the largest city within 50 mi of JAFNPP. Lake Road (County Road 1A) provides road access to the site and transverses JAFNPP property in an east-west direction just south of the plant. Exclusion distances for the JAFNPP site are approximately 3000 ft to the east, over 1 mi to the west, and about 1.5 mi to the southern site boundary. The nearest location with public access to the reactor building and any points of potential gaseous effluents, with the exception of the lake shoreline, are at the northeast corner of the property. The nearest residence lies outside the site boundary to the east-southeast at 0.71 miles (Entergy 2006c). See Figure 2-2.

JAFNPP features include the reactor building, turbine building, administration building and control room, ISFSI, and several support facilities. The most prominent feature on the site is the off-gas stack, which is 385 ft high. Only 3 percent of the site is occupied by JAFNPP structures, with the remainder consisting of forest shrub, grasslands, and wetlands or ponds (Entergy 2006c). See Figure 2-3.

The site lies mainly within the Erie-Ontario Lowlands physiographic province. This province consists of a relatively flat plain that rises gently from Lake Ontario to the Appalachian Uplands, which form the province’s southern border. Erie-Ontario Lowlands are bounded on the east by Tug Hill Upland, through which small portions of the transmission line pass. The site is a generally flat and featureless plain. It has an elevation of 270 ft rising to 310 ft 1 mi away at the southern extremity. The surface soils are derived from bouldery-ablation tills that immediately overlay a compact basal till lying on bedrock (AEC 1973).

2.2.2 Water Use

Water use associated with the operation of JAFNPP consists of fresh water drawn from Lake Ontario used primarily for cooling. Water from Lake Ontario is used for the cooling and auxiliary systems. JAFNPP receives its potable water from the City of Oswego. JAFNPP is not a direct user of groundwater, and there are no plans for direct groundwater use in the future. There are no production wells onsite (Entergy 2006c).

2.2.3 Water Quality

JAFNPP is located on the southeastern shore of Lake Ontario, which is the furthest downstream and smallest of all the Great Lakes, having a surface area of 7340 square miles. It is an international body of water with the border of the United States and Canada being approximately midway across the width of the lake. It has an average depth of 283 ft with a maximum depth of 802 ft (EPA 2006d).

The combination of prevailing west-northwest winds over the lake area and the eastern flow of water from Lake Erie results in the lake being dominated by a counterclockwise horizontal circulation pattern. Although winds can play a major role in affecting localized lake water flow patterns, currents on the southern shore of the lake often move in an easterly direction in a relatively narrow band. Because Lake Ontario is the furthest downstream of all the Great Lakes, its water quality is influenced not only by human activities on its own shores, but by impacts on all the other Great Lakes as well. Approximately 80 percent of the influx of water to Lake Ontario comes directly from Lake Erie via the Niagara River. The remaining 20 percent of the influx comes from basin tributaries, groundwater and precipitation. Approximately 93 percent of Lake Ontario's water flows out through the St. Lawrence River with the remaining 7 percent being lost to evaporative processes. The estimated water retention time is 6 years (EPA 2006d).

Changes in wind speed and direction on Lake Ontario can also contribute to vertical mixing of lake water. Strong winds can cause upwelling and sudden oscillations of thermocline depth. Strong easterly winds along the east-west axis of Lake Ontario will cause a surface drift to the right, which can result in tilting of the thermocline. When the tilted thermocline is pushed along the nearshore zone it can become so intense that an outbreak of cold hypolimnion water will upwell to the surface in the nearshore environment and create a steep temperature gradient in the lake center. An increase in longshore current velocity can be associated with these events as well, increasing the dispersion of both pollutants and nutrients from the lake bottom along the shore (EC 2000).

Both meteorological and hydrological processes are responsible for a seasonal thermal response on the lake. Incoming solar radiation heats the surface waters of the lake, more so in the summer, while changes in wind speed and direction aid in the mixing of these heated waters to lower depths in the lake. The mean summer ambient temperature of Lake Ontario in the Nine Mile Point area is approximately 67° Fahrenheit (F). Most of the lake is vertically stratified during the summer (June through September) with warm surface waters (epilimnion) averaging nearly 70°F and cool deeper waters (hypolimnion) ranging between 38.8 and 39.2°F. Mixing of these strata begins as the thermocline breaks down during September as a result of surface water cooling and continues until water temperatures are the same throughout the water column (EC 2000). The date of this overturn varies annually due to short term weather patterns and storms. The isotherms following the overturn tend to be parallel to the shore resulting in a freezing of nearshore waters with the deeper offshore waters remaining open.

Lake Ontario outflows, and thus lake water levels, are controlled by a series of dams on the St. Lawrence River under the authority of the International St. Lawrence River Board of Control (ISLRBC). The ISLRBC requires that Lake Ontario water levels be maintained within a target range of 243 to 247 ft International Great Lakes Datum to support lake navigation and to provide water for power production facilities on the lake. The target level of 243 ft is maintained from April through November when lake water evaporation rates would be highest and the St. Lawrence River is likely close to low-flow conditions (ISLRBC 2004).

Once an oligotrophic system, by 1970 Lake Ontario was almost entirely eutrophic, caused by high levels of anthropogenic nutrients (primarily phosphorous) and uncontrolled pollutant discharge to the lake. The eutrophication of Lake Ontario was recognized as a serious water quality problem by the U.S. and Canada and led to the creation of the bi-national Great Lakes Water Quality Agreement (GLWQA) in 1972. Since then the lake has seen dramatic improvement in water quality. Much of this improvement can be attributed to stricter controls on land use in the Lake Ontario basin and lake-wide management plans sponsored by the GLWQA that reduced levels of non-point source pollution entering the lake. However, changes in lake water quality since the 1970s have altered the biological landscape within Lake Ontario. Nutrient supplies and other environmental pressures have had direct effects on all trophic levels within the lake ecosystem (Stewart et al. 1999).

The New York State Department of Environmental Conservation (NYSDEC) conducted a study of water quality throughout New York State over the past 30 years, including selected basic water quality parameters of Lake Ontario; this information is summarized in Table 2-2. Data was collected in the Nine Mile Point area in 1972 and 1978, the City of Oswego water intake (approximately 8 mi southwest of JAFNPP) in 1998 and 1999, and at the Monroe County water intake (approximately 50 mi west of JAFNPP) in 2000 (NYSDEC 2000b).

Today, the largest source of pollutants and nutrients (including phosphorous and nitrogen) entering Lake Ontario is through the Niagara River, which drains Lake Erie. As in the past, additional nutrients also still enter the lake through runoff from agricultural lands, urban areas, sewage outflows, and erosional processes. The NYSDEC water quality study indicated that although over the past 30 years there have been general reductions in some pollutants, such as phosphorous and dissolved solids, nitrogen inputs to Lake Ontario have increased. Runoff from agricultural lands and atmospheric deposition are likely significant contributors to lake nitrogen levels.

In another bi-national effort, in 1989 the U.S. and Canada developed the Lake Ontario Toxics Management Plan. The plan addressed persistent bioaccumulative and toxic chemicals (PBTs), which include mirex, polychlorinated biphenyls (PCBs) and dioxins (NYSDEC 2000b). PBTs enter Lake Ontario through various tributaries and have historically accumulated in sediments at the bottom of the lake. Several portions of Lake Ontario’s New York shoreline are classified by the NYSDEC as “impaired,” requiring total maximum daily load (TMDL) development in order to reduce the input of the specific pollutants (NYSDEC 2006g). Some Lake Ontario biota saw reductions in toxic chemical concentrations from the 1960s through the 1980s that were generally attributed to restrictions placed on the manufacture and use of PBTs, but those declines have since leveled off. This may be due in part to the sequestration of chemicals in the benthic lake sediments. Consumption advisories for certain lake fish species continue to be issued by NYSDEC based on PBT levels found in some fish samples (NYSDEC 2000b).

Table 2-2. Selected Water Quality Parameters of Lake Ontario

	Year			
Parameter	**1972**[(a)]	**1978**[(b)]	**1998-99**[(c)]	**2000**[(e)]
pH	8.0	8.4	7.96	7.6
Total alkalinity (mg/L)	72–90	94.2	92	83
Total phosphorus (mg/L)	0.01–0.28	0.027	0.006[(d)]	0.005[(d)]
Total dissolved solids (mg/L)	107–186	202	NA	160
Total nitrates (mg/L)	0.04–0.40	< 0.18	NA	0.34
Turbidity	2–6 JTU	3.0 NTU	0.5 NTU	0.09 NTU

mg/L = milligram(s) per liter
JTU = Jackson Turbidity Unit(s)
NTU = Nephelometric Turbidity Unit(s)

(a) Source: AEC 1974
(b) Source: NMPC 1985
(c) Source (except total phosphorus): Heritage Power 2000
(d) Source: EPA 2005
(e) Source (except total phosphorus): MCWA 2001; pH and alkalinity data are from water distribution system and not from ambient lake water

JAFNPP uses a Betz Clam-Trol CT-1 (a chlorine-based molluscicide) program within their service and cooling water systems to control zebra mussels (*Dreissena polymorpha*) and quagga mussels (*D. bugensis*). The site-specific SPDES permit limits the administration of the molluscicide program to a maximum of four times per year and includes special conditions for outfall monitoring during applications and strict discharge limitations (Entergy 2006c). Biofouling control at JAFNPP is achieved through the application of sodium hypochlorite in the service water system and the condenser waterboxes. Sodium hypochlorite injection occurs continuously, but at a concentration and volume that does not result in the exceedance of the SPDES limit of 0.2 parts per million (ppm) total residual chlorine (TRC), as measured in the discharge canal. Waterbox chlorination is limited to two hours per day, not to exceed a total of nine hours per week, and during daytime hours only when ichthyoplankton entrainment levels are historically low. The JAFNPP SPDES permit also prescribes a waterbox chlorination limitation of 0.2 ppm TRC (Entergy 2006a).

Treated effluent from the sanitary waste water treatment system is regulated as Outfall 012 before discharging into a drainage ditch that flows into Lake Ontario. The effluent is monitored for flow, biochemical oxygen demand, suspended solids, settable solids, fecal coliform, pH, and total residual chlorine. Maximum permitted flow is 60,000 gpd as a 30-day average. During 2006, daily flow ranged from 400 to 25,000 gpd (Entergy 2006c).

JAFNPP operates in accordance with applicable local, State, and Federal discharge limitations (Entergy 2006c). The NRC staff review of the past five years of JAFNPP SPDES reports found no notices of violation.

Groundwater is available in the Nine Mile Point area from both confined and unconfined aquifers. There are four hydrostratigraphic units in existence within the JAFNPP site area: non-lithified sediments and soils, the Oswego Sandstone, the Pulaski Formation and the Whetstone Gulf Formation, in descending order. The unconfined aquifer is composed of clay-rich soils derived from glacial till and the uppermost portion of the Oswego Sandstone. Due to the increase of interbedded silts and clays within the Oswego Sandstone at depth, the sandstone becomes relatively impermeable at 20 ft. The first confined aquifer lies in both the lower portion of the Oswego sandstone and uppermost portion of the Pulaski Formation, which is composed of sandstone, siltstone and shale. An additional confined aquifer lies within the Pulaski Formation at depth within a sandstone unit bounded by siltstone and shale. The underlying Whetstone Gulf Formation has a low permeability as it is dominated by black shales with interbedded sandstone and siltstones. All three aquifers are confined under pressure and would result in artesian wells if utilized at the surface.

Within a two mile radius of JAFNPP, the local water table elevation varies from 300 to 246 ft National Geodetic Vertical Datum with an average gradient of 0.7 percent to the north-northwest (toward Lake Ontario). The normal groundwater level within the site boundary is approximately 255 ft and can have annual variations of up to 2 ft.

Groundwater recharge in this area occurs as a result of precipitation and localized seepage from ponds and swamps through the surface soils into the unconfined aquifer. Due to the low permeability of the clay-rich soils in the immediate vicinity of the site, most of the precipitation runs off toward surface culverts or directly toward Lake Ontario. Groundwater recharge to the Oswego Sandstone most commonly occurs through filtration of water through the unsaturated zone of the unconfined aquifer and can also occur directly through local outcrops located to the south and southeast of JAFNPP. Recharge to the lower confined aquifers occurs through fractures in the Oswego Sandstone or directly through surface outcrops upgradient of the site. Due to a permeability of 1×10^{-5} cm/s and an average gradient of 0.7 percent, groundwater velocity within the unconfined aquifer is estimated at a few yards per year.

2.2.4 Climate, Meteorology, and Air Quality

2.2.4.1 Climate

The climate of western New York State is representative of the humid continental type, warm summer subtype. The climate is designated Dfb in the Koeppen system and is sometimes referred to as hemiboreal. Typical of the Dfb climate zone, weather changes between summer and winter are very large around the JAFNPP site with cold, snowy winters and long, warm (not hot) summers. Latitude, topography, and proximity to large bodies of water such as Lake Ontario have a profound effect on the climate and short-term weather.

JAFNPP's proximity to Lake Ontario makes it subject to locally extreme amounts of precipitation in the winter. This phenomenon, called "lake effect snow," is produced when cold arctic air crosses the warmer lake, absorbing water vapor, which then falls as precipitation on the adjacent shore. The elevated areas south and east of JAFNPP frequently set daily records for snowfall in the Untied States because the lake effect snow is enhanced by orographic uplift.

The following climatological data is based on 30 years of observations (from 1971 to 2000) from the nearest National Oceanic and Atmospheric Administration (NOAA) station in Oswego, New York (NOAA 2004a). Average minimum temperature in January was 16.7°F, and average maximum temperature in July was 80.0°F. Month-long average temperatures ranged from 23.6°F in January to 70.8°F in July. Average monthly precipitation ranged from 2.83 in. in February to 4.47 in. in November. Average annual precipitation was 42.9 in. Precipitation occurred almost uniformly throughout the year, caused by advancing polar fronts in the winter and advection of tropical moisture in the summer.

2.2.4.2 Meteorology

Meteorological measurements for JAFNPP are collected nearby at the Nine Mile Point Nuclear Station through an agreement between the two managing companies (Entergy and Constellation Nuclear, respectively). Measurements are made from a 200-ft main tower and also at a nearby shorter tower (approximately 100 ft). At the main tower, winds and temperature are measured at three levels—at 30, 100, and 200 ft. The Nine Mile Point meteorological system determines atmospheric stability by using the EPA-approved Delta-T method. More information on the main tower and the data collected there is in the Nine Mile Point Environmental Impact Statement(NRC 2006, Section 2.2.4).

Severe thunderstorms with winds exceeding 58 mph and/or property damage occur an average of five days per year in Oswego County (2001 through 2006) (NOAA 2004b). Since 1950, eight tornadoes have been reported in Oswego County (NOAA 2004b). The strongest tornado reached F3[1] strength near the town of Phoenix on May 2, 1983, and resulted in no injuries. The other seven tornadoes were categorized as F1 or lower. One of these struck a mobile home, resulting in minor injuries to three people. The probability of a tornado striking JAFNPP is estimated to be 3 x 10^{-3} in a reactor's licensing period of 40 years (Entergy 2001).

Wind resources are expressed in terms of wind power classes ranging from Class 1 to Class 7. Each class represents a range of mean wind power density or approximate mean wind speed at specified heights above the ground. The wind energy resource for most of the Lake Ontario shoreline of Oswego County is rated between Class 3 and 4 (Renewable Resource Data Center 2004, Figure 3-25). Areas designated as Class 3 or greater are suitable for most wind energy applications.

2.2.4.3 Air Quality

JAFNPP is located in Oswego County which is part of the Central Air Quality Control Region 7 of the New York State Department of Environmental Conservation. With the exception of ozone, Region 7 is designated as being in attainment of or as unclassifiable for all criteria pollutants, as defined in 40 CFR 81.333. Jefferson County, northeast of Oswego County, is designated as a nonattainment area for ozone and classified as moderate for the 8-hour ozone National Ambient Air Quality Standards and marginal for the 1-hour. The Clean Air Act established Class 1 Federal Areas where visibility is important. No areas designated as Prevention of Significant Deterioration Class I are within 62 mi of JAFNPP.

There are four emergency diesel generators, two diesel fire pumps, and two auxiliary boilers on the JAFNPP site. The emergency generators and fire pumps are exempt from air permitting due to the small size and limited usage of these units. Emission from the boilers is regulated under a Certificate to Operate an Air Contamination Source (7-3556-00020/00012) issued by NYSDEC. This certificate limits fuel usage, fuel type, and hours of operation of the boilers.

2.2.5 Aquatic Resources

Lake Ontario is the source of water for the circulating and service water system at JAFNPP. Station discharge from both the main condenser and service water system is returned to the lake. Site drainage includes two offsite ditches on either side of the plant and two onsite storm sewer outfalls; all ditches and outfalls discharge to Lake Ontario and are regulated under the plant's SPDES permit (Entergy 2006c). There are no natural watercourses onsite. Associated transmission corridors cross 60 watercourses of which seven are classified by the New York State Water Resources Commission as suitable for water supplies and 27 for agriculture and industry (AEC 1973).

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(1) The Fujita six-point scale (F0 to F5) is used to rate the intensity of a tornado based on the damage it inflicts to structures and vegetation. Lowest intensity is F0; highest is F5.

Lake Ontario, the source and the receiving water body for JAFNPP, is last in the chain of Great Lakes. It is the smallest of the five Great Lakes and with a watershed of 24,720 mi^2, Lake Ontario has the highest ratio of watershed land area to lake surface area of all the Great Lakes (EPA 2006a). The lake's drainage basin is almost evenly split between the province of Ontario and the state of New York. Approximately 7 percent of the drainage basin is urbanized: major industrial centers on the lake shore include Hamilton and Toronto in Ontario and Rochester in New York. Although not categorized as urban, the Syracuse-Oswego area in New York is relatively densely populated. Forests cover about 49 percent of the basin, with agriculture practiced over approximately 39 percent. In general, the New York shoreline is less urbanized than the Canadian shoreline and is not intensively farmed (Stewart et al. 1999).

Shipping is a major activity on Lake Ontario and has encouraged the development of manufacturing industry and port cities. The Port of Oswego, approximately 6 mi west of JAFNPP, had an overall annual tonnage of 457,770 in 2002. The port has a main channel depth of 27 ft, and its primary cargoes include aluminum, potash, urea, limestone, salt, cement, and petroleum products (GLSLSS 2006). Lake Ontario also supports a minor commercial fishing industry, grossing just $46,000 in 2004. Recreational fishing is much more important to the Lake Ontario area, with the total economic value to coastal communities estimated to range from $100 million to more than $200 million per year (EPA 2006c).

Lake Ontario has two major basins: Kingston Basin, which is shallow and in the northeastern corner of the lake, and a deeper main basin that covers the majority of the lake. The bottom of Lake Ontario is relatively smooth with the exception of the sill that separates the Kingston and main basins. The main basin is further split into three sub-basins: Rochester, Mississauga, and Niagara (from east to west). With the majority of the lake's water coming in from the Niagara River and the prevailing west-southwest winds, circulation in Lake Ontario flows in an easterly direction along the southern and eastern shores and within sub-basins of the lake (EPA 2006b).

Being a relatively deep lake, Lake Ontario experiences seasonally dependent horizontal and vertical thermal stratification. Stratification occurs when different water temperatures create different water densities, which prevents mixing. Horizontal stratification occurs in the main basin between near-shore and offshore zones and lasts from mid-autumn until approximately mid-June when offshore waters finally warm and mixing can occur. For the remainder of the summer, main basin waters are vertically stratified, meaning that warm surface waters do not mix with cool, deeper waters. The vertical stratification begins to break down during September when surface waters begin to cool and slowly sink and mix with deeper waters. Mixing continues until an isothermal condition prevails throughout the winter (EPA 2006b). During the winter months, inshore areas of Lake Ontario freeze, but of all the Great Lakes, Lake Ontario has the least amount of ice cover, with typically 85 percent of the lake ice-free throughout the winter. In general, waters are warmer in the southeastern portion of the lake and cooler in the northwestern portion. Lake water temperatures typically range from 32 to 39.2°F in January and from 53.6 to 68°F in July (PC 2006).

Lake Ontario is oligotrophic with low primary productivity—roughly half that of Lake Erie. Lake water clarity ranges from 16.4 to 32.8 ft. Over the years, the trophic status of Lake Ontario has continually been influenced by human activities, including point-source pollution from industry and waste disposal and non-point source pollution from agriculture and urban development. The lake is affected not only by its drainage basin but also by being the most downstream Great Lake. Thus, pollution sources in the upper Great Lakes impact Lake Ontario as well (EPA 2006b).

Since the first Euro-Americans arrived in the Great Lakes area, Lake Ontario has experienced ecological stress that included overfishing, anthropogenic eutrophication, land-use changes, contaminant discharge, loss and degradation of critical habitat, colonization of invasive species, and substantial declines and profound changes in fish communities (NYSDEC 2004).

Lake Ontario was an oligotrophic system prior to European colonization of the Great Lakes area. However, with increasing industrial development on the northern shore of the lake and the subsequent increase in nutrient inputs (anthropogenic sources of phosphorous and nitrogen), the lake experienced excess algal growth and became mesotrophic with inshore areas becoming eutrophic. Phosphorous levels peaked in the 1960s and 1970s until water pollution controls were implemented throughout the Great Lakes. Since then, nutrient levels in the lake have declined, and the lake has returned to a more balanced oligotrophic state (Mills et al. 2005; EPA 2006b).

Although water quality has improved over the last 20 years in response to lake-wide management plans, the Lake Ontario ecosystem is still very much in transition. NYSDEC and the Ontario Ministry of Natural Resources (OMNR) annually stock the lake with salmonids to support a lucrative sport fishery. Non-native fish populations such as the alewife (*Alosa pseudoharengus*) are highly dynamic with large fluctuations in population from year to year, and pelagic zooplankton production is continually declining. Oligotrophic fish populations are slowly recovering, and invasive species such as quagga mussels (*Dreissena bugensis*) and the cladoceran waterflea (*Cercopagis pengoi*) are thriving (NYSDEC 2004; OMNR 2006).

There have been a series of milestones in the management of Lake Ontario. In 1955, the Canadian/U.S Convention on Great Lakes Fisheries created the Great Lakes Fishery Commission (GLFC). The GLFC is a bi-national cooperative agency that coordinates fisheries research and facilitates cooperative fishery management among the state, provincial, tribal, and federal agencies. The GLFC is responsible for implementing the *Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC 1994). Eight states bordering the Great Lakes, the Province of Ontario, two intertribal agencies, and several federal agencies are signatory to this management plan, working together and leveraging each others' resources to rehabilitate native lake species, control exotic species, prevent and manage fishery diseases, coordinate law enforcement, produce new research, publish state-of-the-lake reports, and determine total allowable catch and allocation agreements and fish stocking levels (GLFC 2006).

The GLFC also funded the 1971 Salmonid Communities in Oligotrophic Lakes (SCOL-1) symposium, which examined the effects of cultural eutrophication, exploitation, and exotic species introduction on salmonid communities in the five Great Lakes. In 2004, these issues were revisited in a second symposium (SCOL-2) with an emphasis on linkages between trophic levels (GLFC 2007).

In 1972, the first Great Lakes Water Quality Agreement (GLWQA) was signed between the International Joint Commission (IJC) of Canada and the United States. Both countries pledged to address the deterioration of Great Lakes water quality from point source and non-point source pollution. A new GLWQA was signed in 1978 that outlined a commitment to restoring and maintaining the “chemical, physical, and biological integrity” of the Great Lakes. In 1987, the IJC drafted a protocol that focused on the overall human and aquatic ecosystem health of the Great Lakes. Remedial action plans and lake-wide management plans were developed that implemented an ecosystem approach to improving the Great Lakes waters. The plans are designed to work in concert with local resource management plans, such as those that address a specific fishery (IJC 2004).

Close to JAFNPP, the Little Salmon and Oswego rivers are two of the ten major tributaries that feed Lake Ontario. Both rivers have been designated by the NYSDOS Division of Coastal Resources as “Significant Coastal Fish and Wildlife Habitats.” Little Salmon River empties into Lake Ontario at Mexico Point near the town of Mexico, approximately 10 mi east of JAFNPP. The river provides an important fish spawning and nursery area and supports large concentrations of warmwater species including northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), rock bass (*Ambloplites rupestris*), white sucker (*Catostomus commersonii*), and brown bullhead (*Ameiurus nebulosus*). Little Salmon River is one of the primary salmonid habitats in eastern Lake Ontario. As a result of NYSDEC’s ongoing sport fishery stocking program, Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Onchorhynchus kisutch*), brown trout (*Salmo trutta*), and steelhead trout (*Oncorhynchus mykiss*) can also be found in Little Salmon River during spawning periods (NYSDOS 2006).

The Oswego River is located in the city of Oswego, approximately 4 mi west of JAFNPP. Land along this river has been impacted by extensive human disturbance, including a number of locks and dams that impede or act as barriers to fish migrating upriver to spawn. However, the river is still an important habitat for warmwater fish species including alewife, gizzard shad (*Dorsoma cepedianum*), brown bullhead, white perch (*Morone americana*), yellow perch (*Perca flavescens*), smallmouth bass (*Micropterus dolomieu*), largemouth bass, walleye (*Sander vitreus*), pumpkinseed (*Lepomis gibbosus*), and black crappie (*Pomoxis nigromaculatus*). The river is the primary spawning and nursery area for walleye in the Oswego County area, and in 1982, lake sturgeon (*Acipenser fulvescens*) were also spotted in the river, making it the only Lake Ontario tributary that historically supported this species. Stocked salmonids also attempt to use this river for spawning (NYSDOS 2006).

Lake Ontario offshore waters have been dominated historically by lake trout (*Salvelinus namaycush*), Atlantic salmon (*Salmo salar*), deepwater sculpin (*Myoxocephalus thompsoni*), coregonids (*Coregonus* spp.), and burbot (*Lota lota*). By the 1970s, Lake Ontario's major native fish stocks were near extinction as a result of cumulative ecological stressors including overfishing, anthropogenic eutrophication, industrial pollution, degradation and loss of habitat, and colonization of invasive species.

The external parasite, sea lamprey (*Petromyzon marinus*), was also seriously impacting fish populations. Populations of the sea lamprey, an invasive species, sharply increased in the early 1900s, coincident with high numbers of lake trout. It is believed that commercial fishing and sea lampreys acted together to drive large piscivores in Lake Ontario to near extinction (Mills et al. 2005). Atlantic salmon, deepwater sculpin, lake trout, burbot, and coregonids all but disappeared, while non-native fish such as alewife, rainbow smelt (*Osmerus mordax*), and white perch proliferated. Alewife, a planktivore fish that is prey for large piscivores, first appeared in Lake Ontario by the late 1800s, and in the absence of abundant piscivores, the alewife population exploded. Rainbow smelt experienced significant increases around the same time and were implicated in the decline of native cisco (*Coregonus artedii*) populations (Jackson 1997).

In 1968, the first year of what were to become annual releases, brown trout, Chinook salmon, coho salmon, and steelhead trout were stocked to reduce alewife populations and create a sport fishery. Between 1968 and the late 1980s, salmonid stocking rates rose steadily to more than 8 million individuals per year. Concurrently, water conditions were improving and Lake Ontario returned to an oligotrophic system, but by 1990, the high rates of salmonid stocking and the low lake nutrient levels were affecting the Lake Ontario food web—including decreases in the size of salmon returning to spawn and reduced angler harvest rates, likely due to a reduction in prey. Current combined NYSDEC and OMNR salmonid stocking rates have been maintained between 4.0 and 5.5 million individuals per year. Improvements in habitat and water quality have resulted in the decline of Lake Ontario's carrying capacity at all levels. Food web studies of the lower trophic levels conducted in the 1980s and 1990s indicated declines in algal abundance (phytoplankton) and zooplankton biomass and production. Because phytoplankton and zooplankton rely on the very nutrients that impact water quality, the effect of nutrient reductions extends into the food web (Jackson 1997; Mills et al. 2003).

Currently, growth of stocked salmonids is sustained primarily by alewife populations and to a lesser degree by rainbow smelt and slimy sculpin (*Cottus cognatus*). Salmonid predation has been so excessive that the present alewife population has been reduced almost entirely to pre-reproductive individuals: from the early 1980s to the 1990s, the alewife population declined 42 percent (Jackson 1997). Alewives are the primary planktivores in Lake Ontario, and historically, intense feeding pressure on large plankton species by the alewife population has selected for smaller species. The precipitous alewife population decline has subsequently changed the Lake Ontario plankton community—there has been a shift from smaller to larger zooplankton species. Zooplankton have an intermediate position in the Lake Ontario food web and are an important link between phytoplankton and fish. Larger zooplanktons also feed on smaller zooplankton species, and the presence of large zooplankton therefore competes with other invertebrates and fish for smaller zooplankton prey (NYSDEC 2004).

The lower food web declines in Lake Ontario were likely exacerbated by the new presence of exotic (invasive) species. By the 1990s, exotic species, including the zebra mussel; the quagga mussel; the amphipod *Echinogammarus ischmus*, a non-native cladoceran; the round goby (*Neogobius melanostomus*); and the bloody red shrimp (*Hemimysis anomala*) had been introduced to the Great Lakes via transoceanic shipping. Through their efficient phytoplankton grazing and ability to cover any available substrate quickly and entirely, zebra and quagga mussels significantly increased water clarity throughout the 1990s, causing profound impacts throughout the food web. Historically, the native amphipod *Diporeia* spp. accounted for 60 to 80 percent of Lake Ontario's benthic community. However, the spread of dreissenid mussels altered Lake Ontario's benthic habitat. *Diporeia* spp. declined after dreissenid introduction, impacting bottom fish species including native lake whitefish (*Coregonus clupeaformis*) (Mills et al. 2003). More recent benthic studies indicate that quagga mussels have largely replaced zebra mussels in all benthic habitats of Lake Ontario; this transition may have occurred due to round goby predation on zebra mussels. Since first appearing in Lake Ontario in 1998, the round goby, an aggressive, bottom-dwelling fish, has established itself in Lake Ontario and is expected to trigger further changes in the benthic community. Additionally, where round gobies have become abundant, numbers of native bottom-dwelling fish have declined, such as tessellated darters (*Etheostoma olmstedi*) and sculpins (*Cottidae* spp.) (Stewart et al. 1999). Despite other improvements in the Lake Ontario ecosystem, the unintentional introduction of non-native species to the benthic, planktonic and fish communities will likely prevent Lake Ontario from ever returning to its original state.

The reduction in available nutrients combined with the increased penetration of light and extended, seasonal, warm water periods, has also resulted in the return and increased growth of submerged aquatic vegetation, primarily filamentous *Cladophora* spp. The vegetation coverage provides protection and nursery areas for a number of invertebrate and fish species (NYSDEC 2003). However, the increasing clarity of Lake Ontario water may cause a shift of some light-sensitive fish species, such as the walleye, to relocate into deeper waters (Stewart et al. 1999).

There are no aquatic species Federally listed as threatened or endangered under the Endangered Species Act (ESA) in the vicinity of JAFNPP (Entergy 2006b). Through consultation with the U.S. Fish and Wildlife Service (FWS), no aquatic species (fish, molluscs, or aquatic plants) were identified as potentially occurring at the site or in watercourses along or across the associated transmission corridors.

Five aquatic species that have been designated by New York State as threatened, endangered, or a species of special concern and that may occur in the vicinity of JAFNPP are listed in Table 2-3. There were no reported takings of these fish at JFNPP in 2004 (EA 2005).

Table 2-3. Aquatic Species Listed as Endangered, Threatened, or a Species of Special Concern by New York State, Potentially Occurring in Oswego and Onondaga Counties

Scientific Name	Common Name	Federal Status	State Status
Acipenser fulvescens	lake sturgeon	—	T
Erimyzon sucetta	lake chubsucker	—	T
Lythrurus umbratilis	redfin shiner	—	S
Myoxocephalus thompsoni	deepwater sculpin	—	E
Prosopium cylindraceum	round whitefish	—	E

— = No listing S = Species of Special Concern Source: Entergy 2006c
E = Endangered T = Threatened

State-threatened lake sturgeon (*Acipenser fulvescens*) are found primarily in freshwater lakes and large rivers in northeastern North America. In New York, lake sturgeon have been found in the St. Lawrence River, Lake Ontario, Lake Erie, the Niagara River, Lake Champlain, Cayuga Lake, the Seneca Canals, and in the Grasse, Oswego, and Oswegatchie rivers. The Oswego River is a historic spawning ground for lake sturgeon and is the only Lake Ontario tributary where lake sturgeon have been found in recent years. One of New York's largest freshwater fish, mature adults are between 3 and 5 ft long and weigh between 10 and 80 pounds (lb). Lake sturgeon subsist primarily on small organisms: leeches, snails, clams and other invertebrates, small fish, and algae. They spawn from May to June in areas with clean, large rubble such as along windswept rocky shores and in the rapids of streams. Young fish grow rapidly but have a slow reproductive cycle: females do not reach sexual maturity until they are 14 to 23 years old, and they spawn only every four to six years during their 80-year lifespan. Lake sturgeon were historically abundant, but as their value increased, population levels decreased significantly due to overfishing. Other threats to lake sturgeon include the construction of dams that cut off upstream spawning grounds, channelization, and pollution (NYSDEC 1999e; WSG 2006).

Lake chubsuckers (*Erimyzon sucetta*), a State-threatened species, are medium-sized with an average length of 8 to 10 in. They are found only in quiet, clear, well-vegetated waters because they are intolerant of turbid or silty conditions. Lake chubsuckers feed along the water bottom on copepods, cladocerans, and aquatic insect larvae. In New York, lake chubsuckers were historically found in embayments along the south shore of Lake Ontario and the eastern shore of Lake Erie. No lake chubsuckers have been caught in New York for more than 60 years. Siltation, wetland drainage, increased water turbidity, and pollution have likely caused the decline or extirpation of this species (ROM 2006; NYSDEC 1999b).

The redfin shiner (*Lythrurus umbratilis*), a State species of special concern, occurs in the Great Lakes and Mississippi River Basin, western New York to Minnesota, south to Louisiana, and Gulf drainages west to Texas. The redfin shiner is essentially a pool dweller but can also be found in moderate- to low-gradient streams with some vegetation and sand or gravel bottoms. Within New York, the redfin shiner has been found only at a few sites in Tonawando Creek, the Niagara River, and Johnson Creek. Redfin shiners are found in schools feeding on filamentous algae, bits of higher plants, and aquatic and terrestrial insects. They become sexually mature in their second or third summer and spawn from early June to mid-August in nests within sunfish nesting territories. One reason for their low occurrence may be that they require clear water during spawning, but the rest of the year they can tolerate siltation (NYSDEC 1999d; WSG 2006).

The State-endangered deepwater sculpin (*Myoxocehalus thompsoni*) is the largest of New York's freshwater sculpins; they can be up to 9 in. long but average length is 2 to 5 in. Deepwater sculpin are found in deep, cool lake waters at depths ranging from 240 to 300 ft. Found in all the Great Lakes except for Erie, the deepwater sculpin was once prolific in Lake Ontario. Competition with alewife and rainbow smelt, as well as alewife and rainbow smelt predation on sculpin eggs and larvae, may have caused a decline in the deepwater sculpin population—the species was thought to be extirpated until catches were reported from 1996 to 1999. The deepwater sculpin is a bottom feeder, so continual exposure to contaminated sediments may be another possible cause for their decline. NYSDEC identified the non-native round goby as another potential source of competition for this species (NYSDEC 1999a; OME 1999).

The State-endangered round whitefish (*Psosopium cyclindraceum*) has an average length of 8 to 12 in., occasionally reaching 22 in. This species feeds primarily at or near the bottom on small aquatic organisms, including eggs of lake trout and other fish. Round whitefish were historically found in all the Great Lakes except Lake Erie; only seven New York State waters are known to contain round whitefish populations. Lake Ontario once supported a small round whitefish commercial fishery, but the last commercial catch was in 1942. Round whitefish are now protected from harvest or possession by the State of New York Endangered Species Law. Reasons for the species' decline may include predation by yellow perch on round whitefish eggs and fry, loss or degradation of spawning sites, siltation, and lake acidification (WSG 2006; NYSDEC 1999c).

2.2.6 Terrestrial Resources

2.2.6.1 Terrestrial Resources at the JAFNPP Site

JAFNPP is on a flat plain 20 ft above the shore of Lake Ontario, with hills to the immediate south of the property (USGS 1982). As part of the Erie and Ontario Lake Plain ecoregion, this area was shaped by glacial erosion and deposition processes (NYSDEC 2006d). After the last glacial period, which ended between 19,000 and 11,000 years ago (PRI 2006), the region was colonized by vegetation that probably consisted of upland forest and wetland communities (NRC 2006).

Typical natural communities in this area vary, depending on the underlying geology and soils, but include beech-maple, maple-basswood, and hemlock-northern hardwood forests; grasslands; shrub lands; and wetland communities (SUNY Oswego 2006a). When the property was purchased by Entergy, it was partially forested and being used for recreation and residential purposes (Entergy 2006). The area was once used as an artillery range (AEC 1973). Currently, the area immediately around the plant is maintained in a landscaped condition. The majority of the property (600 ac) is not landscaped and is expected to develop to climax communities unless further disturbed.

Dominant communities on the site include 66 percent forest, 21 percent open grasslands, and 10 percent wetlands and ponds (Entergy 2006c). These areas are in various states of succession, ranging from early grassland/meadow communities in recently disturbed areas to secondary growth hardwood forests (Entergy 2006c). Common tree species include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), Canadian hemlock (*Tsuga canadensis*), white ash (*Fraxinus amerincana*), basswood/American linden (*Tilia americana*), black birch / sweet birch (*Betula lenta*), yellow poplar/tulip poplar (*Liriodendron tulipifera*), and oaks (*Quercus* spp.), including chestnut (*Q. prinus*), red (*Q. rubra*), black (*Q. velutina*), white (*Q. alba*), and bur oaks (*Q. macrocarpa*) (AEC 1973). Surveys for rare plants have not been performed at the site.

The FWS National Wetlands Inventory database indicates that there are wetland areas on site (FWS 2006c). While no formal wetland delineation activities have been performed, Entergy estimates that there are approximately 70 ac of wetlands and ponds on the property (Entergy 2006c). Swamps and arborvitae and cattail marshes are scattered throughout the area near the site (AEC 1973).

A variety of mammals, birds, reptiles, amphibians, and insects are commonly seen at the JAFNPP site and in the surrounding area. Reptiles including snakes, turtles, and tortoises may be found in the area, as well as amphibians including frogs, toads, salamanders, and newts (SUNY Oswego 2006c).

Migratory waterfowl frequent the site and congregate near the discharge area offshore. These include greater scaup (*Aythya marila*), golden eye (*Bucephala clangula*), merganser (*Mergus merganser*), canvasback (*A. valisineria*), and oldsquaw (*Clangula hyemalis*) (Entergy 2006). The discharge area has been designated by the New York State Natural Heritage Program as part of a waterfowl winter concentration area. Impingement of diving ducks has not been observed at JAFNPP but has been an issue at the Nine Mile Point Nuclear Station just west of JAFNPP (NRC 2006). Removal of zebra mussels (*Dreissena polymorpha*) and other food sources from intake structures is considered an effective method of reducing the chances of diving duck injury and mortality.

Other birds that may breed in the area include the red-shouldered hawk (*Buteo lineatus*), sharp-shinned hawk (*Accipiter striatus*), Cooper’s hawk (*A. cooperii*), common nighthawk (*Chordeiles* *minor*), red-headed woodpecker (*Melanerpes erthrocephalus*), horned lark (*Eremophila alpestris*), golden-winged warbler (*Vermivora chrysoptera*), cerulean warbler (*Dendroica cerulean*), vesper sparrow (*Pooecetes gramineus*), and grasshopper sparrow (*Ammodramus savannarum*) (NRC 2006).

Common small mammal species in the area include the white-footed mouse (*Peromyscus leucopus*), deer mouse (*P. maniculatus*), woodchuck (*Marmota monax*), meadow jumping mouse (*Zapus hudsonius*), meadow vole (*Microtus pennsylvanicus*), red squirrel (*Tamiasciurus hudsonicus*), raccoon (*Procyon lotor*), and cottontail rabbit (*Sylvilagus floridanus*) (NMPC 1985). Larger mammals include red and gray foxes (*Vulpes vulpes, Urocyon cinereoargenteus*), coyotes (*Canis latrans*), and white-tailed deer (*Odocoileus virginianus*) (SUNY Oswego 2006b).

No wildlife management plans currently exist for the JAFNPP property. The site likely provides productive habitat for wildlife, and hunting is not allowed on the property. Some animal mortality may occur from vehicle collisions. Migratory bird collisions with buildings have been rare and are not anticipated to be a significant source of injury during the renewal term. Surveys for rare animals have not been performed at the site.

The area around the plant is maintained through a combination of mowing and herbicide application. Lawns are mowed as needed. Two drainage swales are vegetated with low-growing herbaceous cover, which should help to reduce and absorb runoff and protect water quality while providing some habitat for small animals (EPA 2006c). No maintenance activities occur around wetlands or Lake Ontario. Roundup™ herbicide is used for weed control in isolated locations by licensed applicators using hand sprayers. Entergy is required to submit annual pesticide use reports to NYSDEC, listing qualified applicators. These reports estimate herbicide use at 33 gallons (gal) in 2003, 30 gal in 2004, and 17 gal in 2005 (Entergy 2004b, 2005c, 2006d). When used according to label directions, such herbicide applications are not expected to have significant environmental impacts.

Important terrestrial habitats near JAFNPP include Teal Marsh 4 mi west of the site, a rare shrub fen 4 mi south of the site, and Butterfly Creek Wetlands 6 mi east of the site (NRC 2006). Local parks where wildlife may comprise important recreational attractions include Selkirk Shores State Park five mi east of the site, Fairhaven Beach State Park 20 mi southwest of the site, and Beaver Lake Nature Center 25 mi south of the site (NYSHPO 2006a; NYSHPO 2006c; Onondaga County Parks 2006). Little environmental interaction occurs between these areas and the JAFNPP site, with the exception of bird travel between the site and these locations.

Ecological issues of statewide concern include chronic wasting disease (CWD) in white-tailed deer (NYSDEC 2006a), botulism in shore birds (NYSDEC 2006e), and vegetation damage resulting from caterpillars (NYSDEC 2006b) and wood wasps (NYSDEC 2006f). The NRC staff is not aware of any linkage between continued operation of JAFNPP and these issues.

2.2.6.2 Terrestrial Resources in Transmission Corridors

There are four transmission lines that connect JAFNPP to other facilities and substations (Entergy 2006c). See Table 2-1. Two of the transmission lines, the Edic and Scriba 345-kV lines, are within the scope of license renewal. The Edic transmission line runs approximately 70 mi southeast to the Edic Substation near Utica, New York. The corridor associated with this line is 150-ft wide and crosses Erie-Ontario Lake plain and fringe areas of Tug Hill plateau and the Mohawk Valley (AEC 1973). These areas are predominantly forested, with some agricultural, low-density residential, and wetland areas (AEC 1973). Important resource areas crossed by this line include Catfish Creek, Butterfly Creek, the Little Salmon River, Mohawk River, Nine Mile Creek, numerous wetlands, and various state wildlife management areas (Microsoft 2005).

The Edic line is owned and maintained by NYPA (Entergy 2006c). The NRC staff met with NYPA personnel on December 4, 2006, to discuss their transmission line maintenance program. NYPA maps land use and vegetative cover within the transmission corridor using a geographic information system. This information is used to develop a maintenance plan for each mapped parcel to remove only tall-growing species that may interfere with line operations, while allowing other species to grow. Dead trees that may fall into the lines are removed from the edges of the ROW by corridor maintenance personnel (NYPA 1998). Herbicides are applied to individual plants by licensed applicators only as needed to ensure that that tall-growing vegetation does not interfere with line operations. Maintenance personnel follow the NYPA *Systemwide Right-of-Way Management Plan* (NYPA 1998).

The transmission line towers are constructed of weathering steel, which requires little maintenance and is less reflective than galvanized steel (AEC 1973). There is evidence that some portions of the transmission line corridor are used by off-road vehicles and hunters, but these activities appear to be limited in area and intensity.

Two invasive exotic plant species, common reed (*Phragmites australis*) and Japanese knotweed (*Polygonum cuspidatum*), have been noted by NYPA personnel as occurring within the Edic transmission corridor. Common reed is a threat to wetland areas because it crowds out native vegetation and may negatively alter wildlife habitat. It is commonly controlled to protect native species of plants and animals and promote a balanced, productive native ecosystem. This is typically performed using herbicides, but mowing and controlled burns may be effective in removing it (PCA 2006a). Japanese knotweed is an introduced species that can rapidly crowd out native plant species and alter native ecosystems. It is commonly controlled with diluted pesticides applied to a cut stem or to the leaves (PCA 2006b).

The eastern portion of the Edic transmission line passes near the towns of Annesville, Lee, Western, Floyd, Trenton, and Marcy, where chronic wasting disease (CWD) in white-tailed deer is an issue of concern (NYSDEC 2006c). This disease is contagious between deer and leads to severe weight loss and death, but there is no evidence that it is transmissible to humans or livestock (NYSDEC 2006a). NYSDEC is working to control the spread of CWD in this area.

Continued operation and maintenance of the lines is not anticipated to contribute appreciably to the spread of this disease among the white-tailed deer population.

The second transmission line within the scope of this license renewal review is the 345-kV Scriba line. The Scriba line is approximately 4900 feet in length and runs southward from the JAFNPP 345-kV switchyard over Entergy property, then turns westward, crossing a portion of the Nine Mile Point Nuclear Station site and enters the Scriba substation. The portion of the transmission corridor that is not on the JAFNPP site is maintained by NYPA, the owner of the line. The Scriba line crosses forested and landscaped areas maintained by JAFNPP and NYPA using periodic mowing and vegetation control procedures.

2.2.6.3 Terrestrial Species of Concern

Terrestrial species that are listed by the FWS or the State of New York and have the potential to occur on or in the vicinity of the JAFNPP site or along the Edic and Scriba transmission corridors are presented in Table 2-4.

The NRC staff met with NYPA on December 4, 2006. At this meeting, the NRC staff was informed that no threatened or endangered species have been reported by maintenance personnel as occurring in or near the transmission corridor. Corridor maintenance personnel are trained in identifying endangered species and are expected to take measures to avoid damage to these species if they are identified within the transmission line corridor during the renewal period.

Consultation with New York Natural Heritage Program (NYNHP) revealed the existence of two important natural heritage areas near the Edic transmission line corridor. The areas consist of State-listed upland sandpiper (*Bartramia longicauda*) habitat and a rare fen. In addition, the NYNHP staff identified the area immediately offshore from the JAFNPP site as an important State-recognized waterfowl winter concentration area. The pied-billed grebe (*Podilymbus podiceps*) and least bittern (*Ixobrychus exilis*) are known to forage nearby. Both species are listed as threatened by the State of New York.

Table 2-4. Federally Listed and New York State-Listed Terrestrial Species Potentially Occurring in the Vicinity of JAFNPP and in Associated Transmission Line Corridors

Scientific Name	Common Name	Federal Status	State Status
Reptiles			
Ambystoma jeffersonianum	Jefferson salamander	—	S
Ambystoma laterale	blue-spotted salamander	—	S
Clemmys guttata	spotted turtle	—	S
Clemmys insculpta	wood turtle	—	S

Scientific Name	Common Name	Federal Status	State Status
Clemmys muhlenbergii	bog turtle	T	E
Crotalus horridus	timber rattlesnake	—	T
Sisturus catenatus catenatus	massasauga rattlesnake	C	E
Birds			
Accipiter cooperli	Cooper's hawk	—	S
Accipiter striatus	sharp-shinned hawk	—	S
Ammodramus henslowli	Henslow's sparrow	—	T
Ammodramus savannarum	grasshopper sparrow	—	S
Aquila chrysaetos	golden eagle	—	E
Asio flammeus	short-eared owl	—	E
Bartramia longicauda	upland sandpiper	—	T
Buteo lineatus	red-shouldered hawk	—	S
Charadrius melodius	piping plover	E	E
Chlidonias niger	black tern	—	E
Chordeiles minor	common nighthawk	—	S
Circus cyaneus	northern harrier	—	T
Cistothorus platensis	sedge wren	—	T
Dendroica cerulean	cerulean warbler	—	S
Eremophila alpestris	horned lark	—	S
Falco peregrinus	peregrine falcon	—	E
Gavia immer	common loon	—	S
Haliaeetus leucocephalus	bald eagle	T	—
Ixobrychus exilis	least bittern	—	T

Table 2-4 (cont.)

Scientific Name	Common Name	Federal Status	State Status
Birds (cont.)			
Lanius ludovicianus	loggerhead shrike	—	E
Melanerpes erythrocephalus	red-headed woodpecker	—	S
Pandion haliaetus	osprey	—	S
Podilymbus podiceps	pied-billed grebe	—	T
Sterna hirundo	common tern	—	T
Vermivora chrysoptera	golden-winged warbler	—	S
Mammals			
Myotis leibii	small-footed bat	—	S
Myotis sodalis	Indiana bat	E	E

Plants			
Carex chordorrhiza	creeping sedge	—	T
Eleocharis quadrangulata	angled spikerush	—	E
Eleocharis obtuse var. *ovata*	blunt spikerush	—	E
Lycopodium complanatum	northern running pine	—	E
Polygonum setaceum var. *interjectum*	swamp smartweed	—	E
Polystichum archostichoides	Christmas fern	—	S
Thelypteris noveboracensis	New York fern	—	S
Trillium flexipes	nodding trillium	—	E
Trillium sessile	toad-shade	—	E
Trillium spp.	trillium	—	S

— = No listing
C = Candidate for federal listing
E = Endangered
S = Species of Special Concern (New York State)
T = Threatened

Source:
Entergy 2006c (except creeping sedge)
NYSDEC 2006g (creeping sedge)

Federally Protected Species

The endangered Indiana bat (*Myotis sodalis*) is a chestnut-brown, medium-sized bat that forages for insects near streamside and upland forests (FWS 2006b). These bats roost and hibernate in caves or mines, known as hibernacula, or under the loose bark of recently dead trees. Reasons for the decline of this species include natural mortality, human disturbance of hibernating bats, and deforestation, especially the removal of dead standing trees and trees near streams (FWS 1983). Indiana bats may be utilizing large dead trees with loose bark either onsite or along the margins of the Edic or Scribal transmission corridors. There have been no reports of Indiana bats using dead trees along the transmission corridors; however, there has been no systematic survey of this potential habitat.

The threatened bog turtle (*Clemmys muhlenbergii*) is a very small black turtle that lives in open sedge meadows and fens bordered by wooded areas (FWS 2001). The bog turtle's diet consists primarily of insects but also includes plants, frogs, and carrion (Bury 1979). The greatest threats to the bog turtle include the degradation and destruction of open wetland habitat and illegal collection (Groombridge 1982). Two potential sources of habitat loss within the transmission corridor, if such habitat is present, are the colonization by common reed and the natural progression by trees. The common reed establishes a dense monoculture that is unsuitable for many wetland species, including bog turtles (FWS 2001). Because the bog turtle depends on open wetlands without any tree cover, the current transmission corridor maintenance program may preserve potential bog turtle habitat. The NRC staff is unaware of any reported occurrences of bog turtles inhabiting wetlands along the Edic or Scriba transmission corridors; however, there has not been a systematic survey of these lines for this species.

Federally protected species identified in the review of Nine Mile Point include the massasauga rattlesnake, bald eagle, and piping plover. The massasauga rattlesnake (*Sisturus catenatus catenatus*) is a candidate species for Federal protection. It lives in wet prairies, sedge meadows, and early successional fields, and natural succession of woody vegetation may cause habitat deterioration (NRC 2006). It is not known to occur near the JAFNPP site.

The threatened bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey that is usually found near large bodies of water. The bald eagle is a transient species and is not found in the vicinity of JAFNPP or associated transmission line rights-of-way.

The endangered piping plover (*Charadrius melodius*) is a small, stocky sandy-colored bird resembling a sandpiper. Like the bald eagle, it may migrate through the area, but are not found in the vicinity of the JAFNPP site or associated transmission line rights-of-way (NRC 2006).

State-Protected Species

The NRC staff consulted with NYNHP on December 7, 2006 to determine which State-listed species were known to occur near JAFNPP and the Edic and Scriba transmission lines. The NYNHP identified three State-threatened bird species and one State-threatened plant species. No other State-listed species were identified as occurring near the site on along the Edic and Scriba transmission corridors.

The State-threatened upland sandpiper (*Bartramia longicauda*) is a small brown-and-white mottled bird that inhabits open, grassy areas, including pastures, upland meadows, and fallow fields. This species feeds on invertebrates and grains. It has declined due to excessive hunting in the past and has not recovered from this historical stress (CDEP 2004b). One area of known upland sandpiper habitat was identified by the NYNHP as occurring near the JAFNPP site.

The State-threatened pied-billed grebe (*Podilymbus podiceps*) is a diving duck that forages in an area near the JAFNPP site. It lives in marshes and ponds and feeds mostly on aquatic invertebrates, occasionally eating fish, reptiles and amphibians. Although this species is found throughout North America, it is rare in New York (Cornell Laboratory of Ornithology 2003).

The State-threatened least bittern (*Ixobrychus exilis*) is found in emergent vegetation in freshwater marshes not far from the JAFNPP site. It feeds on small fish, amphibians, insects, invertebrates, and occasionally shrews and mice. Its decline is attributed to the destruction of wetland habitat (CDEP 2004a).

The State-threatened creeping sedge (*Carex chordorrhiza*) is a wetland plant known to occur near the JAFNPP site.

2.2.7 Radiological Impacts

JAFNPP conducts an annual Radiological Environmental Monitoring Program (REMP) in which radiological impacts to employees, the public, and the environment in and around the JAFNPP site are monitored, documented, and compared to the appropriate standards. The objectives of the REMP are to:

- Measure and evaluate the effects of facility operation on the environs and verify the effectiveness of the controls on radioactive material sources
- Monitor natural radiation levels in the environs of the JAFNPP site
- Demonstrate compliance with the requirements of applicable Federal regulatory agencies, including technical specifications and the ODCM

Radiological releases are summarized in two JAFNPP reports: the *Annual Radiological Environmental Operating Report* (Entergy 2005b) and *Annual Radioactive Effluent Release Report* (Entergy 2006a; 2005a; 2004a; 2003; 2002a; 2002b). Limits for all radiological releases are specified in the JAFNPP ODCM (Entergy 2004c) and used to meet Federal standards and requirements. The REMP includes monitoring of the waterborne environment (surface, sediment from shoreline); airborne environment (radioiodine and particulates, direct radiation); and ingestion pathways (milk, fish, food products). During 2005, 2318 analyses were performed on collected samples of environmental media and showed no significant or measurable radiological impact from the operations at JAFNPP (Entergy 2005b).

The New York State Department of Health also measures the levels of radiation exposure and concentration of radioactive material at locations surrounding Nine Mile Point and JAFNPP. The State measures direct radiation and radioactivity in air, milk, water, sediments, vegetation, and fish. The State's 10-year monitoring data from 1995 through 2004 shows radiation levels typical for background levels for air, water, milk, fish, sediment samples, vegetation, and direct radiation (New York State Department of Health 2007).

Historical data on releases from JAFNPP and the resultant dose calculations demonstrate that the calculated doses to maximally exposed individuals in the vicinity of JAFNPP were a small fraction of the limits specified in the JAFNPP ODCM (Entergy 2004c) to meet 10 CFR Part 20; 10 CFR Part 50, Appendix I; and EPA radiation standards in 40 CFR Part 190. For 2005, dose estimates were calculated based on actual liquid and gaseous effluent release data and conservative models to simulate the transport mechanisms. The results are described in the *2005* Annual *Radioactive Effluent Release Report* (Entergy 2006a). A summary of the calculated maximum dose to an individual located at the JAFNPP boundary from liquid and gaseous effluents released during 2005 is as follows:

- The maximum whole-body dose to an offsite member of the general public from liquid effluents was 1.68 10^{-5} millirem (mrem), well below the 3-mrem-dose criteria in 10 CFR Part 50, Appendix I.
- The maximum whole-body dose to the likely most-exposed member of the general public from gaseous effluents was 4.39 mrem, below the 5-mrem-dose criteria in 10 CFR Part 50, Appendix I.

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from JAFNPP operations during the renewal period and, the impacts to the environment are therefore not expected to change.

2.2.8 Socioeconomic Factors

The NRC staff reviewed the JAFNPP Environmental Report (ER) (Entergy 2006c) and information obtained from County, City, school district, and local economic development staff. The following sections describe the housing market, community infrastructure, population, and economy in the region surrounding the JAFNPP site.

2.2.8.1 Housing

JAFNPP employs a permanent workforce of 716 employees (Entergy 2006c). Approximately 78 percent live in Oswego County, New York, and 18 percent in Onondaga County, New York (Table 2-5). Both counties are in the Syracuse metropolitan statistical area (MSA), which also includes Cayuga and Madison counties. Given the residential locations of JAFNPP employees, the most significant impacts of plant operations are likely to occur in Oswego and Onondaga counties. The focus of the analysis in this draft environmental impact statement (draft SEIS) is therefore on the impacts of JAFNPP in these two counties.

Table 2-5. JAFNPP Permanent Employee Residence by County in 2006

County	Number of JAFNPP Personnel	Percentage of Total
Oswego	556	77.7%
Onondaga	127	17.7%
Other	33	4.6%
Total	716	100.0%

Source: Entergy 2006c

JAFNPP schedules refueling outages at 24-month intervals. During refueling outages, site employment increases by 700 to 900 workers for approximately 30 days. These workers are assumed to be from the same geographic areas as the permanent JAFNPP staff.

The number of housing units and housing vacancies in Oswego and Onondaga counties in 2000 and 2005 are shown in Table 2-6. In Oswego County, the total number of housing units and occupied units grew at an average annual rate of 0.34 and 0.64 percent, respectively, from 2000 to 2005. With an annual average population growth rate of 1.1 percent during this period, the number of units available grew more slowly than the demand for housing.

Table 2-6. Number of Occupied, Vacant, and Total Housing Units in Oswego and Onondaga Counties, New York, in 2000 and 2005

County	Housing Units	Year		Approximate Change
		2000	2005	
Oswego	Occupied	45,522	46,964	+3.2%
	Vacant	7,309	6,766	–7.4%
	Total	52,831	53,730	+1.7%
Onondaga	Occupied	181,153	183,032	+1.0%
	Vacant	15,480	17,704	+14.4%
	Total	196,633	200,736	+2.1%

Source: USCB 2006a

In Onondaga County, the total number of housing units grew at an annual average rate of 0.42 percent from 2000 to 2005, while average annual growth of occupied units was slightly less at 0.20 percent (USCB 2006a).

2.2.8.2 Public Services

This section contains a discussion of public services including water supply, education, and transportation.

Water Supply

Slightly more than half of Oswego County's population receives potable water from one of the county's 29 public water districts, with the remaining population receiving water from private groundwater wells (NRC 2006). Public water districts in the county obtain water from Lake Ontario or a variety of groundwater aquifers and springs and the Onondaga County Water

Authority (OCWA) (OCDPCD 1997). Public water suppliers draw water from three principal groundwater aquifers (Sand Ridge, Fulton, and Tug Hill) with substantial groundwater resources available from other local or regional aquifers that have been largely unused (OCDPCD 1997). The three major public water supply systems in Oswego County are the Oswego Water System, the City of Fulton, and the Metropolitan Water Board.

Table 2-7 lists the daily water consumption and maximum daily capacity for the three major public water supply systems in Oswego County.

Table 2-7. Major Public Water Supply Systems in Oswego County, Average Daily Use, and Maximum Daily Capacity

Water Supplier	Average Daily Use in million gpd	Maximum Daily Capacity in million gpd
Oswego Water System	8.0	20.1
City of Fulton	2.4	2.4
Metropolitan Water Board	25.0	62.5

Source: NRC 2006

The Oswego Water System (OWS) provides water service to approximately 23,950 customers in the communities of Oswego, Minetto, Scriba, and Volney, and potable water to JAFNPP (OCDPCD 1997). Current JAFNPP usage is approximately 137,500 gpd with no restrictions on supply (Entergy 2006g). While the OWS could potentially withdraw up to approximately 62.5 million gpd from Lake Ontario, the design capacity of the water plant is only 20.1 million gpd (NRC 2006). County planning officials estimate that the capacity of the OWS is adequate to meet the demands of an additional 4000 to 8000 residential customers (OCDPCD 1997).

The City of Fulton water supplier serves approximately 12,900 customers. The City has 10 groundwater wells extracting up to 2.4 million gpd. As average daily demand exceeds supply in the city, the City of Fulton has an agreement with the OCWA to obtain up to 3 million gpd to cover the extra demand (OCDPCD 1997).

The Metropolitan Water Board (MWB) functions as a potable water wholesaler to public water districts and water authorities in both Oswego and Onondaga counties. Most of the MWB's water is sold to the OCWA, with 25 percent of its pipeline capacity available to Oswego County. While the capacity of MWB is 60 million gpd, the MWB withdrew an average of only 25 million gpd in 1998, of which 200,000 gpd was provided to communities in Oswego County. The MWB therefore has large excess capacity to support future growth in the county (OCDPCD 1997).

Education

JANFPP is located in the Mexico Central School District, which had an enrollment of 2682 students in 2005. Including the Mexico Central School District, Oswego County contains 9 school districts. In 2000, there were 35,240 students enrolled in schools in the county with an average class size of 21 students. The average expenditure per student in low-need districts in New York is approximately $15,000. Onondaga County has a total of 18 school districts. Total enrollment in the district is approximately 132,240 students based on data from the 2000 Census Bureau (Entergy 2006g).

Transportation

The road structure in the immediate vicinity of JAFNPP consists primarily of smaller county roads rather than state or interstate highways. JAFNPP is accessed from the east by Lake Road, a two-lane paved road east of the intersection of County Route 1A and Lakeview Road (see Figure 2-2). According to the Oswego County Planning and Community Development Department, the average daily traffic count for County Route 1A from County Route 1 to Lakeview Road was 4900 vehicles in 1995 (NRC 2006).

Due to the rural nature of JAFNPP's location, there is no state level of service determination for the county roads that service JAFNPP and the immediate area. The Oswego County Department of Public Works reviewed traffic patterns for the major roads around the JAFNPP as part of a reconstruction project for County Route 1A. The County determined that traffic counts were within acceptable levels (NRC 2006).

2.2.8.3 Offsite Land Use

In order to accommodate and regulate growth and development, Oswego and Onondaga counties have developed county-specific comprehensive growth management plans characterizing current conditions and setting standards, regulations, and goals for land use and development. Land-use planning and zoning regulations have been developed by towns, villages, and municipalities within Oswego and Onondaga counties. Therefore, land use standards may vary greatly in different regions within the counties. Neither county has implemented growth control measures that would limit residential housing development.

Agriculture remains the predominant land use in the county, but rural residential development has increased. In all or parts of many towns, residential development surrounding major employment centers has reached or is approaching suburban density. Most towns in Oswego County have developed some type of land-use regulation, either zoning or subdivision regulations. Although elements of the rural landscape remain, the community character is clearly residential (OCDPCD 1997). Residential growth has been strongest in towns in southern Oswego County and the town of Scriba in northern Oswego County. Commercial and industrial land uses, particularly energy production, such as the Nine Mile Point Nuclear Station and Sithe Industries, which operates a natural gas fueled power plant, have centered near the cities of Oswego and Fulton and their surrounding areas. State-regulated wetlands account for

13 percent of the total land area in Oswego County, and development is restricted in these areas (OCDPCD 1999).

Onondaga County is somewhat more developed, with an increase of both residential and commercial land uses in towns and villages near Syracuse. Growth has been steady throughout northern and central Onondaga County. County planning officials expect residential growth to continue in northern and central Onondaga County following the *Onondaga County Settlement Plan* (Syracuse-Onondaga County Planning Agency 2001). This plan proposes to control growth within the county by guiding county infrastructure investments only to developed areas.

Seventeen state parks, 20 state wildlife management areas, and one national wildlife refuge are located within a 50-mi radius of JAFNPP. The Montezuma National Wildlife Refuge is north of Cayuga Lake in Seneca County, approximately 44 mi southwest of the site (NRC 2006).

Land use in Oswego and Onondaga counties is listed in Table 2-8.

2.2.8.4 Visual Aesthetics and Noise

The area around JAFNPP is generally flat, forested, and rural. The most prominent features on the site are the reactor building and the off-gas stack, which is 385 ft high. Due to the forest cover in the area, the physical plant is not visible from local communities. However, plant structures can be seen by recreational boaters and fishermen on Lake Ontario.

Table 2-8. Land Use in Oswego and Onondaga Counties

	Percentage of Total	
Land Use	**Oswego County (1995)**	**Onondaga County (2006)**
Agriculture, forested, vacant	55%	51%
Residential	36%	29%
Public	6%	10%
Commercial	3%	10%
Total	100%	100%

Sources: Oswego County: OCPCD 1997; Onondaga County: Syracuse-Onondaga County Planning Agency 2006

Currently, there are no reports of noise complaints from the areas surrounding JAFNPP or from recreational users of Lake Ontario. Additionally, noise concerns have not been considered a problem at the site due to the plant's distance from local communities (Entergy 2006c). EPA recommends that noise levels for residential areas near the boundary of an industrial facility not exceed an annual equivalent sound level of 55 decibels. There is no expected increase in noise levels associated with the proposed license renewal activities.

2.2.8.5 Demography

In 2000, approximately 109,440 persons lived within a 20-mi radius of JAFNPP, which equates to a population density of 87 persons per mi^2. This density translates to a Category 3 (60 to 120 persons per mi^2 or fewer than 60 persons per mi^2 with at least one community of 25,000 or more persons within 20 mi) using the generic environmental impact statement (GEIS) measure of sparseness (Entergy 2006c). At the same time, there were approximately 914,668 persons living within a 50-mi radius of the plant, for a density of 117 persons per mi^2. The Syracuse MSA, located within 50 mi of the site, had a total population in 2000 of 732,117. Therefore, JAFNPP falls into Category 3 (one or more cities with 100,000 or more persons and fewer than 190 persons per mi^2 within 50 mi) of the NRC sparseness and proximity matrix. A Category 3 value indicates that JAFNPP is in a medium density population area (NRC 2006).

Table 2-9 shows population growth rates and projections from 1970 to 2020 in Oswego and Onondaga counties. Oswego County grew at a relatively slow annual rate of less than 0.1 percent for the period of 1990 to 2000. The average annual growth rate for New York for this period was 0.5 percent. Only slight increases in population are expected for the period 2000 through 2020. The population declined in Onondaga County during the 1990s and this trend is expected to continue during the period 2000 to 2020 (NRC 2006).

In 2000, Oswego, the largest city in Oswego County, located approximately 5 mi southwest of JAFNPP had a population of 17,954 persons (USCB 2006a). The second largest city, Fulton, located approximately 12 mi south of JAFNPP had a population of 11,855 persons. The town of Scriba had an estimated population of 7331 persons. The U.S. Census Bureau lists 21 other towns in Oswego County, all of which have populations between 500 and 9000 persons (USCB 2006a). Most of the remaining population lives in unincorporated rural areas (OCDPCD 1997).

Although some towns and municipalities surrounding Syracuse have experienced modest growth, Onondaga County and Syracuse declined in population from 1990 to 2000. In 2000 the Onondaga Reservation in southern Onondaga County had an estimated population of 1473 persons (NRC 2006).

Table 2-9. Population Growth in Oswego and Onondaga Counties, New York, from 1970 to 2000 and Projected for 2010 and 2020

	Oswego County		Onondaga County	
Year	**Population**	**Annual Growth Percent[(a)]**	**Population**	**Annual Growth Percent[(a)]**
1970	100,897	—	472,835	—
1980	113,931	+1.2	463,920	–0.2
1990	121,771	+0.7	468,973	+0.01
2000	122,377	+0.05	458,336	–0.02
2010	123,400	+0.08	442,531	–0.4
2020	123,591	+0.02	423,235	–0.4

— = No data available.

(a) Annual percent growth rate is calculated over the previous decade.

Sources: Population data for 1970 through 2000 (USCB 2006); projected population data for 2010 and 2020 (NRC 2006a)

Transient Population

Within 50 mi of JAFNPP, colleges and recreational opportunities attract daily and seasonal visitors who create demand for temporary housing and services. In Oswego County, 6.6 percent of all housing units are considered temporary housing for seasonal, recreational, or occasional use. By comparison, temporary housing accounts for only 1.0 percent and 3.1 percent of total housing units in Onondaga County and the State of New York, respectively (NRC 2006).

Migrant Farm Workers

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers may follow the harvesting of crops, particularly fruit, throughout the northeastern U.S. rural areas. Others may be permanent residents near JAFNPP who travel from farm to farm harvesting crops.

Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting by census takers. If uncounted, these workers would be “underrepresented” in USCB minority and low-income population counts.

Onondaga and Oswego counties host relatively small numbers of migrant workers. According to 2002 Census of Agriculture estimates, 1745 temporary farm laborers (those working fewer than 150 days per year) were employed on 170 farms in Onondaga County, and 718 were employed on 93 farms in Oswego County (Entergy 2006g).

2.2.8.6 Economy

This section contains a discussion of the economy, including employment and income, unemployment, and taxes.

Employment and Income

Between 1990 and 2004, total employment in Oswego County increased 2.5 percent (24,396 to 25,011 persons) and decreased in Onondaga County by 3.6 percent (232,120 to 223,649 persons) (USCB 2006b). Government and health care sectors employed the largest number of people in both counties followed closely by retail, manufacturing, and the service industry. The largest employer in Oswego County in 2006 was the State University of New York at Oswego (SUNY Oswego) with 3934 employees (Table 2-10). The majority of jobs in Oswego County are located in the cities of Oswego and Fulton (Oswego County 2006).

Personal income in Oswego County totaled $2.9 million in 2004, with a per capita personal income of $23,481. In Onondaga County, personal income totaled $14.7 million, with a per capita income of $32,122. Both are lower than the state's per capita personal income in 2004, which was $38,364 (FedStats 2006).

Unemployment

The unemployment rate in Oswego and Onondaga counties in October 2006 was 4.3 and 3.7 percent, respectively. Although there have been fluctuations, the overall rates in both counties have remained about the same over the past decade. The current rate for the state (November 2006) is 4.0 percent (NYSDOL 2006).

Taxes

JAFNPP is assessed annual property taxes by Oswego County, the Town of Scriba, and Mexico Central Schools. Property taxes paid to Oswego County and the Town of Scriba fund services such as transportation, education, public health, and public safety. See Table 2-11.

The continued availability of JAFNPP and the associated tax base is an important feature in the ability of the Town of Scriba and Oswego County communities to continue to invest in infrastructure and to draw industry and new residents.

Table 2-10. Major Employers in Oswego County in 2006

Firm	Number of Employees
SUNY Oswego	3934
County of Oswego	1048
Constellation Energy Group	900
Central Square School District	841
Oswego Health	730
Oswego City School District	723
Novelis Corporation	714
Fulton School District	647
Huhtamaki Packaging	630
Wal-Mart	620
Oswego Opportunities (non-profit)	604
Oswego County Bringing Our Community Education Solutions (BOCES)	569
Entergy Nuclear Northeast	560

Source: Oswego County 2006

In 2005, Entergy paid approximately $7.2 million in taxes for JAFNPP. It is estimated that a minimum of $38.1 million in taxes will be paid by Entergy for JAFNPP through the original license period (Entergy 2006c). These property taxes, and other local taxes, along with JAFNPP operating payroll and locally purchased goods and services, aid the local economy.

The energy market in the state of New York has been deregulated to encourage the development of competition in the production and sale of electricity. A study performed by the New York State Board of Real Property Services concluded that the value of many power-generating plants is likely to decline in a deregulated market. Therefore, Entergy expects that future property taxes assessed through the license renewal term should be similar to or may be less than the estimated in lieu payments (NRC 2006).

Table 2-11. Oswego County, Town of Scriba, and Mexico Central Schools Tax Revenues, 2002 to 2005; JAFNPP Property Tax, 2002 to 2005; and JAFNPP Property Tax as a Percentage of Tax Revenues

Entity	Year	Tax Revenues (in millions of dollars)	Property Tax Paid by JAFNPP (in millions of dollars)	JAFNPP Property Tax as Percentage of Tax Revenues
Oswego County	2002	$152.9	$2.9	1.9%
	2003	$156.1	$2.9	1.9%
	2004	$172.5	$2.9	1.7%
	2005	$162.4	$2.9	1.8%
	2006	$161.0	$2.9	1.8%
Town of Scriba	2002	$4.0	$0.4	10.9%
	2003	$4.9	$0.4	9.0%
	2004	$4.3	$0.4	10.3%
	2005	$5.1	$0.4	8.6%
	2006	$4.6	$0.4	9.4%
Mexico Central Schools	2002	$32.4	$3.9	12.1%
	2003	$32.7	$3.9	12.0%
	2004	$34.1	$3.9	11.5%
	2005	$34.0	$3.9	11.4%
	2006	$34.0	$3.9	11.6%

Source: Entergy 2006c (years 2002–2005)
Entergy 2006g (year 2006)

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the JAFNPP site and in the surrounding area.

2.2.9.1 Cultural Background

The region around JAFNPP contains prehistoric and historic Native American and Euro-American cultural resources. There are 43 properties listed in the National Register of Historic Places within approximately 10 mi of JAFNPP (Entergy 2006c). The nearest National Register site is the Riverside Cemetery in Scriba; none are located in areas affected by operation of JAFNPP.

Paleo Indians occupied North America from 12,000 to 10,000 years ago, subsisting on hunting game and gathering plant material. In the New York area, Paleo Indians migrated into an environment changed by retreating glacial ice. Evidence from archaeological work in the state suggests that small game and plants played a significant role in the lives of the people. Stone tools show little variability over wide areas of North and South America, but raw material for these tools often have sources far from where archaeologists find the tools. Known Paleo-Indian sites near JAFNPP include the Potts Site southeast of Scriba (Ritchie 1994).

During the Archaic Period, from approximately 10,000 years ago to about 3500 years ago, people underwent local changes to adapt to resources. In the New York area, as forests evolved from spruce and pine to mixed deciduous communities, populations near present day JAFNPP probably were low in density to begin with but steadily increased in density as both resource quality and the cultural means to access resources improved. Archaeologists find evidence of more occupation by the end of the Archaic Period when climate reached its modern condition. They interpret the settlement patterns they find as suggestive of an increase in breadth of resources sought by prehistoric people as they lived in smaller territories. Archaic people collected, hunted, and gathered most of what they needed for survival in their home territory. Large base camps found near major water sources provided a focal point for groups during the hard months. During other seasons, camps divided and people engaged in more mobile foraging activities. Primary areas of occupation were along the Oswego River about 7 mi to the west of JAFNPP. Small hunting parties may have crossed the JAFNPP site and hunting encampments could be present. One late Archaic archaeological deposit near the JAFNPP area is the Oberlander 1 site in Oswego County on the Oneida River (Ritchie 1994).

The Transitional Period, from approximately 3500 years ago to about 1000 years ago, is viewed by New York archaeologists as representing a continuum of change in adaptation by prehistoric peoples. The central defining characteristic of the period is the introduction of stone (steatite) vessels at the beginning and the first production of pottery at the end (Ritchie and Funk 1973). Over the same period, burial treatment became more elaborate, and people once again got some materials for making stone tools from distant sources (Ritchie and Funk 1973).

The "Woodland" culture occupied the region between 3000 years ago until the time of European contact. In the Woodland culture, Native Americans became regionally distinct cultural entities. Woodland people ultimately became dependent on maize agriculture, lived in villages, used the bow and arrow in hunting, and began to regularly make and use pottery. Known examples of prehistoric sites are rare on the shore of Lake Ontario. Known archaeological resources found in Oswego County are concentrated along the Oswego River, Oneida Lake, along the Salmon River, and at the mouth of the Salmon River.

JAFNPP is situated within a region bordered by Lake Ontario to the north. No major drainage occurs within 5 mi. Any large prehistoric sites would most likely be found along major waterways away from JAFNPP. Since JAFNPP is not within the daily foraging radius of any major river valley, prehistoric people visiting the area could have made overnight camps along minor streams as they hunted and collected local resources. The terrain to the south and east of JAFNPP consists of glacial kettle ponds and wetlands surrounded by small knolls and hills. Paleo-Indian and Archaic Period peoples could have foraged for resources in and around these kettle ponds. Later prehistoric groups could have used this area for hunting and foraging on a reduced scale. JAFNPP is also situated on a rocky coastal bluff. This, along with the lack of a beach, would not have been attractive for fishing. Any archaeological sites found in the vicinity of the JAFNPP would consist of small scatters of stone tools and debris from making stone tools, associated with cooking hearths.

The Native American societies in the region shared several important characteristics at the time they were first contacted by Europeans. These included an economic base that combined hunting and gathering with growing domesticated plants; and an annual settlement that varied in population size between semi-permanent river-side villages in summer, large camps in winter, and population dispersal among scattered camps in the spring and fall.

The JAFNPP site is located on Onondaga Indian Nation's eighteenth century lands, although the territorial boundaries between Native American groups were in flux throughout the historic period and until the mid-nineteenth century. Treaties between New York Indians and the United States government in 1794 and 1838 eroded tribal territorial holdings in the state of New York. European settlement and exploration of the region occurred slowly with most of the settlement activity concentrated away from JAFNPP near the mouth of the Oswego River near Forts Ontario and Oswego.

In 1788, the state purchased large tracts of land from the Onondaga, Oneida, and Cayuga nations; the lands, which were divided into parcels, included Scriba's Patent, and that included the JAFNPP. George Scriba, a resident of Holland, New York, took possession of nearly 0.5 million ac of land in the patent. The patent was divided into 16 townships in Oswego County, and George Scriba began to sell portions to speculators and settlers (Kozub and Carter 2003).

The town of Scriba was created in 1811, although settlers in the area arrived as early as 1798. The scene for the first non-Indian settlement was at "Scriba Corners." The township of Scriba flourished throughout the nineteenth century with small farms, apple orchards, and a booming cider industry. Seven homesteads, a railroad line, and a stave factory (for cider barrels) existed on the JAFNPP tract in 1867 (Stone 1867).

The early economy was based on timber harvesting and lumber production. As forests were cut, residents moved to farming, especially dairy and fruit production (Churchill 1895). The Oswego Canal opened in 1828 and the Syracuse & Oswego Railroad opened in 1848. The canal and railroad precipitated surges in the lumber industry and in agriculture (Churchill 1895). By 1855 more than half of the county's workers were farmers (Wellman 1987). However, by the late 1800s, the shipping industry in Oswego collapsed, as did agriculture, and farmers began to leave. It took Oswego County 90 years to return to the population level of 1870. By 1900, at least 12 residences had located in the JAFNPP area (USGS 1900). The number of farms and homes remained relatively stable until 1955, when there were 14 residences (USGS 1955).

Camp Oswego, also known as the Camp Drum Anti-Aircraft Artillery Firing Range, was located immediately to the west of JAFNPP on property now occupied by Nine Mile Point Nuclear Station (USGS 1955). The camp was established during World War II and continued to operate well into the 1950s as a summer training base. Sometime after 1956, the camp was closed and the land was later purchased by Niagara-Mohawk Electric Company for construction of the Nine Mile Point Nuclear Station.

2.2.9.2 Historic and Archaeological Resources at JAFNPP

During preparation and review of the *Final Environmental Statement Related to Operation of James A. Fitzpatrick Nuclear Power Plant* (AEC 1973), it was determined that no known historic places and archaeological sites existed within the plant site or in the ROW for the transmission line. The New York State Historic Preservation Office (SHPO) was contacted during the early stages of site construction for information about archaeological resources in the vicinity of JAFNPP and received certification that the plant would not have a harmful effect on any sites of historic and archaeological importance (AEC 1973). Subsequently, Entergy contacted the New York State Office of Parks, Recreation, and Historic Preservation (NYSHPO) regarding license renewal for JAFNPP in February 2006 (Entergy 2006c). In April 2006, NYSHPO responded to Entergy stating that they consider the project area to be "sensitive for archaeological resources" (NYSHPO 2006b).

The JAFNPP site is generally flat, with the area surrounding the plant largely forested and rural (Entergy 2006c). Aerial photographs show that a considerable portion (approximately one-third) of the site has been disturbed due to the construction of JAFNPP. After a review of NYSHPO site files, NRC staff confirmed that no known archaeological and historic architectural sites have been recorded at JAFNPP. In addition, according to NYSHPO records, there have been several archaeological studies and surveys conducted in the vicinity of JAFNPP and one actual study of the site. The results of these studies are summarized chronologically below.

The first known archaeological survey in the vicinity of JAFNPP was conducted in 1977 by Pratt and Pratt Archaeological Associates, Inc., for Niagara Mohawk Power Corporation. This report consisted of a literature search and survey for siting a power line and substation (Nine Mile Point Nuclear Station Unit 2—Volney 765-kV line) that crossed JAFNPP property. The literature review found no recorded prehistoric archaeological sites or National Register properties within the proposed substation site and corridor area. However, the report indicated there was a high potential for finding historic sites within the project corridor but only a moderate potential that these sites would be impacted by the proposed project. In 1983, Pratt and Pratt Archaeological Associates, Inc., published an addendum to the 1977 report, which did not change the conclusions of the earlier report.

In 1987, a comprehensive literature review and cultural resource inventory was conducted at the JAFNPP site by Hartgen Archeological Associates, Inc. Again, the literature review found no recorded prehistoric or historic archaeological sites on file at the New York State Museum or SHPO. However, Hartgen noted that due to environmental conditions, the JAFNPP site and surrounding area could have been used for foraging and hunting by limited numbers of prehistoric peoples for short durations, and concluded that there was a low to moderate probability of prehistoric sites being found on the plant site. The survey also reported that historic development within the JAFNPP site consisted primarily of scattered homes along North Lake Road and Oswego County Route 29. As late as 1955, the number of structures identified on maps within the JAFNPP property was only 16. Given that these historic structures once stood on the JAFNPP site, the potential for finding historic resources on the site is high.

Most of the other archaeological studies and surveys conducted between 1987 and 2004 consisted of literature searches for water and electric transmission line and roadway projects. These studies and surveys found no significant prehistoric or historic sites within their project areas.

In October 2006, Entergy contracted Enercon Services, Inc., to perform a phase 1A literature review and archaeological sensitivity assessment for the JAFNPP site. The assessment included a walk-over of selected undeveloped portions of the JAFNPP site that were identified as being potentially sensitive for cultural resources. As stated in previous archaeological reviews, Enercon also concluded that there is a potential for finding prehistoric sites on the small knolls and hills next to kettle ponds across the eastern and southern portions of the JAFNPP property. The assessment also concluded that since the site was mostly orchard farmland prior to the construction of JAFNPP, it is very likely that historic resources associated with those farms exist on the site.

A walk-over of selected undeveloped portions of the JAFNPP site by NRC staff confirmed the existence of historic resources on the plant site. Early maps of the JAFNPP area indicate that a number of structures, mostly of nineteenth-century origin, existed on the JAFNPP site prior to construction. Most of these sites today consist of foundations and probable associated historic artifact scatters. Prehistoric cultural resources could also be present in the relatively undisturbed southern and eastern portions of the JAFNPP site in areas next to kettle ponds.

2.2.10 Related Federal Project Activities and Consultations

The NRC staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating license for JAFNPP. Any such activity could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency in the preparation of the JAFNPP SEIS.

The 7068-ac Montezuma National Wildlife Refuge, located approximately 44 mi southwest of JAFNPP serves as a major resting area for waterfowl and other waterbirds on their journeys to and from nesting areas in northeastern and east-central Canada. This refuge is also in the middle of one of the most active flight lanes in the Atlantic Flyway (FWS 2006a).

The Onondaga Reservation, a 5953-ac Indian reservation, is located in Onondaga County. As of the 2000 census, the Indian reservation had a population of 1473 (Answers.com 2006).

JAFNPP shares an eastern boundary with the Nine Mile Point Nuclear Station, a two-unit electricity-generating nuclear power plant operated by Nine Mile Point Nuclear Station, LLC. There are also approximately 25 hydropower electricity-generating facilities within 50 mi of the JAFNPP site.

NRC is required under Section 102 of the National Environmental Policy Act of 1969 (NEPA) to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. Federal agency comment correspondence is included in Appendix E.

2.2.10.1 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (CZMA) grants the National Oceanic and Atmospheric Administration (NOAA) the authority to encourage and assist states and territories with developing management programs that preserve, protect, develop, and, when possible, restore coastal zone resources. A "coastal zone" is generally described as the coastal waters and the adjacent shore lands strongly influenced by each other and includes islands, transitional and intertidal areas, salt marshes, wetlands, beaches, and Great Lakes waters (NOAA 2007).

Federal activities that are reasonably likely to affect coastal use or resources, such as license renewal of nuclear power plants, must be consistent with the approved State coastal management program (CMP). The federal consistency provision is promulgated in Section 307(c)(3)(a) of the CZMA and requires applicants for Federal licenses or permits to certify that any proposed activity in the coastal zone is consistent with the enforceable policies of the State CMP (NOAA 2007). A copy of the applicant’s consistency certification, as submitted to the Federal agency, is provided to the State agency responsible for conducting consistency reviews. Upon receipt of all necessary information, the State has six months to notify the applicant and Federal agency of whether it concurs with or objects to the applicant’s certification. The Federal license or permit being sought by the applicant cannot be granted without State approval of the consistency certification (DOC 2003).

In 1982, NOAA certified New York State's CMP, as codified in 19 NYCRR Parts 600–601. Implementation of the CMP and a consistency review are performed by the New York State Department of State Division of Coastal Resources (NYSDOS 2007). JAFNPP is located on a Great Lakes coastline that falls under the jurisdiction of the CZMA, and license renewal is a Federal activity that requires a consistency determination. As such, Entergy submitted a copy of its New York State CMP certification, as contained within Attachment D of the ER (Entergy 2006c), to the State on July 31, 2006. New York State requires review of the draft SEIS prior to making a consistency determination. To ensure the six-month review time frame is maintained, upon request of the State, Entergy withdrew its consistency certification and will resubmit the certification closer to the date of the draft SEIS issuance (Entergy 2006e).

2.2.10.2 Clean Water Act Section 401 Water Quality Certification

Under Section 401 of the Clean Water Act of 1977 (CWA), an applicant for a Federal license or permit to conduct any activity that may result in discharge into navigable waters must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. A license or permit cannot be granted by the Federal agency until this certification has been obtained or waived by the State. Furthermore, a license or permit cannot be granted if certification has been denied by the State, interstate agency, or the EPA Administrator. The 401 Water Quality Certification sets forth applicable effluent limitations and prescribes monitoring requirements to ensure that the applicant remains in compliance with those limitations. Any Federal license or permit for a 401 Water Quality Certification that has been obtained may be suspended or revoked by the issuing Federal agency upon judgment that the facility or licensed activity has violated its certification or any applicable provisions of the CWA.

In New York, the NYSDEC Department of Water reviews and issues Section 401 Water Quality Certifications. JAFNPP's original 401 Certification and Initial Reporting Requirements is dated June 1, 1973, and accompanied the original licensing action by the NRC. In accordance with Section 401 regulations, Entergy submited a Section 401 Water Quality Certification application to NYSDEC in April 2007 (Entergy 2007b) to accompany the request for license renewal. Upon receipt of the application, NYSDEC will have 12 months to review the application and grant or deny a certification. NYSDEC anticipates issuing a decision for JAFNPP in March 2008, approximately three months prior to the NRC's expected license renewal decision in May 2008 (assuming the standard 22-month NRC license renewal review timeline). Until NYSDEC has issued a Section 401 Water Quality Certification for JAFNPP, the NRC will not be able to grant the license renewal.

2.3 References

6 NYCRR Part 374. Title 6 of the *Codes, Rules, and Regulations of the State of New York*, Part 374.3. “Management of Specific Hazardous Wastes – Standards for Universal Waste.”

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.”

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities.”

19 NYCRR Parts 600–601. Title 19 of the *Codes, Rules, and Regulations of the State of New York* Chapter XIII: Waterfront Revitalization of Coastal Areas and Inland Waterways, Parts 600 - 603: Local Government Waterfront Revitalization Programs.

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.”

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations.”

40 CFR Part 260. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 260 “Hazardous Waste Management System: General.”

40 CFR Part 261. *Code of Federal Regulations*, Title 40, *Protection of Environment,* Part 261, “Identification and Listing of Hazardous Waste.”

40 CFR Part 273. *Code of Federal Regulations,* Title 40, *Protection of Environment,* Part 273, “Standards for Universal Waste Management.”

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3.0 ENVIRONMENTAL IMPACTS OF REFURBISHMENT

Environmental issues associated with refurbishment activities are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).(1) The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this draft supplemental environmental impact statement (SEIS) unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1 and, therefore, additional plant-specific review of these issues is required.

License renewal actions may require refurbishment activities for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment determined to be Category 1 issues are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS for which these conclusions could not be reached for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

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(1) 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 its Addendum 1.

Table 3-1. Category 1 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Impacts of refurbishment on surface-water quality	3.4.1
Impacts of refurbishment on surface-water use	3.4.1
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Refurbishment	3.5
GROUND-WATER USE AND QUALITY	
Impacts of refurbishment on ground-water use and quality	3.4.2
LAND USE	
Onsite land use	3.2
HUMAN HEALTH	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

Category 1 and Category 2 issues related to refurbishment that are not applicable to James A. FitzPatrick Nuclear Power Plant (JAFNPP) because they are related to plant design features or site characteristics not found at the James A FitzPatrick site are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) indicated that it has performed an evaluation of structures and components pursuant to Section 54.21 of Title 10 of the *Code of Federal Regulations* (10 CFR 54.21) to identify activities that are necessary to continue operation of JAFNPP during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities and are described in the Environmental Report (ER; Entergy 2006).

However, Entergy stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53 (c)(3)(ii) Subparagraph
TERRESTRIAL RESOURCES		
Refurbishment impacts	3.6	E
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)		
Threatened or endangered species	3.9	E
AIR QUALITY		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
SOCIOECONOMICS		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services, transportation	3.7.4.2	J
Historic and archaeological resources	3.7.7	K
ENVIRONMENTAL JUSTICE		
Environmental justice	Not addressed[a]	Not addressed[a]

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the applicant's environmental report and the NRC staff's environmental impact statement.

plant operations as evaluated in the *Final Environmental Statement Related to Operation of James A. FitzPatrick Nuclear Power Plant* (AEC 1973). In addition, Entergy's evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of JAFNPP beyond the end of the existing operating license. Therefore, refurbishment is not considered in this draft SEIS.

3.1 References

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 54. *Code of Federal Regulation*s, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy). 2006. *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: – Applicant's Environmental Report, Operating License Renewal Stage.* Lycoming, New York. Accessible at ML062160557.

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4.0 ENVIRONMENTAL IMPACTS OF OPERATION

Environmental issues associated with operation of a nuclear power plant during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996a; 1999).[(1)] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, OR LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B and are applicable to the James A. FitzPatrick Nuclear Power Plant (JAFNPP). Section 4.1 addresses issues applicable to the JAFNPP cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality, while Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative impacts. The results

1 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 its Addendum 1.

of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Finally, Section 4.10 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to JAFNPP because they are related to plant-design features or site characteristics not found at JAFNPP are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to the JAFNPP cooling system operation during the renewal term are listed in Table 4-1. Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) stated in its Environmental Report, *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: Applicant's Environmental Report, Operating License Renewal Stage* (JAFNPP ER) (Entergy 2006a), that it is not aware of any new and significant information associated with the renewal of the JAFNPP operating license (OL). The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the NRC staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that

  > 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.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

Table 4-1. Category 1 Issues Applicable to the Operation of the JAFNPP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Altered thermal stratification of lakes	4.2.1.2.3
Temperature effects on sediment transport capacity	4.2.1.2.3
Scouring caused by discharged cooling water	4.2.1.2.3
Eutrophication	4.2.1.2.3
Discharge of chlorine or other biocides	4.2.1.2.4
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4
Discharge of other metals in wastewater	4.2.1.2.4
Water use conflicts (plants with once-through cooling systems)	4.2.1.3
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4
Entrainment of phytoplankton and zooplankton	4.2.2.1.1
Cold shock	4.2.2.1.5
Thermal plume barrier to migrating fish	4.2.2.1.6
Distribution of aquatic organisms	4.2.2.1.6
Premature emergence of aquatic insects	4.2.2.1.7
Gas supersaturation (gas bubble disease)	4.2.2.1.8
Low dissolved oxygen in the discharge	4.2.2.1.9
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10
Stimulation of nuisance organisms	4.2.2.1.11
HUMAN HEALTH	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that

    > 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.

    The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- Altered thermal stratification of lakes. Based on information in the GEIS, the Commission found that

    > 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.

    The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of altered thermal stratification of lakes during the renewal term beyond those discussed in the GEIS.

- Temperature effects on sediment transport capacity. Based on information in the GEIS, the Commission found that

    > 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.

    The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that

    > 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- Eutrophication. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information including plant monitoring data and technical reports. Therefore, the NRC staff concludes that there would be no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that

> Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information including the State Pollutant Discharge Elimination System (SPDES) permit for JAFNPP. Therefore, the NRC staff concludes that there would be no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that

> Effects are readily controlled through [National Pollutant Discharge Elimination System] NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information including the SPDES permit for JAFNPP. Therefore, the NRC staff concludes that there would be no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in wastewater. Based on information in the GEIS, the Commission found that

  > These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information including the SPDES permit for JAFNPP. Therefore, the NRC staff concludes that there would be no impacts of discharges of other metals in wastewater during the renewal term beyond those discussed in the GEIS.

- Water-use conflicts (plants with once-through cooling systems). Based on information in the GEIS, the Commission found that

  > These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of water-use conflicts for plants with once-through cooling systems during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that

  > 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.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of available information. Therefore, the NRC staff concludes that there would be no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information, including JAFNPP's original CWA Section 316(a) demonstration report (NYPA 1976). Therefore, the NRC staff concludes that there would be no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information, including JAFNPP's original CWA Section 316(a) demonstration report (NYPA 1976). Therefore, the NRC staff concludes that there would be no impacts of thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that

> Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information, including JAFNPP's original CWA Section 316(a) demonstration report (NYPA 1976). Therefore, the NRC staff concludes that there would be no impacts on distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that

> Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of microbiological organisms during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that

  > 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.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to JAFNPP are listed in Table 4-2 and discussed in the sections that follow.

Table 4-2. Category 2 Issues Applicable to the Operation of the JAFNPP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2	B	4.1.1
Impingement of fish and shellfish	4.2.2.1.3	B	4.1.2
Heat shock	4.2.2.1.4	B	4.1.3

4.1.1 Entrainment of Fish and Shellfish in Early Life Stages

For power plants with once-through cooling systems, the entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue that requires site-specific assessment before license renewal. Applicable Category 2 issues are listed in Table 4-2. The NRC staff reviewed the JAFNPP ER (Entergy 2006a) and related documents, including Entergy's *Proposal for Information Collection* dated January 31, 2006 (Entergy 2006b), and the *2004 SPDES Biological Monitoring Report for the James A. FitzPatrick Nuclear Power Plant,* dated May 2005 (EA 2005), and visited the JAFNPP site several times. The NRC staff also reviewed the applicant's most current SPDES permit (NY-0020109) and the accompanying fact sheet, the State of New York Best Technology Available (BTA) determination letter dated March 1, 1996, and the State of New York 401 Certification letter dated November 5, 1975 (Entergy 2006a).

Section 316(b) of the Clean Water Act of 1977 (CWA), common name of the Federal Water Pollution Control Act, requires that the location, design, construction, and capacity of cooling water intake structures reflect the best available technology for minimizing adverse environmental impacts (33 U.S.C. 1326). Entrainment of fish and shellfish into the cooling water system is a potential adverse environmental impact that can be minimized by the use of best available technology. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify facility operation, or take other mitigative measures. Licensees must comply with Section 316(b) of the CWA. However, EPA's Phase II Rule has been suspended and compliance with the rule is based on EPA's best professional judgment.

JAFNPP has a once-through heat dissipation system that uses water from Lake Ontario for condenser cooling and service water. Under normal operating conditions at JAFNPP, all three circulating water pumps are operating to produce a combined intake flow of 352,600 gallons per minute (gpm) (518 million gallons per day [gpd]), as measured through the condensers. Three 50 percent-capacity service water pumps also draw water from the intake bay, downstream of the traveling screens, at a rate of 36,000 gpm (52 million gpd). At the submerged offshore intake structure, water velocity at the outer face of the bar racks is 1.2 feet per second (ft/s) and 1.6 ft/s through the bar racks. Once in the D-shaped intake tunnel, average water velocity is 4.7 ft/s. Reinforced invert paving and wire mesh-reinforced gunite lining provides for hydraulic smoothness throughout the tunnel (Entergy 2006a). Once in the screenwell-pumphouse intake bay, the water flows through the trash bars and traveling screens. Each traveling screen has a design capacity flow rate of 125,000 gpm and design approach velocity of 1.2 ft/s; the screens rotate from 10 to 20 feet per minute (ft/m). Screen wash pumps operate periodically and in response to pressure differentials to remove debris from the traveling screens. Screen wash pumps take water from the service water system and spray the traveling screens at a rate of 720 gpm/screen, at a minimum of 80 pounds per square inch (lb/in^2) gauge pressure (Entergy 2006b).

The maximum allowable temperature rise of the cooling system water through the main condenser is 32.4 degrees Fahrenheit (°F) above ambient water temperature (Entergy 2006a). Organisms entrained in the intake flow that are small enough to pass through the vertical traveling screens enter the station cooling system where they are subjected to thermal stress and mechanical and hydraulic forces. In a study of the Haddam Neck Plant, a nuclear power plant with a once-through cooling system that formerly operated on the Connecticut River, it was found that mechanical damage is the main cause of entrainment mortality, while thermal shock was responsible for only about 20 percent of mortality (Marcy 2004). While some entrainment survival may occur, for this review NRC staff conservatively assumed that 100 percent of entrained organisms die.

During periods of cold weather, when inlet water temperature is below 45°F, warm discharge water is recirculated from the discharge tunnel into the intake bay by a tempering gate—the amount of raw intake water is reduced approximately 16 to 18 percent during this mode of operation. Total entrainment loss is directly proportional to both the density of ichthyoplankton in the nearfield source of water and to the raw water intake flow during the period of consideration. JAFNPP has compiled monthly actual intake flow data from January 1998 through July 2005, and actual pumping rates have historically been lower than plant-design flows. This is because the circulating water pumps operate at various head differentials and the plant's cooling water needs vary in response to reduced generation, environmental conditions, and periodic maintenance outages. This historical operation is considered representative of the current and expected future cooling water intake flow operations at JAFNPP (Entergy 2006b).

In the late 1960s, the New York Power Authority (NYPA) and the Niagara Mohawk Power Corporation conducted ecological studies in the nearshore vicinity of the Nine Mile Point promontory to determine the potential impact of power plants on the Lake Ontario aquatic ecosystem. Part of this program included weekly monitoring of the distribution of fish eggs and larvae at contour depths from 20 to 100 ft, from April through December of 1973 through 1979. Egg collections consisted primarily of alewife (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*); larval samples were also dominated by alewife. Alewife were the primary component of the ichthyoplankton community, followed by rainbow smelt, white perch (*Morone americana*), sculpin (*Cottidae* spp.), and tessellated darter (*Etheostoma olmstedi*). Low numbers of other species were collected, including yellow perch (*Perca flaverscens*), rainbow smelt, and *Morone* spp., but overall, the data indicated that the Nine Mile Point vicinity was a significant spawning habitat for only alewife and rainbow smelt. A study of species composition and distribution of fish larvae collected in the Nine Mile Point area published in 1975 concluded the area is not a desirable spawning or nursery habitat because of extensive nearshore wave action and unsuitable bedrock and rubble substrate (TI 1979).

The ecological studies revealed that the temporal distribution of eggs and larvae in the Nine Mile Point vicinity is generally characterized by two spawning groups: those that spawn from winter to early spring (burbot [*Lota lota*], *Coregonus* spp., rainbow smelt, and yellow perch), and those that spawn from late spring through summer (alewife, white perch, and carp [*Cyprinus carpio*]). Subsequently, eggs and larvae from these groups are most abundant from April to June and from July to August, respectively. Eggs and larvae were most abundant at the 20-ft contour depth; their numbers were lower at deeper contours (TI 1979).

Because Nine Mile Point Nuclear Station (NMPNS) Unit 1 is so close to JAFNPP and NMPNS's intake and cooling systems are similar to JAFNPP's, entrainment data from NMPNS were reviewed for this analysis. NMPNS sampled water directly from the Unit 1 intake forebay once or twice a month from 1973 through 1978. The species composition of the intake water was generally very similar to the species composition of Lake Ontario, except that intake water ichthyoplankton densities were lower than lake water ichthyoplankton densities and species that occurred at low frequencies in the lake samples were not detected at all in the intake water samples. Temporal abundance was also similar (Entergy 2006b).

The first year NMPNS Unit 1 entrainment data were collected when both NMPNS Unit 1 and JAFNPP were operating was 1976. Burbot and *Coregonus* spp. were most frequently entrained at NMPNS Unit 1 in the early spring, rainbow smelt in mid-spring, and alewife in late spring and summer. Abundance of entrained fish was highest in the summer due to the large alewife population: weekly average alewife densities were 0 to 34.4 eggs per cubic meter (m^3) and 0 to 0.5 larvae per m^3. Weekly average rainbow smelt densities were 0 to 0.15 eggs per m^3 and 0 to 0.02 larvae per m^3. Conservatively assuming the maximum weekly density and that NMPNS Unit 1 was running at full capacity, weekly entrainment totals were estimated at 350 million alewife eggs and 4.9 million alewife larvae; and 1.5 million rainbow smelt eggs and 205,000 rainbow smelt larvae. For perspective, these numbers were extrapolated using alewife fecundity data and compared to the estimated standing stock number of alewife in the U.S. waters of Lake Ontario (12.56 billion in 1976), resulting in an estimated loss of approximately 0.0002 percent of alewife population females and 0.014 percent alewife larvae. An estimated 0.00001 percent female rainbow smelt population loss was calculated for egg entrainment and 0.025 percent for larval entrainment (Entergy 2006b).

A 1997 NMPNS entrainment study showed much lower total entrainment numbers than the 1977 data: corrected for flow into the plant, an estimated 86.6 million ichthyoplankton were entrained from April through August at NMPNS Unit 1. Alewife represented 90.7 percent of the ichthyoplankton entrainment, followed by the tessellated darter at 4.2 percent (3.6 million) and the threespine stickleback (*Gasterosteus aculeatus*) at 2.8 percent (2.4 million). Rainbow smelt accounted for only 0.1 percent. The difference in the 1977 and 1997 entrainment numbers is likely due primarily to the difference in abundance of alewife and rainbow smelt lake-wide (Entergy 2006b). Both alewife and rainbow smelt populations throughout Lake Ontario have likely declined due to excessive salmonid predation and lake-wide food web changes that occurred primarily in response to *Dreissenid* spp. invasion and lake water quality improvements (Mills et al. 2003).

The status of Lake Ontario's alewife population is of particular concern. As prey fish for stocked salmonids, alewife support the lake's major sport fisheries, which are strong contributors to local economies. To put the 1997 alewife entrainment data into perspective, NRC staff calculated alewife fecundity loss in a similar manner to the 1976 calculations above. In performing these calculations, NRC used a 1997 Lake Ontario (U.S. waters) alewife standing stock population of 941,300,000 (Entergy 2006a); assumed a 1:1 sex ratio; assumed an alewife average lifetime fecundity of 26,272 eggs (Entergy 2006b); and conservatively assumed the entire percentage of entrained alewife ichthyoplankton was composed of eggs. In estimating total entrainment for all of 1997, NRC staff also conservatively assumed that the April to August rate of entrainment was maintained throughout the entire year, which due to the spawning habits of alewife and lower intake flows during winter months, is highly unlikely. By multiplying the number of female alewife by fecundity and dividing this number by entrainment, the estimated loss of population fecundity in the U.S. waters of Lake Ontario caused by NMPNS Unit 1 was 0.0015 percent for 1997. This minor percentage of ichthyoplankton loss would not result in a detectable impact on the lake's alewife population.

On January 24, 2006, JAFNPP applied for a renewal of its New York SPDES permit, which was scheduled to expire on August 1, 2006. Until this renewal permit is finalized, the existing permit (NY-0020109) remains in effect. As stated earlier, no entrainment studies have been completed by JAFNPP since the original Nine Mile Point promontory baseline ecology studies done in the 1970s. On July 9, 2004, the EPA published a final rule that addressed cooling water intake structures at existing facilities with flow levels that exceed a minimum threshold value of 50 million gpd (316(b) Phase II regulations). Owners of such facilities that did not utilize closed cycle cooling were provided a number of compliance alternatives to demonstrate compliance with the new regulations. The demonstration is implemented through the NPDES permitting program. To demonstrate compliance, JAFNPP is currently conducting a one-year entrainment sampling program that was approved by the New York State Department of Environmental Conservation (NYSDEC). The program began in April 2006 and will conclude in March 2007. A second year of entrainment sampling may occur to verify the 2006 results. An entrainment survival study may also be undertaken if it appears there is a high survival rate for ichthyoplankton. The goal of the entrainment program is to estimate the seasonal and annual total abundance of fish eggs and larvae that flow into the cooling water intake system. The goal of the survival study, if undertaken, would be to determine the effects the cooling water intake system has on entrained organisms (Entergy 2006b). The majority of fish, fish larvae, and eggs are not expected to survive passage through the JAFNPP cooling system, as cooling water temperature rises up to 32.4°F above ambient intake water temperature and organisms would experience significant hydrodynamic changes and mechanic forces (AEC 1973).

In the 2006 JAFNPP entrainment sampling program, intake water was sampled weekly from April to November of 2006 and every two weeks from November 2006 through March 2007. One daytime and one nighttime sample were taken on the same day each week from the forebay at two sample depths, 14 ft and 20 ft below the water surface, for a total of 160 entrainment samples. The sampling was conducted using a pump with 3-inch (in.) intake and discharge hoses and a plankton net suspended in a tank. Each sample was at least 100 m^3 (26,417 gallons) as calibrated by an in-line flow meter (Entergy 2006b). As of the date of publication of this draft SEIS, the results of the one year study are not available. Nevertheless, the NRC staff did review preliminary (unpublished) study data to support this analysis.

In reviewing the historical entrainment data at NMPNS Unit 1, it appears that the primary factor influencing entrainment rates is the abundance of eggs and larvae in the water near the plant intake. Potential entrainment losses at JAFNPP, when compared to the standing stock of the lake's fish species, are not likely to adversely affect the Lake Ontario fish community. A study on entrainment and impingement rates at a nuclear power plant located on the Upper Mississippi River (LaJeone and Monzingo 2000) concluded that naturally occurring environmental conditions have a greater effect on fish populations than plant operations, and fluctuations in the annual impingement and entrainment numbers reflect primarily river conditions and fish populations' responses to them. The estimated 0.0015 percent fecundity loss of the female alewife in Lake Ontario (U.S. waters) standing stock from NMPNS Unit 1 in 1997 was a conservative estimate of the potential entrainment impact that is possible at JAFNPP and would not result in a detectable impact on the alewife fishery. Until the results of the 2006 entrainment study are finalized, there can be no definitive quantification of the current entrainment impacts on Lake Ontario at JAFNPP. However, based on the results of historical entrainment studies, similar operations at NMPNS Unit 1, and no change in operations at JAFNPP during the license renewal term, there is no evidence to suggest that past, current, or future entrainment of eggs, larvae, or juvenile forms of these species would destabilize or noticeably alter any important attribute of Lake Ontario. The preliminary data from the recent entrainment study at JAFNPP supports this conclusion. Therefore, the NRC staff has determined that the potential impacts of entrainment of fish and shellfish by JAFNPP during the 20-year renewal period would be SMALL. The NRC staff identified potential mitigation measures, including closed cycle cooling, and derating the facility and scheduling outages during historic periods of high ichthyoplankton density. However, the NRC staff concluded that none of the mitigation measures considered would be beneficial enough to reduce the significance of the adverse entrainment impacts to the Lake Ontario fishery. Under the provisions of the state NPDES permitting program, however, NYSDEC may impose further restrictions or require modifications to the cooling system to reduce the impact of entrainment.

4.1.2 Impingement of Fish and Shellfish

For plants with once-through cooling systems, the impingement of fish and shellfish on debris screens associated with plant cooling systems is considered a Category 2 issue, which requires a site-specific assessment before license renewal. The NRC staff reviewed the JAFNPP ER (Entergy 2006a) and related documents, including Entergy's *Proposal for Information Collection* dated January 31, 2006 (Entergy 2006b), and the *2004 SPDES Biological Monitoring Report for the James A. FitzPatrick Nuclear Power Plant,* dated May 2005 (EA 2005), and visited the JAFNPP site several times. The NRC staff also reviewed the applicant's most current SPDES permit (NY-0020109) and the accompanying fact sheet, the State of New York Best Technology Available (BTA) determination letter dated March 1, 1996, and the 401 Certification letter dated November 5, 1975 (Entergy 2006a).

Section 316(b) of the CWA, requires that the location, design, construction, and capacity of cooling water intake structures reflect the best available technology for minimizing adverse environmental impacts (33 U.S.C. 1326). Impingement of fish and shellfish into the cooling water system is a potential adverse environmental impact that can be minimized by the use of best technology available. Licensees may be required as part of the NPDES renewal to alter the intake structure, redesign the cooling system, modify facility operation, or take other mitigative measures. Licensees must comply with Section 316(b) of the CWA. However, EPA's Phase II Rule has been suspended and compliance with the rule is based on EPA's best professional judgment.

JAFNPP does not have a fish return system for fish impinged on the traveling screens. Therefore, impinged fish are not returned to the lake and do not survive (Entergy 2006a). JAFNPP operates a high-frequency/high-amplitude acoustic fish deterrence system (FDS) annually from April through October that is specifically designed to deter alewife. Historical studies have shown that 97 percent of alewife impingement occurs during these months (Ross and Dunning 1996). The JAFNPP FDS consists of nine overlapping, wide-beam, high-frequency transducers mounted on top of the submerged intake structure. The transducers produce an array sound field, ensuring 360° coverage from the water surface to the lake bottom and extending at least 33 ft from the perimeter of the intake structure. Per the JAFNPP SPDES permit, the FDS is dewinterized and operational by the first week of April each year and is removed from service (winterized) each October. The FDS was put into long-term operation in 1998 (EA 2005).

Impingement of fish was monitored at JAFNPP annually from 1976 to 1997 and again in 2004. In issuing the most recent SPDES permit, NYSDEC determined that JAFNPP's impingement database was adequate to support a transition to a long-term, less intensive monitoring program, requiring the plant to conduct only one, one-year impingement program during the five-year permit period from 2001 to 2006 (Entergy 2006a). The results of JAFNPP impingement monitoring from 1976 to 1997 are summarized in Table 4-3. Generally, alewife and rainbow smelt account for the majority of individuals impinged from 1976 through 1994. The threespine stickleback is the third-most frequently impinged species, but larger impingement numbers did not occur until 1995 to 1997 and 2004 with one anomaly year in 1978 (EA 2005). These impingement trends reflect lake-wide conditions. The abundance of alewife and rainbow smelt has declined over the past decade due to ecological stressors, invasive species, and increasing predatory pressure; concurrently the threespine stickleback population has greatly increased. Fish population studies of Lake Ontario suggest that the lake pelagic fish community may be undergoing a change (Schaner and Prindle 2004).

The *2004 SPDES Biological Monitoring Report for JAFNPP* also suggests that weather conditions can dramatically affect impingement rates, with other studies supporting this observation. An exceptionally high number of alewife were impinged in 1976 (almost 4 million fish) as compared to the rest of the data from 1977 to 1997 and 2004; the latter data is more representative than the 1976 data of impingement abundance observed during the past two decades. Although annual die-offs of alewife occur every year, a catastrophic die-off of alewife occurred in the winter and early spring of 1977, resulting in an estimated 60 to 75 percent loss of the adult alewife population, explaining the high 1976 impingement numbers (EA 2005).

The alewife was the most common species taken during the entire 22-year impingement study. Rainbow smelt were most abundant in 1978, 1979, 1987, 1990, and 1992, and typically the second-most abundant species impinged each year. Comparing impingement rates to lake-wide population estimates for U.S. waters, in 1997 alewife and rainbow smelt impingement at JAFNPP represented only 0.0015 percent and 0.0012 percent of the populations, respectively (EA 2005).

Table 4-3. Results of Impingement Monitoring at JAFNPP from 1976 through 1997 (Corrected for Flow and Traveling Screen Efficiencies)

Scientific Name	Common Name	Fish Impingement, 1976–1997		Percentage of Fish Impinged, Average Over 22-Year Period (1976–1997)
		Total Number Fish Impinged[a]	Range of Annual Number of Fish Impinged[a]	
Alosa pseudoharengus	alewife	7,546,639	1,312–3,916,717	58.73%
Cottus spp.	sculpins	35,232	747–4,916	0.27%
Dorosoma cepedianum	gizzard shad	116,239	26–26,173	0.90%
Etheostoma olmstedi	tessellated darter	34,423	68–6,708	0.27%
Gasterosteus aculeatus	threespine stickleback	3,114,822	78–1,392,763	24.24%
Morone americana	white perch	69,669	53–13,353	0.54%
Notropis atherinoides	spottail shiner	82,245	282–11,683	0.64%
Osmerus mordax	rainbow smelt	1,780,388	1,527–282,373	13.86%
Percopsis omiscomaycus	trout perch	70,120	180–12,183	0.55%

Source: EA 2005

(a) Number of fish taken on the intake screens over a one year period.

The alewife is of special concern because Lake Ontario's valuable salmonid sport fishery is primarily dependent on this single-forage species. Alewife populations show high mortality rates after especially cold winters and have historically experienced mass die-offs. Alewife are easily stressed and during peak population levels, stress can result in large spring die-offs. Susceptibility to cold is related to inadequate lipid reserves, and in spring, alewife are in a weakened condition due to lack of forage in the winter and by the stress related to spawning (Eshenroder at al. 1995). They are affected by both osmotic stress associated with life in fresh water and exposure to fluctuating water temperatures when they move to inshore waters (e.g., exposure to colder waters during an upwelling event can cause the fish to die). Stressed fish are more susceptible to impingement because they exhibit little or no motility and are passively drawn into the intake (UWSGI 2002).

This alewife population instability has been compounded by excessive salmonid predation—in 1991 the predator demand was estimated to be equal to the total prey production, and modeling suggested that a die-off of more than 25 percent above average would cause the alewife population to crash (Stewart and Schaner 2002). U.S. Geological Survey (USGS) data indicate that Lake Ontario alewife numbers are moderate and have remained stable since the mid-1990s. Abundance is considerably less than it was in the 1980s, but as discussed in Section 2.2.5 of this draft SEIS, the alewife population decrease was likely caused by excessive salmonid predation and changes in the Lake Ontario food web (O'Gorman et al. 2005). In response to the decreasing alewife population, New York State and Ontario, Canada, both reduced their salmonid stocking programs in 1993. However, in 1997 the stocking rates were increased slightly again. Additionally, since 1997, increasing natural reproduction of Chinook salmon (*Oncorhynchus tshawytscha*) has been observed, so predation pressure continues on the alewife (Schaner and Prindle 2004). O'Gorman et al. (2005) report that although the 2004 alewife population in the U.S. waters of Lake Ontario is well below the long-term (19-year) average, the wet weight condition of adult alewife in the fall of 2004 was higher than in any year since 1980, indicating the population was more in balance with the productivity of Lake Ontario. This recent population stabilization may be occurring because of fewer individuals to compete for food, a switch in alewife diet from the zebra muscle-decimated amphipod *Diporeia* sp. to the possum shrimp (*Mysis* sp.), and the population's subsequent movement toward deeper lake waters, where they avoid the intake structure altogether (EA 2005).

Rainbow smelt impingement rates appear to be influenced by meteorological conditions (strong winds and increased wave action) and lake-wide population changes due to cannibalism of young smelt by adult smelt and salmonid predation on adult smelt (EA 2005). Similar to the alewife population, changes in the Lake Ontario ecosystem brought on by improvements in water quality and invasive species have altered the distribution of the rainbow smelt population away from the area of the intake structure and to deeper portions of the Lake where food is more plentiful (Mills et al. 2005).

Impingement abundance of other fish, including white perch, yellow perch, smallmouth bass (*Micropterus dolomieu*), and salmonids also appears to fluctuate with regard to population dynamics and short-term meteorological events that influence the impingement process. Results from the JAFNPP impingement monitoring program in 1976 to 1997 and 2004 indicate that late fall and winter storms tend to increase impingement of the young-of-year fish for these species. During the 2004 impingement monitoring, no rare, threatened, or endangered species were collected at JAFNPP (EA 2005). Data from the 2004 impingement monitoring are summarized in Table 4-4. The total impingement at JAFNPP in 2004 was 230,534 organisms, of which threespine stickleback comprised 87.44 percent of total impingement, alewife 7.29 percent, rainbow smelt 0.66 percent, smallmouth bass 0.48 percent, white perch 0.21 percent, yellow perch 0.17 percent, salmonids 0.06 percent, and all others species 3.69 percent (EA 2005).

Table 4-4. Results of Impingement Monitoring at JAFNPP, 2004
(Corrected for Flow and Traveling Screen Efficiencies)

Scientific Name	Common Name	Fish Impingement, 2004: Total Number of Fish Impinged[(a)]	Fish Impingement, 2004: Average Monthly Number of Fish Impinged[(a)]	Percentage of Fish Impinged, Annual Average, 2004
Alosa Pseudoharengus	alewife	9,203	767	21.40%
Cottus spp.	sculpins	432	36	1.00%
Dorosoma cepedianum	gizzard shad	35	3	0.08%
Etheostoma olmstedi	tessellated darter	18	2	0.04%
Gasterosteus aculeatus	threespine stickleback	32,543	2,712	75.66%
Morone americana	white perch	71	6	0.17%
Notropis atherinoides	spottail shiner	118	10	0.27%
Osmerus mordax	rainbow smelt	315	26	0.73%
Percopsis omiscomaycus	trout perch	275	23	0.64%

Source: EA 2005

(a) Total number of fish taken on the intake screens during 2004.

The 2004 alewife and rainbow smelt impingement rates comprise just 0.0074 percent and 0.0001 percent of estimated lake-wide populations, respectively, when compared to 2005 lake-wide standing stock estimates of alewife and rainbow smelt. These represent very minor losses to the populations. The 2005 standing stock numbers were estimated by a joint pelagic planktivore monitoring program conducted by the NYSDEC and the Ontario Ministry of Natural Resources(OMNR). The NYSDEC/OMNR report indicated that the 2005 alewife population was the lowest since the bi-national pelagic planktivore monitoring program began in 1997, making 0.0074 percent a conservative estimate; however, the rainbow smelt population had increased in 2005 from two previous low years (Schaner and LaPan 2005). Threespine stickleback is an invasive species that has been prominent in the Lake Ontario ecosystem since the early 1990s. There is no formal monitoring program conducted for this species, but monitoring programs for pelagic fish of interest (alewife and rainbow smelt) have noted that threespine stickleback have been the dominant catch in most lake tows (Schaner and Prindle 2004).

Since the inception of the JAFNPP impingement monitoring program, a total of 2966 salmonids (corrected for intake flow and traveling screen efficiencies) have been impinged from 1976 through 1997, and in 2004. In 2005 alone, the NYSDEC salmonid stocking program stocked 3,554,745 salmonids in Lake Ontario and its tributaries (Eckert 2005). OMNR also conducts its own stocking program. Concentrated stocking efforts began in 1980, with Ontario and New York limiting stocking to a total of 8 million salmonids per year. In response to the prey fish population concerns, current combined stocking levels have been maintained between 4 and 5.5 million salmonids per year since 1993 (Mills et al. 2003).

A number of biological, environmental, and meteorological factors may work in concert to influence yearly variations in impingement species abundance. The recent increase in threespine stickleback impingements may be partly caused by the lake-wide decrease in alewife and the dominating presence of zebra mussels. Impingement rates are highest in the spring and peak in May when approximately 35 percent of all impingement occurs. This corresponds with fish migrating toward warmer inshore waters to spawn. The timing of the migration may vary according to meteorological conditions. Impingement rates then begin to fall again in June as fish migrate back to deeper waters after spawning. Impingement rates once again increase from October through December, when 21 percent of all impingement occurs. This is thought to occur because at this time, young-of-year fish, especially alewife and rainbow smelt, grow to a size that is particularly susceptible to impingement. Certain meteorological conditions, such as strong westerly and northwesterly winds, wave height, and water temperature, also appear to influence young-of-year impingement at this time of year (EA 2005).

Other factors impacting impingement include the timing and duration of station outages for refueling and maintenance. During maintenance or refueling outages, typically only one or two of the three main circulating water pumps are operational, significantly reducing the flow of lake water into the plant. The reduced flow through the intake generally results in reduced impingement. In recent years, plants outages have become less frequent and shorter in duration due to improvements in plant operational efficiency, so outage reduction effects on impingement are less than those that occurred in the 1980s and 1990s (EA 2005). Warm discharge water is also recirculated during periods of cold weather, reducing lake water flow into the plant. JAFNPP has compiled monthly actual intake flow data from January 1998 through July 2005, and actual pumping rates have historically been lower than plant-design flows. This is because the circulating water pumps operate at various head differentials and the plant's cooling water needs vary in response to reduced generation, environmental conditions, and periodic maintenance outages. These historical data are considered representative of the current and expected future cooling water intake flow operations at JAFNPP (Entergy 2006b).

Generally, meteorological conditions that change fish populations appear to have the most profound effect on impingement rates at JAFNPP. Periodic die-offs of populations occur due to a combination of climatic conditions and the physical condition of population individuals. As mentioned above, this was most prominently seen in the winter/spring 1977 alewife die-off: the alewife impingement rate dropped from 3,916,717 fish in 1976 to 187,305 in 1977 (EA 2005).

Historically, changes in fish populations around JAFNPP have likely been the result of naturally occurring fluctuations. When the changes are profound (such as a mass winter die-off of alewife), they are easily observed in the annual estimates of fish impinged at JAFNPP. However, when the changes are subtle and over a longer period of time, it is difficult to differentiate between meteorological conditions and daily plant operations, the two main factors in fish impingement.

Due to the susceptibility of alewife to be impinged in the intake area, the delicate nature of alewife, and the strong fright response to high frequency sound that alewife demonstrate, at the time of JAFNPP's last SPDES permit issuance, NYSDEC determined the FDS installed at JAFNPP was the best technology available for reducing impingement impacts (Entergy 2006a). This determination is documented in a letter from the NYSDEC dated March 1, 1996. Testing of the FDS occurred in spring of 1991 and 1993, and it was shown to reduce alewife impingement by over 87 percent. Another deterrence system test was conducted in 1997, and preliminary results confirmed the FDS reduced alewife impingement by 87 percent (EA 2005). The FDS has only been proven to deter alewife; no studies have been done to document its effectiveness on other pelagic species. Since the FDS was installed, there have been no significant alewife impingement events at JAFNPP.

In the JAFNPP *Proposal for Information Collection* dated January 31, 2006 (Entergy 2006b), submitted to the NYSDEC to satisfy 316(b) Phase II regulations, JAFNPP proposed to obtain no new impingement data because a recent annual impingement study had been completed in 2004. Since plant operations will not change significantly, these 2004 impingement rates are indicative of future impingement rates, and are considered by the NRC staff to be too small to have any observable impact on the lake-wide populations and biomass. Based on the results of past impingement studies and the operating history of the JAFNPP intake structure and FDS, the NRC staff concludes that the potential impacts of impingement for fish and shellfish at JAFNPP are SMALL. The NRC staff identified potential mitigation measures, including installing a fish return system, closed cycle cooling, and derating the facility and scheduling plant outages during historic peak impingement periods. However, the NRC staff concluded that none of the mitigation measures considered would be beneficial enough to reduce the significance of adverse impingement impacts to the Lake Ontario fishery. Under the provisions of the state NPDES permitting program, however, NYSDEC may impose further restrictions or require modifications to the cooling system to reduce the impact of impingement.

4.1.3 Heat Shock

Heat shock can be defined as acute thermal stress caused by exposure to a sudden elevation of water temperature that adversely affects the metabolism and behavior of fish and can lead to death. Heat shock is most likely to occur when an offline unit returns to service or when a station has a discharge canal, effectively trapping fish in the flow of the heated discharge from the plant. For plants with once-through cooling systems, the effects of heat shock are listed as a Category 2 issue, requiring a plant-specific assessment before license renewal. In the GEIS, the NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue for once-through plants because of continuing concerns about thermal-discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions. Information to be considered includes (1) the type of cooling system (whether once-through or cooling pond) and (2) evidence of a CWA Section 316(a) variance or equivalent State documentation. To perform this evaluation, the NRC staff visited the JAFNPP site several times, reviewed the JAFNPP ER (Entergy 2006a), reviewed JAFNPP's original CWA Section 316(a) demonstration report (NYPA 1976), and reviewed JAFNPP's most current SPDES permit (NY-0020109), which was issued on August 1, 2001, and is in force until a new permit is issued by NYSDEC (Entergy 2006a).

Section 316(a) of the CWA establishes a process whereby the applicant can demonstrate that the established thermal discharge limitations are more stringent than necessary to protect balanced indigenous populations of fish and wildlife and obtain facility-specific thermal discharge limits (33 U.S.C. 1326). The JAFNPP CWA Section 316(a) demonstration was submitted to the NYSDEC in 1976 by NYPA, the former owner of JAFNPP. The demonstration was based on pre-operational and post-operational engineering, hydrological, and ecological data, and concluded that thermal discharge from the plant would not result in any long-term adverse impacts to the Lake Ontario ecosystem. The JAFNPP CWA Section 316(a) demonstration followed procedures prescribed by the EPA during meetings between NYPA and EPA, and as outlined in the draft EPA document, *316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements*, dated May 1, 1977 (EPA 1977). The 316(a) demonstration included a description of the plant, baseline hydrographic characteristics of Lake Ontario and the site, plant thermal discharge characteristics, a description of the biological community in the Nine Mile Point vicinity and a selection of representative fish species, and an evaluation of potential impacts of the plant's thermal discharge. The potential thermal discharge effects were based on thermal tolerance and behavior data for the representative fish species, field data collected in the vicinity of JAFNPP, and a review of literature on the effect of thermal discharges. It was concluded that the multi-port diffuser design of the JAFNPP discharge structure would prevent the thermal discharge from harming the biological community in the Nine Mile Point vicinity (NYPA 1976).

NYSDEC accepted the conclusions of the 316(a) demonstration in their first issuance of the JAFNPP SPDES permit containing the CWA Section 316(a) variance specifying alternative thermal effluent limitations for the plant, and subsequently in renewed permits issued thereafter. JAFNPP's SPDES permit states that thermal discharge from the plant ensures the "protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife in Lake Ontario" and as such, the plant is allowed alternative effluent limitations. These limitations are included in Part 1, Condition 8 of the plant's SPDES permit and state that the water temperature at the surface of the lake shall not be raised more than 3°F over the ambient temperature of the water, with the exception of a 35-acre (ac) (1.524.6 x 10^6 ft^2) mixing zone from the point of discharge. To ensure this condition is met, the permit allows a maximum discharge temperature of 112°F as measured at the discharge outlet in the screenwell-pumphouse, with a maximum allowable intake-discharge temperature difference (ΔT) of 32.4°F. The net addition of heat rejected to Lake Ontario is limited to 6.00 x 10^9 British thermal units per hour (BTU/hr) (Entergy 2006a). Total heat rejected to the lake is a function of electrical load—heat rejection increases with an increase in electrical load. When JAFNPP is operating at full power, the heat rejection rate is calculated to be 5.714 x 10^9 BTU/hr (NYPA 1976).

Because of the proximity of NMPNS (3200 ft west of JAFNPP), the U.S. Atomic Energy Commission (AEC) in its 1973 *Final Environmental Statement Related to the Operation of James A. FitzPatrick Nuclear Power Plant* determined that under certain conditions JAFNPP discharge could exceed New York State thermal criteria (AEC 1973). As such, and as a condition of the plant SPDES permit, JAFNPP conducts a thermal monitoring program consisting of continual discharge temperature and ΔT recording, and has proposed mitigation measures, such as flow reductions, should corrective action be needed to maintain compliance with the New York State thermal criteria. To date, no additional mitigation measures have been necessary. JAFNPP submits quarterly reports to NYSDEC that contain information on daily electrical output, water use, and intake and discharge water temperatures (Entergy 2006a; AEC 1973).

Heat shock to fish is a function of the temperature increase that the fish are subjected to in the discharge flow area and the residence time of the fish in the heated discharge flow (Fry 1971; Dean 1973). Cold shock can occur when fish acclimated to warm effluents are abruptly exposed to very low ambient temperatures. This may occur during plant outages when discharge flow is lower than during normal operation (NYPA 1976). According to JAFNPP personnel, to date, there have been no heat or cold shock events during station operation that have resulted in the immediate distress or acute mortality of fish. If such an event were observed by JAFNPP personnel, the incident would have to be reported to NYSDEC as a condition of the SPDES permit (Section 5b[1][iv]) (Entergy 2006a).

The multi-port diffuser design and offshore location of JAFNPP's discharge structure have likely prevented heat and cold shock events. Analysis of the JAFNPP diffuser design in the 1976 NYPA 316(a) demonstration indicated that the discharge plume (before surfacing) decreases in ΔT from 31.5°F to 13.5°F in one second and further decreases to 9°F four seconds after discharge. Additionally, hydrothermal field surveys confirmed the rapid dilution of the thermal effluent: the 3°F isotherm would cover a maximum surface area of 27.5 ac (1196 x 10^3 ft^2), well within the maximum 35-ac mixing zone allowed in the JAFNPP SPDES permit Section 316(a) variance (NYPA 1976).

The 316(a) demonstration study reported that voluntary exposure to the heated effluent by representative fish species would not likely cause mortalities because the velocity of the discharge stream would not allow fish to maintain themselves long enough in an area where the discharge water temperature would be lethal. Fish behavior studies have indicated that when given a range of temperatures, fish demonstrate avoidance responses to unsuitable temperatures; the offshore, open area location of the JAFNPP discharge structure allows fish to avoid the heated discharge stream. The design of the multi-port diffuser discharge structure could entrain fish into the high-velocity discharge jet stream, but it was demonstrated that fish entrained at the point of discharge would be in safe water temperatures in less than one second, making plume entrainment mortality unlikely. Regarding cold shock, acclimation to elevated temperatures is a precondition for cold shock mortality. The diffuser jets at JAFNPP preclude this acclimation as fish are not able to maintain themselves in the area of heated discharge. Additionally, during plant outages, because of JAFNPP's proximity to NMPNS (providing another source of heated discharge) and the location of the discharge structure, cold shock would not be expected to impact fish in the JAFNPP vicinity (NYPA 1976).

The NRC staff has reviewed the available information, including that provided by the applicant, visited the site, and reviewed other public sources of information on heat shock. Plant operating conditions have not changed significantly since the original 316(a) demonstration, and it can therefore be reasonably concluded that the extent and distribution of JAFNPP's thermal plume has remained relatively unchanged. The NRC staff evaluated the potential impacts to aquatic resources due to heat shock during continued operation and determined that thermal impacts were unlikely because of the design and location of the JAFNPP discharge structure. Furthermore, there have been no observable impacts related to plant thermal discharges. Therefore, it is the NRC staff's conclusion that the potential impacts to fish and shellfish due to heat shock during the renewal term are SMALL. The NRC staff identified potential mitigation measures, including closed cycle cooling, helper cooling towers, derating the plant, and certain operational procedures. However, the NRC staff concluded that none of the mitigation measures considered would be beneficial enough to reduce the significance of heat shock impacts to Lake Ontario.

4.2 <u>Transmission Lines</u>

The JAFNPP ER (Entergy 2006a) describes two 345-kilovolt (kV) and two 115-kV transmission lines that connect JAFNPP with the transmission system (see Section 2.1.7 of this draft SEIS for a description of the transmission lines). Two of the limes, the Edic and the Scriba 345-kV lines, are within the scope of the license renewal review. Offsite line maintenance for both lines is accomplished by the lines' owner, NYPA. For the two 345-kV transmission line right-of-ways (ROWs), NYPA uses a vegetation management plan approved by the New York State Public Service Commission. NYPA uses an integrated vegetation management computer application, which employs geographic information system technology. The vegetation management program is designed to control tall-growing tree species and to enhance the abundance of lower growing desirable vegetation. Field inventories are conducted annually for the ROW scheduled for clearing the following year. The inventories and treatment recommendations are reviewed and approved by the NYPA forestry staff. The majority of clearing is performed using mechanical methods. Herbicide applications are individually applied to selected plant species by licensed contractors, and a safe buffer is maintained around wetlands, and stream and river crossings. A safe buffer is also used around wells and springs that are used for residential water supplies. Areas where herbicides are used are posted with information regarding the chemicals used and when they were applied. Herbicides are not applied on NYPA ROWs using aerial application methods.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to transmission lines from JAFNPP are listed in Table 4-5. Entergy stated in the JAFNPP ER that it was not aware of any new and significant information associated with the renewal of the JAFNPP OL. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the NRC staff concluded in the GEIS that the impacts would be SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-5. Category 1 Issues Applicable to the JAFNPP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Floodplains and wetland on power line right of way	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line right of way	4.5.3

A brief description of the NRC staff's review and GEIS conclusions, as codified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for each of these issues follows:

- Power line ROW management (cutting and herbicide application). Based on information in the GEIS, the Commission found that

> The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line ROW maintenance during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that

> Impacts are expected to be of small significance at all sites.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that

> No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetland on power line ROW. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line ROWs on floodplains and wetlands during the renewal term beyond those discussed in the GEIS.

- Air quality effects of transmission lines. Based on the information in the GEIS, the Commission found that

  Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- Onsite land use. Based on the information in the GEIS, the Commission found that

  Projected onsite land use changes required during the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no onsite land-use impacts during the renewal term beyond those discussed in the GEIS.

- Power line ROW. Based on information in the GEIS, the Commission found that

  Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line ROWs on land use during the renewal term beyond those discussed in the GEIS.

One issue related to transmission lines is a Category 2 issue, and another issue related to transmission lines is being treated as a Category 2 issue. These issues are listed in Table 4-6 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-6. Category 2 and Uncategorized Issues Applicable to the JAFNPP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	HUMAN HEALTH		
Electromagnetic fields—acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields—chronic effects	4.5.4.2	NA	4.2.2

4.2.1 Electromagnetic Fields—Acute Effects

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is 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 along the portions of the transmission lines that are within the scope of this draft SEIS.

In the GEIS, the NRC staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC®) criteria, it was not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC® for preventing electric shock from induced currents.

As described in Section 2.1.7 of this draft SEIS, two single-circuit 345-kV lines exiting the switchyard connect JAFNPP to the transmission grid. One line, approximately 70 miles (mi) long, connects to the transmission system at NYPA's Edic Substation. The other line, approximately 4900 ft (0.9 mi) long, connects to the transmission system at the National Grid Scriba Substation located on the NMPNS site. Although JAFNPP owns the lines within the site property boundary, lines exiting the property boundary are owned and maintained by NYPA. These two lines were evaluated concerning adherence to the NESC® steady-state limit (Entergy 2006a).

As stated above, the NESC® specifies minimum vertical clearances to the ground for electric lines. For electric lines operating at voltages exceeding 98-kV alternating current (AC) to ground, the clearance provided must limit the steady-state current due to electrostatic effects to 5 milliamperes (mA) if the largest anticipated vehicle were short-circuited to ground. The largest vehicle anticipated under JAFNPP's 345-kV lines is a tractor-trailer that is 65 ft long and13.5 ft tall, parked along a roadway. The 5-mA design standard limits electric fields within the ROW to 7 to 8 kV/meter (Entergy 2006a).

According to the NYPA Transmission Engineering Department, the two 345-kV transmission lines at JAFNPP are operated and maintained in a manner consistent with the design criteria listed in the GEIS, Section 4.5.4.1. Specifically, these lines meet a more stringent induced shock standard than the 5-mA design criterion of NESC® (1981). The State of New York Public Service Commission (NYPSC) requires that transmission lines in New York be designed so that the short-circuit current to ground, produced from the largest anticipated vehicle or object, is limited to less than 4.5 mA. This allows no more than 7.0 kV/meter electric field levels on the ROWs. In 1991, NYPA demonstrated to the NYPSC that its transmission lines, including the two 345-kV lines associated with JAFNPP, do not exceed safety levels of 6.5 kV/meter for electric fields or 4.5 mA for induced shocks (Entergy 2006a).

Nuisance shocks are further controlled through NYPA's annual routine inspection of ROWs for land intrusion, along with its program of informing landowners about induced shock hazards and assisting them with grounding any metallic structures in or near a ROW.

Entergy's assessment concluded that electric shock is of SMALL significance for the JAFNPP 345-kV transmission lines (Entergy 2006a). The lines are operated within their original design specifications, the ROWs are routinely monitored for any land-use changes, and NYPA has demonstrated that the 345-kV transmission lines meet the NESC® (1981) requirements for preventing induced shock hazards. Due to the small significance of the issue, mitigation measures such as installing warning signs at road crossings or increasing clearances are not warranted.

Based on a review of the available information, including that provided by the applicant (Entergy 2006a), the NRC staff's site audit, the scoping process, and an evaluation of other information, the staff concludes that the potential impacts for electric shock during the renewal term are SMALL. The NRC staff identified potential mitigation measures, including installing road signs at road crossings and increased clearances. However, the NRC staff concluded that none of the mitigation measures considered would be beneficial enough to reduce the significance of the adverse impacts to people.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of 60-Hz electromagnetic fields from power lines are not designated as Category 1 or 2 and will not be until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy (DOE). An NIEHS report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency-electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the NRC staff to change its position with respect to the chronic effects of electromagnetic fields. Footnote 4 to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, states

> If in the future, the Commission finds that, contrary to current indications, a consensus has been reached by appropriate Federal health agencies that there are adverse health effects from electromagnetic fields, the Commission will require applicants to submit plant-specific reviews of those health effects as part of their license renewal applications. Until such time, applicants for license renewal are not required to submit information on this issue.

The NRC staff considers the GEIS finding of “Uncertain” still appropriate and will continue to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to JAFNPP in regard to radiological impacts are listed in Table 4-7. Entergy stated in its ER (Entergy 2006a) that it is not aware of any new and significant information associated with the renewal of the JAFNPP OL. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER, the staff’s site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-7. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

A brief description of the NRC staff's review and the GEIS conclusions, as codified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, for each of these issues follows:

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that

  > Radiation doses to the public will continue at current levels associated with normal operations.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that

  > 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.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to radiological impacts of routine operations.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Term

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-8. JAFNPP stated in its ER (Entergy 2006a) that it is not aware of any new and significant information associated with the renewal of the JAFNPP OL. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER, the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-8. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

A brief description of the NRC staff's review and the GEIS conclusions, as codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, for each of these issues follows:

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that

  > Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that

  Only impacts of small significance are expected.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-9 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and environmental justice, which was not addressed in the GEIS.

Table 4-9. Category 2 Issues Applicable to Socioeconomics and Environmental Justice During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SOCIOECONOMICS			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services: transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental justice	Not addressed[a]	Not addressed[a]	4.4.6

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in the NRC staff's environmental impact statement.

4.4.1 Housing Impacts

In determining housing impacts, the applicant chose to follow Appendix C of the GEIS, which presents a population characterization method that is based on two factors, sparseness and proximity (GEIS, Section C.1.4). Sparseness measures population density within 20 mi of the site, and proximity measures population density and city size within 50 mi. Each factor has categories of density and size (GEIS, Table C.1). A matrix is used to rank the population category as low, medium, or high (GEIS, Figure C.1).

In 2000, approximately 109,440 persons lived within a 20-mi radius of JAFNPP (Entergy 2006a), which equates to a population density of 87 persons per square mile (mi^2). This density translates to Category 3 (60 to 120 persons per mi^2 or fewer than 60 persons per mi^2 with at least one community of 25,000 or more persons within 20 mi) using the GEIS sparseness factor. At the same time, there were approximately 914,668 persons living within a 50-mi radius of the plant, for a density of 117 persons per mi^2. The Syracuse MSA, located within 50 mi of the site, had a total population in 2000 of 732,117. Therefore, JAFNPP falls into Category 3 (one or more cities with 100,000 or more persons and fewer than 190 persons per mi^2 within 50 mi) using the GEIS proximity factor. A Category 3 value indicates that JAFNPP is in a medium-density population area (NRC 2006a).

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. However, there are no major refurbishment activities required for JAFNPP license renewal. Therefore, there would be no refurbishment-related impacts to area housing.

Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, states that impacts on housing availability are expected to be of small significance at plants located in a medium-density population area where growth-control measures are not in effect. Oswego County is not subject to growth-control measures that would limit housing development, and Entergy does not anticipate a need for additional full-time workers during the license renewal period.

Since Entergy has no plans to add employees to support plant operations during the license renewal period, there would be no increase in demand for housing in the vicinity of the JAFNPP site. Therefore, there would be no housing impacts during the license renewal period and no mitigation would be required.

4.4.2 Public Services: Public Utility Impacts

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to demand and thus there is no need to add capital facilities. Impacts are considered MODERATE if service capabilities are overtaxed during periods of peak demand. Impacts are considered LARGE if services (e.g., water, sewer) are substantially degraded and additional capacity is needed to meet ongoing demand. The GEIS indicates that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies.

Analysis of impacts on the public water supply system considered both plant demand and plant-related population growth. Section 2.1.8.1 of this draft SEIS describes the JAFNPP permitted withdrawal rate and actual use of water. The Oswego Water System (OWS) provides potable water to JAFNPP (OCDPCD 1997). Current plant usage averages 137,500 gpd with no restrictions on supply. The OWS serves approximately 23,950 customers in the Oswego, Minetta, Scriba, and Volney. The water plant obtains its water from Lake Ontario and has an allowable withdrawal allocation of approximately 62.5 million gpd. The full design capacity of the water plant is 20.1 million gpd, although 8 million gpd is reserved for Sithe Energies, Inc., with the remaining 12 million gpd available for other industrial, residential, and commercial customers. In 2001, consumptive daily demand averaged 8 million gpd, and peak demand was approximately 10 million gpd (NRC 2006a).

Since Entergy has no plans to add employees to support plant operations during the license renewal period, there would be no increase in demand for public water. Therefore, there would be no impacts to public water supply during the license renewal period and no mitigation would be required.

4.4.3 Offsite Land Use

Offsite land use during the license renewal term is a Category 2 issue (10 CFR 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR 51 Subpart A, Appendix B notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

SMALL - Little new development and minimal changes to an area's land-use pattern.

MODERATE - Considerable new development and some changes to the land-use pattern.

LARGE - Large-scale new development and major changes in the land-use pattern.

Tax revenue can affect land use because it enables local jurisdictions to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be SMALL. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be MODERATE. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development.

4.4.3.1 Population-Related Impacts

Since Entergy has no plans to add employees to support plant operations during the license renewal period; there would be no change in land use conditions in the vicinity of the JAFNPP site. Therefore, there would be no population-related land use impacts during the license renewal period and no mitigation would be required.

4.4.3.2 Tax-Revenue-Related Impacts

JAFNPP is assessed annual property taxes by Oswego County, the Town of Scriba, and Mexico Central Schools. Property taxes paid to Oswego County and the Town of Scriba fund such services as transportation, education, public health, and public safety.

Entergy has entered into an agreement with Oswego County, the Town of Scriba, and the Mexico Central Schools regarding property taxes paid to those entities for JAFNPP. The agreement stipulates that Entergy, instead of paying property taxes for JAFNPP based on the assessed value of the plant, will make standardized annual payments in lieu of taxes to the taxing entities.

Since Entergy has indicated that there would be no major plant refurbishment or license renewal-related construction activities necessary to support the continued operation of the JAFNPP beyond the end of the existing operating license term during the license renewal period, there would be no increase in the assessed value of JAFNPP and annual payments to the Town of Scriba, the Mexico Central Schools, and Oswego County would remain constant throughout the license renewal period. Based on this information, there would be no tax revenue-related land-use impacts during the license-renewal period and no mitigation would be required.

4.4.4 Public Services: Transportation Impacts

Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, states

> Transportation impacts (level of service) of highway traffic generated during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites.

All applicants are required by 10 CFR 51.53(c)(3)(ii)(J) to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license.

Since Entergy has no plans to add employees to support plant operations during the license renewal period, there would be no change in traffic volume and levels of service on roadways in the vicinity of the JAFNPP site. Therefore, there would be no transportation impacts during the license renewal period and no mitigation would be required.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act of 1966 (NHPA), as amended, requires Federal agencies to take into account the potential effects of their undertakings on historic properties. The historic-review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800. The renewal of an OL for a nuclear power plant is an undertaking that could possibly affect either known or potential historic properties that may be located on or near the plant site. In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties in the areas of potential effect. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Office (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

As discussed in Section 2.2.9.2 of this draft SEIS, Entergy contacted the New York State Office of Parks, Recreation, and Historic Preservation (NYSHPO) on February 9, 2006, regarding preparation of its application for the license renewal of JAFNPP (Entergy 2006a). In accordance with 36 CFR 800.8(c), the NRC contacted the NYSHPO (NRC 2006b), the Advisory Council on Historic Preservation (NRC 2006c), and the appropriate Federally recognized Native American Tribes with current and historical ties to the region on September 15, 2006.

On December 4, 2006, NRC staff conducted a search of the NYSHPO files for the region around JAFNPP. Although no prehistoric or historic archaeological sites have been recorded on the JAFNPP property or along the associated transmission line corridors, literature reviews, surveys, and sensitivity assessments of the JAFNPP site demonstrate there is a potential for historic and archaeological resources on undisturbed portions of the site. The potential exists for prehistoric sites to be found in and around the kettle ponds and associated wetland areas. Early maps of the JAFNPP site indicate that a number of structures, most from the nineteenth century, existed on the JAFNPP site prior to construction. Most of these structures today consist of foundations and have probable associated historic artifact scatters. Prehistoric cultural resources could also be present in the relatively undisturbed southern and eastern portions of the JAFNPP site next to kettle ponds. A walk-over of selected undeveloped portions of the JAFNPP site by NRC staff confirmed the existence of historic resources on the plant site.

Camp Oswego (also known as Camp Drum Anti-Aircraft Artillery Firing Range) was established during World War II immediately west of JAFNPP on property that is now occupied by Nine Mile Point Nuclear Station (USGS 1955). The camp operated well into the 1950s as a summer training base and closed sometime after 1956. The Niagara-Mohawk Electric Company later purchased the land for construction of the Nine Mile Point Nuclear Station.

Continued operations at JAFNPP during the renewal term would likely protect any archaeological sites present within the JAFNPP site boundary by protecting the site from development and providing secured access. However, because there is the potential for cultural resources to be present at the site, the applicant should take care during normal operations and maintenance activities related to operations not to inadvertently affect cultural resources. To avoid such adverse impacts, environmental review procedures have been put in place at JAFNPP regarding undertakings that involve land-disturbing construction or operational activities in undisturbed areas. Entergy has no plans to alter current operations during the license renewal period. Additionally, Entergy states that any maintenance activities necessary to support license renewal would be limited to previously disturbed areas onsite. There is no planned expansion of the existing facilities and there are no planned refurbishment activities to support license renewal (Entergy 2006a).

Based on the NRC staff's review of NYSHPO files, archaeological reviews, surveys, assessments, and other information, the NRC staff concludes that the potential impacts on historic and archaeological resources during the license renewal term would be SMALL. This conclusion is based on the following: (1) no new ground disturbance or refurbishment activities would occur during the renewal period, (2) the applicant understands that archaeological and historic resources could be present at the JAFNPP site, and (3) the applicant has administrative controls in place to ensure that if cultural resources are found at JAFNPP, they will be protected. The NRC staff has determined that the impact of license renewal on historic and archaeological resources would be SMALL, and additional mitigation is not warranted.

4.4.6 Environmental Justice

Under Executive Order 12898 (59 FR 7629), Federal agencies are responsible for identifying and addressing potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. Although the Executive Order is not mandatory for independent agencies such as the NRC, the NRC has voluntarily committed to undertake environmental justice reviews. In 2004, the Commission issued a *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (NRC 2004).

The Council of Environmental Quality (CEQ) provides the following information in *Environmental Justice: Guidance Under the National Environmental Policy Act* (1997):

> **Disproportionately High and Adverse Human Health Effects.** Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. 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 NEPA [National Environmental Policy Act]) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group (CEQ 1997).

> **Disproportionately High and Adverse Environmental Effects.** A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as

defined by NEPA). 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).

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the operation of JAFNPP during the renewal term. In assessing the impacts, the following CEQ (1997) definitions of minority individuals and populations and low-income population were used:

- Minority individuals. Individuals 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 meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

- Minority populations. 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.

- Low-income population. 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, on Income and Poverty.

4.4.6.1 Minority Population in 2000

According to 2000 census data, 11.5 percent of the population (approximately 109,350 individuals) residing with a 50-mi radius of JAFNPP were minority individuals. The largest minority group was Black or African American (57,308 or 6 percent), followed by Hispanic or Latino (10,034 or about 1 percent). About 3.5 percent of Oswego County were minorities, with Hispanics the largest minority group (1.3 percent). Hispanics resided throughout the 50-mi radius, but most were in Jefferson County (USCB 2006).

Census block groups with minority populations exceeding 20 percent were considered minority block groups. Based on 2000 census data, Figure 4-1 shows minority block groups within a 50-mi radius of JAFNPP in which more than 20 percent of the block group population is minority (USCB 2006).

4.4.6.2 Low-Income Population in 2000

According to 2000 census data, approximately 45,007 individuals (approximately 4.7 percent) residing within a 50-mi radius of JAFNPP were identified as living below the Federal poverty threshold. The 1999 Federal poverty threshold was $17,029 for a family of four. The median

Figure 4-1. Minority Block Groups in 2000 within a 50-mi Radius of JAFNPP (USCB 2006).

household income for New York in 1999 was $43,393, while 14.6 percent of the state population was determined to be living below the 1999 Federal poverty threshold.

Oswego County had one of the lowest median incomes ($36,598) and the highest percentage (14 percent) of individuals living below the poverty level when compared to the other counties in the area. Conversely, Onondaga County had one of the highest median incomes ($40,847) and the lowest percentage (7.3 percent) of individuals living below the poverty level when compared to other counties in the area.

Census block groups were considered low-income block groups if the percentage of the population living below the Federal poverty threshold exceeded 14 percent. Based on 2000 Census data, Figure 4-2 shows low-income block groups within a 50-mi radius of JAFNPP (USCB 2006).

4.4.6.3 Analysis of Impacts

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as minority and low-income populations who reside within a 50-mi radius of JAFNPP. Based on the analysis of impacts for other resource areas, NRC expects no high and adverse impacts from the operation of JAFNPP during the renewal term. However, if impacts occur, NRC expects the impacts to affect all populations in the area equally.

NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Section 4-4 of Executive Order 12898 (1994) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who rely principally on fish and/or wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In Section 2.2.8.5 of this draft SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Special pathways that took into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the JAFNPP site were considered.

Entergy has a comprehensive Radiological Environmental Monitoring Program (REMP) at JAFNPP to assess the impact of site operations on the environment. Samples are collected from the aquatic and terrestrial pathways applicable to the site. The aquatic pathways include

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2 **Figure 4-2.** Low-Income Block Groups within a 50-mi Radius of JAFNPP (USCB 2006).

Lake Ontario fish, surface waters and lakeshore sediment. The terrestrial pathways include airborne particulates and radioiodine, milk, food products and direct radiation. During 2005, 2318 analyses were performed on collected samples of environmental media as part of the required REMP and showed no significant or measurable radiological impact from JAFNPP operations. Cesium-137 was detected in one aquatic sample (shoreline sediment) at very low levels and was attributed to fallout from past weapons testing. The 2005 results for all samples are consistent with the previous five-year historical results and exhibit no adverse trends (Entergy 2005).

The results of the 2005 REMP demonstrate that the routine operation at the JAFNPP site had no significant or measurable radiological impact on the environment. No elevated radiation levels were detected in the offsite environment as a result of the hydrogen injection program, storage of radioactive waste, or implementation of the Independent Spent Fuel Storage Installation. The results of the REMP continue to demonstrate that the operation of the plant did not result in a significant measurable dose to a member of the general population or adversely impact the environment as a result of radiological effluents (Entergy 2005). REMP continues to demonstrate that the dose to a member of the public from the operation of JANFPP remains significantly below the federally required dose limits specified in 10 CFR Part 20, 40 CFR Part 190, and 10 CFR Part 72.

Based on recent monitoring results, concentrations of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals in areas surrounding JAFNPP have been quite low (at or near the threshold of detection) and seldom above background levels (Entergy 2005). Consequently, no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

4.5 Groundwater Use and Quality

No Category 1 or Category 2 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, are potentially applicable to JAFNPP groundwater use and quality during the renewal term. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS.

4.6 Threatened or Endangered Species

Threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-10.

Table 4-10. Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

Entergy contacted the U.S. Fish and Wildlife Service (FWS) on February 9, 2006, regarding threatened and endangered species at the JAFNPP site (Entergy 2006a). No information regarding the transmission lines was provided in this letter. In its response letter to Entergy, dated May 19, 2006, the FWS (Entergy 2006a) identified the Federally and State-listed Indiana bat (*Myotis sodalis*) and the Federally and State-listed bog turtle (*Clemmys muhlenbergii*) as potentially occurring within the transmission corridor. The Indiana bat is known to roost within 11 mi of the site, and the bog turtle is known to occur within 12 mi of the site. The bog turtle was also identified in the JAFNPP Final Environmental Statement (FES) for operation as probably occurring within the marshes that are crossed by JAFNPP to the Edic transmission line (AEC 1973).

On December 7, 2006, NRC staff met with New York Natural Heritage Program (NYNHP) to discuss potential impacts of continued operation on State-listed species. The NYNHP found that upland sandpiper (*Bartramia longicauda*) habitat has been identified near the JAFNPP-to-Edic transmission line corridor. No other State-listed species are known to occur near the JAFNPP facility or transmission corridors. The NYNHP staff have not identified any significant foreseeable impacts on State-protected species or areas that would result from continued operation or maintenance activities during the renewal term.

The NRC staff met with the New York Power Authority (NYPA) on December 4, 2006. At this meeting, the NRC staff was informed that no threatened or endangered species have been reported by maintenance personnel as occurring in or near the transmission corridor. Corridor maintenance personnel are trained in identifying endangered species and are expected to take measures to avoid damage to these species if they are identified within the transmission line corridor during the renewal period.

This Category 2 issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of JAFNPP during the license renewal term. The characteristics and habitat of threatened or endangered species in the vicinity of the JAFNPP site are discussed in Sections 2.2.5 and 2.2.6 of this draft SEIS. The NRC initiated informal consultation with the FWS on September 19, 2006, to determine which species may be affected by continued operations and maintenance procedures at the JAFNPP site and the associated transmission lines (NRC 2006d). NRC submitted a Biological Assessment to the FWS, thus consultation with the FWS in ongoing (NRC 2007).

4.6.1 Aquatic Species

No Federally listed or proposed threatened or endangered aquatic species, with the exception of transient individuals, are known to exist in the vicinity of JAFNPP or the aquatic habitats crossed by the transmission lines associated with JAFNPP (FWS 2007). There are no plans to conduct refurbishment or construction activities at JAFNPP during the license renewal term (Entergy 2006a). The NRC staff's conclusion is that there would be no impacts on threatened and endangered aquatic species from operation of JAFNPP during the renewal term, and mitigation is therefore not warranted.

4.6.2 Terrestrial Species

Currently, no threatened or endangered species are known as occurring at the JAFNPP site or within the Edic or Scriba transmission corridors. The State-protected upland sandpiper is known to occur near the transmission corridor, but no impacts to this species are expected as a result of continued use or maintenance of the lines. The Federally protected bog turtle and Indiana bat have the potential to occur at the JAFNPP site.

The NRC staff encourages NYPA to report the existence of any Federally or State-listed endangered species within or near the transmission corridors to NYSDEC and/or FWS if any such species are identified during the renewal term. If any evidence of injury or mortality of migratory birds or threatened or endangered species is seen within the corridor during the renewal period, NYPA is encouraged to promptly report this to the appropriate wildlife management agencies. Care should also be taken to ensure that the corridor does not provide a path for invasive plant species to colonize wetland areas that would not otherwise be colonized without the corridor. In particular, common reed (*Phragmites australis*) may colonize and degrade undocumented bog turtle habitat (FWS 2001). Likewise, transmission corridor maintenance activities should be conducted in a manner that avoids damage to wetlands within and near the corridor. Maintenance personnel should be aware of the foraging and roosting needs of Indiana bats, and the removal of standing dead trees and trees harboring Indiana bats should be avoided during times of the year when bats may be present.

The NRC staff, after discussions with the FWS, finds that the Indiana bat and the bog turtle may be present on the JAFNPP site or along the Edic and Scriba transmission corridors. The NRC staff has determined that the continued operation of the JAFNPP may affect, but is not likely to adversely affect, either species. Therefore, the NRC staff's preliminary conclusion is that the potential impacts on Federally protected species of an additional 20 years of JAFNPP operation would be SMALL. The NRC staff has initiated informal Section 7 consultation under the Endangered Species Act of 1972 with the FWS for both the Indiana bat and the bog turtle. The consultation is ongoing and may result in additional requirements to ensure protection of these two species.

4.7 Evaluation of New and Potentially Significant Information on Impacts of Operations During the Renewal Term

The NRC staff has not identified new and significant information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to plant operation during the renewal term. The NRC staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment. The NRC staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and has conducted its own independent review, including public scoping meetings, to identify issues with new and significant information. Processes for identification and evaluation of new information are described in Section 1.2.2.

4.8 Cumulative Impacts

The NRC staff considered potential cumulative impacts on the environment resulting from the incremental impact of license renewal when added to other past, present, and reasonably foreseeable future actions. For the purposes of this analysis, past actions are related to the resources when JAFNPP was licensed and constructed, present actions are related to the resources during current operations, and future actions are those that are reasonably foreseeable through the end of plant operations including the license renewal term. The geographic area over which past, present, and future actions are assessed is dependent on the affected resource.

The impacts of the proposed action, license renewal, as described in this chapter of the draft SEIS, are combined with other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non-Federal) or entity is undertaking the actions. The combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

4.8.1 Cumulative Impacts on Aquatic Resources

This section assesses the impacts of the proposed action that relate to the withdrawal and discharge of lake water by the JAFNPP once-through cooling system, combined with other past, present, and reasonably foreseeable future actions that occur within the defined geographic area of Lake Ontario. The geographic area considered for the analysis of cumulative impacts on aquatic resources focuses on the southeastern portion of Lake Ontario within a 50-mi radius of the Nine Mile Point promontory. This area is large enough to encompass the ecological resources and potential cumulative impacts of concern but is not too large as to make the analysis impractical.

Like the other Great Lakes, Lake Ontario has experienced significant changes in the structure and functioning of its aquatic ecosystem since the beginning of the Euro-American historical period, and the cumulative impacts of past actions have resulted in the existing water quality and aquatic resource conditions near JAFNPP. Lake Ontario is a dynamic aquatic ecosystem and over the years has evolved in response to ecological stressors such as overfishing, contaminant releases from industry, cultural eutrophication, land-use changes, and the introduction of non-native species. These stressors have profoundly changed the species composition and abundance of organisms from almost all trophic levels lake-wide. It is likely these changes to Lake Ontario's aquatic resources have not stabilized, and continuing changes in this complex ecosystem can be expected in the future. Furthermore, potential impacts of climate change on Lake Ontario cannot be quantified at this time but could include changes in water temperature, summer stratification, water quality, water level, productivity, and subsequently, aquatic species composition and abundance (UCS 2003).

Since the 1970s, there have been a number of bi-national management efforts between the U.S. and Canada to restore the ecological integrity of Lake Ontario, including the creation of the Great Lakes Fishery Commission (GLFC) and the International Joint Commission, and the signing of three Great Lakes Water Quality Agreements (Mills et al. 2005). The most recent agreement took place in 1987 and committed Canada and the U.S. to developing lake-wide management plans for each of the Great Lakes. Part of this effort includes the creation of remedial action plans that address areas of concern and sources of 11 lake-wide critical pollutants. The plans coordinate localized efforts throughout Lake Ontario by other groups such as the GLFC and State and Province fishery management programs (EPA 1998).

While Lake Ontario water quality has vastly improved since the implementation of these bi-national efforts, the status of its fisheries is still considered to be the most damaged of the five Great Lakes (USGS 2002). Lake researchers believe there is an incongruity between the goals of the fishery stakeholders and what Lake Ontario ecosystem can actually support (Stewart et al. 1999). Furthermore, the colonization of non-native species has so fundamentally changed the lake's ecosystem that it is unlikely to ever return to its original state. Management of invasive species at the local level, where resource uses are affected by their presence, is a major activity by Lake Ontario management groups and a foreseeable continuing focus of these groups. Contributions to cumulative impacts on Lake Ontario aquatic resources during the license renewal period can be reasonably expected to be similar to those currently impacting the lake. However, given the emphasis on lake-wide management plans and remedial action plans to collaboratively protect and restore the lake and its resources, potential cumulative effects will likely be carefully assessed and managed over time.

Future use of Lake Ontario likely includes its continued use for water supply, waste water disposal, cooling water for power plants, shipping, and recreational fishing and boating. Additionally, future continued development of the southeastern Lake Ontario watershed may impact the lake's water quality. However, the State of New York has a comprehensive water resources management program, and with coordinated efforts between State agencies and the above-mentioned bi-national groups, such activities would be regulated to avoid adverse impacts to the lake. Port Oswego, approximately 6 mi west of JAFNPP, will likely continue to receive cargo ships. The discharge of ballast water from foreign ships, the primary vector for invasive species, has become an issue of special importance for lake managers. According to the National Oceanic and Atmospheric Administration (NOAA), approximately 183 aquatic non-indigenous species have populated the five Great Lakes (NOAA 2006). In response, when ships enter the St. Lawrence Seaway, ballast water is now carefully monitored by the U.S. Coast Guard, the St. Lawrence Seaway Development Corporation, and Transport Canada Marine Safety (GLSLSS 2007).

In addition to JAFNPP, four power-generating facilities near JAFNPP withdraw water from and discharge water to Lake Ontario—Constellation Energy Group's two-unit Nine Mile Point Nuclear Station, immediately west of and adjacent to JAFNPP; Dynegy Independence Station, a 1064-MW natural gas-fired combined-cycle cogeneration plant approximately 7 mi southwest of JAFNPP; NRG Energy, Inc., Oswego Steam Station, an oil and natural gas-fired 1700-MW peaking plant approximately 7.5 mi southwest of JAFNPP; and Indeck-Oswego Energy Center, a 50-MW gas-turbine combined-cycle cogeneration facility approximately 6.5 mi southwest of JAFNPP (Dynegy 2007; NRG 2007; Indeck 2007). It can be reasonably assumed that these facilities will remain in operation throughout the JAFNPP license renewal period, and water withdrawals and discharges from these facilities will be regulated by the NYSDEC under the SPDES permitting process.

Additional impacts to the Lake Ontario fishery could occur due to the number of dams on Lake Ontario tributaries. Brookfield Power operates eight hydroelectric facilities along the Oswego and Salmon rivers. It is expected that these dams will remain in operation for the duration of the JAFNPP license renewal period (Brookfield 2006). Dams generally impact fish populations: migration and other fish movements can be impeded or blocked entirely; quantity, quality, and access to essential habitat can be affected; and fish may suffer mortality or morbidity while passing through the turbines or over spillways. Additionally, changes in river discharge regime, water quality, and primary and secondary productivity caused by the dams may indirectly impact fish populations (Larinier 2000).

A study of species composition and distribution of fish larvae collected in the Nine Mile Point nearshore waters published in 1975 concluded the coastline area of Lake Ontario was not a desirable fish spawning or nursery habitat because of extensive nearshore wave action and unsuitable bedrock and rubble substrate (TI 1979). However, Lake Ontario offshore waters are important forage areas for the lake's valuable salmonid populations and their prey species, the alewife and rainbow smelt. Recent studies have suggested that prey fish populations are moving offshore in response to changes in Lake Ontario's food web, which have occurred mostly from the introduction of invasive species to the lake in the early 1990s. Alewife in particular may be moving to deeper waters to escape forage competition from round goby, a thriving and aggressive Lake Ontario invasive species (USGS 2002).

As discussed in Section 4.1 of this draft SEIS, the NRC staff found no new and significant information to indicate that the conclusions regarding any of the Category 1 issues related to the cooling system at JAFNPP are inconsistent with the GEIS (NRC 1996). Assuming no future changes in station cooling system design or operation, the NRC staff determined that potential losses of aquatic resources resulting from these Category 2 issues during the license renewal term would not alter any important attribute of Lake Ontario. Furthermore, the NYSDEC may impose further restrictions or require modifications to the JAFNPP cooling system to reduce impacts of entrainment and impingement. The temperature and volume of heated effluent discharged by JAFNPP to Lake Ontario will continue to be monitored daily by plant personnel and regulated by the NYSDEC. Additionally, the transmission line ROW maintenance activities in the vicinity of stream and river crossings employ procedures to minimize erosion and shoreline disturbance while encouraging vegetative cover. Therefore, impacts from maintenance of transmission lines associated with JAFNPP would have negligible impact on aquatic resources related to the Lake Ontario basin.

Because Lake Ontario and the Nine Mile Point promontory area are influenced by many controlling factors, the impact of JAFNPP operations during the license renewal term can only be qualitatively described with some degree of certainty. The NRC staff concludes, however, that the SMALL impacts of the JAFNPP cooling system, including entrainment and impingement of fish and shellfish, heat shock, or any of the cooling system-related Category 1 issues are not contributing to an overall decline in Lake Ontario water quality or its aquatic resources. Therefore, the NRC staff concludes that the contribution of impacts associated with the continued operation of JAFNPP during the renewal period to the cumulative impacts likely to be experienced in the southeastern portion of Lake Ontario would be SMALL.

4.8.2 Cumulative Impacts on Terrestrial Resources

This section analyzes past, present, and future actions that could result in adverse cumulative impacts on terrestrial resources, including wildlife population, upland habitat, wetlands, floodplains, invasive species, land use, and protected species. For the purposes of this analysis, the geographic area that encompasses the past, present, and foreseeable future actions that could contribute to adverse cumulative impacts on terrestrial resources includes Oswego and Oneida counties, which contain JAFNPP and its associated transmission corridors that are within the scope of the license renewal review.

Since the initial construction of JAFNPP and the associated transmission line, there have been changes in land use and land cover with resulting changes on terrestrial ecosystems both at the JAFNPP site and along the transmission corridor.

Initial construction of JAFNPP resulted in a change in land use for part of the property from residential to industrial. Most of the property was left undeveloped and allowed to mature from secondary growth forests toward old-growth forests, with some areas continuing as wetlands and ponds (Entergy 2006b). Construction of the transmission lines to the Edic Substation and the Lighthouse Hill Hydroelectric Station converted a portion of forested land to low shrubby and herbaceous cover, with resulting changes in the wildlife and plant species present. In some locations, this caused a forested area to be fragmented. This effect increases habitat for species that live on forest edges and reduces habitat for species that live in the interior of forest parcels. Some species, particularly insects and small mammals, have difficulty crossing transmission corridors (Forman 2001). Other contributors to forest fragmentation in this region include construction of the transmission lines associated with Nine Mile Point Nuclear Station, clearing and continued use of land for farming, road construction and maintenance, and commercial and residential development. In some areas, abandoned farms adjacent to forests are developing into forests, reducing the impacts of fragmentation. The NRC staff has not identified any interior species populations that have significantly decreased in the region as a result of the cumulative impacts of forest fragmentation. The NRC staff has not found any information to conclude that continued operation or maintenance activities of JAFNPP or the associated transmission lines would have significant negative impacts on any non-protected plant or animal species, including interior species populations. Therefore, the NRC staff believes that the incremental impact of license renewal on terrestrial species and habitat, would be minor.

NRC staff identified two invasive species in the area that may degrade terrestrial habitat. Their spread could be accelerated by present and future actions. Common reed is thought to have been introduced by accident in the late 1700s or early 1800s and has spread across North America (PCA 2006a). Japanese knotweed (*Polygonum cuspidatum*) was introduced intentionally in the U.S. in the late 1800s, probably as an ornamental plant, and has spread throughout the eastern U.S. (PCA 2006b). These two species are spreading throughout New York at various rates due to natural and human processes, resulting in habitat loss for native species (PCA 2006a, 2006b). Both species are spread by the wind; Japanese knotweed usually grows in streamside areas, while common reed colonizes wetlands (PCA 2006a, 2006b). Open areas like transmission corridors have lower wind resistance than forests (Forman 2001), potentially allowing wind-borne seeds to spread farther through transmission corridors than adjacent forests. Construction and maintenance of the transmission line corridor has created a potential pathway for the spread of these species. Potential preventative and mitigative measures include surveys and programs for monitoring and removing these species within the corridor and at the JAFNPP site. Given the ability of these species to drastically alter local ecosystems, the impacts of the introduction and spread of these species could over time significantly alter the habitat. NRC staff does not believe, however, that the continued operation and maintenance of the JAFNPP transmission lines contribute significantly to this impact.

The FWS has identified the Federally protected Indiana bat and the bog turtle as potentially occurring near or within the project area, which includes the Edic and Scriba transmission corridors. The NRC staff has initiated informal consultation under Section 7 of the Endangered Species Act of 1972 with the FWS. As part of that consultation the FWS will assess the cumulative impacts to both species. The NRC staff has preliminarily determined that continued operation of the JAFNPP for an additional year may affect but is not likely to adversely affect the Indiana bat and the bog turtle. The consultation with the FWS is ongoing and may result in additional requirements to ensure protection of these two species.

The NRC staff examined the cumulative effects of forest fragmentation, the spread of invasive species, and impacts to Federally protected species as they relate to terrestrial resources within the project area. The NRC staff finds that the impacts could be MODERATE, depending on the extent of alteration of habitat within the project area due to the spread of invasive Japanese knotweed and the common reed. However, the NRC staff finds that the direct impacts of continued operation of JAFNPP and the maintenance of the transmission corridors on terrestrial resources to be SMALL.

4.8.3 Cumulative Impacts on Human Health

4.8.3.1 Cumulative Impacts Resulting from Continued Operation of the Transmission Lines

Cumulative impacts resulting from continued operation of the electrical transmission lines associated with JAFNPP were evaluated to determine whether there was the potential for adverse cumulative impacts to terrestrial resources, wetlands, floodplains, or aquatic resources. Other than the existing power transmission lines from JAFNPP and the Nine Mile Point Nuclear Station, the NRC staff is unaware of any planned activities within the area that could have additional cumulative impacts. Furthermore, the NRC staff concluded in Section 4.2.1 of this draft SEIS that the potential impacts for electric shock from existing transmission lines during the renewal period are SMALL and that no additional mitigation measures are warranted.

Therefore, the NRC staff has determined that the cumulative impacts of the continued operation of the JAFNPP transmission lines are also SMALL and that no additional mitigation is warranted.

4.8.3.2 Cumulative Radiological Impacts

The radiological dose limits for protection of the public and workers were developed by the EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. The dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. For the purpose of this analysis, the area within an 80-km (50-mi) radius of the JAFNPP site was included. The Radiological Environmental Monitoring Program (REMP) conducted by Entergy in the vicinity of the JAFNPP site measures radiation and radioactive materials from all sources, including JAFNPP and the adjacent Nine Mile Point Nuclear Station (owned by Constellation Nuclear). Results for 2001 through 2005 were reviewed as part of the cumulative impacts assessment. Additionally, in Sections 2.2.7 and 4.3 of this draft SEIS, the NRC staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of

JAFNPP during the renewal term would be SMALL. Therefore, both REMP and the NRC staff's conclusion considered cumulative impacts. The NRC and the State of New York would regulate any future actions in the vicinity of the JAFNPP site that could contribute to cumulative radiological impacts.

4.8.4 Cumulative Socioeconomic Impacts

The continued operation of JAFNPP during the license renewal term would not add to any socioeconomic impacts beyond those already being experienced in the region. The NRC staff determined that there would be no impacts on housing, public utilities, public services, and environmental justice. There would also be no impact on offsite land use because no refurbishment actions are planned at JAFNPP and no incremental sources of plant-related tax payments are expected. There are no reasonably foreseeable scenarios that would alter these conclusions in regard to cumulative impacts. Therefore, the NRC staff concludes that there would be no cumulative socioeconomic impacts from continued operations at JAFNPP and mitigation would not be required.

4.8.5 Conclusions Regarding Cumulative Impacts

The NRC staff considered the potential impacts resulting from the operation of JAFNPP during the license renewal term and other past, present, and future actions in the vicinity of JAFNPP. The NRC staff's preliminary determination is that the potential cumulative impacts resulting from JAFNPP operation during the license renewal term would generally be SMALL. The NRC will work with the FWS to determine whether the impacts of license renewal on protected terrestrial species would significantly add to these impacts.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither JAFNPP nor the NRC staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with the JAFNPP operation during the renewal term. Consequently, the NRC staff concludes that environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 11 Category 2 issues applicable to JAFNPP operation during the renewal term and for environmental justice and chronic effects of electromagnetic fields. For these 11 issues and environmental justice, the NRC staff concluded that the potential environmental impact of renewal term operations of JAFNPP would be of SMALL significance in the context of the standards set forth in the GEIS and that additional mitigation would not be warranted. In addition, the NRC staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, the NRC staff did not conduct an evaluation of this issue.

4.10 References

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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 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.”

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property,* Part 800, “Protection of Historic Properties.”

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, “Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle.”

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5.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

Environmental issues associated with postulated accidents are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).(1) The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) Single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter describes the environmental impacts from postulated accidents that might occur during the license renewal term.

5.1 Postulated Plant Accidents

Two classes of accidents are evaluated in the GEIS. These are design-basis accidents (DBAs) and severe accidents, as discussed below.

5.1.1 Design-Basis Accidents

(1) 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.

In order to receive NRC approval to operate a nuclear power facility, an applicant for an initial operating license must submit a safety analysis report (SAR) as part of its application. The SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents, without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in 10 CFR Part 50 and 10 CFR Part 100.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license (OL). The results of these evaluations are found in license documentation such as the applicant's final safety analysis report (FSAR), the staff's safety evaluation report (SER), the final environmental statement (FES), and Section 5.1 of this supplemental environmental impact statement (SEIS). A licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant, including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal period. Accordingly, the design of the plant relative to DBAs during the extended period is considered to remain acceptable and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, design-basis accidents are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, applicable to the James A. FitzPatrick Nuclear Power Plant (JAFNPP), is listed in Table 5-1.

Table 5-1. Category 1 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
POSTULATED ACCIDENTS	
Design basis accidents	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that

> The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.

Entergy stated in its Environmental Report (ER; Entergy 2006a) that it is not aware of any new and significant information associated with the renewal of the JAFNPP OL. The staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to design basis accidents beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

Severe accidents initiated by external phenomena such as tornadoes, floods, earthquakes, fires, and sabotage have not traditionally been discussed in quantitative terms in FESs and were not specifically considered for JAFNPP in the GEIS (NRC 1996). However, in the GEIS the staff did evaluate existing impact assessments performed by NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from beyond design basis earthquakes at existing nuclear power plants is SMALL. Also, the GEIS for license renewal has already "performed a discretionary analysis of terrorist acts in connection with license renewal, and concluded that the core damage and radiological release from such acts would be no worse than the damage and release to be expected from internally initiated events." The GEIS contains an analysis of terrorist acts in connection with license renewal, and concluded that the core damage and radiological release from such acts would be no worse than the damage and release to be expected from internally initiated events. (Amergen Energy, Co. LLC., License Renewal for Oyster Creek Nuclear station), CLI-07-08, 65 NRC --. (slip op.) (Feb. 26, 2007). Based on the above, the Commission concludes that the risk from sabotage and beyond design basis earthquakes at existing nuclear power plants is small and additionally, that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents.

Based on information in the GEIS, the Commission found that

> The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

Therefore, the Commission has designated mitigation of severe accidents as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue, applicable to JAFNPP, is listed in Table 5-2.

The NRC staff has not identified any new and significant information with regard to the consequences from severe accidents during its independent review of the JAFNPP ER (Entergy 2006a), the staff's site audit, the scoping process, and its evaluation of other available information and public comments on the draft SEIS. Therefore, the NRC staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for JAFNPP. The results of its review are discussed in Section 5.2.

Table 5-2. Category 2 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	POSTULATED ACCIDENTS		
Severe Accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	L	5.2

5.2 Severe Accident Mitigation Alternatives

Section 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for JAFNPP; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section presents a summary of the SAMA evaluation for JAFNPP conducted by Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy), and described in the ER, and the NRC's review of this evaluation. The details of the review are described in the NRC staff evaluation that was prepared with contract assistance from Pacific Northwest National Laboratory. The entire evaluation for JAFNPP is presented in Appendix G.

The SAMA evaluation for JAFNPP was conducted with a four-step approach. In the first step Entergy quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic safety assessment (PSA) and other risk models.

In the second step Entergy examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. Entergy initially identified 293 potential SAMAs for JAFNPP. Entergy screened out 230 SAMAs from further consideration because they are not applicable at JAFNPP due to design differences, have already been implemented at JAFNPP, or are addressed by a similar SAMA. The remaining 63 SAMAs were subjected to further evaluation.

In the third step Entergy estimated the benefits and the costs associated with each of the remaining SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997). The cost of implementing the proposed SAMAs was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost-beneficial, meaning the benefits of the SAMA were greater than the cost (a positive cost-benefit). Entergy found five SAMAs to be potentially cost-beneficial (Entergy 2006a). However, based on further consideration of potentially cost-beneficial SAMAs at other plants, Entergy identified one additional potentially cost-beneficial SAMA (Entergy 2006b).

The potentially cost-beneficial SAMAs do not relate to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. Entergy's SAMA analyses and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

Entergy submitted an assessment of SAMAs for JAFNPP as part of the ER (Entergy 2006a). This assessment was based on the most recent JAFNPP PSA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the JAFNPP Individual Plant Examination (IPE) (NPA 1991) and Individual Plant Examination of External Events (IPEEE) (NPA 1996).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 2.74×10^{-6} per year. This CDF is based on the risk assessment for internally-initiated events. Entergy did not include the contribution to risk from external events within the JAFNPP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of 4. The breakdown of CDF by initiating event is provided in Table 5-3.

As shown in Table 5-3, events initiated by station blackout (SBO) and transients are the dominant contributors to the CDF. Anticipated transient without scram (ATWS) sequences are not significant contributors to the CDF.

Entergy estimated the dose to the population within 50 mi of the JAFNPP site to be approximately 0.0163 person-Sv (1.63 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Containment failures within the late time frame (greater than 24 hours following event initiation) and the early time frame (0 to 24 hours following event initiation) dominate the population dose risk at JAFNPP, contributing about equally to the population dose risk.

The NRC staff has reviewed Entergy's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDFs and offsite doses reported by Entergy.

Table 5-3. JAFNPP Core Damage Frequency

Initiating Event	**CDF (per year)**	**Percent Contribution to CDF**
Station Blackout	1.27 x 10-6	46
Transients with loss of containment heat removal	7.78×10^{-7}	28
Transients with loss of all emergency core cooling system (ECCS) injection	2.66×10^{-7}	10
ATWS	1.38×10^{-7}	5
Loss of a 4.16kv alternate current (AC) safeguard bus	1.18×10^{-7}	5
Loss of both direct current (DC) divisions	9.55×10^{-8}	3
Loss of coolant accident (LOCAs)	2.83×10^{-8}	1
Loss of a division of DC power	2.60×10^{-8}	1
Relay room flooding	2.53×10^{-8}	1
Total CDF (from internal events)	**2.74×10^{-6}**	**100**

Table 5-4. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] Per Year)	Percent Contribution
Late Containment Failure	0.87	53
Early Containment Failure	0.76	47
Intact Containment	negligible	negligible
Total	**1.63**	**100**

[1]One person-Rem = 0.01 person-Sv

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, Entergy searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, Entergy considered insights from the plant-specific PSA and SAMA analyses performed for other operating plants that have submitted license renewal applications. Entergy identified 293 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures and training.

Entergy removed 230 SAMAs from further consideration because they are not applicable at JAFNPP due to design differences, have already been implemented at JAFNPP, or are addressed by a similar SAMA. A detailed cost-benefit analysis was performed for each of the 63 remaining SAMAs.

The staff concludes that Entergy used a systematic and comprehensive process for identifying potential plant improvements for JAFNPP, and that the set of potential plant improvements identified by Entergy is reasonably comprehensive and, therefore, acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

Entergy evaluated the risk-reduction potential of the remaining 63 SAMAs. The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement.

Entergy estimated the costs of implementing the 63 candidate SAMAs through the application of engineering judgment, and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles.

The staff reviewed Entergy's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is similar to or somewhat higher than what would actually be realized). Accordingly, the staff based its estimates of averted risk for the various SAMAs on Entergy's risk reduction estimates.

The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The staff found the cost estimates to be consistent with estimates provided in support of other plants' analyses.

The staff concludes that the risk reduction and the cost estimates provided by Entergy are sufficient and appropriate for use in the SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by Entergy was based primarily on NUREG/BR-0184 (NRC 1997) and was conducted consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed – one at three percent and one at seven percent (NRC 2004). Entergy provided both sets of estimates (Entergy 2006a and 2006b).

Entergy identified five potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a seven percent discount rate, and considering the combined impact of both external events and uncertainties). The potentially cost-beneficial SAMAs are:

- SAMA 26 – provide additional DC battery capacity to ensure longer battery capability during the station blackout event, which would extend high pressure coolant injection (HPCI)/ reactor core isolation cooling (RCIC) operability and allow more time for AC power recovery.

- SAMA 30 – modify plant equipment to provide 16-hour SBO injection to improve capability to cope with longer SBO scenarios.

- SAMA 36 – modify plant equipment to extend DC power availability in an SBO event, which would extend HPCI/RCIC operability and allow more time for AC power recovery.

- SAMA 61 – modify plant procedures to allow use of a portable power supply for battery chargers, which would improve the availability of the DC power system.

- SAMA 62 – modify plant procedures to open the doors of the emergency diesel generator (EDG) buildings upon receipt of a high temperature alarm, which improves the reliability of the EDGs following high temperatures in the EDG buildings.

In supplemental information to the ER, Entergy provided a revised assessment based on a separate accounting of uncertainties (Entergy 2006b). The revised assessment resulted in identification of the same potentially cost-beneficial SAMAs. However, based on further consideration of potentially cost-beneficial SAMAs at other plants, Entergy identified one additional potentially cost-beneficial SAMA (Entergy 2006b). This alternative involves use of a portable generator (to power battery chargers) to extend the coping time in loss of AC power events.

The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

5.2.6 Conclusions

The NRC staff reviewed Entergy's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by Entergy are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PSA, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process and increasing the estimated SAMA benefits for internal events by a multiplier to account for potential benefits in external events.

Based on its review of the SAMA analysis, the staff concurs with Entergy's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the staff considers that further evaluation of these SAMAs by Entergy is warranted. However, none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.3 References

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U.S. Nuclear Regulatory Commission (NRC). 1997. *Regulatory Analysis Technical Evaluation Handbook*. NUREG/BR-0184, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission*. NUREG/BR-0058, Rev. 4, Washington, D.C.

New York Power Authority (NYPA). 1991. "James A. FitzPatrick Nuclear Power Plant Docket No. 50-333, Individual Plant Examination,"(JPN-91-048), September 1991.

New York Power Authority (NYPA). 1996. "James A. FitzPatrick Nuclear Power Plant Individual Plant Examination for External Events," (JAF-RPT-MISC-02211), June 1996, Revision 0.

6.0 ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE AND SOLID WASTE MANAGEMENT

Environmental issues associated with the uranium fuel cycle and solid waste management are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).(1) The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to the uranium fuel cycle and solid waste management.

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to James A. FitzPatrick Nuclear Power Plant (JAFNPP). The generic potential impacts of the radiological and non-radiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-

(1) 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 its Addendum 1.

Water-Cooled Nuclear Power Reactor." The U.S. Nuclear Regulatory Commission (NRC) staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to JAFNPP from the uranium fuel cycle and solid waste management are listed in Table 6-1.

Table 6-1. Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term

ISSUE– 10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (spent fuel and high level waste disposal)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste storage and disposal	6.1; 6.2.2.2; 6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6;6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
Onsite spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy), which operate JAFNPP, stated in its Environmental Report (ER) for JAFNPP (Entergy 2006) that it is not aware of any new and significant information associated with the renewal of the JAFNPP operating license. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the NRC staff's review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of these issues follows:

- Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste). Based on information in the GEIS, the Commission found that

  > Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part [10 CFR 51.51(b)]. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). Based on information in the GEIS, the Commission found that

  > 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 [Roentgen Equivalent Man], or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of 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 judgment as to the regulatory NEPA [National Environmental Policy Act of 1969] implications of these matters should be made and it makes no sense to repeat the same judgment 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (spent fuel and high level waste disposal). Based on information in the GEIS, the NRC found that

> For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem [1 mSv] 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 [1 mSv] 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 [1 mSv] per year. The lifetime individual risk from 100 millirem [1 mSv] 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 [DOE 1980]. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA’s [Environmental Protection Agency’s] generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing “containment requirements” that limit the cumulative amount of radioactive material released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths world-wide for a 100,000 metric tonne [of heavy metal] (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment 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 Category 1.

On February 15, 2002, based on a recommendation by the Secretary of the Department of Energy, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and high-level nuclear waste. The U.S. Congress approved this recommendation on July 9, 2002, in House Joint Resolution 87, which designated Yucca Mountain as the repository for spent nuclear waste. On July 23, 2002, the President signed House Joint Resolution 87 into law; Public Law 107-200, 116 Stat. 735 (2002) designates Yucca Mountain as the repository for spent nuclear waste. This development does not represent new and significant information with respect to the offsite radiological impacts from license renewal related to disposal of spent nuclear fuel and high-level nuclear waste.

EPA developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000-year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63. In response to the Court's decision, EPA issued its proposed revised standards on August 22, 2005 (70 Federal Register [FR] 49014). In order to be consistent with EPA's revised standards, NRC proposed revisions to 10 CFR Part 63 on September 8, 2005 (70 FR 53313).

Therefore, for the high-level waste and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, we assumed that limits would be developed along the lines of the 1995 NAS report, *Technical Bases for Yucca Mountain Standards* (NAS 1995), and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository that would comply with such limits could and likely would be developed at some site.

Despite the current uncertainty with respect to these rules, some judgment as to the regulatory NEPA implications of offsite radiological impacts of spent fuel and high-level waste disposal should be made. The NRC staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no offsite radiological impacts related to spent fuel and HLW disposal during the renewal term beyond those discussed in the GEIS.

- Nonradiological impacts of the uranium fuel cycle. Based on information in the GEIS, the Commission found that

> The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Low-level waste storage and disposal. Based on information in the GEIS, the Commission found that

> The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small.
>
> Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of low-level waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Mixed waste storage and disposal. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Onsite spent fuel. Based on information in the GEIS, the Commission found that

> The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

- Nonradiological waste. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

- Transportation. Based on information contained in the GEIS, the Commission found that

> 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 [megawatt days per metric ton of uranium] 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.

JAFNPP meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS (NRC 1999). The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts of transportation associated with license renewal beyond those discussed in the GEIS.

6.2 References

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 54. *Code of Federal Regulations*, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 63. *Code of Federal Regulations*, Title 10, *Energy*, Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR Part 191. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

70 FR 53313. 70 *Federal Register* 53313. 2005, September 8. "Implementation of a Dose Standard After 10,000 Years; Proposed Rule."

70 FR 49014. 70 *Federal Register* 49014. 2005, August 22. "Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Proposed Rule."

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy). 2006. *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: Applicant's Environmental Report, Operating License Renewal Stage.* Lycoming, New York. Accessible at ML062160557.

National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards.* National Academy Press, Washington, D.C.

National Environmental Policy Act (NEPA) of 1969. 42 USC 4321, et seq.

Public Law 107-200, 116 Stat. 735. 2002. "Approving the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel, pursuant to the Nuclear Waste Policy Act of 1982."

U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS-0046F, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2. Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Plants NUREG-1437, Volume 1, Addendum 1. Office of Nuclear Regulatory Research, Washington, D.C.

7.0 ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors, NUREG-0586, Supplement 1* (NRC 2002). The NRC staff's evaluation of the environmental impacts of decommissioning presented in NUREG-0586, Supplement 1, identifies a range of impacts for each environmental issue.

The incremental environmental impacts associated with decommissioning activities resulting from continued plant operation during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).(1) The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues were then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

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(1) 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 its Addendum 1.

7.1 Decommissioning

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B that are applicable to James A. FitzPatrick Nuclear Power Plant (JAFNPP) decommissioning following the renewal term are listed in Table 7-1. Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operation, Inc. (Entergy) stated in its Environmental Report (ER; Entergy 2006) that it is aware of no new and significant information regarding the environmental impacts of JAFNPP license renewal. The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of JAFNPP Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
DECOMMISSIONING	
Radiation Doses	7.3.1; 7.4
Waste Management	7.3.2; 7.4
Air Quality	7.3.3; 7.4
Water Quality	7.3.4; 7.4
Ecological Resources	7.3.5; 7.4
Socioeconomic Impacts	7.3.7; 7.4

A brief description of the NRC staff's review and the GEIS conclusions, as codified in Table B-1, for each of the issues follows:

- Radiation doses. Based on information in the GEIS, the Commission found that

  > 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.

  The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no radiation dose impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Waste management. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts from solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Air quality. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts on air quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Water quality. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts on water quality associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Ecological resources. Based on information in the GEIS, the Commission found that

> Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts on ecological resources associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Socioeconomic Impacts. Based on information in the GEIS, the Commission found that

> 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.

The NRC staff has not identified any new and significant information during its independent review of the JAFNPP ER (Entergy 2006), the staff's site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

10 CFR Part 51. *Code of Federal Regulations,* Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy). 2006. *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: – Applicant's Environmental Report, Operating License Renewal Stage.* Lycoming, New York. Accessible at ML062160557.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*. NUREG-1437, Volume 1, Addendum 1. Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Supplement 1, Volumes 1 and 2. Washington, D.C.

8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES TO LICENSE RENEWAL

This chapter examines the potential environmental impacts associated with denying the renewal of an operating license (OL) (i.e., the no-action alternative) and the potential environmental impacts from electric power generating sources other than the James A. FitzPatrick Nuclear Power Plant (JAFNPP); the possibility of purchasing electric power from other sources to replace power generated by JAFNPP and the associated environmental impacts; the potential environmental impacts from a combination of generation and conservation measures; and other generation alternatives that were deemed unsuitable for complete replacement of power generated by JAFNPP. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC's) three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)[(1)] with the additional impact category of environmental justice.

8.1 No-Action Alternative

The NRC's regulations implementing the National Environmental Policy Act (NEPA) of 1969 specify that the no-action alternative be discussed in an NRC environmental impact statement (EIS); see 10 CFR Part 51, Subpart A, Appendix A(4). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the JAFNPP OL and JAFNPP

(1) 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 its Addendum 1.

would then cease facility operations by the end of the current license and initiate the decommissioning of the power plant.

JAFNPP will eventually be required to shut down and to comply with NRC decommissioning requirements in 10 CFR 50.82 whether or not the OL is renewed. If the JAFNPP OL is renewed, shutdown of the unit and decommissioning activities will not be avoided but will be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning following a license renewal period of up to 20 years or following the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the GEIS; Chapter 7 of this draft supplemental environmental impact statement (draft SEIS); and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

Impacts from the decision to permanently cease operations are not considered in NUREG-0586, Supplement 1 (NRC 2002).(2) Therefore, immediate impacts that occur between power plant shutdown and the beginning of decommissioning are considered here. These impacts will occur when the unit shuts down regardless of whether the license is renewed or not. These impacts are discussed below, with the results presented in Table 8-1. Power plant shutdown will result in a net reduction in power production capacity. The power not generated by JAFNPP during the license renewal term would likely be replaced by (1) power purchased from other electricity providers, (2) generating alternatives other than JAFNPP, (3) demand-side management and energy conservation, or (4) some combination of these options. The environmental impacts of these options are discussed in Section 8.2.

- <u>Land Use</u>

  In Chapter 4 of this draft SEIS, the NRC staff concluded that there would be no impacts of continued power plant operation on land use. Onsite land use would not be affected immediately by the cessation of operations. Power plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the power plant stop operating. As a result, maintenance of the rights-of-way (ROWs) would continue as before. Therefore, there would be no impacts on land use from power plant shutdown.

(2) NUREG-0586 Supplement 1 discusses the socioeconomic impacts of plant closure, but the results of the analysis in Appendix J are not incorporated in the analysis presented in the main body of the NUREG.

1 **Table 8-1**. Summary of Environmental Impacts of the No-Action Alternative

Impact Category	Impact	Comment
Land Use	NO IMPACT	No impacts because power plant shutdown is not expected to result in changes to onsite or offsite land use.
Ecology	SMALL	Impacts are expected to be SMALL because there would be a reduction in cooling water flow and the thermal plume from the power plant, and terrestrial impacts are not expected because there would not be any land-use changes.
Water Use and Quality – Surface Water	SMALL	Impacts are expected to be SMALL because surface water intake and discharges would decrease.
Water Use and Quality - Groundwater	NO IMPACT	There is no groundwater use at the site.
Air Quality	SMALL	Impacts are expected to be SMALL because discharges related to power plant operation and worker transportation would decrease.
Waste	SMALL	Impacts are expected to be SMALL because generation of high-level waste would stop, and generation of low-level and mixed waste would decrease.
Human Health	SMALL	Impacts are expected to be SMALL because radiological doses to workers and members of the public, which are within regulatory limits, would be reduced.
Socioeconomics	MODERATE to LARGE	Impacts are expected to be MODERATE to LARGE because of a decrease in employment and tax revenues to local jurisdictions.
Transportation	SMALL	Transportation impacts would be SMALL because the decrease in employment would reduce traffic.
Aesthetics	NO IMPACT	No impacts are expected because power plant structures would remain in place.
Historic and Archaeological Resources	SMALL	Impacts are expected to be SMALL because shutdown of the power plant would not change land use.
Environmental Justice	SMALL to LARGE	Economic impacts are expected to be SMALL to LARGE because loss of employment opportunities is expected.

- Ecology

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the ecological impacts of power plant operation were SMALL. Cessation of operations would be accompanied by a reduction in cooling water flow and the thermal plume from the power plant.

  The impact of power plant closure on the terrestrial ecosystem would be negligible because the transmission lines to the power plant would remain energized. Therefore, the NRC staff concludes that ecological impacts from shutdown of the power plant would be SMALL.

- Water Use and Quality—Surface Water

  In Chapter 4 of this draft SEIS, the NRC staff concluded that impacts of power plant operation on surface water use and quality were SMALL. When the power plant stops operating, there would be an immediate reduction in the consumptive use of water because of reduction in cooling water flow and in the amount of heat transferred to Lake Ontario. Therefore, the NRC staff concludes that the impacts on surface water use and quality from power plant shutdown would be SMALL.

- Water Use and Quality—Groundwater

  In Chapter 4 of this draft SEIS, the NRC staff concluded that there would be no impacts on groundwater use, availability, and quality. Therefore, the NRC staff concludes that there would be no impact on groundwater use and quality from shutdown of the power plant.

- Air Quality

  In Chapter 4 of this draft SEIS, the NRC staff found the impacts of power plant operation on air quality were SMALL. When the power plant stops operating, there would be a reduction in emissions from activities related to power plant operation such as use of diesel generators and worker transportation. Therefore, the NRC staff concludes that the impact on air quality from shutdown of the power plant would be SMALL.

- Waste

  The impacts of waste generated by power plant operation are discussed in Chapter 6 of this draft SEIS. The impacts of low-level and mixed waste from power plant operation would be SMALL. When the power plant stops operating, the power plant would stop generating high-level waste, and the generation of low-level and mixed waste associated with power plant operation and maintenance would be reduced. Therefore, the NRC staff concludes that the impact of waste generated after shutdown of the power plant would be SMALL.

- Human Health

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of power plant operation on human health were SMALL. After the cessation of operations, the amount of radioactive material released to the environment in gaseous and liquid forms would be reduced. Therefore, the NRC staff concludes that the impact of shutdown of the power plant on human health would be SMALL. In addition, the variety of potential accidents at the power plant would be reduced to a limited set associated with shutdown events and spent fuel handling. In Chapter 5 of this draft SEIS, the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, the NRC staff concludes that the impacts of potential accidents following shutdown of the power plant would be SMALL.

- Socioeconomics

  In Chapter 4 of this draft SEIS, the NRC staff concluded that there would be no socioeconomic impacts of continued power plant operation. Conversely, there would be immediate socioeconomic impacts associated with the shutdown of the power plant because of the reduction in power plant staff. There would also be an immediate reduction in property tax revenues for Oswego County. The NRC staff concludes that the socioeconomic impacts of power plant shutdown would range from MODERATE to LARGE. Some of these impacts would be offset if new power-generating facilities were built at or near the current site. See Appendix J of NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential impacts of power plant shutdown.

- Transportation

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued power plant operation on transportation would be SMALL. Cessation of operations would be accompanied by a reduction in traffic in the vicinity of the power plant. Most of the reduction would be associated with a reduction in the power plant workforce but there would also be a reduction in shipment of material to and from the power plant. Therefore, the NRC staff concludes that the impacts of power plant closure on transportation would be SMALL.

- Aesthetics

  In Chapter 4 of this draft SEIS, the NRC staff concluded that there would be no aesthetic impacts of continued power plant operation. Power plant structures and other facilities would remain in place until decommissioning. Therefore, there would be no aesthetic impacts from power plant closure.

- Historic and Archaeological Resources

  In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued power plant operation on historic and archaeological resources would be SMALL. Onsite land use would not be affected immediately by the cessation of operations. Power plant structures and other facilities are likely to remain in place until decommissioning. The transmission lines associated with the project are expected to remain in service after the power plant stops operating. As a result, maintenance of transmission line ROWs would continue as before. Therefore, the NRC staff concludes that the impacts on historic and archaeological resources from power plant shutdown would be SMALL.

- Environmental Justice

  In Chapter 4 of this draft SEIS, the NRC staff concluded that there would be no disproportionately high and adverse impacts on minority and low-income populations from the continued operation of the power plant. Shutdown of the power plant would have disproportionately high and adverse economic impacts on minority and low-income populations because of the loss of employment opportunities at the site. The NRC staff concludes that the impacts of power plant shutdown on minority and low-income populations could range from SMALL to LARGE. Some of these impacts would be offset if new power-generating facilities are built at or near the current site. See Appendix J of NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of these impacts.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by JAFNPP, assuming that the OL is not renewed. The order of presentation of alternative energy sources in this section does not imply which alternative would be most likely to occur or would have the least environmental impact.

The following power generation alternatives are considered in detail:

- Coal-fired generation at an alternate site (Section 8.2.1)
- Natural gas-fired generation at the JAFNPP site and an alternate site (Section 8.2.2)
- New nuclear generation at the JAFNPP site and an alternate site (Section 8.2.3)

The alternative of purchasing power from other sources to replace power generated at JAFNPP is discussed in Section 8.2.4. Other power-generation alternatives and conservation alternatives considered by the NRC staff and found not to be reasonable replacements for JAFNPP baseload power is discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an Annual Energy Outlook. The *Annual Energy Outlook 2007 with Projections to 2030* was issued in February 2007 (DOE/EIA 2007). EIA projects that natural gas-fired and coal-fired electricity generation will constitute approximately 90 percent of electrical capacity additions between 2006 and 2030. Natural gas-fired generation is typically based on combined-cycle[(3)] or combustion turbine technology, which can supply peak and intermediate capacity and can also be used to meet baseload[(4)] requirements. Coal-fired power plants are generally used to meet baseload requirements. Renewable energy sources, including conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar and wind power are projected by EIA to account for 6 percent of capacity additions (DOE/EIA 2007).

EIA projects that oil-fired generation will continue to decrease in the U.S. through 2030 because high world oil prices encourage switching from oil-fired generation to natural gas and nuclear power and reinforce coal's important role in world electric power generation. Similarly, the relatively high fossil fuel prices of recent years are raising renewed interest in nuclear power and making renewable energy sources more competitive economically. EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. The cost of new oil-fired generation is not expected to be competitive with that of coal, natural gas, or renewable energy sources (DOE/EIA 2007).

EIA also projects a small increase in nuclear power generation through 2030, accounting for 0.6 percent of the generation growth (DOE/EIA 2007). The projected growth in nuclear power generation is not higher because natural gas and coal-fired power plants are projected to be more economical. In spite of this projection, since 1997, the NRC has certified four new standard designs for nuclear power plants under procedures in 10 CFR Part 52, Subpart B. Therefore, a new nuclear power plant alternative for replacing power generated by JAFNPP is considered in Section 8.2.3. The submission to the NRC of these three applications for certification indicates continuing interest in the possibility of licensing new nuclear power plants. The NRC has established a new organization to prepare for and manage future reactor and site licensing applications.

JAFNPP has a gross rating of 881 megawatts-electric (MWe). For the coal alternative, the NRC staff assumed construction of an 816-MWe power plant. For the natural gas alternative, the NRC staff assumed construction of an 816-MWe power plant, which is consistent with the *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: Applicant's Environmental Report, Operating License Renewal Stage* (JAFNPP ER) (Entergy

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(3) In a combined-cycle unit, hot combustion gas in a combustion turbine rotates the turbine to generate electricity. The hot exhaust from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

(4) A baseload plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for baseload generation, i.e., these units generally run near full load.

2006). For the new nuclear alternative, the NRC staff assumed construction of a 1000-MWe power plant. This assumption will overstate the environmental impacts of replacing the 881 MWe from JAFNPP by roughly 13.5 percent.

8.2.1 Coal-Fired Power Generation

The NRC staff believes that the JAFNPP site would not be a viable location for a representative coal-fired power plant. The primary consideration pertinent to this determination is the size of the JAFNPP site. Use of the site would necessitate offsite disposal of combustion waste. Therefore, the NRC staff assumes that the representative coal-fired power plant would be located at an alternate site.

Consistent with the JAFNPP ER, the NRC staff assumes construction of two 408-MWe units for a combined capacity of 816 MWe as a potential replacement for JAFNPP. The assumption of 816 MWe is slightly less generating capacity than JAFNPP's capacity of 881 MWe, but the NRC staff concludes that the differences are not significant and would not change the standard of significance (SMALL, MODERATE, or LARGE) of any impacts.

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the JAFNPP ER (Entergy 2006). The NRC staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered as a reasonable projection of the operating life of a coal-fired power plant.

The coal-fired power plant would consume approximately 2.36 million tons per year (tons/yr) of pulverized bituminous coal with an ash content of approximately 7.11 percent (Entergy 2006). JAFNPP assumes a heat rate[(5)] of 10,200 BTU/kWh and a capacity factor[(6)] of 0.85 in its ER (Entergy 2006). After combustion, 99.9 percent of the ash would be collected and disposed at either an onsite or offsite landfill. In addition, approximately 136,995 tons of scrubber sludge would be disposed of at the power plant site based on annual limestone usage of approximately 46,241 tons. Limestone is used in the scrubbing process for control of sulfur dioxide (SO_2) emissions.

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(5) Heat rate is measure of generating station thermal efficiency. In English units, it is generally expressed in British thermal units (BTUs) per net kilowatt-hour (kWh). It is computed by dividing the total BTU content of the fuel burned for electric generation by the resulting kWh generation. The corresponding metric unit for energy is the Joule (J).

(6) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that would have been generated at continuous full-power operation during the same period.

8.2.1.1 Once-Through Cooling System

For purposes of this section, the NRC staff assumed that a coal-fired power plant located at an alternate site would use a once-through cooling system. The overall impacts of the coal-fired generating system using once-through cooling are discussed in this section and summarized in Table 8-2. The extent of impacts at an alternate site would depend on the location of the site.

In Section 8.2.1.2, the NRC staff evaluates the impacts of using a closed-cycle cooling system at an alternate site.

- Land Use

  Development of the coal-fired power plant would require approximately 1387 acres (ac) of land for the power plant site. Additional land would be necessary to allow for an onsite and peripheral buffer. The NRC estimates that 1700 ac would be required for a 1000-MWe power plant. Depending on the location of the power plant, additional land would be required for offsite infrastructure, particularly transmission lines to connect the power plant to the grid and facilities for coal and limestone delivery, most likely including a rail spur and possibly some upgrades to existing or recently abandoned rail lines. Construction of a barge terminal would also be a reasonable option for a power plant located on Lake Ontario.

  Land-use changes would also occur offsite in an undetermined coal-mining area to supply coal for the power plant. In the GEIS, the NRC staff estimated that approximately 22 ac of land per MWe would be affected for mining the coal and disposing of the waste to support a coal-fired power plant during its operational life. Therefore, the 816-MWe power plant proposed in this analysis would require approximately 17,592 ac of land to support the entire fuel cycle.

  The location and design of coal-fired power plant facilities at an alternate site would be subject to substantial regulatory scrutiny and that a reasonable potential exists for the eventual restoration of disposal areas and the development of compatible uses that would not affect landfill integrity (e.g., recreation). Under these assumptions, the NRC staff expects that land-use impacts would be noticeable but would not affect land-use characteristics at an existing industrial site. Depending particularly on transmission line and rail line routing, this alternative would result in MODERATE to LARGE land-use impacts.

- Ecology

  Impacts on ecological resources from construction and from operation of the representative coal-fired power plant would be highly site-specific. However, as much as 1387 ac of terrestrial habitat would be displaced by the power plant and onsite landfill, and additional terrestrial habitat would be adversely affected from development of offsite infrastructure (e.g., transmission line connection, rail spur construction). Impacts would depend on

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Site Using Once-Through Cooling

Impact Category	Impact	Comments
Land Use	MODERATE to LARGE	Would use approximately 1387 ac for the power plant roads, parking areas, office buildings, and transmission line. There would be additional land impacts for coal and limestone mining. The total impact would depend on whether the alternate site had been previously disturbed or had existing infrastructure.
Ecology	MODERATE to LARGE	Impacts would depend on whether the site had been previously developed. Factors to consider include location and ecology of the site, transmission line route, and rail spur route. In total, impacts would include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.
Water Use And Quality —Surface Water	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the surface water body.
Water Use and Quality —Groundwater	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and discharged and the characteristics of the aquifer.
Air Quality	MODERATE	• Sulfur oxides: 2514 tons/yr • Nitrogen oxides: 591 tons/yr • Particulates: 19 tons/yr of PM_{10} • Carbon monoxide: 591 tons/yr • Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials— mainly uranium and thorium. • Total suspended particulates: 84 tons/yr
Waste	MODERATE	Total waste volume would be approximately 136,995 tons/yr of ash and scrubber sludge requiring approximately 161 ac for disposal during the 40-year life of the power plant.
Human Health	SMALL	Impacts are uncertain but considered SMALL in the absence of more quantitative data.

Table 8-2 (cont.)

Impact Category	Impact	Comments
Socioeconomics	SMALL to LARGE	Impacts are expected to be SMALL to LARGE because of a decrease in employment and tax revenues to local jurisdictions.
Transportation	SMALL to LARGE	Transportation impacts associated with construction could be MODERATE to LARGE. Transportation impacts associated with power plant operations would also be site-dependent and would be SMALL to MODERATE. For rail transportation of coal and lime, the impact would be MODERATE to LARGE. For barge transportation, the impact would be SMALL.
Aesthetics	SMALL to LARGE	Impacts would include visual impairment, construction of new transmission lines, and infrastructure for the delivery of coal and limestone. The impact severity would be dependent on location.
Historic and Archaeological Resources	SMALL to MODERATE	Building a coal-fired power plant and other support facilities would require cultural resource studies. Impacts would vary depending on location and presence of historic and archaeological resources.
Environmental Justice	SMALL to LARGE	Impacts to minority and low-income populations would vary depending on the site location of the power plant and other support facilities.

whether the site had been previously developed. Factors to consider include location and ecology of the site, transmission line route, and rail spur route. In total, impacts would include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.

Impact to aquatic communities as a result of construction would include some permanent alteration of habitat, particularly if a barge terminal were developed for delivery of coal and limestone. Fish and benthic communities would be initially disrupted but would be expected to reestablish with accompanying localized changes in species composition and distribution in response to changes in bottom substrate availability, water depth, and other factors. Potential for some adverse impact on aquatic communities would persist through the operational period as a result of large boat traffic, periodic maintenance dredging, and potential for spills of coal, petroleum products, or other materials. However, construction and maintenance dredging would be conducted in accordance with the provisions of applicable permits from the U.S. Army Corps of Engineers (USACE) and the New York State

Department of Environmental Conservation (NYSDEC). Similarly, spill prevention measures would be effective during the operational period. Once-through cooling water withdrawal and discharge would have adverse aquatic resource impacts.

Given this information, the NRC staff concludes that development of the representative coal-fired power plant at an alternate site in upstate New York would have a MODERATE to LARGE impact on ecological communities.

- <u>Water Use and Quality—Surface Water</u>

Construction phase impacts on water quality of greatest potential concern at an alternate site would include (1) erosion and sedimentation associated with land-clearing operations, and (2) suspension of bottom sediments during construction of cooling water intake and discharge structures and, if the option were chosen, from construction of barge delivery facilities. However, land-clearing activities are subject to storm-water protections in accordance with the State Pollutant Discharge Elimination System (SPDES) program. Work in waterways would be regulated by the USACE under the Clean Water Act of 1977, Section 404, and the Rivers and Harbors Appropriation Act of 1899, Section 10, by the NYSDEC via permits and by the New York Department of State (NYSDOS) under the State's Coastal Zone Management program (if located within the coastal zone). In addition, these adverse effects would be localized and temporary. The NRC staff concludes that impacts on surface water quality associated with construction of the representative power plant would be SMALL.

Potential impacts on water quality and use associated with operation of the representative power plant would be to some extent site-specific. Cooling water and other wastewater discharges would be regulated by a SPDES permit regardless of location. The impact on surface water would depend on the volume of water withdrawn and discharged and the characteristics of the surface water body. The NRC staff concludes that the impacts of surface water use and quality from the operation of a representative power plant located at an alternate site would be SMALL to MODERATE.

- <u>Water Use and Quality—Groundwater</u>

Use of groundwater for a coal-fired power plant at an alternate site is possible. Groundwater withdrawal would require a permit. Overall, the impact to groundwater at an alternate site is considered SMALL to MODERATE and would depend on the volume of water that is withdrawn and discharged and the characteristics of the aquifers.

- <u>Air Quality</u>

The air-quality impacts of coal-fired generation vary considerably from those of nuclear generation due to emissions of sulfur oxides (SO_X), nitrogen oxides (NO_X), particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

Oswego County is designated as unclassifiable or in attainment with all criteria pollutants. The nearest area of non-attainment is Jefferson County, which is classified as marginal for ozone. Onondaga County, where Syracuse is located, is a maintenance area for carbon monoxide and classified as moderate, i.e., less than or equal to 12.7 parts per million (ppm).

A new coal-fired generating power plant in upstate New York would likely need a prevention of significant deterioration (PSD) permit and an operating permit under the Clean Air Act of 1970. The power plant would need to comply with the new source performance standards for such power plants set forth in 40 CFR 60, Subpart D(a). The standards establish limits for particulate matter and opacity (40 CFR 60.42[a]), SO_2 (40 CFR 60.43[a]), and NO_x (40 CFR 60.44[a]). The facility would be designed to meet best available control technology (BACT) or lowest achievable emissions rate (LAER) standards, as applicable, for control of criteria air emissions.

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the Clean Air Act.

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 FR 35714; July 1,1999 [EPA 1999]). The rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a coal-fired power plant were located close to a mandatory Class I Federal area, additional air pollution control requirements would be imposed. It is assumed that an alternate site would not be chosen near a mandatory Class I Federal area.

In 1998, the EPA issued a rule requiring 22 Eastern states, including New York, to revise their state implementation plans to reduce NO_x emissions, which contribute to violations of the national ambient air quality standard for ozone (EPA 1998). The total amount of NO_x that can be emitted by each of the 22 Eastern states in the year 2007 ozone season (May 1 to September 30) is set out at 40 CFR 51.121(e). For New York, the amount is 190,360 tons.

Impacts for particular pollutants are as follows:

Sulfur oxides emissions. A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 a unit is allowed to emit. New units do not receive allowances but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchasing them or reducing SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally. Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative because a nuclear power plant releases negligible amounts of SO_2 during normal operations.

Entergy estimates that by using the BACT to minimize SO_x emissions, the total annual stack emissions would be approximately 2514 tons of SO_x (Entergy 2006).

Nitrogen oxides emissions. Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such power plants in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453 [EPA 1998]), limits the discharge of any gases that contain nitrogen oxides (expressed as NO_2) in excess of 200 nanograms per Joule (ng/J) of gross energy output (1.6 pounds per megawatt hour [lb/MWh]), based on a 30-day rolling average.

Entergy estimates that by using NO_x burners with overfire air and selective catalytic reduction (SCR), the total annual NO_x emissions for a new coal-fired power plant would be approximately 591 tons. Regardless of the control technology, this level of NO_x emissions would be greater than the OL renewal alternative because a nuclear power plant releases negligible amounts of NO_x during normal operations.

Particulate emissions. Entergy estimated that for coal-fired generation, the total annual stack emissions would include 84 tons of total suspended particulates and 19 tons of particulate matter with an aerodynamic diameter of less than or equal to 10 microns (PM_{10}). Fabric filters or electrostatic precipitators would be used for control. In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative because nuclear power plants release few particles during normal operation.

During the construction of a coal-fired power plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during the construction process.

Carbon monoxide emissions. Entergy estimated that for a coal-fired power plant, the total carbon monoxide emissions would be approximately 591 tons/yr. This level of emissions is greater than the OL renewal alternative.

Hazardous air pollutants including mercury. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by the EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000b). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus, subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000b). Accordingly, the EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the Clean Air Act for which emission standards for hazardous air pollutants will be issued (EPA 2000b).

Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 ppm. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired power plant released roughly 5.2 tons of uranium and 12.8 tons of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

Carbon dioxide. A coal-fired power plant would have unregulated carbon dioxide emissions that would contribute to global warming. The level of emissions from a coal-fired power plant would be greater than the OL renewal alternative.

Summary. The GEIS analysis did not quantify emissions from coal-fired power plants but implies that air impacts would be substantial. The GEIS also mentions global warming from unregulated carbon dioxide emissions and acid rain from SO_X and NO_X emissions as potential impacts. Adverse human health effects such as cancer and emphysema have been associated with the products of coal combustion.

The NRC staff concludes that the overall impact on air quality from a coal-fired power plant, located at an alternate site in upstate New York, would be MODERATE. The impacts would be clearly noticeable but would not destabilize air quality.

- Waste

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. The representative coal-fired power plant would generate approximately 136,995 tons of this waste annually for 40 years. The waste would be disposed of onsite, accounting for approximately 161 ac of land area over the 40-year power plant life. Waste impacts to groundwater and surface water would extend beyond the operating life of the power plant if leachate and runoff from the waste storage area occurred. Disposal of the waste would noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land would be available for other uses. Debris would be generated during construction activities.

In 2000, the EPA issued a "Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels" (EPA 2000b). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions, (2) the EPA has identified 11 documented cases of proven damages to human health and the environment by improper management of these wastes in landfills and surface impoundments, (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring, and (4) the EPA identified gaps in state oversight of coal combustion wastes. Accordingly, the EPA announced its intention to issue regulations for disposal of coal combustion waste under Subtitle D of the Resource Conservation and Recovery Act of 1976.

For all of the preceding reasons, the appropriate characterization of impacts from waste generated from burning coal is MODERATE. The impacts would be clearly noticeable but would not destabilize any important resource.

- Human Health

Coal-fired power generation introduces worker risks from fuel and limestone mining, fuel and lime/limestone transportation, and disposal of coal combustion waste. In addition, there are public risks from inhalation of stack emissions. Emission impacts can be widespread, and health risks can be difficult to quantify. The coal alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

In the GEIS, the NRC staff stated that there would be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but the NRC staff did not identify the significance of these impacts. In addition, uranium and thorium discharges from coal-fired power plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, the EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus, subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal are characterized as SMALL.

- Socioeconomics

It is estimated that the 816-MWe coal-fired power plant would take approximately four years to construct with a workforce ranging from 979 to 2040 workers (Entergy 2006). The extent of socioeconomic impacts from the construction of the coal-fired power plant would depend on its location. As the NRC notes in the GEIS, socioeconomic impacts are expected to be larger at a rural site than at an urban site because more of the peak construction workforce would need to move to the area to work. Socioeconomic impacts at a rural site would be LARGE, while impacts at a site in the vicinity of a more populated metropolitan area (e.g., Syracuse) would be SMALL to MODERATE. Impacts during construction would consist of short-term increased demand for rental housing and public services that could temporarily offset the loss of jobs and tax revenue from the closure of JAFNPP. Communities in Oswego County in particular would experience MODERATE to LARGE impacts due to losses in employment and tax revenues from the closure of JAFNPP, especially if the coal-fired power plant is constructed outside the area.

Overall, the socioeconomic impacts of a coal-fired power plant at an alternate site would be SMALL to LARGE depending on the location of the plant.

- Transportation

Transportation-related impacts associated with construction at an alternate site are site-dependent but would be MODERATE to LARGE. Transportation impacts related to power plant operations would also be site-dependent and would be SMALL to MODERATE.

Coal and lime/limestone would likely be delivered to the site by rail or barge. Socioeconomic impacts associated with rail transportation would likely be MODERATE to LARGE. For example, there would be highway traffic delays as trains pass road crossings. Barge delivery of coal and lime/limestone would likely have SMALL socioeconomic impacts.

- Aesthetics

Potential aesthetic impacts of construction and operation of the coal-fired power plant at an alternate site would include visual impairment from a large industrial facility. There would also be an aesthetic impact associated with construction of a new transmission line. Noise and light from the power plant would be detectable offsite. Aesthetic impacts at the power plant site would be mitigated if the coal-fired power plant were located in an industrial area or adjacent to other power plants. Noise impacts from a rail spur, if required, would be most significant for residents living in the immediate vicinity of the power plant and along the rail route.

These impacts are highly site-specific. Therefore, the NRC staff concluded that depending on location aesthetic and noise impacts associated with the development and operation of a coal-fired power plant at an alternate site would range from SMALL to LARGE.

- Historic and Archaeological Resources

  Before construction at an alternate site, historic and archaeological studies would be needed to identify, evaluate, and address the potential impacts of new power plant construction on cultural resources. These studies would be needed for all areas of potential disturbance at the proposed power plant site and other support facilities, and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, other ROWs). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL to MODERATE depending on location and presence of cultural resources.

- Environmental Justice

  Impacts on minority and low-income populations associated with a replacement coal-fired power plant built at an alternate site in New York State would depend on the location of the site and population distribution. Impacts on housing availability and prices during power plant construction could disproportionately affect minority and low-income populations. Closure of JAFNPP would result in the loss of approximately 716 jobs causing economic conditions that could affect employment prospects for minority or low-income populations. Depending on plant location, overall impacts would vary between SMALL and LARGE.

8.2.1.2 Closed-Cycle Cooling System

The environmental impacts of constructing a coal-fired generation system at an alternate site using closed-cycle cooling with cooling towers would be essentially the same as for a coal-fired power plant using a once-through cooling system. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation at an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	25 to 30 additional ac would be required for cooling towers and associated support infrastructure.
Ecology	Impact would depend on ecology at the site. Reduced impact to aquatic ecology.
Water Use and Quality—Surface Water	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State. Decreased water withdrawal and less thermal load on the receiving body of water. Consumptive use of water due to evaporation from cooling towers.
Water Use and Quality—Groundwater	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Introduction of cooling towers and associated plume. Natural draft towers would be up to 520 ft tall. Mechanical draft towers would be up to 100 ft tall and would have an associated noise impact.
Historic and Archaeological Resources	No change
Environmental Justice	No change

8.2.2 Natural Gas-Fired Generation

The environmental impacts of a natural gas-fired alternative are examined in this section. The NRC staff reviewed Entergy's ER and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the natural gas-fired alternative for 40 years is considered as a reasonable projection of the operating life of a natural gas-fired power plant.

Entergy assumed that a replacement natural gas-fired power plant would use combined-cycle technology. In a combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

For operation of a gas-fired facility at the existing JAFNPP site, an additional 25 miles (mi) of pipeline for gas supply would need to be constructed. Offsite infrastructure needed to locate the power plant at an alternate site is conjectural but would reasonably include a natural gas supply pipeline, transmission line, and makeup water and discharge pipelines. The extent to which such infrastructure would be required is location-specific, but such needs would be considered in siting the facility and would be subject to regulatory scrutiny under New York's Public Service Law, Articles VII and X, or comparable process (Entergy 2006).

The natural gas-fired alternative is analyzed for both the existing JAFNPP site and for an unnamed alternate site. Siting a new natural gas-fired power plant at the site of an existing nuclear power plant would reduce environmental impacts by allowing the new facility to take advantage of existing infrastructure, including transmission facilities, roads, parking areas, office buildings, and the existing cooling system (to the extent needed). Approximately 90 ac would be required to locate the gas-fired power plant at an alternative site.

The NRC staff assumed that construction of the gas-fired units would be scheduled to coincide with the expiration date of the JAFNPP OL. Consistent with the JAFNPP ER (Entergy 2006), the NRC staff assumed a combined-cycle natural gas facility based on two 408-MWe combined-cycle units for a total facility size of 816 MWe. This assumption slightly understates the environmental impacts of replacing the 881 MWe from JAFNPP. As a rough estimate, if a natural gas-fired power plant of exactly 881 MWe were built, any numerical impacts in this section, e.g., quantities of air pollutants, might simply be adjusted upward accordingly. However, given these adjustments, the NRC staff has determined that the differences in impacts between 816 MWe and 881 MWe of natural gas-fired generation would not be significant and would not change the standard of significance (SMALL, MODERATE, or LARGE) of any impacts.

The NRC staff assumed that the power plant would use a once-through cooling system. The impacts of using a closed-cycle cooling system are evaluated in Section 8.2.2.2.

8.2.2.1 Once-Through Cooling System

The overall impacts of the natural gas-generating system using a once-through cooling system are discussed in this section and summarized in Table 8-4. The extent of impacts at an alternate site would depend on the location of the site.

Table 8-4. Summary of Environmental Impacts of Natural Gas-Fired Generation at the JAFNPP Site and an Alternate Site Using Once-Through Cooling

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Land Use	SMALL to MODERATE	The natural gas-fired power plant would be constructed on undeveloped portions of the JAFNPP site. It would require upwards of 90 ac for power block, roads, parking areas, and a gas pipeline ROW. It would use existing infrastructure, minimizing new land requirements.	SMALL to MODERATE	Land-use requirements would be larger at the alternate site than at the JAFNPP site because of the need for additional infrastructure such as transmission facilities, roads, parking areas, office buildings, and cooling system. The total impact would depend on whether the alternate site had been previously disturbed.
Ecology	MODERATE	The natural gas-fired alternative at the JAFNPP site would be constructed partly on previously disturbed areas and would disturb relatively little acreage at the site. However, a 25-mi gas supply line would need to be constructed, which, assuming a construction ROW of 75 ft, would disrupt up to 230 ac of terrestrial habitat. Ecological impacts would include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity.	SMALL to MODERATE	Impacts would depend on whether the alternate site is previously developed. Factors to consider include location and ecology of site and transmission line route. Ecological impacts would include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity.

Table 8-4 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Water Use and Quality—Surface Water	SMALL	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use the existing once through cooling system.	SMALL to MODERATE	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. Total impacts would depend on the volume and other characteristics of the receiving body of water.
Water Use and Quality—Groundwater	NO IMPACT	JAFNPP does not have onsite pumpable groundwater wells. Potable water is supplied by the Town of Scriba.	SMALL to MODERATE	The impact to groundwater would depend on the site characteristics, including the amount of groundwater available.
Air Quality	MODERATE	• SO_X: 85 tons/yr • NO_X: 272 tons/yr • Carbon monoxide: 57 tons/yr • PM_{10} particulates: 47 tons/yr • Other: (1) hazardous air pollutants, including arsenic, formaldehyde, and nickel and (2) carbon dioxide emissions, which contribute to global warming	MODERATE	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.
Waste	SMALL	Minimal waste product from fuel combination	SMALL	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.
Human Health	SMALL	Impacts would be minor.	SMALL	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.

Table 8-4 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Socioeconomics	SMALL to LARGE	Impacts are expected to be SMALL to LARGE because of a decrease in employment and tax revenue to local jurisdictions.	SMALL to LARGE	The impacts at an alternate site would be the same as those for the JAFNPP site.
Transportation	MODERATE	Transportation impacts associated with construction would be MODERATE.	MODERATE	Transportation impacts associated with construction would be MODERATE.
Aesthetics	SMALL	Construction and operation of a natural gas-fired power plant at JAFNPP would not alter the overall aesthetic characteristics of the site.	SMALL to LARGE	Construction and operation of a natural gas-fired power plant at an alternate site would change the aesthetic characteristics of the site.
Historic and Archaeological Resources	SMALL to MODERATE	Constructing a natural gas-fired power plant would require cultural resource studies. Impacts would vary depending on the location of the plant on the undeveloped portions of the JAFNPP site and the presence of historic and archaeological resources.	SMALL to MODERATE	The impacts at an alternate site would be the same as those for the JAFNPP site.
Environmental Justice	SMALL to MODERATE	Impacts to minority and low-income populations would vary depending on the location of the power plant site and other support facilities	SMALL to MODERATE	The impacts at an alternate site would be the same as those for the JAFNPP site.

- Land Use

For siting at JAFNPP, existing facilities and infrastructure would be used to the extent possible, limiting the amount of new construction that would be required. Specifically, the NRC staff assumed that the natural gas-fired replacement power plant alternative would require approximately 90 ac of land and would make use of existing transmission facilities, roads, and parking areas. Operation of a new combined-cycle facility at the JAFNPP site would require the construction of approximately 25 mi of natural gas pipeline. It is estimated that the pipeline would require approximately 230 ac for an easement. The onsite facilities would represent expansion of an existing industrial land use.

For construction at an alternate site, the full land-area requirement for a natural gas-fired facility would be necessary because no existing infrastructure would be available. Additional land would be impacted by construction of a transmission line and natural gas pipelines to serve the power plant. The gas line requirements at an alternate site would depend on the characteristics and location of the alternate site.

Regardless of where the gas-fired power plant was built, additional land would be required for natural gas wells and collection stations. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining to supply fuel for JAFNPP. In the GEIS, the NRC staff estimated that approximately 1000 ac would be affected for mining the uranium and processing it during the operating life of a nuclear power plant.

Overall, the land-use impacts of constructing the natural gas-fired power plant at the JAFNPP site would be SMALL to MODERATE. Overall, the land-use impacts of siting the natural gas-fired power plant at an alternate site would depend on the chosen site and are characterized as SMALL to MODERATE.

- <u>Ecology</u>

Entergy expects that development of the gas-fired alternative power plant at the JAFNPP site would be constructed partly on previously disturbed areas and would disturb relatively little acreage at the site. However, to accommodate a gas-fired power plant at the JAFNPP site, a 25-mi gas supply line would need to be constructed, which, assuming a construction ROW of 75 ft, would disrupt up to 230 ac of terrestrial habitat. Ecological impacts to the power plant site and utility easements would include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity.

The GEIS noted that land-dependent ecological impacts from construction would be SMALL unless site-specific factors indicated a particular sensitivity and that operational impact would be smaller than for other fossil fuel technologies of equal capacity. The connection to a gas pipeline approximately 25 mi from the JAFNPP site is a site-specific factor that would make the gas-fired alternative's ecological impacts larger than those of license renewal. Therefore, in this case, ecological impacts of siting a natural gas-fired power plant at the JAFNPP site would be MODERATE.

Impact on ecological resources from construction and operation of the representative natural gas-fired power plant and associated offsite infrastructure at an alternate site is conjectural.

However, ecological resources throughout much of the area would be similar to those for the JAFNPP site alternative. The NRC staff concludes that the associated impact on ecological resources would be SMALL to MODERATE.

- Water Use and Quality—Surface Water

Overall, water requirements for combined-cycle generation are much less than for conventional generators such as nuclear generators and coal-fired generators. A natural gas-fired power plant sited at JAFNPP is assumed to use the existing once-through cooling system. Surface water impacts would be expected to remain SMALL.

A natural gas-fired power plant at an alternate site is assumed to use a once-through cooling system. The impact on surface water would depend on the volume and other characteristics of the receiving body of water. The impacts would be SMALL to MODERATE.

The NRC staff noted in the GEIS that at either the JAFNPP site or an alternate site, some erosion and sedimentation probably would occur during construction. Water-quality impacts from sedimentation during construction are characterized in the GEIS as SMALL. The NRC staff also noted in the GEIS that operational water quality impacts would be similar to, or less than, those from other generating technologies.

- Water Use and Quality—Groundwater

JAFNPP does not have onsite pumpable groundwater wells. Potable water is supplied by the Town of Scriba and cooling water is taken from Lake Ontario. Therefore, there would be no groundwater impacts at the JAFNPP site.

For a natural gas-fired power plant at an alternate site, any groundwater withdrawal would require a permit from the local permitting authority. The impact to groundwater would depend on the site characteristics, including the amount of groundwater available. The impacts would range between SMALL and MODERATE.

- Air Quality

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions but in lesser quantities than the coal-fired alternative. Hence, the gas-fired alternative would be subject to the same type of air-quality regulations as a coal-fired power plant, discussed in Section 8.2.1. The greatest concerns from combined-cycle facilities are the emissions of ozone precursors, NO_x, and volatile organic compounds (VOCs).

JAFNPP projects the following emissions for the natural gas-fired alterative (Entergy 2006):

- o Sulfur oxides: 85 tons/yr
- o Nitrogen oxides: 272 tons/yr
- o Carbon monoxide: 57 tons/yr
- o PM_{10} particulates: 47 tons/yr

A natural gas-fired power plant would also have unregulated carbon dioxide emissions that would contribute to global warming. While these emissions have not traditionally been an important environmental concern, they are becoming increasingly relevant at both the national and international levels.

In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units. Natural gas-fired power plants were found by the EPA to emit arsenic, formaldehyde, and nickel (EPA 2000b). Unlike coal and oil-fired power plants, the EPA did not determine that emissions of hazardous air pollutants from natural gas-fired power plants should be regulated under Section 112 of the Clean Air Act.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process and by employee and delivery vehicles during operations.

The preceding emissions would likely be the same at JAFNPP or at an alternate site. Impacts from the above emissions would be clearly noticeable but would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural gas-fired power plant sited at JAFNPP or at an alternate site is considered MODERATE.

- Waste

There would be spent catalyst from NO_x emissions control and small amounts of solid-waste products (i.e., ash) from burning natural gas fuel. In the GEIS, the NRC staff concluded that waste generation from gas-fired technology would be minimal. Gas firing results in very few combustion by-products because of the clean nature of the fuel. Waste-generation impacts would be so minor that they would not noticeably alter any important resource attribute. Construction-related debris would be generated during construction activities.

In the winter, it might become necessary for a replacement baseload natural gas-fired power plant to operate on fuel oil due to lack of gas supply. Oil combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge. The amount of ash and sludge generated would depend on the type and quantity of fuel oil combusted. Number 2 fuel oil does not produce any appreciable ash.

Overall, the waste impacts would be SMALL for a natural gas-fired power plant sited at JAFNPP or at an alternate site.

- Human Health

In Table 8-2 of the GEIS, the NRC staff identifies cancer and emphysema as potential health risks from gas-fired power plants. The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. Emissions of NO_x from any gas-fired power plant would be regulated. For a power plant sited in New York, NO_x emissions would be regulated by the NYSDEC. Human health effects would not be detectable or would be sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of the natural gas-fired alternative sited at JAFNPP or at an alternate site would be SMALL.

- Socioeconomics

Construction of a natural gas-fired power plant would take approximately two years. In the GEIS, peak employment is determined to be approximately 1200 workers. The NRC staff assumed that construction would take place while JAFNPP continued operation and would be completed by the time it permanently ceased operations. During construction, the communities surrounding the JAFNPP site would experience demands on housing and public services that would have SMALL impacts. These impacts would be tempered by construction workers commuting from other parts of Oswego and Onondaga counties. After construction, the communities would be impacted by the loss of jobs. The current JAFNPP workforce (716 workers) would decline through a decommissioning period to a minimal maintenance size. The gas-fired power plant would introduce a replacement tax base at JAFNPP or an alternate site and approximately 50 new permanent jobs. Impacts in Oswego and Onondaga counties resulting from decommissioning of JAFNPP might be offset to some degree by potential job opportunities in the Syracuse area.

In the GEIS, the NRC staff concluded that socioeconomic impacts from constructing a natural gas-fired power plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts of any nonrenewable technology. Compared to the coal-fired and nuclear alternatives, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would minimize socioeconomic impacts. For these reasons, socioeconomic impacts associated with the construction and operation of a natural gas-fired power plant would be MODERATE for siting at JAFNPP.

The extent of socioeconomic impacts from constructing and operating a natural gas-fired power plant at an alternate site in upstate New York would depend on its location. Impacts near large population centers (i.e., Syracuse) would likely be small, with moderate impacts possible in more rural areas. Communities in Oswego County in particular would experience MODERATE to LARGE impacts due to losses in employment and tax revenues from the closure of JAFNPP, especially if the natural gas-fired power plant is constructed outside the area. Overall, the socioeconomic impacts of a natural gas-fired power plant at an alternate site would be SMALL to LARGE depending on the location of the plant.

- Transportation

Transportation-related impacts associated with construction and operations would depend on the population density and transportation infrastructure in the vicinity of the site. The impacts can be classified as MODERATE for siting at the JAFNPP site or an alternate site.

- Aesthetics

The turbine buildings (106-ft tall) and exhaust stacks (approximately 225-ft tall) would be visible during daylight hours from offsite. The gas pipeline compressors would also be visible. However, development of the natural gas-fired power plant at the JAFNPP site would represent an incremental addition to an existing power plant with similar characteristics. A forest buffer provides a visual screen to residential developments bordering the site. Overall, the NRC staff concludes that aesthetic impacts from development of a natural gas-fired power plant at the JAFNPP site would be SMALL.

At an alternate site, the buildings and associated transmission line and gas pipeline compressors would be visible offsite. The visual impact of a new transmission line would be especially significant. Aesthetic impacts would be mitigated if the power plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with an alternate site are categorized as MODERATE to LARGE. The greatest contributor to this categorization is the aesthetic impact of the new transmission line.

Natural gas generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to total noise produced by power plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal power plant operations. Intermittent sources include the use of an outside loudspeaker and the commuting of power plant employees. However, it is expected that the power plant would comply with all applicable noise ordinances and standards. Therefore, the noise impacts of a natural gas-fired power plant at the JAFNPP site would be SMALL. At an alternate site, these noise impacts would be SMALL to LARGE depending on the location of the site.

- Historic and Archaeological Resources

At both JAFNPP and an alternate site, a cultural resource inventory would be needed for any undeveloped portions of the site that had not been previously surveyed. Other properties, if any, which would be acquired to support the power plant, would also need to be surveyed for cultural resources prior to ground-disturbing activities at the power plant site.

Before construction at JAFNPP or an alternate site, historic and archaeological studies would be needed to identify, evaluate, and address the potential impacts of new power plant construction on cultural resources. These studies would likely be needed for all areas of potential disturbance at the proposed power plant site, other support facilities, and along associated corridors where new construction would occur (e.g., roads, transmission and pipeline corridors, other ROWs). Historic and archaeological resource impacts can generally be effectively managed and as such are considered SMALL to MODERATE depending on the location and presence of cultural resources.

- Environmental Justice

Impacts on minority and low-income populations associated with a replacement natural gas-fired power plant built at JAFNPP or an alternate site in New York State would depend on the location of the site and population distribution. Impacts on housing availability and prices during power plant construction could disproportionately affect minority and low-income populations. Closure of JAFNPP would result in the loss of approximately 716 jobs causing economic conditions that could affect employment prospects for minority or low-income populations. Depending on plant location, overall impacts could vary between SMALL and MODERATE.

8.2.2.2 Closed-Cycle Cooling System

This section discusses the environmental impacts of constructing a natural gas-fired generation system at either the JAFNPP site or an alternate site using closed-cycle cooling. The impacts (SMALL, MODERATE, or LARGE) of this option are the same as for a natural gas-fired power plant using the once-through cooling system. However, there are minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences.

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified four new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the 1300 MWe U.S. Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the 1300 MWe System 80+ Design (10 CFR 52, Appendix B), the 600 MWe AP600 Design (10 CFR 52, Appendix C), and AP 1000 (10 CFR 52, Appendix D). All of these power plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. Consequently, construction of a new nuclear power plant at both the JAFNPP site and an alternate site is considered in this section. The NRC staff assumed that the new nuclear power plant would have a 40-year lifetime.

Table 8-5. Summary of Environmental Impacts of Natural Gas-Fired Generation at Either the JAFNPP Site or an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	25 to 30 additional ac required for cooling towers and associated support infrastructure.
Ecology	Impact would depend on ecology at the site. Additional impact to terrestrial biota from cooling tower drift. Reduced impact to aquatic ecology.
Water Use and Quality—Surface Water	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated. Decrease water withdrawal and less thermal load on receiving body of water. Increase in consumptive use of water due to evaporation.
Water Use and Quality—Groundwater	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Introduction of cooling towers and associated plume with noise impacts from operation of cooling towers.
Historic and Archaeological Resources	No change
Environmental Justice	No change

NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts listed in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs and sited at JAFNPP or an alternate site. The impacts shown in Table S-3 are for a 1000-MWe reactor. The environmental impacts associated with transporting fuel and waste to and from a light-water cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of

NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR 51 Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using once-through cooling is presented in Section 8.2.3.1 and closed-cycle cooling in Section 8.2.3.2.

8.2.3.1 Once-Through Cooling System

The overall impacts of a nuclear generating system using a once-through cooling system are discussed in this section. The impacts are summarized in Table 8-6. The extent of impacts at an alternate site would depend on the location of the site.

- Land Use

  The existing facilities and infrastructure at the JAFNPP site would likely be used, limiting the amount of new construction that would be required. Existing transmission facilities, roads, parking areas, and cooling system would be used. According to the GEIS, light-water reactors require approximately 500 to 1000 ac excluding transmission lines (these estimates are not scaled to any particular facility size). Much of the land that would be used has been previously disturbed. The JAFNPP site consists of approximately 700 ac and would be adequate to support a new nuclear facility. There would be no net change in land needed for uranium mining because land needed to supply the new nuclear power plant would replace the land no longer needed to supply uranium for fueling the existing reactors at JAFNPP. Overall, the land use impact of a replacement nuclear power plant at the existing JAFNPP site would be SMALL. However, the impact would be greater than the OL renewal alternative.

  Land-use requirements at an alternate site would be similar to siting at JAFNPP except for the possible need for additional land for a new transmission line. In addition, it might be necessary to construct a rail spur to bring in equipment during construction. Depending on transmission line routing, siting a new nuclear power plant at an alternate site would result in MODERATE to LARGE land-use impacts.

- Ecology

  Locating a replacement nuclear power plant at the JAFNPP site would alter ecological resources because of construction and the need to convert currently unused land to industrial use. In total, impacts would include habitat degradation, fragmentation, or loss as a result of construction activities and conversion of land to industrial use. Ecological communities would experience reduced productivity and biological diversity from disturbing previously intact land. Overall, the ecological impacts of the nuclear alternative at the

JAFNPP site would be SMALL. The impact would be greater than the OL renewal alternative.

Table 8-6. Summary of Environmental Impacts of New Nuclear Power Generation at the JAFNPP Site and an Alternate Site Using Once-Through Cooling

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Land Use	SMALL	Would require approximately 500 to 1000 ac for the power plant. The new nuclear power plant would require the use of previously disturbed undeveloped portions of the JAFNPP site. Would use the existing infrastructure to the extent possible.	MODERATE to LARGE	Land use requirements would be larger at the alternate site than at the JAFNPP site because of the potential need for land for a transmission line. Overall, impacts would depend on whether the alternate site had been previously disturbed.
Ecology	SMALL	Would use undeveloped areas at current Nine Mile Point site.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line route; potential habitat loss and fragmentation; and reduced productivity and biological diversity.
Water Use and Quality—Surface Water	SMALL	The nuclear alternative would use the existing once-through cooling system.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and the characteristics of the surface body of water.
Water Use and Quality—Groundwater	SMALL	Groundwater is not used at the JAFNPP site.	SMALL to MODERATE	Impacts would depend on the volume of water withdrawn and the characteristics of the groundwater source.
Air Quality	SMALL	Fugitive emissions and emissions from vehicles and equipment during construction. Small amount of emissions from diesel generators and possibly other sources during operation.	SMALL	Same impacts as JAFNPP site.

Table 8-6 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Waste	SMALL	Waste impacts for an operating a nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same impacts as JAFNPP site.
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set out in 10 CFR 51, Appendix B, Table B-1.	SMALL	Same impacts as JAFNPP site.
Socioeconomics	SMALL to MODERATE	During construction, impacts would be MODERATE. Up to 2500 workers during peak period of the five-year construction period. During operation, employment levels would be similar to those for JAFNPP. Overall, socioeconomic impacts from operation would be SMALL.	SMALL to LARGE	The characteristics of the construction period and operation at an alternate site would be similar to those at JAFNPP. Socioeconomic impacts to the local community would depend on the location of the alternate site and would vary from SMALL to LARGE.
Transportation	SMALL to LARGE	Transportation impacts associated with construction would be MODERATE to LARGE. Transportation impacts associated with operations would be SMALL.	SMALL to LARGE	Transportation impacts associated with construction would be MODERATE to LARGE. Transportation impacts associated with operations would be SMALL to MODERATE.
Aesthetics	SMALL to MODERATE	There would be visual aesthetic impacts associated with power plant buildings and structures. There would be both intermittent and continuous noise impacts from the power plant during construction and operations.	SMALL to LARGE	The significance of the impacts would depend on the location of the alternate site. An alternate site could require transmission lines, with aesthetic impacts.

Table 8-6 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Historic and Archaeological Resources	SMALL to MODERATE	Construction of a new nuclear power plant would require cultural resource studies. Impacts could vary depending on the location of the plant on undeveloped portions of the JAFNPP site and presence of historic and archaeological resources.	SMALL to MODERATE	The impacts at an alternate site would be the same as those for the JAFNPP site.
Environmental Justice	SMALL to MODERATE	Impacts to minority and low-income populations would vary depending on the location of the power plant site and other support facilities.	SMALL to MODERATE	The impacts at an alternate site would be the same as those for the JAFNPP site.

At an alternate site, there would be construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts might alter the ecology. Impacts would include habitat degradation, fragmentation or loss, reduced ecosystem productivity (i.e., including wildlife species), and a reduction in biological diversity. Construction and maintenance of transmission lines, a rail spur, or a barge offloading facility would result in the same types of ecological impacts. Overall, the impacts of the nuclear alternative at an alternate site would be MODERATE to LARGE.

- Water Use and Quality—Surface Water

It is assumed that the replacement nuclear power plant alternative at the JAFNPP site would use the existing once-through cooling system, which would minimize incremental water-use and quality impacts. Surface-water impacts would be expected to remain SMALL. The impacts would be sufficiently minor that they would not noticeably alter any important attribute of the resource.

For an alternate site, the cooling water would likely be drawn from a surface body of water. The impact on the surface water would depend on the volume of water needed and the characteristics of the body of water. The impacts would be SMALL to MODERATE.

- Water Use and Quality—Groundwater

  No groundwater is currently used for operation of JAFNPP, and it is unlikely that groundwater would be used for an alternative nuclear power plant sited at JAFNPP. Use of groundwater for a nuclear power plant sited at an alternate site would be a possibility. Any groundwater withdrawal would require a permit from the local permitting authority.

  Overall, the impacts of the nuclear alternative at the JAFNPP site would be SMALL. The impacts of the nuclear alternative at an alternate site would be SMALL to MODERATE.

- Air Quality

  Construction of a new nuclear power plant sited at JAFNPP or an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. An operating nuclear power plant would have minor air emissions associated with diesel generators and other minor intermittent sources. These emissions would be regulated by NYSDEC. Overall, emissions and associated impacts to air quality of a nuclear power plant at either the JAFNPP site or an alternate site would be SMALL.

- Waste

  The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR 51, Subpart A, Appendix B. Construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts of a new nuclear power plant at either the JAFNPP site or an alternate site would be SMALL.

- Human Health

  Human health impacts for an operating nuclear power plant are set out in 10 CFR 51 Subpart A, Appendix B, Table B-1. Overall, human health impacts of a new nuclear power plant at either the JAFNPP site or an alternate site would be SMALL.

- Socioeconomics

  Construction of the new nuclear power plant would be conducted over a period of five years with a peak workforce of 2500. Construction would take place while the existing nuclear unit would continue operation and would be completed by the time JAFNPP permanently ceased operation.

  If the new nuclear power plant were constructed at the JAFNPP site, the construction workers would be in addition to the employees who currently work at the site. Surrounding communities would experience significant demands on rental housing and public services.

After construction, the local communities would be impacted by the loss of the construction jobs. In addition, the large construction workforce and delivery of construction materials would put significant pressure on existing highways near the JAFNPP site. The construction workforce would also add to the local tax base. In total, the socioeconomic impacts during the construction period for the nuclear alternative at the JAFNPP site would be MODERATE.

At an alternate site, the construction impacts would be similar to those at the JAFNPP site. Impacts would be SMALL to LARGE, depending on the location of the alternate site to a large population center.

It is assumed that the replacement nuclear unit would have an operating workforce comparable to the 716 workers currently working at JAFNPP. The replacement nuclear unit would provide a new tax base to offset the loss of tax base associated with decommissioning JAFNPP. For all of these reasons, the socioeconomic impacts for operating a new nuclear power plant at JAFNPP would be SMALL.

The impacts of operating a new nuclear power plant at an alternate site would be generally larger than those at the JAFNPP site, depending on the proximity of the alternate site to a large population center. Impacts would be SMALL to LARGE, depending on the location of the alternate site.

- <u>Transportation</u>

During the five-year construction period, up to 2500 construction workers would be working at the JAFNPP site in addition to the 716 workers who operate JAFNPP. The addition of the construction workers and the delivery of construction materials and equipment would place significant pressure on existing highways. Impacts would be MODERATE to LARGE. Transportation impacts associated with the operation of JAFNPP would be SMALL.

Transportation-related impacts associated with commuting construction workers and the delivery of construction materials and equipment at an alternate site would be site-dependent and would be MODERATE to LARGE. Transportation impacts associated with operations would also be site-dependent and would be SMALL to MODERATE.

- <u>Aesthetics</u>

The nuclear alternative would result in both visual and noise aesthetic impacts. Visual impacts would result from several structures, including, most prominently, the containment building. The replacement nuclear units would also likely be visible at night because of outside lighting. Visual impacts at night would be mitigated by reduced lighting and appropriate shielding. Overall, the visual aesthetic impacts of the nuclear alternative at the JAFNPP site would be MODERATE.

At an alternate site, the aesthetic impacts would be larger. There would also be aesthetic impacts associated with the need for new transmission lines. Light from the new nuclear power plant would be detectable offsite. The impact of light could be mitigated if the power plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with an alternate site would be MODERATE to LARGE including the aesthetic impact of a new transmission line.

Nuclear generation would introduce continuous and intermittent sources of noise from power plant operations. Continuous sources of noise include the mechanical equipment associated with normal power plant operations. Intermittent sources include the use of outside loudspeakers and those associated with the workforce. At the JAFNPP site, power plant-operation noises would be similar to existing noise levels from current power plant operations. Noise impacts of the nuclear alternative at JAFNPP would be SMALL. At an alternate site, noise impacts would be SMALL to LARGE, depending on the location of the site.

- Historic and Archaeological Resources

At both JAFNPP and an alternate site, a cultural resource inventory would be needed for any undeveloped portions of the site that had not been previously surveyed. Other properties, if any, that were acquired to support the power plant would also need to be surveyed for cultural resources, prior to ground-disturbing activities at the power plant site.

Before construction at JAFNPP or an alternate site, studies would be needed to identify, evaluate, and address the potential impacts of new power plant construction on cultural resources. These studies would be needed for all areas of potential disturbance at the proposed power plant site, other support facilities, and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, other ROWs). Historic and archaeological resource impacts would generally be effectively managed and as such would be SMALL to MODERATE depending on location and presence of cultural resources.

- Environmental Justice

Impacts on minority and low-income populations associated with a replacement nuclear power plant at JAFNPP or an alternate site in New York State would depend on the location of the site and population distribution. Impacts on housing availability and prices during power plant construction could disproportionately affect minority and low-income populations. Closure of JAFNPP and construction of a replacement nuclear power plant at an alternate site would result in the loss of approximately 716 jobs causing economic conditions that could affect employment prospects for minority or low-income populations in the vicinity of JAFNPP. Depending on the plant location, overall impacts could vary between SMALL and MODERATE.

8.2.3.2 Closed-Cycle Cooling System

This section discusses the environmental impacts of constructing at an alternate site a nuclear power plant that uses a closed-cycle cooling system with a cooling tower. The impacts (SMALL, MODERATE, or LARGE) of this option would be similar to the impacts for a nuclear power plant using a once-through cooling system. However, there would be minor environmental differences between the closed-cycle and once-through cooling systems. Table 8-7 summarizes the incremental differences.

Table 8-7. Summary of Environmental Impacts of a New Nuclear Power Plant Sited at an Alternate Site with Closed-Cycle Cooling

Impact Category	Change in Impacts from Once-Through Cooling System
Land Use	20 to 30 ac of land would be required on previously disturbed undeveloped land for cooling towers and associated infrastructure.
Ecology	Impacts would depend on ecology at the site. Additional impact to terrestrial ecology from cooling tower drift. Reduced impact to aquatic ecology.
Water Use and Quality—Surface Water	Discharge of cooling tower blowdown containing dissolved solids. Discharge would be regulated by the State of New York. Decreased water withdrawal and less thermal load on receiving body of water. Consumptive use of water due to evaporation from cooling towers.
Water Use and Quality—Groundwater	No change
Air Quality	No change
Waste	No change
Human Health	No change
Socioeconomics	No change
Transportation	No change
Aesthetics	Introduction of cooling towers and associated plume. Natural draft towers would be up to 520 ft tall. Mechanical draft towers would be up to 100 ft tall and would have an associated noise impact.
Historic and Archaeological Resources	No change
Environmental Justice	No change

8.2.4 Purchased Electrical Power

If available, purchased power from other sources would potentially obviate the need to renew the JAFNPP OL. The New York State energy plan (NYSERDA 2002) is designed to promote competition in energy supply markets by facilitating participation by non-utility suppliers. A regulatory structure is in place to appropriately anticipate and meet electricity demands. The New York Independent System Operator (NYISO) anticipates that adequate supplies of electricity will be available to meet anticipated future demands through at least 2021. In theory, purchased power is a feasible alternative to JAFNPP license renewal. There is no assurance, however, that sufficient capacity or energy would be available during the entire time frame of 2014 to 2034 to replace the approximately 881 MWe of baseload generation from JAFNPP. For example, EIA projects that total gross U.S. imports of electricity from Canada and Mexico will gradually increase from 38.4 billion kWh in year 2001 to 48.9 billion kWh in year 2005 and then gradually decrease to 24.4 billion kWh in year 2020 (DOE/EIA 2004). On balance, it appears unlikely that electricity imported from Canada or Mexico would be able to replace JAFNPP's generating capacity.

If power to replace JAFNPP capacity were purchased from sources in the U.S. or from a foreign country, the generating technology would likely be one of those described in this draft SEIS and in the GEIS (i.e., coal, natural gas, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the purchased electrical power alternative to renewal of the JAFNPP OL. Thus, the environmental impacts of imported power would still occur but would be located elsewhere within the region, nation, or in another country. For these reasons, the NRC staff does not believe that purchasing power to make up for the generation at JAFNPP is a meaningful alternative that requires independent analysis.

8.2.5 Other Alternatives

Other generation technologies considered by NRC are discussed in Sections 8.2.5.1 through 8.2.5.11.

8.2.5.1 Oil-Fired Generation

EIA projects that oil-fired power plants will account for very little of the new generation capacity in the U.S. through the year 2030 because of higher fuel costs and lower efficiencies (DOE/EIA 2007). Oil-fired operation is more expensive than nuclear or coal-fired operation. Future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. Increasing domestic concerns over oil security will only exacerbate the move away from oil-fired electricity generation. Therefore, the NRC staff does not consider oil-fired generation by itself a feasible alternative to the baseload generation of JAFNPP.

8.2.5.2 Wind Power

Wind power, by itself, is not suitable for large baseload capacity. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittency, and average annual capacity factors for wind power plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing baseload power. However, current energy storage technologies are too expensive for wind power to serve as a large baseload generator.

Most of western New York is in wind-power Class 2 or 3, in which the average wind speed is 4.4 to 5.6 meters per second (m/s) (Elliott et al. 1986). There is a narrow band of Class 3 and 4 areas along Lake Ontario. Wind turbines are economical in Class 3 through 7 areas, in which the average wind speeds are 7.0 to >8.8 m/s (DOE 2005). Wind turbines typically operate at 25 to 35 percent capacity factor compared to 80 to 95 percent for a baseload power plant (NWPPC 2000). Because the largest commercially available wind turbines produce in the range of 1 MW to 3 MW, 294 to 881 units would be required to replace the JAFNPP generating capacity.

As of September 2006, there were approximately 280 MW of grid-connected wind-power facilities in New York State, with an additional 255 MW of additional capacity in various stages of planning (AWEA 2006). The New York State Energy Research and Development Authority (NYSERDA) estimates there is a statewide potential for approximately 17,000 MW of installed capacity, of which approximately 3200 MW would be available for the peak summer load (NYSERDA 2002). Access to many of the best wind-power sites would require extensive road building, clearing (for towers and blades), and leveling (for the tower bases and associated facilities) in steep terrain. Also, many of the best quality wind sites are on ridges and hilltops that would have greater archeological sensitivity than surrounding areas. For these reasons, development of large-scale, land-based wind-power facilities are likely to be costly and would have MODERATE to LARGE impacts on aesthetics, archaeological resources, land use, and terrestrial ecology.

The offshore wind speeds on Lake Ontario are higher than those onshore and would thus support greater energy production than onshore facilities. Development of an offshore wind-power facility would impact shipping lanes, may disrupt the aquatic ecology, and would be visible for many miles, resulting in considerable aesthetic impacts. These impacts would be MODERATE to LARGE.

For these reasons, the NRC staff concludes that wind power alone is not a feasible substitute at this time for the baseload generation from JAFNPP. However, the NRC staff recognizes that wind power projects are being developed in areas with significant wind potential. Therefore, it is reasonable to include wind power in a combination of alternatives that would replace the generation from JAFNPP. Combined alternatives are discussed in Section 8.2.6.

8.2.5.3 Solar Power

Solar technologies use the sun’s energy and light to provide heat, cooling, light, hot water, and electricity for homes, businesses, and industry. Solar-power technologies, both photovoltaic and thermal, cannot currently compete with conventional fossil-fuel technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. The average capacity factor for photovoltaic cells is approximately 25 percent and for solar thermal systems, 25 to 40 percent. These capacity factors are low because solar power is an intermittent resource, providing power when the sun is strong, whereas JAFNPP provides constant baseload power. Solar technologies simply cannot make up for the capacity from JAFNPP when the sun is not shining.

There can be substantial impacts to natural resources (e.g., wildlife habitat, land use, aesthetics) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high. Based on the land requirement of 14 ac for every 1 MWe generated, over 12,000 ac would be required to replace the approximately 881 MWe produced by JAFNPP. There is not enough land for either type of solar electric system at the existing JAFNPP site, and both would have large environmental impacts at an alternate site.

The construction impacts would be similar to those associated with a large wind farm, as discussed in Section 8.2.5.2. The operating facility would also have considerable aesthetic impact.

Because of the natural resource impacts (land, ecological, and aesthetic), and high technology costs, solar power is not deemed a feasible baseload alternative to license renewal of JAFNPP. However, the NRC staff recognizes that distributed solar power does provide generation and that during the license renewal period, generation from solar power could continue to grow. Therefore, it is reasonable to include solar power in combinations of alternatives to replace the generation from JAFNPP. Combined alternatives are discussed in Section 8.2.6.

8.2.5.4 Hydropower

New York State has a technical potential for 2527 MW of additional installed hydroelectric capacity by the year 2022, only 909 MW of which represents summer peak capacity. If all this capacity were developed, it would be enough to replace the 881-MW generating capacity of JAFNPP. However, as stated in Section 8.3.4 of the GEIS, hydropower’s percentage of U.S. generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern about flooding, destruction of natural habitat, and alteration of natural river courses. DOE/EIA states that potential sites for hydroelectric dams have already been largely established in the U.S., and environmental concerns are expected to prevent the development of any new sites (DOE/EIA 2002).

The NRC staff estimates in the GEIS that land requirements for hydroelectric power are approximately 1 million ac per 1000 MWe. Replacement of JAFNPP generating capacity would require flooding slightly less than this amount of land. Due to the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace JAFNPP, the NRC staff concludes that local hydropower is not a feasible alternative to JAFNPP OL renewal on its own. Any attempts to site hydroelectric facilities large enough to replace JAFNPP would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, the NRC staff states in the GEIS that geothermal technology is not widely used as baseload generation because of the limited geographical availability of the resource and immature status of the technology. As illustrated by Figure 8.4 in the GEIS, geothermal power plants are most likely to be sited in the western continental U.S., Alaska, and Hawaii where geothermal reservoirs are prevalent. A study commissioned by NYSERDA and the DOE, completed in 1996, found that there is some potential for geothermal electric power production in western upstate New York but that high cost inhibits its development (NRC 2006). Therefore, the NRC staff concludes that geothermal energy is not a feasible alternative to renewal of the JAFNPP OL.

8.2.5.6 Wood Waste

The use of wood waste to generate electricity is limited largely to states with significant wood resources, such as California, Georgia, Maine, Michigan, Minnesota, Oregon, and Washington. Electric power is generated in these states by the pulp, paper, and paperboard industries, which consume wood and wood waste for energy, benefiting from the use of waste materials that would otherwise represent a disposal problem.

The NRC staff states in the GEIS that a wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency. The required fuels are variable and site-specific. A significant barrier to using wood waste to generate electricity is the high delivered-fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants generate only 40 to 50 MWe. The overall construction impact per MW of installed capacity is estimated in the GEIS to be approximately the same as that for a coal-fired power plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired power plants, wood-waste power plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion, loss of wildlife habitat), and high inefficiency, the NRC staff has determined that wood waste is not a feasible alternative to renewing the JAFNPP OL.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2006). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the U.S. This group of technologies process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion.

Growth in the municipal waste combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive waste disposal alternative such as landfills; (2) the 1994 Supreme Court decision *C&A Carbone, Inc. v. Town of Clarkstown, New York*, 511 U.S. 383, which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (DOE/EIA 2001).

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term, but it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining in real terms.

Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash is the portion of unburned waste that falls to the bottom of the grate or furnace. Fly ash is the small particles that rise from the furnace during combustion. Fly ash is generally removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently there are approximately 89 waste-to-energy power plants operating in the U.S. These power plants generate approximately 2800 MWe or an average of 31.5 MWe per power plant (IWSA 2006), which is much smaller than needed to replace the 881 MWe of JAFNPP.

The NRC staff states in the GEIS that the initial capital costs for municipal solid-waste power plants are greater than for comparable steam-turbine technology at wood-waste facilities, due to the need for specialized waste-separation and -handling equipment for municipal solid waste. Furthermore, the overall construction impact from a waste-fired power plant is estimated in the GEIS to be approximately the same as that for a coal-fired power plant. Additionally, waste-fired power plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be MODERATE but still larger than the environmental effects of license renewal of JAFNPP. Therefore, municipal solid waste would not be a feasible alternative to renewal of the JAFNPP OL, particularly at the scale required.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS, the NRC staff points out that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload power plant such as JAFNPP. For these reasons, such fuels do not offer a feasible alternative to renewal of the JAFNPP OL.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and therefore do not have the environmental impacts of combustion. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. These fuel cells are commercially available at approximately $4500 per kW of installed capacity (DOE 2006). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

DOE has launched a major initiative, the Solid State Energy Conversion Alliance, to bring about dramatic reductions in fuel cell costs. The goal is to cut the cost to as low as $400 per kW by 2010, which would make fuel cells competitive for virtually every type of power application (DOE 2006). For comparison, the installed capacity cost for a natural gas-fired, combined-cycle power plant is about $400 per kW (DOE 2006). At present, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation and are consequently not a feasible alternative to renewal of the JAFNPP OL.

8.2.5.10 Delayed Retirement

As noted in the GEIS, extending the lives of existing non-nuclear generating power plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. Even without retiring any generating units, Entergy expects to require additional capacity in the near future. Thus, even if substantial capacity were scheduled for retirement and would be delayed, some of the delayed retirement would be needed just to meet load growth.

Older power plants that may be candidates for retirement tend to use less efficient generation and pollution control technologies than modern power plants. Therefore, substantial upgrades are typically required to achieve efficiencies necessary to cost effectively extend operations and meet applicable environmental standards.

The GEIS states that NYISO load and capacity projections assume that nuclear generating units in the State will cease operation upon expiration of their current OLs but do not acknowledge retirement of any non-nuclear generating units in the State from 2005 through 2021. Therefore, any such retirements that do occur in this period would merely act to further increase projected demand.

Based on this information, the NRC staff concluded that delayed retirement of other Entergy generating units would not be a feasible alternative to renewal of the JAFNPP OL.

8.2.5.11 Utility-Sponsored Conservation

The utility-sponsored conservation alternative refers to a situation in which JAFNPP ceases to operate, no new generation is brought online to meet the lost generation, and the lost generation is replaced by more efficient use of electricity. More efficient use would arise from utility-sponsored conservation programs, potentially including energy audits, incentives to install energy-efficient equipment, and informational programs to inform electricity consumers of the benefits of, and possibilities for, electricity conservation.

Demand-side management resource strategies aimed at increasing energy efficiency on the customer side of the electric meter generally fall under the following categories:

- Energy efficiency-selecting equipment that performs the same work with less energy input

- Load response-customers who agree to respond to utility requests to reduce use during times of utility peak demand

- Load management, which encourages customers to reduce their usage during peak times of day and peak season through the use of time-of-use rates, seasonal rates, and interruptible contracts

- Direct load control, in which a utility interrupts power supply to customer equipment

Typically, demand-side management induced load reductions are acknowledged in load forecasts and cannot therefore be used as credits to offset the power generated by JAFNPP. As a practical matter, it would be impossible to increase the energy savings by an additional 881 MWe to replace the JAFNPP generating capability, particularly in upstate New York, which represents a relatively small fraction of electrical load in the State.

Therefore, the NRC staff does not consider energy efficiency, by itself, a feasible alternative to license renewal. However, the NRC staff recognizes that energy conservation is promoted and that increases in energy efficiency occur as a normal result of replacing older equipment with modern equipment. It is reasonable to include conservation in a combination of generation sources that would replace JAFNPP. Combined alternatives are discussed in Section 8.2.6.

8.2.6 Combination of Alternatives

Even though individual alternatives to JAFNPP might not be sufficient on their own to replace JAFNPP capacity due to the small size of the resource or lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost-effective.

There are many possible combinations of alternatives. As discussed previously, these combinations would include baseload gas-fired or coal-fired power plants, purchased power, alternative and renewable technologies, and conservation. For the purpose of this discussion, one combination of alternatives has been assumed: 600 MWe of generation from a combined-cycle facility at the JAFNPP site, 81 MWe of energy conservation, and 200 MWe purchased from other generators. The impacts of other combinations, such as those from combinations that include wind or solar power, would be different and possibly less than the assumed combination. In some areas, such as the aesthetic impact of solar panel or wind turbines, the impacts would be at least as large as the impact of the assumed combination of alternatives. In other areas, such as waste, impacts would be smaller for these alternative technologies.

Table 8-8 contains a summary of the environmental impacts of an assumed combination. The impacts associated with the combined-cycle natural gas-fired units are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generation capacity. While the demand-side management measures would have few environmental impacts, operation of the new natural gas-fired power plant would result in increased emissions and environmental impacts. The environmental impacts associated with power purchased from other generators would still occur but would be located elsewhere within the region or nation, as discussed in Section 8.2.4. The impacts of purchased power are not shown in Table 8-8. The NRC staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options would be reduced to the level of impacts associated with renewal of the JAFNPP OL.

8.3 Summary of Alternatives Considered

As indicated in Chapter 4 of this draft SEIS, the environmental impacts of the proposed action, license renewal of JAFNPP, are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned). The alternative actions, i.e., no-action alternative (discussed in Section 8.1), new generation alternatives (from coal, natural gas, and nuclear discussed in Sections 8.2.1 through 8.2.3, respectively), purchased electrical power (discussed in Section 8.2.4), alternative technologies (discussed in Section 8.2.5), and the combination of alternatives (discussed in Section 8.2.6) were considered.

1 **Table 8-8**. Summary of Environmental Impacts of an Assumed Combination of Generation—
2 Does Not Include Impacts from Purchased Generation Once-Through Cooling Alternative

Impact Category	JAFNPP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land Use	SMALL to MODERATE	The natural gas-fired power plant would be constructed on undeveloped portions of the JAFNPP site. It would require upwards of 110 ac for power block, offices, roads, parking areas, and a gas pipeline ROW. It would use existing infrastructure, minimizing new land requirements. There would be additional land impacts for construction of an underground gas pipeline.	SMALL to LARGE	Land-use requirements would be larger at an alternate site than at the JAFNPP site because of the need for additional infrastructure such as transmission facilities, roads, parking areas, office buildings, and cooling system. The total impact would depend on whether the alternate site had been previously disturbed.
Ecology	SMALL to MODERATE	The natural gas-fired alternative would use undeveloped areas at the JAFNPP site. There would be potential for significant habitat loss and fragmentation and reduced productivity and biological diversity.	SMALL to LARGE	Impacts would depend on whether the alternate site had been previously developed. Factors to consider include location and ecology of the site and transmission line route. In total, impacts would include habitat degradation, fragmentation or loss as a result of construction activities and conversion of land to industrial use. Ecological communities might experience reduced productivity and biological diversity from disturbing previously intact land.

Table 8-8 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Water Use and Quality—Surface Water	SMALL	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use existing once-through cooling system to the degree necessary.	SMALL to MODERATE	Combined-cycle units have lower water requirements than nuclear and coal-fired power plants. The natural gas-fired alternative would use closed-cycle cooling to the degree necessary. Total impacts would depend on the volume of water withdrawal, the constituents of the discharge water, the characteristics of the surface water or groundwater source, and the required new intake structures.
Water Use and Quality—Groundwater	SMALL	Use of groundwater is very unlikely.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge.
Air Quality	MODERATE	• Sulfur oxides: 34 tons/yr • Nitrogen oxides: 109 tons/yr • Carbon monoxide: 7 tons/yr • PM_{10} particulates: 126 tons/yr • Other: (1) hazardous air pollutants, including arsenic, formaldehyde, and nickel and (2) carbon dioxide emissions, which contribute to global warming.	MODERATE	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.

Table 8-8 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Waste	SMALL	Minimal waste product from fuel combination.	SMALL	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.
Human Health	SMALL	Impacts would be minor.	SMALL	The impacts at an unnamed alternate site would be the same as those for the JAFNPP site.
Socioeconomics	SMALL to MODERATE	During power plant construction, impacts would be MODERATE. Construction activities would place noticeable burdens on existing infrastructure, including housing and transportation. During plant operations, employment would decrease from 716 permanent workers to approximately 50. Impacts on housing and vitality of the local economy would be negative. Overall, socioeconomic impacts from operation would be SMALL.	SMALL to LARGE	Construction and operation impacts at an alternate site would be similar to those at the JAFNPP site. Socioeconomic impacts to the local community would depend on the location of the alternate site and would vary from SMALL to MODERATE.
Transportation	MODERATE	Construction-related transportation impacts would be MODERATE.	MODERATE	Transportation impacts of the natural gas-fired alternative at an alternate site would be similar to those at the JAFNPP site.

Table 8-8 (cont.)

Impact Category	JAFNPP Site		Alternate Site	
	Impact	Comments	Impact	Comments
Aesthetics	SMALL	There would be visual aesthetic impacts associated with power plant buildings and structures. There would be both continuous and intermittent noise impacts from power plant operation.	MODERATE to LARGE	Visual aesthetic impacts would be similar to the JAFNPP site, but the significance of the impacts would depend on the location of the alternate site. The natural gas-fired power plant at an alternate site could require transmission lines, with attendant aesthetic impacts.
Historic and Archeological Resources	SMALL to MODERATE	Cultural resource studies would be needed to identify, evaluate, and address the mitigation of potential cultural resource impacts from the construction of a new power plant.	SMALL to MODERATE	The historic and archaeological resource impacts of the natural gas-fired power plant at an alternate site would be similar to those at the JAFNPP site.
Environmental Justice	SMALL to MODERATE	Impacts to minority and low-income populations would vary depending on the location of the power plant site and other support facilities.	SMALL to MODERATE	The impacts at an alternate site would be the same as those for the JAFNPP site.

The no-action alternative would require the replacement of electrical generating capacity by (1) demand-side management and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than JAFNPP, or (4) some combination of these options. For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would not be less than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of JAFNPP. The impacts of purchased electrical power (imported power) would still occur but would occur elsewhere. Alternative technologies are not considered feasible at this time for complete power replacement, and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options would be reduced to the level of impacts associated with renewal of the JAFNPP OL.

The NRC staff concludes that the alternative actions, including the no-action alternative, may have environmental effects in at least some of the impact categories that would reach MODERATE or LARGE significance.

8.4 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 Functions."

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy,* Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

40 CFR Part 51. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

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9.0 SUMMARY AND CONCLUSIONS

By letter dated July 31, 2006, Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating license (OL) for James A. FitzPatrick Nuclear Power Plant (JAFNPP) for an additional 20-year period (Entergy 2006a). If the OL is renewed, State regulatory agencies and Entergy will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OL is not renewed, then the plant must be shut down on or before the expiration of the current OL, which expires on October 17, 2014.

Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4321) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Part 51 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 51). Part 51 identifies licensing and regulatory actions that require an EIS. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[1]

Upon acceptance of the Entergy application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing on September 20, 2006, a Notice of Intent to prepare an EIS and conduct scoping (NRC 2006a). The NRC staff held public scoping meetings on October 12, 2006, in Oswego, New York (NRC 2006b), and conducted a site audit in December 2006 (NRC 2007b). The NRC staff reviewed Entergy's environmental report (ER) for JAFNPP (Entergy 2006b) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The NRC staff also considered the public comments received during the scoping process for preparation of this draft supplemental environmental impact statement (draft SEIS) for JAFNPP (NRC 2007a). The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A of this draft SEIS.

The NRC staff will hold two public meetings in Oswego, New York, in August 2007, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating their comments on this draft

(1) The GEIS was issued in 1996, and Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to GEIS include Addendum 1.

SEIS. When the comment period ends, the NRC staff will consider and address all of the comments received. These comments will be addressed in Appendix A of the final SEIS.

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, including cumulative impacts, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse effects. This draft SEIS also includes the NRC staff's preliminary recommendation regarding the proposed action.

The NRC has adopted the following statement of purpose and need for license renewal from the GEIS:

> 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) decision makers.

The evaluation criterion for the NRC staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

> ... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates

92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

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

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

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

For 69 of the 92 issues considered in the GEIS, the NRC staff analysis in the GEIS shows the following:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the NRC staff relied on conclusions in the GEIS for issues designated Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. The NRC staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis in the GEIS and must be addressed in the draft SEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OL for JAFNPP) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the JAFNPP site or some other unspecified location.

9.1 Environmental Impacts of the Proposed Action-License Renewal

Entergy and the NRC staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Entergy nor the NRC staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process, Entergy, nor the NRC staff has identified any new issue applicable to JAFNPP that has a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to JAFNPP.

Entergy's license renewal application presents an analysis of the Category 2 issues that are applicable to JAFNPP, plus environmental justice (Entergy 2006b). The NRC staff has reviewed the Entergy analysis for each issue and has conducted an independent review of each issue plus environmental justice. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at JAFNPP. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. Entergy has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of JAFNPP, for the license renewal period (Entergy 2006b). In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement and, therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the *Final Environmental Statement Related to Operation of James A. FitzPatrick Nuclear Power Plant* (AEC 1973).

Eleven Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. Four of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 11 Category 2 issues and environmental justice, the NRC staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. For severe accident mitigation alternatives (SAMAs), the NRC staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for

JAFNPP, and the plant improvements already made, the NRC staff concludes that none of the candidate SAMAs are cost-beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, where JAFNPP license renewal impacts are deemed to be SMALL, the NRC staff concluded that these impacts would not result in significant cumulative impacts on potentially affected resources.

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

The adverse impacts of continued operation identified are considered to be of SMALL significance, and none warrants implementation of additional mitigation measures. The adverse impacts of likely alternatives if JAFNPP ceases operation at or before the expiration of the current OL will not be smaller than those associated with continued operation of this unit, and they may be greater for some impact categories in some locations.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of the JAFNPP during the current license period was made when the plant was built. The resource commitments to be considered in this draft SEIS are associated with continued operation of the plant for an additional 20 years. These resources include materials and equipment required for plant maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent offsite storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent storage space. JAFNPP replaces approximately one third of its fuel assemblies during routine refueling outages, typically every 24 months (Entergy 2006b).

The likely power-generation alternatives if JAFNPP ceases operation on or before the expiration of the current OL will require a commitment of resources for construction of the replacement plants as well as for fuel to run the plants.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the JAFNPP site was set when the plant was approved and construction began. That balance is now well established. Renewal of the OL for JAFNPP and continued operation of the plant will not alter the existing balance but may postpone the availability of the site for other uses. Denial of the application to renew the OL will lead to shutdown of the plant and will alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the JAFNPP site into a park or an industrial facility are quite different.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is renewal of the OL for JAFNPP. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at JAFNPP. Chapters 4 through 7 discuss environmental issues associated with renewal of the OL. Environmental issues associated with the no-action alternative and alternatives involving power generation and use reduction are discussed in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OL), the no-action alternative (denial of the application), alternatives involving nuclear or gas- or coal-fired generation of power at the JAFNPP site and an unspecified “alternate site,” and a combination of alternatives are compared in Table 9-1. Continued use of a closed-cycle cooling system for JAFNPP is assumed for Table 9-1.

Substitution of once-through cooling for the recirculating cooling system in the evaluation of the nuclear and gas- and coal-fired generation alternatives would result in somewhat greater environmental impacts in some impact categories.

Table 9-1 shows that the significance of the environmental effects of the proposed action is SMALL for all impact categories (except for collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, for which a single significance level was not assigned [see Chapter 6]). The alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Power Generation

	Proposed Action	No-Action Alternative	Coal-Fired Generation	Natural-Gas-Fired Generation		New Nuclear Generation		Combination of Alternatives	
Impact Category	**License Renewal**	**Denial of Renewal**	**Alternate Site**	**JAFNPP site**	**Alternate Site**	**JAFNPP Site**	**Alternate Site**	**JAFNPP Site**	**Alternate Site**
Land Use	SMALL	NO IMPACT	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE
Ecology	SMALL	SMALL	MODERATE to LARGE	MODERATE	SMALL to MODERATE	SMALL	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE
Water Use and Quality—Surface Water	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Use and Quality—Groundwater	SMALL	SMALL	SMALL to MODERATE	NO IMPACT	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	MODERATE	SMALL	SMALL	MODERATE	MODERATE
Waste	SMALL	SMALL	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL[(a)]	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL	MODERATE to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE
Transportation	SMALL	SMALL	SMALL to LARGE	MODERATE	MODERATE	SMALL to LARGE	SMALL to MODERATE	MODERATE	MODERATE
Aesthetics	SMALL	NO IMPACT	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL	MODERATE to LARGE
Historic and Archaeological Resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Environmental Justice	SMALL	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE

(a) Except for collective offsite radiological impacts from the fuel cycle and from HLW and spent-fuel disposal, for which a significance level was not assigned. See Chapter 6 for details.

9.3 NRC Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS, (2) the ER submitted by Entergy (Entergy 2006b), (3) consultation with Federal, State, and local agencies, (4) the NRC staff's own independent review, and (5) the NRC staff's consideration of public comments received, the preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for JAFNPP are not so great that preserving the option of license renewal for energy planning decision makers would be unreasonable.

9.4 References

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 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

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Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy). 2006b. *James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: Applicant's Environmental Report, Operating License Renewal Stage.* Lycoming, New York. Accessible at ML062160557.

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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, Volume 1, Addendum 1. Office of Nuclear Regulatory Research, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal. NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2006a. "Notice of Acceptance for Docketing of the Application, Notice of Opportunity for Hearing and Notice of Intent to prepare an Environmental Impact Statement and Conduct Scoping Process of Facility Operating License No. DPR-59 for an Additional 20-Year Period, Entergy Nuclear Operations, Inc., James A. FitzPatrick Nuclear Power Plant." Federal Register: Vol. 71, No. 182, pp. 55032-55035. Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2006b. NRC press release announcing Public License Renewal Process and Environmental Scoping Meeting Associated with the Application to Renew the Operating License for JAFNPP. Accessible at ML062760465

U.S. Nuclear Regulatory Commission (NRC). 2007a. Letter to M. Kansler, Entergy. Subject: Environmental Scoping Summary Report. March 2, 2007. Accessible at ML070440393.

U.S. Nuclear Regulatory Commission (NRC). 2007b. *Environmental Scoping Summary Report Associated with the Staff's Review of the Application by Entergy for Renewal of the Operating License for JAFNPP.* Washington, D.C. Accessible at ML070440393.

Appendix A

Comments Received on the Environmental Review

Appendix A:
Comments Received on the Environmental Review

On September 20, 2006, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (71 FR 55032) to notify the public of the NRC staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999),[(1)] related to the renewal application for the James A. FitzPatrick Nuclear Power Plant (JAFNPP) operating license and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) guidance, and Title 10 of the *Code of Federal Regulations*, Part 51 (10 CFR Part 51). As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, State, and local government agencies; Native American tribal organizations; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or submitting comments by November 14, 2006.

The scoping process included two public scoping meetings, which were held at the Town of Scriba Municipal Building in Oswego, New York, on October 12, 2006. The NRC issued press releases and distributed flyers locally. Approximately 14 members of the public attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process. Following the NRC's prepared statements, the meetings were open for public comments. Three attendees provided either oral comments or written statements that were recorded and transcribed by a certified court reporter, and written comments were appended to the transcript. The transcripts of the meetings are an attachment to the meeting summary, which was issued on October 30, 2006 (meeting transcripts, ML063030195 and ML063030209; meeting summary, ML062980148). The documents are publicly available and can be found at the Agencywide Documents Access and Management System (ADAMS) at http://adamswebsearch.nrc.gov/dologin.html or through the NRC's Electronic Reading Room link at http://www.nrc.gov. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC's Public Document Room staff at 1-800-397-4209 or 301-415-4737, or by email at pdr@nrc.gov.

At the conclusion of the scoping period, the NRC staff reviewed the transcripts and all written material received and identified individual comments. Each set of comments from a given commenter was given a unique alpha identifier (Commenter ID letter), allowing each set of comments from a commenter to be traced back to the transcript, letter, or email in which the comments were submitted. Specific comments were numbered sequentially within each comment set. All of the comments received and the NRC staff responses are included in the JAFNPP Scoping Summary Report dated March 2, 2007 (ML070440393).

Comments were consolidated and categorized according to the topic within the proposed supplement to the GEIS or according to the general topic if outside the scope of the GEIS. Comments with similar specific objectives were combined to capture the common essential issues that had been raised in the source comments. Once comments were grouped according to subject area, the NRC staff determined the appropriate action for the comment.

Table A-1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set(s) of comments. The individuals are listed in the order in which they spoke at the public meeting, and in the alphabetical order for the comments received by letter. To maintain consistency with the Scoping Summary Report, the unique identifier used in that report for each set of comments is retained in this appendix. The Commenter ID is preceded by FNP, which stands for James A. FitzPatrick Nuclear Power Plant scoping. Accession numbers indicate the location of the written comments in ADAMS.

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

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 or Category 2 issues or issues that were not addressed in the GEIS. They also address alternatives and related Federal actions.

- General comments (1) in support of or opposed to nuclear power or license renewal or (2) on the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the JAFNPP license renewal application.

- Questions that do not provide new information.

- Specific comments that address issues that do not fall within or are specifically excluded from the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

Comments applicable to this environmental review and the NRC staff's responses are summarized in this appendix. The parenthetical alpha-numeric identifier after each comment refers to the comment set (Commenter ID) and the comment number. This information, which was extracted from the JAFNPP Scoping Summary Report, is provided for the convenience of those interested in the scoping comments applicable to this environmental review. The comments that are general or outside the scope of the environmental review for JAFNPP are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report. The ADAMS accession number for the Scoping Summary Report is ML070440393. This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) at http://www.nrc.gov/reading-rm.html.

Comments in this section are grouped into the following categories:

A.1.1 Aquatic Ecology
A.1.2 Socioeconomics
A.1.3 Postulated Accidents
A.1.4 Uranium Fuel Cycle and Waste Management

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

Commenters' ID	Commenter	Affiliation (If stated)	Comment Source, ADAMS Accession Number[(a)]
FNP-A	Ed Putnam	Candidate, New York State Assembly	Afternoon Scoping Meeting
FNP-B	Tim Judson	Citizens Awareness Network (CAN)	Evening Scoping Meeting
FNP-C	Tom Dellwo	CAN	Evening Scoping Meeting
FNP-D	Joseph J. Heath	General Counsel, Onondaga Nation	Letter (ML063240283)
FNP-E	Christopher M. Hogan	Project Manager, New York State Department of Environmental Conservation	Letter (ML063240331)

(a) The afternoon and evening transcripts can be found under accession numbers ML063030195 and ML063030209, respectively.

Comments Received During Scoping

A.1.1 Aquatic Ecology Issues

Comment: [Environmental Report] Appendix E; Section 4.2: Entrainment of Fish and Shellfish in Early Life Stages, and Section 4.3: Impingement of Fish and Shellfish Statements regarding previous Departmental Best Technology Available (BTA) decisions for FitzPatrick are overstated. While in 1996 and 2001 the Department determined that the high frequency/high amplitude acoustic fish deterrent system (FDS) was BTA for reducing impingement, the Department did not state that the FDS was BTA for reducing entrainment. In fact, the letter Entergy used as a reference specifically states, "Moreover, the fish deterrent system has not been evaluated as an entrainment mitigative device..." In addition, while the State Pollution Discharge Elimination System (SPDES) Permit Fact Sheet that accompanied the 1996 and

2001 SPDES permits discussed the *potential* benefit of the FDS for reducing alewife entrainment, it referenced the need for studies to determine the effectiveness of the FDS system on larval life stages of alewives. Requirements for these studies were made part of the SPDES permit, but Department records indicate that the study was never conducted.

Even if the study had been completed and the Department had made a BTA determination regarding entrainment, documented changes in the fish community in Lake Ontario (as described in Appendix E, Section 2.2.4 of the license renewal application) compel a review of previous determinations to determine if changes are warranted. To that end, Entergy is currently conducting biological sampling at FitzPatrick to determine the extent of current impacts. Data from this sampling will be included in a *Comprehensive Demonstration Study* that Entergy must submit to the Department in early 2008. A new BTA decision will be based, in part, on the *Comprehensive Demonstration Study*. Thus, conclusory statements that entrainment impacts do not warrant mitigation are premature. Decisions regarding the need for mitigation will be addressed via the SPDES permit process. (FNP-E-1)

Comment: [Environmental Report] Section 6.2 Mitigation. Entergy's contention that “the current permits, practices, and programs that mitigate the environmental impacts of plant operations are adequate (page 6-1)” are not necessarily accurate. For example, the decision regarding adequacy of mitigative measures for addressing impacts from impingement and entrainment will be addressed via the SPDES permit process. That permit process will address the adequacy of current practices and, if necessary, will result in requirements for additional measures to reduce impacts. In addition and as explained above, statements in Table 6-1 regarding past BTA determinations are overstated. (FNP-E-2)

Comment: Counter to statements contained in Section 4.2.6, Section 4.3.6, and Table 6-1,federal regulations do not require limiting the focus of mitigation requirements to impacts on fish *populations* (see 10 CFR 51.53(c) and 10 CFR 51.45(c)). In fact, the federal regulations dealing with impingement and entrainment at power plants focus on the reduction in the numbers of individual organisms (see 40 CFR 125-Subparts I and J). (FNP-E-3)

Response: *These comments are related to information regarding entrainment and impingement of fish and shellfish, as provided in the applicant's Environmental Report. Aquatic ecology will be discussed in Chapters 2 and 4 of the SEIS.*

A.1.2 Socioeconomic Issues

Comment: One of the economic factors which affects the retention of current industry in central New York and which also affects the attraction of new industry to this region is the provision of inexpensive, trustworthy, and accessible power. We need this company to be a player in this attempt to bolster the economy of central New York. The Oswego County Public Utility Service offers "low cost electrical energy" to new and expanding business in Oswego County, in the hope that it will inspire new jobs and retain existing jobs through the low-cost electricity provided by Entergy at the FitzPatrick plant. This is a positive initiative, which has begun to be shared with the local economic community.

A similar form of utility incentive for domestic usage would be a welcome message to the residents of this region. It seems inconsistent that this community, which houses nuclear power plants, does not experience significant benefit from the presence. The economic downturn in this region is desperately in need of signs of recovery, and thus nuclear power industry has the capability of leading the way. (FNP-A-10)

Response: *The comments are related to the socioeconomic impacts specific to JAFNPP. Socioeconomic impacts such as taxes are Category 2 issues and will be addressed in Chapters 2 and 4 of the SEIS.*

A.1.3 Postulated Accidents

Comment: The operation of nuclear power plants is not without the potential for accidents, with serious consequences for both short and long term health in surrounding communities. (FNP-D-3)

Response: *The GEIS evaluated severe accidents and design basis accidents, and concluded the impact was small. During the environmental review of JAFNPP, the NRC will determine whether there is any new and significant information bearing on the previous analyses in the GEIS. Section 5.1.2 of the plant-specific SEIS for JAFNPP will address this issue. In addition, alternatives to mitigate severe accidents must be considered on a plant-specific basis for all plants that have not previously considered such alternatives. The applicant provided a severe accident mitigation alternatives (SAMA) analysis as part of the license renewal application for JAFNPP. The NRC staff's review of the SAMA analysis will discussed in Section 5.2 and Appendix G of the SEIS for JAFNPP.*

A.1.4 Uranium Fuel Cycle and Waste Management Issues

Comment: From start to finish, the production of nuclear energy is fraught with hazards. The mining and enrichment of uranium produces radioactive isotopes that contaminate and degrade the surrounding environment. (FNP-D-2)

Comment: Finally, creation of nuclear energy leads to the accumulation of extremely hazardous, radioactive material that persists in the environment for tens of thousands of years. Additionally, this process creates byproducts, which, in a worst-case scenario, could be obtained and used to create dangerous weapons. (FNP-D-4)

Response: *Environmental impacts associated with the uranium fuel cycle were addressed in the GEIS. The GEIS concluded those impacts including the off-site radiological impact of* *storage, transportation, and disposal of spent fuel and other radioactive waste are Category 1 issues. The impact of these Category 1 issues was judged to be small in the GEIS. During the environmental review of JAFNPP, the NRC determine whether there is any new and significant information bearing on the previous analysis.*

Appendix B

Contributors to the Supplement

Appendix B:
Contributors to the Supplement

The overall responsibility for the preparation of this supplement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC). The supplement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations, Lawrence Livermore National Laboratory, and Pacific Northwest National Laboratory.

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(a) Lawrence Livermore National Laboratory is operated for the U.S. Department of Energy by the University of California.

(b) Pacific Northwest National Laboratory is operated for the U.S. Department of Energy by Battelle.

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc., Application for License Renewal of James A. FitzPatrick Nuclear Power Plant

Appendix C:
Chronology of NRC Staff Environmental Review Correspondence Related to Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc., Application for License Renewal of James A. FitzPatrick Nuclear Power Plant

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) and other correspondence related to the NRC staff's environmental review, under Title 10 of the *Code of Federal Regulations*, Part 51 (10 CFR Part 51), of the Entergy application for renewal of the James A. FitzPatrick Nuclear Power Plant (JAFNPP) operating license. All documents, with the exception of those containing proprietary information, are publicly available at the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://adamswebsearch.nrc.gov/dologin.htm. The ADAMS accession numbers for each document are included below. Persons who do not have access to ADAMS, or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's PDR reference staff by telephone at 1-800-397-4209 or 301-415-4737, or by e-mail at pdr@nrc.gov.

July 27, 2006	Summary of meeting held on June 26, 2006, between NRC and Entergy to discuss submittal of JAFNPP license renewal application. (Accession No. ML062090176)
July 31, 2006	Letter from P. Dietrich, Entergy, submitting the application for renewal of the operating license for the JAFNPP. (Accession No. ML062160491)
July 31, 2006	*James A. FitzPatrick Nuclear Power Plant — License Renewal Application, Appendix E: Applicant's Environmental Report, Operating License Renewal Stage*. (Accession No. ML062160557)
August 4, 2006	NRC press release announcing the availability of the license renewal application for JAFNPP. (Accession No. ML062160240)
August 7, 2006	Letter to P. Dietrich, Entergy, Receipt and Availability of the License Renewal Application for JAFNPP. (Accession No. ML062190106)

August 11, 2006	*Federal Register* Notice of Receipt and Availability of Application for Renewal of JAFNPP (Operating License No. DPR-59) for an Additional 20-Year Period (71 FR 55032). (Accession No. ML071000081)
September 7, 2006	Letter to M. Bennett, Penfield Library, regarding the maintenance of reference material at the SUNY Oswego—Penfield Library, related to the JAFNPP license renewal application. (Accession No. ML062500286)
September 7, 2006	Letter to C. Ferlito, Oswego Public Library, regarding the maintenance of reference material at the Oswego Public Library, related to the JAFNPP license renewal application. (Accession No. ML062500247)
September 14, 2006	Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Entergy Nuclear Operations, Inc., for the renewal of the operating license for JAFNPP. (Accession No. ML062570127)
September 15, 2006	Letter to D. L. Kilma, Advisory Council on Historic Preservation (ACHP), the JAFNPP License Renewal Application Review. (Accession No. ML062480229)
September 15, 2006	Letter to B. Castro, New York State Historic Preservation Office, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480220)
September 15, 2006	Letter to L. Henry, Tuscarora Nation, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480205)
September 15, 2006	Letter to W. Jacobs, Cayuga Nation, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480069)
September 15, 2006	Letter to R. Halbritter, Oneida Indian Nation, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480063)

September 15, 2006	Letter to I. Powless, Jr., Onondaga Indian Nation, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480057)
September 15, 2006	Letter to B. Snyder, Seneca Nation of Indians, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480035)
September 15, 2006	Letter to J. Ransom, St. Regis Mohawk Tribe, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480053)
September 15, 2006	Letter to R. Hill, Tonawanda Band of Senecans, Request for Comments Concerning the JAFNPP License Renewal Application Review. (Accession No. ML062480044)
September 19, 2006	Letter to M. Moriarty, U.S. Fish and Wildlife Service Northeast Regional Office, Request for List of Protected Species Within the Area Under Evaluation for the JAFNPP License Renewal Application Review. (Accession No. ML062630292)
September 20, 2006	Notice of Acceptance for Docketing of the Application, Notice of Opportunity for Hearing and Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process for Facility Operating License No. DPR-59 for an Additional 20-Year Period, Entergy Nuclear Operations, Inc., James A. FitzPatrick Nuclear Power Plant (71 FR 55032). (Accession No. ML071000085)
September 20, 2006	NRC press release announcing the opportunity to request a hearing on application to renew operating license for JAFNPP. (Accession No. ML062630056)
September 25, 2006	Meeting Notice, Forthcoming Meeting to Discuss the License Renewal Process and Environmental Scoping for JAFNPP License Renewal Application Review. (Accession No. ML062680355)
September 26, 2006	Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for JAFNPP. (Accession No. ML062480235)

October 3, 2006	NRC press release announcing Public License Renewal Process and Environmental Scoping Meeting Associated with the Application to Renew the Operating License for JAFNPP. (Accession No. ML062760465)
October 3, 2006	Transcripts of the Proceedings of the JAFNPP Public Scoping Meetings. (Accession Nos. ML063030195 [afternoon], ML063030209 [evening])
October 30, 2006	Summary of Public Environmental Scoping Meetings Related to the Review of the JAFNPP License Renewal Application. (Accession No. ML062980148)
November 7, 2006	Letter to K. Lynch, New York State Department of Environmental Conservation (NYSDEC) Region 7, Request for List of State Protected Species Within the Area Under Evaluation for the JAFNPP License Renewal Application Review. (Accession No. ML062960276)
November 7, 2006	Letter to P. Dietrich, Entergy, Request for Additional Information Regarding the Review of the License Renewal Application for JAFNPP. (Accession No. ML062850382)
November 13, 2006	Letter from J. Heath, General Council for the Onondaga Nation, concerning the JAFNPP license renewal application. (Accession No. ML063240283)
November 14, 2006	Letter from C. Hogan, NYSDEC, in response to request for comments on the JANFPP License Renewal Environmental Report. (Accession No. ML 063240331)
November 27, 2006	Letter to M. Kansler, Entergy, Environmental Site Audit Regarding the JAFNPP License Renewal Application. (Accession No. ML063250406)
November 29, 2006	Letter to M. Kansler, Entergy, Request for Additional Information Regarding Severe Accident Mitigation Alternatives for JAFNPP. (Accession No. ML063060257)

November 30, 2006	Letter from T. Seoane, NYDEC Natural Heritage Program, Report on Rare or State-Listed Animals, Significant Natural Communities, and Other Habitats in Regards to the JAFNPP License Renewal Application Review. (Not publicly available)
December 6, 2006	Letter from P. Dietrich, Entergy, JAFNPP License Renewal Application, Amendment 1. (Accession No. ML063480585)
December 6, 2006	JAFNPP License Renewal Application Amendment 1 Attachments. (Accession No. ML063480596)
December 7, 2006	Letter from A. Wonderley, Oneida Indian Nation, in response to JAFNPP Environmental Review of License Renewal Application. (Accession No. ML063480314)
January 8, 2007	Letter to M. Kansler, Entergy, Environmental Project Manager and Schedule Change for the License Renewal Environmental Review of JAFNPP. (Accession No. ML063550121)
January 26, 2007	Summary of Site Audit Related to the Review of the License Renewal Application for JAFNPP. (Accession No. ML070220055)
January 29, 2007	Letter from P. Dietrich, Entergy, License Renewal Application Amendment 4 Concerning SAMA Request of Additional Information. (Accession No. ML070370170)
March 2, 2007	Letter to M. Kansler, Entergy, Environmental Scoping Summary Report (Accession No. ML070440393)
March 7, 2007	Letter to E Alkiewicz, NYPA, Information Regarding Transmission Line Corridor Inspection for the JAFNPP License Renewal Application Review. (Accession No. ML070400200)
May 21, 2007	Letter to M. Moriarty, USFWS, regarding the Biological Assessment for Proposed License Renewal of James A. FitzPatrick Nuclear Power Plant. (Accession No. ML071310069)

Appendix D

Organizations Contacted

Appendix D:
Organizations Contacted

During the course of the U.S. Nuclear Regulatory Commission staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, local, and Native American Tribal agencies were contacted:

Advisory Council on Historic Preservation, Washington, DC

Cayuga Nation, Akron, New York

City of Oswego, Oswego, New York

County of Oswego, Oswego, New York

New York Department of State, Albany, New York

New York Power Authority, White Plains, New York

New York State Department of Environmental Conservation, Albany, New York

New York State Department of Health, Albany New York

New York State Energy Research and Development Authority, Albany, New York

New York State Historic Preservation Office, Waterford, New York

Onondaga Indian Nation, Nedrow, New York

Oneida Indian Nation, Verona, New York

Seneca Nation of Indians, Irving, New York

St. Regis Mohawk Tribe, Akwesasne, New York

Tonawanda Band of Senecans, Basom, New York

Town of Scriba, Scriba, New York

Tuscarora Indian Nation, Lewiston, New York

US Fish and Wildlife Service, Northeast Regional Office, Hadley, New York

Appendix E

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc., Compliance Status and Consultation Correspondence

Appendix E: Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc., Compliance Status and Consultation Correspondence

Consultation correspondence related to the evaluation of the application for renewal of the operating license for James A. FitzPatrick Nuclear Power Plant (JAFNPP) is identified in Table E-1. Copies of the consultation correspondence are included at the end of this appendix.

The licenses, permits, and other approvals obtained from Federal, State, regional, and local authorities for JAFNPP, are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (R. Franovich)	New York State Historic Preservation Office (B. Castro)	September 15, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)[a]	Onondaga Indian Nation (I. Powless, Jr.)	September 15, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	U.S. Fish and Wildlife Service Northeast Regional Office (M. Moriarty)	September 19, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	New York State Department of Environmental Conservation (K. Lynch)	November 7, 2006
New York State Department of Environmental Conservation Natural Heritage Program (T. Seoane)[b]	U.S. Nuclear Regulatory Commission (S. Hernandez)	November 30, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	U.S. Fish and Wildlife Service Northeast Regional Office (M. Moriarty)	May 21, 2007

(a) Similar letters were sent to other Native American Tribes listed in Appendix C.

(b) Not publicly available.

Table E-2. Federal, State, Local, and Regional Licenses, Permits, and Other Approvals for the James A. FitzPatrick Nuclear Power Plant (JAFNPP)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
NRC	Atomic Energy Act, 10 CFR 50	License to operate	DPR-59	October 17, 2014	Authorization to operate JAFNPP.
DOT	49 CFR 107, Subpart G	Hazardous Materials Certificate of Registration	051706600001O	June 30, 2007	Authorization to ship radioactive and hazardous materials.
NYSDEC	6 NYCRR Part 201	Certificate to Operate an Air Contamination Source	7-3556-0020/00012	Not Applicable	Authorization to operate air emission sources (diesel generators and boilers).
NYSDEC	6 NYCRR Part 372	Hazardous Waste Generator Identification	NYD000765073	Not Applicable	Authorization for hazardous waste generation.
NYSDEC	6 NYCRR Part 675	Water Withdrawal Registration	NYGLWR-4004	November 20, 2008	Authorization to withdraw water from Lake Ontario.
NYSDEC	6 NYCRR Part 596	Hazardous Substance Bulk Storage Registration Certificate	7-000117	August 16, 2008	Authorization for onsite bulk storage of hazardous substances.
NYSDEC	6 NYCRR Part 750	State Pollutant Discharge Elimination System (SPDES) Permit	NY-0020109	August 1, 2006[a]	Permit to discharge wastewaters to waters of the State.
NYSDEC	6 NYCRR Part 612	Petroleum Bulk Storage Registration Certificate	7-140600	November 20, 2010	Authorization for onsite bulk storage of petroleum products.
NYSDEC	6 NYCRR Part 373	Hazardous Waste Part 373 Permit	7-3556-0020/0004-0	Not Applicable	Authorization to the accumulation and temporary storage onsite of mixed waste for >90 days.

Table E-2. (cont.)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
NYSDEC	6 NYCRR Part 325	Pesticide Application Business Registration	79632	July 31, 2008	Authorization to apply pesticide.
CVDEM	Title 44, Code of Virginia, Chapter 3.3, Section 44-146.30	Application for Registration to Transport Hazardous Radioactive Materials	EF-S0083107	August 31, 2007	Authorization to transport radioactive waste into the Commonwealth of Virginia.
SCDHEC	Act No.429 of 1980, South Carolina Radioactive Waste Transportation and Disposal Act	South Carolina Radioactive Waste Transport Permit	0031-31-07	December 31, 2007	Authorization to transport radioactive waste into the State of South Carolina.
TDEC	Tennessee Department of Environment and Conservation Regulations	Tennessee Radioactive Waste-License-for-Delivery	T-NY003-L07	December 31, 2007	Authorization for the shipment of radioactive material into Tennessee to a disposal/processing facility.

CFR *Code of Federal Regulations*
CVDEM Commonwealth of Virginia (Department of Emergency Management)
DOT U.S. Department of Transportation
JAFNPP James A. FitzPatrick Nuclear Power Plant
NRC Nuclear Regulatory Commission
NYCRR New York State Codes Rules and Regulations
NYSDEC New York State Department of Environmental Conservation
SCDHEC South Carolina Department of Health and Environmental Control
TDEC Tennessee Department of Environment and Conservation

(a) JAFNPP continues to operate under the existing permit while NYSDEC completes the SPDES permit renewal.

September 15, 2006

Ms. Bernadette Castro, SHPO
Parks, Recreation & Historic Preservation
Agency Building #1
Empire State Plaza
Albany, NY 12238

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW (SHPO NO. 06PR0982)

Dear Ms. Castro:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating license for James A. FitzPatrick Nuclear Power Plant (JAFNPP), which is located on Lake Ontario in Oswego County, approximately seven miles northeast of the City of Oswego, New York. JAFNPP is operated by Entergy Nuclear Operations, Inc. (Entergy). The application for renewal was submitted by Entergy in a letter dated July 31, 2006, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined 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 operations 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 may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On October 12, 2006, the NRC will conduct two public NEPA scoping meetings at the Town Municipal Building, 42 Creamery Road, Oswego, New York 13126. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in August 2007.

B. Castro -2-

If you have any questions or require additional information, please contact Mr. Samuel Hernandez, Environmental Project Manager, by phone at 301-415-4049 or by e-mail at shq@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

cc: See next page

B. Castro -2-

If you have any questions or require additional information, please contact Mr. Samuel Hernandez, Environmental Project Manager, by phone at 301-415-4049 or by e-mail at shq@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
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Docket No. 50-333

cc: See next page

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DATE	09/ 05 /06	09/ 05 /06	09/ 12 /06	09/ 15 /06

OFFICIAL RECORD COPY

FitzPatrick Nuclear Power Plant

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Ms. Carol Ferlito
Oswego Public Library
140-142 East Second Street
Oswego, NY 13126

September 15, 2006

The Honorable Irving Powless, Jr., Chief
Onondaga Indian Nation
Box 319B
Nedrow, NY 13120

SUBJECT: REQUEST FOR COMMENTS CONCERNING THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW

Dear Chief Powless:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of an application from Entergy Nuclear Operations, Inc., (Entergy) for the renewal of the operating license for the James A. FitzPatrick Nuclear Power Plant (JAFNPP), located on Lake Ontario in Oswego County, approximately seven miles northeast of the city of Oswego, New York. JAFNPP is in close proximity to lands that may be of interest to the Onondaga Indian Nation. As described below, the NRC's process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 of the *Code of Federal Regulations* Part 51.28(b) (10 CFR 51.28(b)), the NRC invites the Onondaga Indian Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8(c), the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating license for JAFNPP will expire in October 17, 2014. Entergy submitted its application for renewal of the JAFNPP operating license in a letter dated July 31, 2006.

The NRC is gathering information for a JAFNPP site-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The supplement will contain the results of the review of the environmental impacts on the area surrounding the JAFNPP site that are related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others) and will contain a recommendation regarding the environmental acceptability of the license renewal action. Enclosed for your information is a map showing the location of the JAFNPP site.

I. Powless -2-

The NRC will hold two public scoping meetings for the JAFNPP license renewal supplement to the GEIS on October 12, 2006, at the Town Municipal Building, 42 Creamery Road, Oswego, New York 13126. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

The license renewal application (LRA) is publicly available at the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://adamswebsearch.nrc.gov/dologin.htm. The accession number for the LRA is ML062160557. Persons who do not have access to ADAMS, or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's PDR reference staff by telephone at 1-800-397-4209, or 301-415-4737, or by e-mail at pdr@nrc.gov.

The JAFNPP LRA is also available on the internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/fitzpatrick.html. In addition, the following public libraries have agreed to make the LRA available for public inspection: Penfield Library SUNY, 7060 State Route 104, Oswego, New York 13126; and **Oswego Public Library, 140-142 East Second Street, Oswego, New York 13126**.

The GEIS, which documents the NRC's assessment of the scope and impact of environmental effects that would be associated with license renewal at any nuclear power plant site, can also be found on the NRC's website or at the NRC's PDR.

Please submit any comments that the Onondaga Indian Nation may have to offer on the scope of the environmental review by November 14, 2006. Written comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington D.C. 20555-0001. Electronic comments may be submitted to the NRC by e-mail at FitzPatrickEIS@nrc.gov. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and mail a copy to you.

The staff expects to publish the draft supplement to the GEIS in August 2007. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft supplemental environmental impact statement (SEIS) will be sent to you for your review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for JAFNPP is planned for April 2008. If you need additional information regarding the environmental review process, please contact Mr. Samuel Hernandez, Environmental Project Manager, at 301-415-4049 or by e-mail at shq@nrc.gov.

Sincerely,

/RA/

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosure:
JAFNPP Location Map

cc w/encl: See next page

I. Powless -3-

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Sincerely,

/RA/

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosure:
JAFNPP Location Map

cc w/encl: See next page

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NAME	Y. Edmonds	J. Muir	S. Hernandez	R.Franovich
DATE	09/06/06	09/07/06	09/12/06	09/15/06

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Oneida
Wayne
Onondaga
Madison
Cayuga
Seneca
Ontario

Enclosure

Letter to I. Powless, dated: September 15, 2006

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DISTRIBUTION:
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FitzPatrick Nuclear Power Plant

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FitzPatrick Nuclear Power Plant

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Oswego County Administrator
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New York State Energy, Research,
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Suny-Oswego
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Oswego, NY 13126

Ms. Carol Ferlito
Oswego Public Library
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Oswego, NY 13126

September 19, 2006

Marvin Moriarty
Northeast Regional Office
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Moriarty:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Entergy Nuclear Operations, Inc. (Entergy) for the renewal of the operating license for James A. Fitzpatrick Nuclear Power Plant (JAFNPP). JAFNPP is located on Lake Ontario in Oswego County, approximately seven miles northeast of the City of Oswego, New York (Latitude 43.52 N, Longitude 76.39 W). As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC regulations that implements the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

Entergy has stated that if a renewed license is granted, it has no plans to alter current operations over the license renewal period, and that JAFNPP would use existing plant facilities and transmission lines and would not require additional construction or disturbance of new areas. The JAFNPP site covers approximately 702 acres, of which approximately 21 acres is industrial. The area surrounding JAFNPP is largely forested and rural, characterized by rolling terrain rising gently up from the lake.

JAFNPP uses a once-through open-cycle cooling system with an intake and discharge on Lake Ontario. The shore-facing intake is located approximately 900 feet offshore. Water coming into the intake passes through trash racks and traveling water screens. JAFNPP operates a fish deterrence system installed at the offshore intake structure from April to October of each year as required by their New York SPDES Permit.

The discharge water is returned to the lake through a discharge tunnel and diffuser system. The discharge structure is located approximately 1,400 feet offshore. The transmission lines in the scope of NRC's environmental review for license renewal are those that were originally constructed for the specific purpose of connecting the plant to the transmission system.

M. Moriarty -2-

A single 345-kilovolt (kV) transmission line was built to connect JAFNPP to the New York Power Pool transmission grid. The line runs from the plant switchyard to the Edic Substation located in Utica, New York. The transmission line right-of-way is 400 feet wide although only 150 feet were cleared for a total of 1,273 acres. The corridor passes through land that is primarily pine forest and swamp forest. There is also a short 345-kV transmission line from JAFNPP and the Nine Mile Point Nuclear Station. It runs 4,900 feet from the plants switchyard to the National Grid Scriba Substation. In addition to the 345-kV lines, offsite power is provided to JAFNPP by two single circuit 115-kV transmission lines connected to the plant's 115-kV bus.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests information on Federally listed, proposed, and candidate species and critical habitat that may be in the vicinity of JAFNPP and its associated transmission line right-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

We plan to hold two public NEPA scoping meetings at 1:30 p.m. and 7:00 p.m. on October 12, 2006, at the Scriba Town Municipal Building, 42 Creamery Road, Oswego, New York, 13126. On December 04, 2006, we plan to conduct a site audit at the JAFNPP facility. You and your staff are invited to attend both public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is August 2007.

If you have any questions concerning the NRC staff review of the license renewal application, please contact Mr. Samuel Hernandez, Environmental Project Manager at 301-415-4049 or by e-mail at shq@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosures:
1. JAFNPP Location Map
2. Transmission Lines Map

cc w/encls: See next page

M. Moriarty -2-

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Sincerely,
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Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

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2. Transmission Lines Map

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DATE	09/19/06	09/18/06	09/19/06	09/19/06

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<u>Letter to M. Moriarty from Rani Franovich, dated September 19, 2006</u>

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW

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JAFNPP
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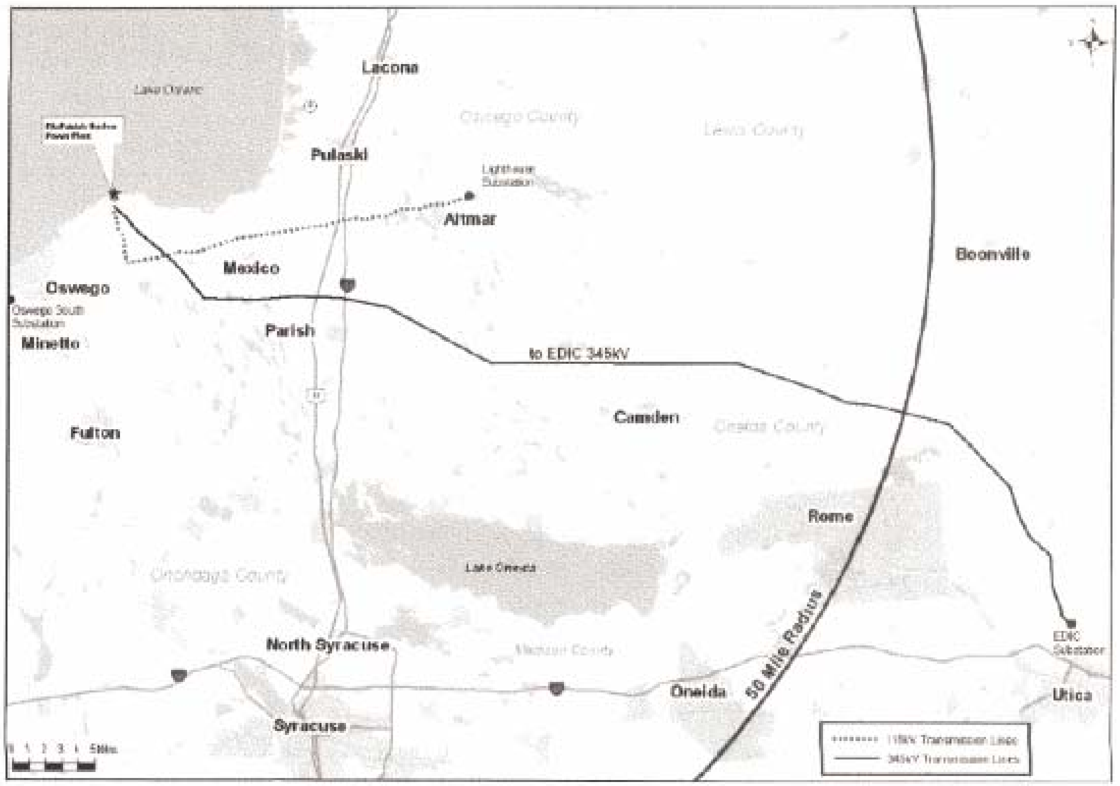
Ontario

Enclosure 1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Camden
Oneida County
Fulton
Rome
Lake Oneida
Onondaga County
North Syracuse
Madison County
EDIC Substation
Oneida
50 Mile Radius
Utica
Syracuse
115kV Transmission Lines
345kV Transmission Lines

FitzPatrick Nuclear Power Plant

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FitzPatrick Nuclear Power Plant

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Ms. Carol Ferlito
Oswego Public Library
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Oswego, NY 13126

November 7, 2006

Kenneth P. Lynch
Region 7 Office
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SUBJECT: REQUEST FOR LIST OF STATE PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW

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To support the SEIS preparation process, the NRC requests information on state listed, proposed, and candidate species and critical habitat that may be in the vicinity of JAFNPP and its associated transmission line right-of-ways. In addition, please provide any information you consider appropriate that might help the NRC to evaluate impacts that extended operation of JAFNPP for up to an additional 20 years under the terms of a license renewal might impose on state listed species.

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If you have any questions concerning the NRC staff review of the LRA, please contact Mr. Samuel Hernandez, Environmental Project Manager at 301-415-4049 or via e-mail at shq@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosures:
1. JAFNPP Location Map
2. Transmission Lines Map

cc w/encls: See next page

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Rani Franovich, Branch Chief
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Letter to K. Lynch from Rani Franovich, dated November 7, 2006

SUBJECT: REQUEST FOR LIST OF STATE PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATION REVIEW

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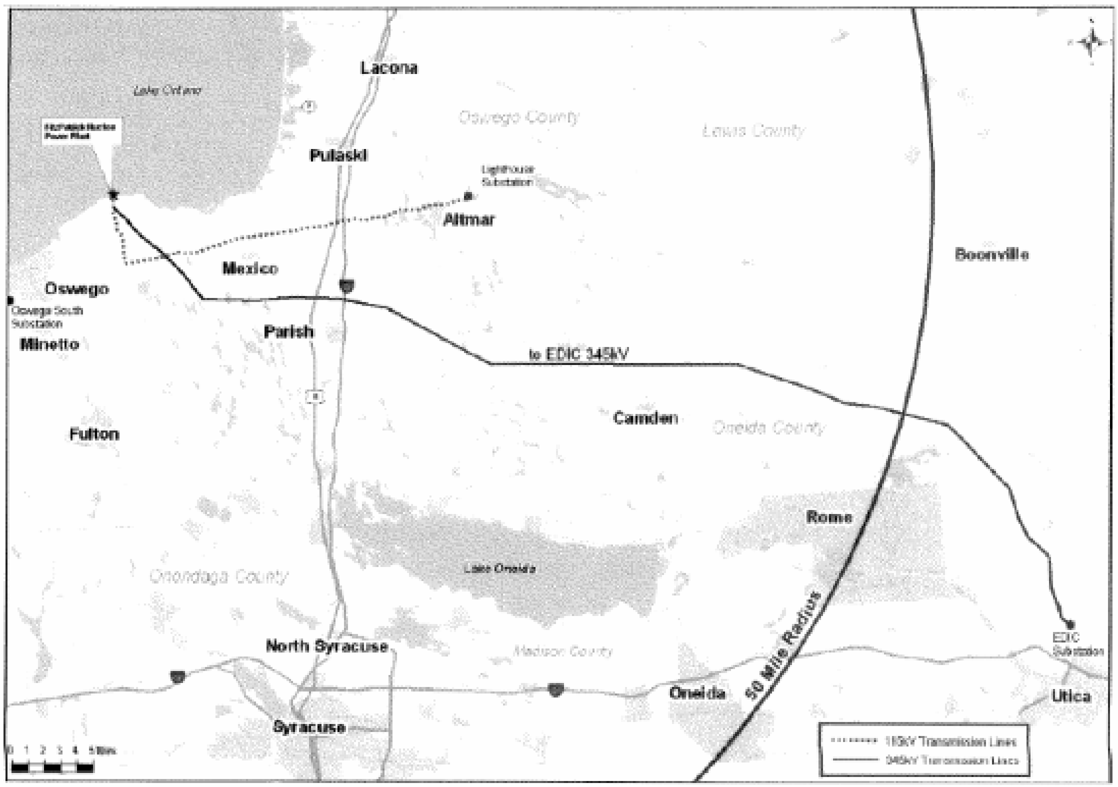
Enclosure 1



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Enclosure 2

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Appendix F

GEIS Environmental Issues Not Applicable to James A. FitzPatrick Nuclear Power Plant

Appendix F:
GEIS Environmental Issues Not Applicable to James A. FitzPatrick Nuclear Power Plant

Table F-1 lists those environmental issues identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999),[(1)] and Title 10 of the *Code of Federal Regulations*, Part 51 (10 CFR Part 51), Subpart A, Appendix B, Table B-1, that are not applicable to James A. FitzPatrick Nuclear Power Plant (JAFNPP) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to James A. FitzPatrick Nuclear Power Plant

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Altered salinity gradients	1	4.2.1.2.2; 4.4.2.2	The JAFNPP cooling system does not discharge to an estuary.
Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	4.3.2.1: 4.4.2.1	The JAFNPP cooling system does not use makeup water from a small river with low flow.
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER BASED HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Impingement of fish and shellfish	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Heat shock	1	4.3.3	This issue is related to heat-dissipation systems that are not installed at JAFNPP.

(1) 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 its Addendum 1.

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
Groundwater use conflicts (potable and service water, and dewatering; plants that use <100 gallons per minutes [gpm])	1	4.8.1.1; 4.8.1.2	JAFNPP does not use groundwater.
Groundwater use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1; 4.8.2.1	JAFNPP does not use groundwater.
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	4.8.1.3; 4.4.2.1	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	JAFNPP do not have or use Ranney wells.
Groundwater quality degradation (Ranney wells)	1	4.8.2.2	JAFNPP do not have or use Ranney wells.
Groundwater quality degradation (saltwater intrusion)	1	4.8.2.1	The JAFNPP cooling system does not discharge to an estuary.
Groundwater quality degradation (cooling ponds in salt marshes)	1	4.8.3	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Groundwater quality degradation (cooling ponds at inland sites)	2	4.8.3	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
TERRESTRIAL RESOURCES			
Cooling tower impacts on crops and ornamental vegetation	1	4.3.4	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Cooling tower impacts on native plants	1	4.3.5.1	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Bird collisions with cooling towers	1	4.3.5.2	This issue is related to heat-dissipation systems that are not installed at JAFNPP.
Cooling pond impacts on terrestrial resources	1	4.4.4	This issue is related to heat-dissipation systems that are not installed at JAFNPP.

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
		HUMAN HEALTH	
Microbial organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river).	2	4.3.6	The JAFNPP cooling system does not discharge to a small river.

F.1 References

10 CFR Part 51. *Code of Federal Regulations,* Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.

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, Volume 1, Addendum 1, Washington, D.C.

Appendix G

NRC Staff Evaluation of Severe Accident Mitigation Alternatives for James A. FitzPatrick Nuclear Power Plant

Appendix G:
NRC Staff Evaluation of Severe Accident Mitigation Alternatives for James A. FitzPatrick Nuclear Power Plant

G.1 Introduction

Entergy Nuclear FitzPatrick, LLC, and Entergy Nuclear Operations, Inc. (Entergy) submitted an assessment of severe accident mitigation alternatives (SAMAs) for the James A. FitzPatrick Nuclear Power Plant (JAFNPP) as part of the environmental report (ER) (Entergy 2006a). Supplemental information on the SAMA assessment was provided in Amendment 1 to the license renewal application (Entergy 2006b). This assessment was based on the most recent JAFNPP probabilistic safety assessment (PSA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer code, and insights from the JAFNPP individual plant examination (IPE) (NPA 1991) and individual plant examination of external events (IPEEE) (NPA 1996). In identifying and evaluating potential SAMAs, Entergy considered SAMA candidates that addressed the major contributors to core damage frequency (CDF) and population dose at JAFNPP, as well as SAMA candidates for other operating plants which have submitted license renewal applications. Entergy identified 293 potential SAMA candidates. This list was reduced to 63 unique SAMA candidates by eliminating SAMAs that: are not applicable to JAFNPP due to design differences, have already been implemented at JAFNPP, or are similar in nature and could be combined with another SAMA candidate. Entergy assessed the costs and benefits associated with each of the potential SAMAs, and concluded in the ER that several of the candidate SAMAs evaluated are potentially cost-beneficial.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to Entergy, by letter dated November 29, 2006 (NRC 2006). Key questions concerned: major plant and modeling changes incorporated within each evolution of the PSA model; source term and release time category assumptions used in the Level 2 analysis; justification for the multiplier used for external events; identification of SAMAs to reduce the fire CDF; and further information on several specific candidate SAMAs and low cost alternatives. Entergy submitted additional information by letters dated December 6, 2006 (Entergy 2006b) and January 29, 2007 (Entergy 2007). In the responses, Entergy provided: a summary of the major changes made to each PSA model version and resultant changes to dominant risk contributors to CDF; a discussion of the Level 2 analysis and the process for assigning severe accident source terms and binning release categories; a revised assessment of the baseline SAMA benefits considering a multiplier to account for external events exclusive of uncertainties; a discussion of measures that have been taken to reduce risk in dominant fire zones and why the fire CDF for those zones cannot be further reduced in a cost effective manner; and additional information regarding several specific SAMAs. Entergy's responses addressed the NRC staff's concerns.

G.2 Estimate of Risk for JAFNPP

Entergy's estimates of offsite risk at JAFNPP are summarized in Section G.2.1. The summary is followed by the NRC staff's review of Entergy's risk estimates in Section G.2.2.

G.2.1 Entergy's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the JAFNPP Level 1 and 2 PSA model, which is an updated version of the IPE (NPA 1991), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PSA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent JAFNPP Level 1 and Level 2 PSA model available at the time of the ER, referred to as the JAFNPP PSA (Revision 2, October 2004 model). The scope of the JAFNPP PSA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 2.74×10^{-6} per year. The CDF is based on the risk assessment for internally-initiated events. Entergy did not include the contribution from external events within the JAFNPP risk estimates; however, it did account for the potential risk reduction benefits associated with external events by multiplying the estimated benefits for internal events by a factor of 4.(1) This is discussed further in Sections G.2.2 and G.6.2.

The breakdown of CDF by initiating event is provided in Table G-1 (Entergy 2006a). As shown in this table, events initiated by station blackout and transients are the dominant contributors to the CDF. Anticipated transient without scram (ATWS) sequences are insignificant contributors to the CDF.

The Level 2 JAFNPP PSA model that forms the basis for the SAMA evaluation represents an updated version of the original IPE Level 2 model. The current Level 2 model utilizes a single containment event tree (CET) containing both phenomenological and systemic events. The Level 1 core damage sequences are binned into one of 48 Plant Damage State (PDS) bins which provide the interface between the Level 1 and Level 2 CET analysis. CET nodes are evaluated using supporting fault trees and logic rules.

The result of the Level 2 PSA is a set of 7 release categories with their respective frequency and release characteristics. The results of this analysis for JAFNPP are provided in Table E.1-10 of the ER (Entergy 2006a). The frequency of each release category was obtained by summing the frequency of the individual accident progression CET endpoints binned into the release category. Source terms were developed for each of the 7 release categories using the

(1) In the ER, Entergy bounded the combined impact of external events and uncertainties by applying a multiplier of 16 to the estimated SAMA benefits for internal events. In supplemental information to the ER, Entergy revised the analysis to include a multiplier of 4 to account for potential SAMA benefits in both internal and external events, and provided a separate accounting of uncertainties.

results of Modular Accident Analysis Program (MAAP 4.04) computer code calculations. These release categories and source terms were further collapsed into three distinct source term bins to represent no containment failure, early releases, and late releases.

Table G-1. JAFNPP Core Damage Frequency for Internal Events

Initiating Event	**CDF (per year)**	**Percent Contribution to CDF**
Station Blackout	1.27 x 10-6	46
Transients with loss of containment heat removal	7.78x 10^{-7}	28
Transients with loss of all emergency core cooling system (ECCS) injection	2.66 x 10^{-7}	10
ATWS	1.38x 10^{-7}	5
Loss of a 4.16kv alternating current (AC) safeguard bus	1.18 x 10^{-7}	5
Loss of both direct current (DC) divisions	9.55 x 10^{-8}	3
Loss of coolant accidents (LOCAs)	2.83 x 10^{-8}	1
Loss of a division of DC power	2.60 x 10^{-8}	1
Relay room flooding	2.53 x 10^{-8}	1
Total CDF (internal events)	**2.74 x 10^{-6}**	**100**

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within a 50-mile radius) for the year 2034, emergency response evacuation modeling, and economic data. The core radionuclide inventory is derived from a reference core inventory for a boiling water reactor (BWR) in MACCS2. Core inventory was scaled to account for the JAFNPP-specific power level, and long-lived radionuclide inventory was increased by 25 percent to reflect the expected core exposure and fuel management practices at JAFNPP (Entergy 2007). The magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on information provided in NUREG/BR-0184 (NRC 1997a).

In the ER, Entergy estimated the dose to the population within 50 miles of the JAFNPP site to be approximately 1.63 person-rem per year. The breakdown of the total population dose by containment release mode is summarized in Table G-2. Containment failures within the late time frame (greater than 24 hours following event initiation) and the early time frame (0 to 24 hours following event initiation) dominate the population dose risk at JAFNPP, contributing about equally to the population dose risk.

Table G-2. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose (Person-Rem[1] Per Year)	Percent Contribution
Late Containment Failure	0.87	53
Early Containment Failure	0.76	47
Intact Containment	negligible	negligible
Total	**1.63**	**100**

[1]One person-Rem = 0.01 person-Sv

G.2.2 Review of Entergy's Risk Estimates

Entergy's determination of offsite risk at JAFNPP is based on the following three major elements of analysis:

- The Level 1 and 2 risk models that form the bases for the 1991 IPE submittal (NPA 1991), and the external event analyses of the 1996 IPEEE submittal (NPA 1996),

- The major modifications to the IPE model that have been incorporated in the JAFNPP PSA, and

- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PSA model into offsite consequence measures.

Each of these analyses was reviewed to determine the acceptability of Entergy's risk estimates for the SAMA analysis, as summarized below.

The NRC staff's review of the JAFNPP IPE is described in an NRC report dated May 9, 1994 (NRC 1994). Based on a review of the IPE submittal and responses to RAIs, the NRC staff concluded that the IPE submittal met the intent of GL 88-20 (NRC 1988); that is, the licensee's IPE process is capable of identifying severe accident risk contributors or vulnerabilities.

No vulnerabilities were identified in the IPE. However, the licensee noted that a number of actions were under evaluation as a result of the IPE process that would reduce the risk of core damage and loss of containment function. Specific improvements identified for implementation included: increasing the reactor core isolation cooling (RCIC) turbine exhaust set points, repowering the RCIC enclosure exhaust fans from AC to DC, and fire protection system modifications to provide emergency diesel generator (EDG) jacket water cooling directly or through the emergency service water (ESW) system. Over 10 additional items were identified for follow-on evaluation by the licensee (NRC 1994).

There have been two revisions to the IPE model since the 1991 IPE submittal, specifically, a complete revision of the model in 1998 (Revision 1) in partial response to the boiling-water reactor owner group (BWROG) peer review, and a revision in October 2004 (Revision 2) completing the response to the BWROG peer review. The Revision 2 model reflects the JAFNPP configuration and design as of December 2003 and uses component failure and unavailability data as of December 2002. A comparison of internal events CDF between the 1991 IPE and the current PSA model indicates an increase of about 40 percent in the total CDF (from 1.9×10^{-6} per year to 2.7×10^{-6} per year). A listing of those changes that resulted in the greatest impact on the internal events CDF was provided by Entergy in supplemental information to the ER (Entergy 2006b) and in response to an RAI (Entergy 2007) and is summarized in Table G-3.

The CDF value from the 1991 IPE (1.92×10^{-6} per year) is near the lower end of the range of the CDF values reported in the IPEs for other BWR 3/4 plants. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events CDF for BWR 3/4 plants ranges from 9×10^{-8} per year to 8×10^{-5} per year, with an average CDF for the group of 2×10^{-5} per year (NRC 1997b). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal events CDF results for JAFNPP are comparable to that for other plants of similar vintage and characteristics.

The NRC staff considered the peer reviews performed for the JAFNPP PSA, and the potential impact of the review findings on the SAMA evaluation. In the ER (Entergy 2006a) and in response to an NRC staff RAI (Entergy 2007), Entergy described the previous peer reviews, including independent consultant team reviews of draft versions of the IPE and Revision 1, as well as the BWROG Peer Review of a draft of Revision 1 conducted in December 1997. The BWROG review concluded that the JAFNPP PSA can be effectively used to support risk ranking of systems, structures, and components, and to support applications involving risk significance determinations when supported by deterministic analyses and when noted items are addressed. Entergy stated that all major issues and observations from the BWROG Peer Review have been addressed and incorporated into the current PSA (Revision 2).

Given that the JAFNPP internal events PSA model has been peer-reviewed and the peer review findings were all addressed, and that Entergy has satisfactorily addressed NRC staff questions regarding the PSA, the NRC staff concludes that the internal events Level 1 PSA model is of sufficient quality to support the SAMA evaluation.

Table G-3. JAFNPP PSA Historical Summary

PSA Version	Summary of Changes from Prior Model	CDF (per year)
1991	IPE Submittal	1.92×10^{-6}
1998 (Revision 1)	- Incorporated impact of design changes (supply EDG jacket cooling water through the ESW system cross-tie, bonnet vents on the low-pressure coolant injection (LPCI) and core spray injection valves, keylock bypass switches, normal position of residual heat removal (RHR) minimum flow bypass valve, and RCIC enclosure fan power supply changed to an AC inverter feed from a DC power source) - Revised model to include catastrophic common cause failure of both 125V DC battery control boards, and other common cause equipment failures - Revised model to assume loss of all AC power in the same division in which there is a loss of DC power - Revised internal flooding analysis to include a relay room flooding scenario - Revised transient sequences to directly result in core damage if manual depressurization of the reactor vessel fails - Revised model to assume core damage occurs given failure to initiate Standby Liquid Control System (SLCS) - Updated initiating event frequencies and component failure and unavailability database	2.44×10^{-6}

Table G-3. JAFNPP PSA Historical Summary (cont.)

PSA Version	Summary of Changes from Prior Model	CDF (per year)
2004 (Revision 2)	- Reduced station battery depletion time from 8 to 4 hours, and updated non-recovery probabilities for loss of offsite power - Revised model to include additional accident initiators: loss of non-safeguard 4.16kV AC Buses, loss of condensate system, loss of instrument air system, loss of ultimate heat sink, and loss of reactor water level instrumentation - Revised model to assume loss of both high-pressure coolant injection (HPCI) and RCIC during accidents involving a loss of containment heat removal - Revised system fault tree models to include additional electrical and instrumentation and control (I&C) component common cause failures - Reevaluated dependencies between post-initiator human actions and recovery actions - Updated initiating event frequencies and component failure data for instrument, master and slave trip units	2.74×10^{-6}

As indicated above, the current JAFNPP PSA does not include external events. In the absence of such an analysis, Entergy used the JAFNPP IPEEE to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

The JAFNPP IPEEE was submitted in June 1996 (NPA 1996), in response to Supplement 4 of Generic Letter 88-20 (NRC 19961b). While no fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events were identified, a listing of improvement opportunities was developed as discussed below. In a letter dated September 21, 2000, the NRC staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 2000a).

The JAFNPP IPEEE seismic analysis (NPA 1996) utilized a seismic margin assessment (SMA) approach following NRC guidance (NRC 1991) and Electric Power Research Institute (EPRI) guidance (EPRI 1991). This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators. The seismic analysis was completed in conjunction with the Seismic Qualification User Group (SQUG) program (SQUG 1992). The overall seismic approach employed plant walkdowns to identify vulnerabilities, development of seismic fragility values for components and structures, and quantification of high confidence low probability of failure (HCLPF) for initiating events. A relay chatter evaluation was performed using the standard approach for an Unresolved Safety Issue (USI) A-46 (NRC 2000b) program plant. The conclusions of the JAFNPP IPEEE seismic margin analysis are:

- The overall plant HCLPF capacity at JAFNPP is 0.22g peak ground acceleration (PGA). This value reflects implemented improvements to strengthen block walls in the Emergency Diesel Generator Building, which increased the plant HCLPF value from 0.17g to 0.22g. Several buildings and structures have HCLPF values at the 0.22g level. Thus, further increases in seismic capacity would require multiple plant modifications.

- A vulnerability to fire or explosion as a result of the seismic-induced failure of the hydrogen line in the turbine building was identified. A note was added to procedure AOP-14, “Earthquake,” stating that the piping can be isolated by closing the hydrogen supply valve 89A-H2HAS-1. Based on this procedure change, the applicant concludes that seismic-induced flooding and fires do not pose major risks.

- No unique decay heat removal vulnerabilities to seismic events were found.

- No unique seismic-induced containment failure mechanisms were identified.

The NRC review and closeout of USI A-46 for JAFNPP is documented in a letter dated April 12, 2000 (NRC 2000b). Based on the information provided by the applicant, the NRC staff finds that seismic risks are not dominant contributors to external event risk and that the treatment of seismic events is reasonable for the purposes of the SAMA analysis.

The JAFNPP IPEEE fire analysis employed EPRI’s fire-induced vulnerability evaluation (FIVE) methodology to perform a qualitative and quantitative screening review and then a probabilistic risk analysis to estimate the CDF contribution for the areas that did not screen out. After qualitative screening, fire event initiation frequencies were determined for the unscreened areas for use in quantitative screening along with the assumption that all equipment in a compartment was damaged by the fire. Using results from the IPE, a conservative CDF for the compartment was determined and areas with a CDF of less than 1×10^{-6} per year (or 1×10^{-7} per year if containment bypass may result) were screened out. Fire propagation and suppression analysis was then conducted on the unscreened compartments. Fire-induced CDFs were determined by propagating the fire initiating events and associated equipment failures determined by the fire propagation and suppression analysis through event trees similar to those in the IPE. The potential impact on containment performance and isolation was evaluated following the core damage evaluation. The JAFNPP fire CDF results are presented in Table E.1-12 of the ER for the ten fire areas considered in the analysis, and the fire zones/compartments within each fire area. The total fire CDF, found by summing the values for all compartments, is 2.56 x 10^{-5} per year. The ten fire areas and their contributions to the fire CDF are listed in Table G-4.

In the IPEEE, three opportunities for improvements with respect to fire events were identified. These improvements involve: (1) addition of a bypass switch to allow opening of the LPCI and core spray injection valves and an associated procedure for use of these switches during plant fires, (2) changes to administrative procedures to impose strict limitations on unattended combustible materials in the cable spreading room, and (3) relocation of heat detectors in the cable spreading room to limit contribution from transient fires. In supplemental information to the ER, Entergy indicated that the first two of these improvements have been implemented as recommended in the IPEEE. The third improvement is considered to be addressed by the changes to administrative procedures to limit unattended combustible material loading in the room. Entergy stated that none of these improvements are credited in the IPEEE fire CDF (Entergy 2006b).

In the ER, Entergy states that the IPEEE CDF values are screening values and that a more realistic fire CDF may be about a factor of three lower (or 8.53 x 10^{-6} per year) based on conservatisms in several areas as qualitatively assessed in the ER. In supplemental information, Entergy presented the results of a sensitivity analysis to quantitatively justify the factor of three reduction (Entergy 2006b). The sensitivity analysis included the following: (1) lower probability of occurrence of spurious actuation or failure due to hot shorts and open circuits within cable jackets in the Cable Spreading Room, Reactor Building East Crescent, and Relay Room and (2) lower ignition frequency for a fire in the Main Control Room. The results of this sensitivity analysis are shown for the four impacted areas in the last two columns of the table below. These reductions would quantitatively justify a reduction in the fire CDF by a factor of 2.3.

Entergy noted that this fire CDF would be further reduced by IPEEE improvements not included in the CDF estimate, including monitoring and controlling the quantity of combustible materials in critical process areas. These measures would reduce the fire CDF in all dominant fire zones. Based on the results of the sensitivity analysis and the existence of remaining conservatisms, the NRC staff finds the use of a fire CDF of 8.53 x 10^{-6} per year to be reasonable for the purposes of the SAMA analysis.

The NRC staff inquired about additional steps taken to reduce fire risk and the possibility of additional SAMAs that might be feasible to reduce the fire risk. Entergy provided a listing of fire-related SAMAs that have been implemented. Most of these SAMAs are improvements in the fire protection program, which would decrease the fire risk, but are not explicitly credited in the fire risk analysis. In addition, all but one of the six dominant fire zones (i.e., zones within the above-mentioned fire areas with a compartment frequency greater than 1.0 x 10^{-6} per year) are

Table G-4. Fire Areas and Their Contribution to the Fire CDF

Fire Area Description	CDF (per year) IPEEE	CDF (per year) Sensitivity Analysis[a]
Cable Spreading Room	6.71×10^{-6}	4.66×10^{-7}
Relay Room	5.81×10^{-6}	6.8×10^{-7}
Reactor Building	3.43×10^{-6}	2.46×10^{-6}
Control Room	3.00×10^{-6}	7.17×10^{-7}
Cable Tunnels	1.96×10^{-6}	no change
Diesel Generator Building	1.93×10^{-6}	no change
Battery Room	1.45×10^{-6}	no change
Turbine Building	1.29×10^{-6}	no change
Standby Gas Treatment Building	3.72×10^{-8}	no change
Electric Bays	8.98×10^{-10}	no change
TOTAL	2.56×10^{-5}	1.10×10^{-5}

[a] Source: Entergy 2006b

equipped with fire detection systems, three of the six dominant fire zones have fire suppression systems, and the Main Control Room, which has neither fire detection or fire suppression systems, is always occupied ensuring prompt fire detection and manual suppression. Entergy stated that no further cost-effective changes were identified to reduce CDF in the dominant fire zones (Entergy 2006b). The NRC staff concludes that the opportunity for fire-related SAMAs has been adequately explored and that it is unlikely that there are any potentially cost-beneficial, fire-related SAMA candidates.

The IPEEE analysis of high winds, floods and other external events followed the screening and evaluation approaches specified in Supplement 4 to GL 88-20 (NRC 1991b) and did not identify any sequences or vulnerabilities that exceeded the 1.0×10^{-6} per year criterion (NPA 1996). However, the licensee identified a condition where low pressures associated with hurricanes, tornadoes, and high winds could threaten the integrity of the air intake duct work supplying the

EDG room. Operating procedures were developed to open switchgear room doors or to open damaged duct work if necessary to ensure adequate ventilation of the switchgear room and adequate supply of combustion air to the EDGs. Based on this result, Entergy concluded that these other external hazards would not be expected to impact the conclusions of the SAMA analysis and did not consider them further.

Based on the aforementioned results, the external events CDF is approximately 3.1 times the internal events CDF (based on a fire CDF of 8.53×10^{-6} per year and an internal events CDF of 2.74×10^{-6} per year). Accordingly, the total CDF (from internal and external events) would be approximately 4.1 times the internal events CDF. In revised SAMA analyses submitted in response to an RAI, Entergy multiplied the benefit that was derived from the internal events model by a factor of 4 to account for the combined contribution from internal and external events. The NRC staff agrees with the applicant's overall conclusion concerning the impact of external events and concludes that the applicant's use of a multiplier of 4 to account for external events is reasonable for the purposes of the SAMA evaluation.

The NRC staff reviewed the general process used by Entergy to translate the results of the Level 1 PSA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in response to NRC staff requests for additional information (Entergy 2006a, 2007). The current Level 2 model utilizes a single CET containing both phenomenological and systemic events. The Level 1 core damage sequences are binned into one of 48 PDS bins based on binning criteria reflecting the state of the reactor, containment and cooling systems as the accident progresses. The PDSs provide the interface between the Level 1 and Level 2 analysis. CET nodes are evaluated using supporting fault trees and logic rules.

Entergy characterized the releases for the spectrum of possible radionuclide release scenarios using a set of 7 release categories based on the timing and magnitude of the release and whether or not the containment remains intact. The frequency of each release category was obtained by summing the frequency of the individual accident progression CET endpoints binned into the release category. The release characteristics for each release category were developed by grouping the hundreds of source terms generated for internal initiators into the 7 categories based on similar properties. Source term release fractions were developed for each of the 7 release categories using the results of Modular Accident Analysis Program (MAAP 4.04) computer code calculations. The release categories, their frequencies, and release characteristics are presented in Tables E.1-8, E.1-10, and E.1-11 of the ER, respectively (Entergy 2006a). These release categories and source terms were further collapsed into three distinct source term bins to represent no containment failure, early releases, and late releases.

The NRC staff noted that in collapsing the 7 release categories into three source term bins, releases occurring between 0 to 8 hours and between 8 to 24 hours were grouped into one bin. In response to an RAI, Entergy performed a sensitivity study that showed that this simplification results in less than a 2 percent change on population dose (Entergy 2007). Based on these results the NRC staff concludes that the applicant's characterization of releases is adequate for the purposes of the SAMA evaluation.

The NRC staff's review of the Level 2 IPE concluded that it addressed the most important severe accident phenomena normally associated with the Mark I containment type, and identified no significant problems or errors (NRC 1994). It should be noted, however, that the current Level 2 model is a revision to that of the IPE. The Level 2 PSA model was included in the independent consultant and BWROG peer reviews mentioned previously. The changes to the Level 2 model to update the methodology and to address peer review recommendations are described in Section E.1.4.2.2 of the ER. Based on the NRC staff's review of the Level 2 methodology, and the fact that the Level 2 model was reviewed in more detail as part of the BWROG peer review, and updated to address the review findings, the NRC staff concludes that the Level 2 PSA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

Entergy used the MACCS2 code and scaled the reference BWR core inventory for the JAFNPP plant-specific power level. Entergy also increased the long-lived radionuclide core inventory by 25 percent to address JAFNPP specific fuel enrichment and burnup. In response to an NRC staff RAI, Entergy identified that the 25-percent increase was based on a best estimate inventory of long-lived isotopes (such as Sr-90, Cs-134 and Cs-137) from an ORIGEN computer code calculation assuming 4.66 percent enrichment and average burnup based on expected fuel management practices (Entergy 2007). The best-estimate evaluation resulted in an increase of approximately 25 percent in the inventories of the aforementioned radionuclides. The NRC staff considers the methods and assumptions for power scaling and 25 percent increase in long-lived inventory reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff reviewed the process used by Entergy to extend the containment performance (Level 2) portion of the PSA to an assessment of offsite consequences (essentially a Level 3 PSA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within a 50-mile radius for the year 2034, emergency evacuation modeling, and economic data. This information is provided in Attachment E to the ER (Entergy 2006a).

Entergy used site-specific meteorological data for the 1994 calendar year as input to the MACCS2 code. The data were collected from the onsite meteorological monitoring system and regional National Weather System (NWS) stations. In response to an NRC staff RAI, Entergy identified the location of the National Weather System stations as being at Fulton-Oswego County Airport and NWS Station No. 14733 in Buffalo, NY (Entergy 2007). Based on a review of meteorological data between 1985 and 2001, Entergy stated that it considered the year 1994 data to be the most representative set of data because it contained no significant extremes and reflected average meteorological conditions at the site (Entergy 2006a). Missing data was obtained from either the upper elevation on the met tower or from estimates based on adjacent valid measurements of the missing hour. The NRC staff notes that previous SAMA analyses results have shown little sensitivity to year-to-year differences in meteorological data and concludes that the use of the 1994 meteorological data in the SAMA analysis is reasonable.

The population distribution the applicant used as input to the MACCS2 analysis was estimated for the year 2034, based on the New York Statistical Information System projections from year 2000 to 2030 (Brown 2005). The 2000 population was adjusted to account for transient population. These data were used to project county-level resident populations to the year 2034 using a least squares fit method. The NRC staff considers the methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model was modeled as a single evacuation zone extending out 16 kilometers (10 miles) from the plant. Entergy assumed that 100 percent of the population would move at an average speed of approximately 2.0 meters per second (4.4 miles per hour) with a delayed start time of 2.25 hours (Entergy 2006a). This assumption is similar to the model used in NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone (EPZ). Sensitivity analyses were performed in which the evacuation delay time was increased to 4.5 hours, and the evacuation speed was decreased to 1.0 meters per second. The results were less than a one percent increase in the total population dose. The NRC staff questioned why the evacuation speed of 2.0 meters per second (4.4 miles per hour) was different than that used for the Nine Mile Point SAMA analysis (NRC 2006). In response, Entergy stated that the JAFNPP evacuation speed was based on evacuation times provided in the 2003 version of the evacuation time study (ETE) (KLD Associates 2003), whereas the Nine Mile Point evacuation time estimate was based on an ETE study performed in 1993 (Entergy 2007). The NRC staff also asked Entergy to address the potential impact on the population dose if 5 percent of the population fails to evacuate the EPZ (NRC 2006). In response, Entergy performed a sensitivity analysis that showed only a slight increase in population dose (less than 1 percent for the late release) would result (Entergy 2007). The NRC staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data was provided from the 2002 Census of Agriculture (USDA 2002). These included the value of farm and non-farm wealth. Other data such as daily cost for an evacuated person, population relocation cost, daily cost for a person who is relocated, cost of farm and non-farm decontamination, and property depreciation were provided from the Code Manual for MACCS2 (NRC 1997c). The data from the default values given in the MACCS2 code manual were adjusted using the consumer price index of 179.9, the average value for 2002. Information on regional crops were obtained from the 2002 Census of Agriculture. Crops for each county were mapped into the seven MACCS2 crop categories.

The NRC staff concludes that the methodology used by Entergy to estimate the offsite consequences for JAFNPP provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and offsite doses reported by Entergy.

G.3 Potential Plant Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by Entergy are discussed in this section.

G.3.1 Process for Identifying Potential Plant Improvements

Entergy's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- Review of the most significant basic events from the current, plant-specific PSA,
- Review of potential plant improvements identified in the JAFNPP IPE and IPEEE,
- Review of SAMA candidates identified for license renewal applications for six other U.S. General Electric (GE) plants, and
- Review of other NRC and industry documentation discussing potential plant improvements.

Based on this process, an initial set of 293 candidate SAMAs, referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, Entergy performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA is not applicable at JAFNPP due to design differences,
- The SAMA has already been implemented at JAFNPP, or
- The SAMA is similar in nature and could be combined with another SAMA candidate.

Based on this screening, 230 SAMAs were eliminated leaving 63 for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table E.2-1 of the ER (Entergy 2006a). In Phase II, a detailed evaluation was performed for each of the 63 remaining SAMA candidates, as discussed in Sections G.4 and G.6 below. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of 4, as previously discussed.

G.3.2 Review of Entergy's Process

Entergy's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth (RRW) perspectives at JAFNPP, and included selected SAMAs from prior SAMA analyses for other plants.

Entergy provided a tabular listing of the PSA basic events sorted according to their RRW (Entergy 2006a). SAMAs impacting these basic events would have the greatest potential for reducing risk. Entergy used a RRW cutoff of 1.005, which corresponds to about a one-half percent change in CDF given 100-percent reliability of the SAMA. This equates to a benefit of approximately $2,500 (after the benefits have been multiplied to account for external events). Entergy also provided and reviewed the large early release frequency (LERF)-based RRW events down to a RRW of 1.005. Entergy correlated the top Level 1 and Level 2 events with the SAMAs evaluated in the ER, and showed that all of the significant basic events are addressed by one or more SAMAs (Entergy 2006a).

NRC staff noted that no Phase II SAMAs were recommended for event NR-LOSP-7HR, non-recovery of offsite power in seven hours, which is the highest risk reduction worth non-initiator event. The NRC staff asked the applicant to identify and evaluate SAMAs for this event (NRC 2006). In response to the RAI, Entergy stated that procedure and training improvements for restoring power to vital equipment following a recovery of the offsite power supply have been implemented, but that hardware improvements that could facilitate recovery of offsite power would merely shift NR-LOSP-7HR to a slightly later time on the power recovery curve and therefore would have little impact on the RRW of the event (Entergy 2007). Entergy further noted that other Phase II SAMAs (26 through 36 and 62), if implemented, would reduce the CDF contribution from this basic event. These SAMAs would enhance AC or DC system reliability or otherwise cope with loss of offsite power and SBO events. These Phase II SAMAs were evaluated in the ER.

NRC staff also noted that no Phase I or Phase II SAMAs were recommended for event IE-RRFLOOD, transient caused by internal flooding in the relay room, although a procedure change has been implemented to address the event. In an NRC staff RAI, the applicant was asked to provide justification for why no SAMAs were identified to address internal flooding events (NRC 2006). Entergy responded that additional methods of mitigating this flood event would entail either moving the fire protection line or installing a guard pipe to channel floodwater out of the relay room, both of which were judged to be costly relative to the risk significance of the related flood scenarios (Entergy 2007). The remaining flood scenarios are not risk-significant (i.e., above the 1.005 RRW threshold for SAMA identification).

For a number of the Phase II SAMAs listed in the ER, the information provided did not sufficiently describe the proposed modification. Therefore, the NRC staff asked the applicant to provide more detailed descriptions of the modifications for several of the Phase II SAMAs candidates (NRC 2006). In response to the RAI, Entergy provided the requested information (Entergy 2007).

The NRC staff questioned the ability of some of the candidate SAMAs to accomplish their intended objectives (NRC 2006a). In response to the RAIs, Entergy addressed the NRC staff's concerns by either re-evaluating the existing SAMA using revised modeling assumptions, or by evaluating an alternative (additional) SAMA (Entergy 2007). This is discussed further in Section G.6.2.

The NRC staff also questioned Entergy about lower cost alternatives to some of the SAMAs evaluated, including: the use of a redundant diesel fire pump to address event FXT-ENG-FR-76PI (failure of diesel driven fire pump 76P-1), the use of a local hand wheel or gas bottle supplies for manual venting of containment, and the use of a portable generator to provide alternate DC power feeds (NRC 2006). In supplemental information and in response to the RAIs, Entergy addressed the suggested lower cost alternatives, some of which are covered by an existing procedure, or are addressed by a new SAMA (Entergy 2006b, 2007). This is discussed further in Section G.6.2.

In the ER, Entergy states that in both the IPE and IPEEE, several enhancements related to severe accident insights were recommended and implemented, and that these enhancements were included in the comprehensive list of Phase I SAMA candidates. However, the list of Phase I SAMA candidates was not provided in the ER. Therefore, the NRC staff requested that the applicant indicate whether the enhancement has been implemented, and whether credit for the enhancement is taken in the current PSA model (used for the SAMA analysis) (NRC 2006). In supplemental information to the ER, Entergy indicated that Phase I SAMAs 253, 256, 262, and 280 through 293 include enhancements recommended in the IPE and IPEEE (Entergy 2006b). Entergy further indicated that most of these SAMAs have been implemented and that SAMA 280 was determined to be unnecessary. Those enhancements that have not been implemented or determined to not be necessary (SAMAs 281 through 284) were retained for consideration during Phase II. In response to the RAI, Entergy noted that except for Phase I SAMAs 94, 101, 120, and 267, the implemented Phase I SAMAs mentioned in the ER have been credited in the current PSA model (Entergy 2007). The absence of these four implemented modifications from the PSA model adds conservatism to the benefit estimates for Phase II SAMAs.

Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER, together with those identified in supplemental information to the ER and in response to NRC staff RAIs, addresses the major contributors to internal event CDF.

Entergy did not identify JAFNPP-specific candidate SAMAs for seismic events. In the JAFNPP IPEEE seismic analysis, the overall plant HCLPF value was determined to be 0.22g. This value reflects implemented improvements to strengthen block walls EGB-272-6, 7, 9, and 10 in the Emergency Diesel Generator Building, which increased the plant HCLPF value from 0.17g to 0.22g. Several buildings and structures have HCLPF values at the 0.22g level. Thus, further increases in seismic capacity would require multiple plant modifications. The JAFNPP IPEEE also identified that there is a fire-induced seismic vulnerability due to failure of the hydrogen line in the turbine building. The NRC staff requested that the applicant provide details on actions taken to reduce this risk and whether a SAMA to further reduce this risk is cost-beneficial (NRC 2006). In their response, Entergy stated the hydrogen supply is protected by excess flow valves outside the turbine building that are intended to limit hydrogen release in the event of a line break (Entergy 2007). Entergy also indicated that this event has already been further mitigated by making a modification to plant abnormal procedure AOP-14, “Earthquake,” to require that plant operators close hydrogen supply valve 89A-H2HAS-1 following a seismic event (Phase I SAMA 286). Finally, Entergy notes that the turbine building fire risk provided in the ER (which does not reflect the implemented plant procedure) is less than 1×10^{-6} per year, and cannot be further reduced in a cost-effective manner. Based on the licensee's IPEEE, the A-46 efforts to identify and address seismic outliers, the modifications that have already been implemented, and the expected cost associated with further seismic risk analysis and potential plant modifications, the NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored and that it is unlikely that there are any cost-beneficial, seismic-related SAMA candidates.

Entergy also did not identify any JAFNPP-specific candidate SAMAs for fire events. The fire risk at JAFNPP is dominated by ten fire areas, eight of which have fire CDF contributions in excess of 1×10^{-6} per year, with the largest contributor being the Cable Spreading Room. The NRC staff asked the applicant to explain what measures were taken to further reduce risk and why the fire risk cannot be further reduced in a cost-effective manner (NRC 2006). In supplemental information to the ER, Entergy stated that the fire area CDFs are conservative and presented the results of a sensitivity analysis that reduced modeling conservatisms (Entergy 2006b). This analysis, as discussed previously in Section G.2.2, reduced the individual CDF contributions for three of the top four dominant fire areas to below the 1×10^{-6} per year threshold. Entergy also noted that the fire CDF is further reduced by IPEEE improvements not included in the CDF estimate, such as restraining or relocating flammables cabinets, monitoring and controlling the quantity of combustible materials in critical process areas, and monitoring and control of pre-staging of outage materials (Phase I SAMAs 287 through 289). These measures would reduce the fire CDF in all dominant fire zones. Therefore, modifications to further reduce the fire CDF are unlikely to be cost-beneficial (Entergy 2006b). Entergy also stated that all but one of the six dominant fire zones are equipped with fire detection systems, three of the six dominant fire zones have fire suppression systems, and the Main Control Room, which has neither fire detection or fire suppression systems, is always occupied ensuring prompt fire detection and manual suppression (Entergy 2006b). Therefore, no cost-effective hardware changes or other modifications were identified.

As stated earlier, other external hazards (high winds, external floods, and transportation and nearby facility accidents) are below the threshold screening frequency and are not expected to impact the conclusions of the SAMA analysis. However, the licensee identified a condition where low pressures associated with hurricanes, tornadoes, and high winds could threaten the integrity of the air intake duct work supplying the EDG room. Operating procedures were developed to open switchgear room doors or to open damaged duct work if necessary to ensure adequate ventilation of the switchgear room and adequate supply of combustion air to the EDGs. No plant modifications were identified for these external hazards. The NRC staff concludes that the applicant's rationale for eliminating fire and other external hazards enhancements from further consideration is reasonable.

The NRC staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that Entergy used a systematic and comprehensive process for identifying potential plant improvements for JAFNPP, and that the set of potential plant improvements identified by Entergy is reasonably comprehensive and, therefore, acceptable. This search included reviewing insights from the plant-specific risk studies, and reviewing plant improvements considered in previous SAMA analyses. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the prior implementation of plant modifications for fire risks and the absence of external event vulnerabilities reasonably justifies examining primarily the internal events risk results for this purpose.

G.4 Risk Reduction Potential of Plant Improvements

Entergy evaluated the risk-reduction potential of the 63 remaining SAMAs that were applicable to JAFNPP. The majority of the SAMA evaluations were performed in a bounding fashion in that the SAMA was assumed to completely eliminate the risk associated with the proposed enhancement. Such bounding calculations overestimate the benefit and are conservative.

Entergy used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the JAFNPP PSA model. The changes made to the model to quantify the impact of SAMAs are detailed in Section E.2.3 of Attachment E to the ER (Entergy 2006a). Table G-5 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk. The estimated benefits reported in Table G-4 reflect the combined benefit in both internal and external events, as well as a number of changes to the analysis methodology subsequent to the ER. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction estimates of certain SAMAs provided in the ER (NRC 2006). SAMAs 8, 14, and 22 were each modeled by assuming that reactor building failures were completely eliminated, yet the results presented in the ER indicated no reduction in offsite dose. In response to the RAI, Entergy revised the estimated benefit values submitted in the ER for these SAMAs and all other SAMAs which directly impact the containment event tree model and alter the distribution of releases within a release bin (Entergy 2007). In response to this RAI, Entergy also changed the CDF reductions for Phase II SAMAs 11, 16, 17, and 39 to 0 percent to correct erroneous entries in the ER. The CDF reduction values for these SAMAs are now consistent with that for SAMA 25, which resolves another NRC staff RAI questioning that the benefit estimates for these SAMAs should not have been different (NRC 2006). Table G-4 reflects all of these revisions. Revision of these benefit estimates had no impact on the original conclusions.

For SAMA 57, control containment venting within a narrow band of pressure, the staff noted that the analysis assumptions were not directly related to the impact of the SAMA on CDF. In supplemental information to the ER, Entergy described a sensitivity analysis to assure that the benefit values reported for this SAMA are conservative. The sensitivity analysis resulted in a decrease in the assessed benefit; Entergy thus concluded that the benefit values reported in Table S-1 of the supplemental submittal (and in Table G-4) are conservative (Entergy 2006b).

For SAMA 61, develop a procedure to use a portable power supply for battery chargers, the staff noted that the events eliminated in the analysis were not included in the list of risk significant events in ER Table E.1-2. In response to an NRC staff RAI, Entergy reevaluated the benefit by eliminating the failures of both DC battery chargers and both 125-V DC battery control boards, which resulted in an increase in the assessed benefit (Entergy 2007).

The NRC staff has reviewed Entergy's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on Entergy's risk reduction estimates.

G.5 Cost Impacts of Candidate Plant Improvements

Entergy estimated the costs of implementing the 63 candidate SAMAs through the application of engineering judgment, and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles. The cost estimates provided in the ER did not account for inflation. For those SAMAs whose implementation costs were originally developed for severe accident mitigation design alternative analyses (i.e., during the design phase of the plant), additional costs associated with performing design modifications to the existing plant were not included.

The NRC staff reviewed the bases for the applicant's cost estimates (presented in Section E.2.3 of Attachment E to the ER), in supplemental information to the ER (Entergy 2006b), and in response to NRC staff RAIs (Entergy 2007). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other applicant's analyses of SAMAs for operating reactors and advanced light-water reactors. The NRC staff noted that several of the cost estimates provided by the applicant were drawn from previous SAMA analyses for a dual-unit site. For those cost estimates that were taken from a dual-unit SAMA analysis, Entergy reduced the estimated costs by half. The staff reviewed the costs and found them to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The NRC staff questioned the estimated cost of $400,000 for implementation of SAMA 57, control containment venting within a narrow band of pressure, for what appears to be a procedure and training issue (NRC 2006). In supplemental information to the ER, Entergy further described this modification as requiring detailed engineering studies, potential hardware modifications, procedure changes, simulator changes, and training (Entergy 2006b). Based on this additional information, the NRC staff considers the estimated cost to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC staff concludes that the cost estimates provided by Entergy are sufficient and appropriate for use in the SAMA evaluation.

1 **Table G-5**. SAMA Cost/Benefit Screening Analysis for JAFNPP [a]

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
Common cause failures of the SW system	CDF contribution due to common cause failure of ESW pumps was eliminated	1	1	5,000	6,000	
1 - Add a service water pump						5,900,000
Decay Heat Removal Capability – Torus Cooling	Completely eliminate loss of torus cooling mode of RHR system events	8	9	40,000	52,000	
2 - Install an independent method of suppression pool cooling						5,800,000
15 - Dedicated suppression pool cooling						5,800,000
Decay Heat Removal Capability – Drywell Spray	Completely eliminate loss of drywell spray mode of RHR system events	8	9	40,000	51,000	5,800,000
10 - Install a passive containment spray system						

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [(b)]	($) [(b)]	
Filtered Vent	Reduce successful torus venting accident progression source terms by a factor of two	0	4	16,000	23,000	
3 - Install a filtered containment vent to provide fission product scrubbing.						1,500,000
Option 1: Gravel bed filter						
Option 2: Multiple venturi scrubber						
20 - Install a filtered vent						1,500,000
Containment Vent for ATWS Decay Heat Removal	Completely eliminate ATWS sequences associated with containment bypass	3	8	28,000	38,000	
4 - Install a containment vent large Entergyugh to remove anticipated transient without scram (ATWS) decay heat						>1,000,000
52 - Install an ATWS sized vent						>1,000,000

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Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($) [b]	Total Benefit Using 3% Discount Rate ($) [b]	Cost ($)
Molten Core Debris Removal[c]	Completely eliminate containment failures due to core-concrete interaction (not including liner failure)	0	64	34,000	48,000	
5 - Create a large concrete crucible with heat removal potential under the base mat to contain molten core debris						>100,000,000
6 - Create a water cooled rubble bed on the pedestal.						19,000,000
9 - Create a core melt source reduction system						>5,000,000
24 - Install a reactor cavity flooding system						8,750,000
Flooding the Rubble Bed[c]	Completely eliminate dry core-concrete interactions	0	22	12,000	16,000	2,500,000
23 - Provide a means of flooding the rubble bed						

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
Base Mat Melt-Through[c]	Completely eliminate containment failures due to base mat melt-through	0	~0	~0	~0	>5,000,000
12 -Increase the depth of the concrete base mat or use an alternative concrete material to ensure melt-through does not occur						
Reactor Vessel Exterior Cooling[c]	Reduce probability of vessel failure by a factor of two	0	3	2,000	2,000	2,500,000
13 - Provide a reactor vessel exterior cooling system						
Drywell Head Flooding	Completely eliminate drywell head failures due to high temperature	0	0	0	0	
7 - Provide modification for flooding the drywell head						>1,000,000
19 - Increase the temperature margin for seals						12,000,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
21 - Provide a method of drywell head flooding						>1,000,000
Reactor Building Effectiveness[c]	Completely eliminate reactor building failures	0	31	17,000	24,000	
8 - Enhance fire protection system and SGTS hardware and procedures						>2,500,000
14 - Construct a building connected to primary containment that is maintained at a vacuum						>1,000,000
22 - Use alternate method of reactor building spray						>2,500,000
Strengthen Containment[c]	Completely eliminate all energetic containment failure modes (Direct containment heating [DCH], steam explosions, late over-pressurization)	0	28	13,000	19,000	
11 - Strengthen primary and secondary containment						12,000,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [(b)]	($) [(b)]	
16 - Create a larger volume in containment						8,000,000
17 - Increase containment pressure capability (sufficient pressure to withstand severe accidents)						12,000,000
25 - Add ribbing to the containment shell						12,000,000
Vacuum Breakers	Completely eliminate vacuum breaker failures	~0	7	22,000	31,000	>500,000
18 - Install improved vacuum breakers (redundant valves in each line)						
DC Power	**Increase time available to recover offsite power (before HPCI and RCIC are lost) from 14 to 24 hours during SBO scenarios**	**39**	**44**	**209,000**	**270,000**	
26 - Provide additional DC battery capacity						**500,000**

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [(b)]	($) [(b)]	
27 - Use fuel cells instead of lead-acid batteries						>1,000,000
30 - Provide 16-hour SBO injection						**500,000**
34 - Install fuel cells						>1,000,000
36 - Extended SBO provisions						**500,000**
Improved DC System						
28-Incorporate an alternate battery charging capability	Completely eliminate loss of DC battery chargers	3	~0	8,000	10,000	90,000
29 - Modification for improving DC bus reliability	Completely eliminate loss of 125 VDC bus B initiator	1	1	5,000	6,000	500,000
61 - power supply for battery chargers[(d)]	**Completely eliminate loss of DC battery chargers and battery control boards**	**2**	**2**	**10,000**	**13,000**	**10,000**
Dedicated DC Power and Additional Batteries and Divisions	Completely eliminate loss of DC battery control board BCB-2A	1	1	5,000	6,000	
32 - Add a dedicated DC power supply						3,000,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($) [b]	Total Benefit Using 3% Discount Rate ($) [b]	Cost ($)
33 - Install additional batteries or divisions						3,000,000
35-Install DC Buss cross-ties.						300,000
Alternate Pump Power Source 31 - Provide an alternate pump power source	Completely eliminate SBO diesel generator failures	1	1	3,000	4,000	>1,000,000
Locate RHR Inside Containment 37 - Locate RHR inside containment	Completely eliminate all RHR ISLOCA sequences	1	1	3,000	4,000	>500,000
Interfacing System Loss of Coolant Accident (ISLOCA) 38 - Increase frequency of valve leak testing	Completely eliminate all ISLOCA events	1	2	7,000	10,000	100,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
Main Steam Isolation Valve (MSIV) Design	Completely eliminate containment bypass due to MSIV leakage failures	0	20	9,000	13,000	>1,000,000
39 - Improve MSIV design[c]						
Main Feedwater	Completely eliminate loss of feedwater initiator	1	1	3,000	4,000	
40-Install a digital feedwater upgrade						1,500,000
Backup Water for feedwater/condensate injection						
41-Create ability to connect to existing or alternate water sources to feedwater/condensate	Completely eliminate contribution due to failure of alternate injection from feedwater/condensate	1	1	3,000	4,000	170,000
43-Install motor driven feedwater pump	Completely eliminate the failure of feedwater turbine driven pumps	~0	0	0	0	1,650,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
Diesel to condensate storage tank (CST) Makeup Pumps	Completely eliminate switchover from CST to torus failures	2	~0	2,000	3,000	135,000
42 - Install an independent diesel for the CST makeup pumps						
High Pressure Injection System	HPCI system is always available	3	1	8,000	10,000	
44 - Provide an additional high pressure injection pump with independent diesel						>1,000,000
45 - Install independent AC high pressure injection system						>1,000,000
46 - Install a passive high pressure system						>1,000,000
48 - Install an additional active high pressure system						>1,000,000
49 - Add a diverse injection system						>1,000,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction CDF	% Risk Reduction Population Dose	Total Benefit Using 7% Discount Rate ($) [(b)]	Total Benefit Using 3% Discount Rate ($) [(b)]	Cost ($)
Improve the Reliability of High Pressure Injection System 47 - Improved high pressure systems	Reduce HPCI system failure probability by a factor of 3	2	~0	6,000	7,000	>1,000,000
Increase reliability of instrument air after loss of offsite power (LOSP) 50-Modify EOPs for ability to align diesel power to more air compressors	Reduce probability of failure of normal electric power supply to air compressors by a factor of 10	~0	0	0	0	1,200,000
Safey relief valve (SRVs) Reseat 51 - Increase SRV reseat reliability	Completely eliminate stuck open SRV events	4	4	18,000	23,000	2,200,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [(b)]	($) [(b)]	
Diversity of Explosive Valves	Completely eliminate common cause failures of SLC explosive valves	~0	0	0	0	
53 - Diversify explosive valve operation						>200,000
Prevent catastrophic containment failure	Reduce CDF contribution in scenarios where containment venting is successful by a factor of 2	2	2	10,000	14,000	
54-Implement passive overpressure relief						>500,000
Improve control rod drive (CRD) reactor vessel injection reliability	Eliminate failure of CRD reactor vessel injection	~0	0	0	0	
55-Change CDR flow control valve failure position to the “fail-safest” position						>140,000
Large Break LOCA	Completely eliminate large break LOCAs	~0	0	0	0	>100,000
56 - Provide digital large break LOCA protection						

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) (b)	($) (b)	
Controlled Containment Venting	Reduce probability of operator to recognize the need to vent the torus by a factor of 3	14	16	74,000	95,000	400,000
57 - Control containment venting within a narrow band of pressure						
RHR heat removal	Completely eliminate CDF contribution from failure of cross-tie from fie protection to RHR heat exchanger “A”	~0	1	2,000	3,000	
58-Provide tap from fire protection to RHR heat exchanger “B” via RHRSW header B						150,000
Injection and containment heat removal	Complete eliminate failure from residual heat removal service water (RHRSW)loop B	11	12	56,000	73,000	
59- Provide a cross-tie between RHRSW trains downstream of the RHRSW pump discharge valves						400,000

Table G-5. SAMA Cost/Benefit Screening Analysis for JAFNPP (cont.)

SAMA	Assumptions	% Risk Reduction		Total Benefit Using 7% Discount Rate	Total Benefit Using 3% Discount Rate	Cost ($)
		CDF	Population Dose	($) [b]	($) [b]	
Turbine Bypass	Eliminate CDF contribution due to loss of power conversion system (PCS) initiator	10	7	42,000	52,000	
60-Improve turbine bypass valve capability						745,000
Emergency Diesel Generators		**21**	**24**	**116,000**	**149,000**	
62-Develop a procedure to open the doors of the EDG buildings upon receipt of a high temperature alarm	**Reduce probability of EDG to run failures by a factor of three.**					**10,000**
Reactor Vessel Instrumentation	Completely eliminate CDF contribution due to loss of reactor vessel water level reference leg	2	2	7,000	9,000	
63-Provide additional reactor vessel monitoring and actuation system						1,200,000

(a) SAMAs in bold are potentially cost-beneficial

(b) Unless noted otherwise by Footnote (c) or (d), estimated benefits taken from Table S-1 in the supplemental information to the ER (Entergy 2006b)

(c) Estimated benefits taken from a revised assessment provided in response to RAI 5.7 (Entergy 2007)

(d) Estimated benefits taken from a revised assessment provided in response to RAI 5.1 (Entergy 2007)

G.6 Cost-Benefit Comparison

Entergy's cost-benefit analysis and the NRC staff's review are described in the following sections.

G.6.1 Entergy's Evaluation

The methodology used by Entergy was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997a). The guidance ivolves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) - COE where,

APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure costs ($)

AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. Entergy's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3 percent and one at 7 percent (NRC 2004).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δperson-rem/year)

x monetary equivalent of unit dose ($2000 per person-rem)

x present value conversion factor (10.76 based on a 20-year period with a 7-percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997a), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, which assumes elimination of all severe accidents due to internal events, Entergy calculated an APE of approximately $35,000 for the 20-year license renewal period.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction

x offsite economic costs associated with a severe accident (on a per-event basis)

x present value conversion factor.

For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, Entergy calculated an annual offsite economic risk of about $3,300 based on the Level 3 risk analysis. This results in a discounted value of approximately $36,000 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction

x occupational exposure per core damage event

x monetary equivalent of unit dose

x present value conversion factor.

Entergy derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997a). Best estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, Entergy calculated an AOE of approximately $1,000 for the 20-year license renewal period.

Averted Onsite Costs

Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. Entergy derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook (NRC 1997a).

Entergy divided this cost element into two parts – the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

ACC = Annual CDF reduction

x present value of cleanup costs per core damage event

x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, Entergy calculated an ACC of approximately $32,000 for the 20-year license renewal period.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction

x present value of replacement power for a single event

x factor to account for remaining service years for which replacement power is required

x reactor power scaling factor

For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, Entergy calculated an RPC of approximately $22,000 for the 20-year license renewal period.

Using the above equations, Entergy estimated the total present dollar value equivalent associated with completely eliminating severe accidents from internal events at JAFNPP to be about $125,000. Use of a multiplier of 4 to account for external events increases the value to $500,000 and represents the dollar value associated with completely eliminating all internal and external event severe accident risk at JAFNPP.

Entergy's Results

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 7 percent discount rate, and considering the combined impact of both external events and uncertainties), Entergy identified five potentially cost-beneficial SAMAs. The potentially cost-beneficial SAMAs are:

- SAMA 26 – provide additional DC battery capacity to ensure longer battery capability during the station blackout event, which would extend HPCI/RCIC operability and allow more time for AC power recovery.
- SAMA 30 – modify plant equipment to provide 16-hour SBO injection to improve capability to cope with longer SBO scenarios.
- SAMA 36 – modify plant equipment to extend DC power availability in an SBO event, which would extend HPCI/RCIC operability and allow more time for AC power recovery.
- SAMA 61 – modify plant procedures to allow use of a portable power supply for battery chargers, which would improve the availability of the DC power system.
- SAMA 62 – modify plant procedures to open the doors of the EDG buildings upon receipt of a high temperature alarm, which improves the reliability of the EDGs following high temperatures in the EDG buildings.

Entergy performed additional analyses to evaluate the impact of alternative discount rates and remaining plant life on the results of the SAMA assessment. No additional SAMA candidates were determined to be potentially cost-beneficial (Entergy 2006a). In supplemental information to the ER, Entergy provided a revised assessment based on a separate accounting of uncertainties. The revised assessment resulted in identification of the same potentially cost-beneficial SAMAs. However, based on further consideration of potentially cost-beneficial SAMAs at other plants, Entergy identified one additional potentially cost-beneficial SAMA for JAFNPP (Entergy 2006b). The potentially cost-beneficial SAMAs, and Entergy's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of Entergy's Cost-Benefit Evaluation

The cost-benefit analysis performed by Entergy was based primarily on NUREG/BR-0184 (NRC 1997a) and was conducted consistent with this guidance.

In the ER, Entergy evaluated the reduction in risk for each SAMA in the context of an upper bound analysis which combined the impact of external events with the impact of uncertainty. The impact of external events was considered by applying a multiplier of 4.1 to the estimated SAMA benefits in internal events (1 + [fire CDF of 8.53×10^{-6} per year] / [internal events CDF of

2.74 x 10^{-6} per year]). The impact of uncertainties was considered by applying an additional multiplier of 3.83, which represents the ratio of the 95th percentile CDF to the mean CDF for internal events. Entergy bounded the combined impact of external events and uncertainties by applying a multiplier of 16 to the estimated SAMA benefits in internal events.

In an RAI, the NRC staff requested that the baseline evaluation be revised to include only the impact of internal and external events (without uncertainties), and that the impact of analysis uncertainties on the SAMA evaluation results be considered separately (NRC 2006). In supplemental information to the ER, Entergy revised the baseline benefit values by applying a multiplier of 4 to the estimated SAMA benefits in internal events to account for potential SAMA benefits in both internal and external events (Entergy 2006b).

As a result of the revised baseline analysis (using a multiplier of 4 and a 7 percent real discount rate), Entergy found that the same five SAMA candidates (mentioned above) remained potentially cost-beneficial. No additional SAMA candidates were found to be potentially cost-beneficial. When benefits were evaluated using a 3 percent discount rate, as recommended in NUREG/BR-0058, Revision 4 (NRC 2004), no additional SAMAs were determined to be potentially cost-beneficial.

Entergy considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. In the ER, Entergy presents the results of an uncertainty analysis of the internal events CDF which indicates that the 95 percentile value is a factor of 3.83 times the mean CDF. Entergy re-examined the Phase II SAMAs to determine if any would be potentially cost-beneficial if the revised baseline benefits were increased by an additional factor of 4. No additional SAMAs were identified.

The NRC staff questioned the ability of several of the candidate SAMAs identified in the ER to accomplish their intended objectives or provide the estimated risk reductions (NRC 2006). In response to the RAI, Entergy provided revised or new evaluations as discussed below.

- Phase II SAMA 57, control containment venting within a narrow pressure band, was identified as a potential SAMA to further reduce the risk contribution from basic event NVP-XHE-FO-LVENT, operator fails to vent containment using the direct torus vent. This SAMA would be subject to the same failure-to-vent human error as in the basic event. The NRC staff questioned both the risk reduction estimate provided by Entergy for this SAMA, as well as whether an alternative SAMA to create a passive vent system might be more effective in reducing the risk from this event and be cost-beneficial (NRC 2006).

  In the ER, Entergy estimated the benefit of controlling containment venting within a narrow pressure band by reducing the probability of operator failure to vent by a factor of 3. In supplemental information to the ER, Entergy included a sensitivity analysis in which continued vessel injection from LPCI or Core Spray was credited for those sequences in which torus venting is successful and alternative injection systems fail after torus venting (Entergy 2006b). Since the available net positive suction head (NPSH) is likely to be less than the required NPSH with the vent open, a failure probability of 0.9 was assigned for this new success path. The PSA model change resulted in about a 0.5-percent reduction in CDF, a 0.6-percent reduction in population dose, and a benefit (including the impact of uncertainties) of approximately $10,000. Entergy concluded that the original benefit values reported for SAMA 57 (and reported in Table G-4) are more conservative (Entergy 2006b). Therefore, this SAMA continues to not be cost-beneficial at JAFNPP.

The NRC staff also asked the applicant to provide an evaluation of the costs and benefits of converting the vent system to a passive design. In response, Entergy evaluated a new SAMA that would convert the existing torus vent to a passive torus vent (Entergy 2007). The benefit of this SAMA was conservatively estimated by removing operator failure to implement torus venting (NVP-XHE-FO-LVENT was set to zero). Entergy estimated that this modification would result in a CDF reduction of about 18 percent, a population dose reduction of about 20 percent, and a benefit (7 percent baseline with uncertainty) of approximately $377,000. However, Entergy estimated the cost of implementing this SAMA to be greater than $1M. Therefore, this SAMA alternative would not be cost-beneficial at JAFNPP.

- Phase II SAMA 61, develop a procedure to use a portable power supply for battery chargers, was identified as a potential SAMA to improve DC system reliability. The staff questioned the risk reduction estimate provided by Entergy for this SAMA since the events identified as being eliminated for the analysis were not included in the list of risk significant events in ER Table E.1-2. In response to an NRC staff RAI, Entergy performed a revised evaluation by eliminating failures of both DC battery chargers and both 125-V DC battery boards. The PSA model change resulted in about a 2-percent reduction in CDF, a 2-percent reduction in population dose, and a benefit (including the impact of uncertainties) of approximately $40,000. Entergy concluded that this SAMA remains potentially cost-beneficial (Entergy 2007).

The NRC staff noted that for certain SAMAs considered in the ER, there may be alternatives that could achieve much of the risk reduction at a lower cost. Several of these alternatives were evaluated by Entergy subsequent to the ER, and described in the supplemental information to the ER (Entergy 2006b). One such alternative involves use of a portable generator to extend the coping time in loss of AC power events (to power battery chargers). Based on a bounding analysis in which the probability of non-recovery of offsite power for 7 hours was changed to 24 hours for SBO scenarios, this alternative was estimated to result in a CDF reduction of about 39 percent, a population reduction of 44 percent, and a benefit (including impact of uncertainties) of $838,000. Since the estimated cost of implementing and using the portable generator is $712,000, Entergy concluded that this SAMA is potentially cost-beneficial to JAFNPP.

The NRC staff asked the applicant to evaluate several additional lower cost alternatives to the SAMAs considered in the ER. These alternatives included: (1) use a portable generator to provide alternate DC feed to panels supplied only by the DC bus, (2) addition of a redundant diesel fire pump to address event FXT-ENG-FR-76P1, diesel driven fire water pump 76P-1 fails to continue to run (an alternative to SAMA 49, which involves addition of an entire new injection system), and (3) several additional alternatives (NRC 2006). Entergy provided a further evaluation of these alternatives, as summarized below.

- Use of a portable generator to provide power to an individual 125 VDC Motor Control Center (MCC), which would support returning HPCI to service in the event its bus was to fail -- Based on a bounding analysis in which failure of the HPCI system was eliminated, this alternative was estimated to result in a CDF reduction of about 3 percent, a population dose reduction of 1 percent, and a benefit (including impact of uncertainties) of $34,000 (Entergy 2006b). However, Entergy estimated the cost of implementing this alternative to be approximately $700K. Therefore, this alternative would not be cost-beneficial at JAFNPP.

- Use of a third redundant diesel fire pump to address event FXT-ENG-FR-76PI -- Based on a bounding analysis in which events FXT-EG-FR-76PI and FPS-MAI-MA-P4 are set to zero in the PSA model, this alternative was estimated to result in a CDF reduction of about 1 percent, a population dose reduction of 1 percent, and a benefit (including the impact of uncertainties) of $20,000. However, Entergy estimated the cost of implementing this alternative to be approximately $2M (Entergy 2007). Therefore, this alternative would not be cost-beneficial at JAFNPP.

- Entergy indicated that the remaining low cost alternatives identified in the RAI are already implemented or already addressed by existing plant procedures.

In response to an NRC staff RAI, Entergy indicated that the five potentially cost-beneficial SAMAs identified in the ER plus the one additional potentially cost-beneficial SAMA identified in the supplemental information to the ER have all been entered into the licensee's engineering request process to be evaluated for implementation (Entergy 2007). SAMAs 26, 30, 36 and the one additional SAMA were combined into a single engineering request to determine and implement the best approach to extend station battery capacity. SAMA 61 has been approved as a minor modification and is scheduled for installation for late 2007. SAMA 62 was implemented in November 2006 by revising applicable annunciator response procedures.

The NRC staff notes that all of the potentially cost-beneficial SAMAs identified in either Entergy's baseline analysis or uncertainty analysis are included within the set of SAMAs that Entergy plans to further evaluate. The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the other SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

Entergy compiled a list of 293 SAMAs based on a review of: the most significant basic events from the plant-specific PSA, insights from the plant-specific IPE and IPEEE, Phase II SAMAs from license renewal applications for other plants, and review of other NRC and industry documentation. A qualitative screening removed SAMA candidates that (1) were not applicable at JAFNPP due to design differences, (2) had already been implemented at JAFNPP, or (3) were similar and could be combined with another SAMA. Based on this screening, 230 SAMAs were eliminated leaving 63 candidate SAMAs for evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate were developed as shown in Table G-4. The cost-benefit analyses showed that five of the SAMA candidates were potentially cost-beneficial in the baseline analysis (Phase II SAMAs 26, 30, 36, 61, and 62). Entergy performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. No additional SAMAs were identified as potentially cost-beneficial in the ER. However, as a result of additional analysis, Entergy concluded that one additional SAMA is potentially cost-beneficial, i.e., use of a portable generator to extend the coping time in loss of AC power events. Entergy has indicated that the potentially cost-beneficial SAMAs have been entered into the engineering request process to be evaluated for implementation. The NRC staff concluded that all of these SAMAs are potentially cost-beneficial.

The NRC staff reviewed the Entergy analysis and concludes that the methods used and the implementation of those methods was sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by Entergy are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The NRC staff concurs with Entergy's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by Entergy is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to Title 10 of the *Code of Federal Regulations*, Part 54.

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10. SUPPLEMENTARY NOTES

Docket No. 50-333; Operation License No. DPR-59

11. ABSTRACT *(200 words or less)*

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted to the NRC by Entergy Nuclear FitzPatrick, LLC and Enerty Nuclear Operations, Inc. (Entergy) to renew the operating licenses for James A. FitzPatrick Nuclear Power Plant (JAFNPP) for an additional 20 years under 10 CFR Part 54. The draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for JAFNPP are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Entergy; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments received during the scoping process.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*	
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