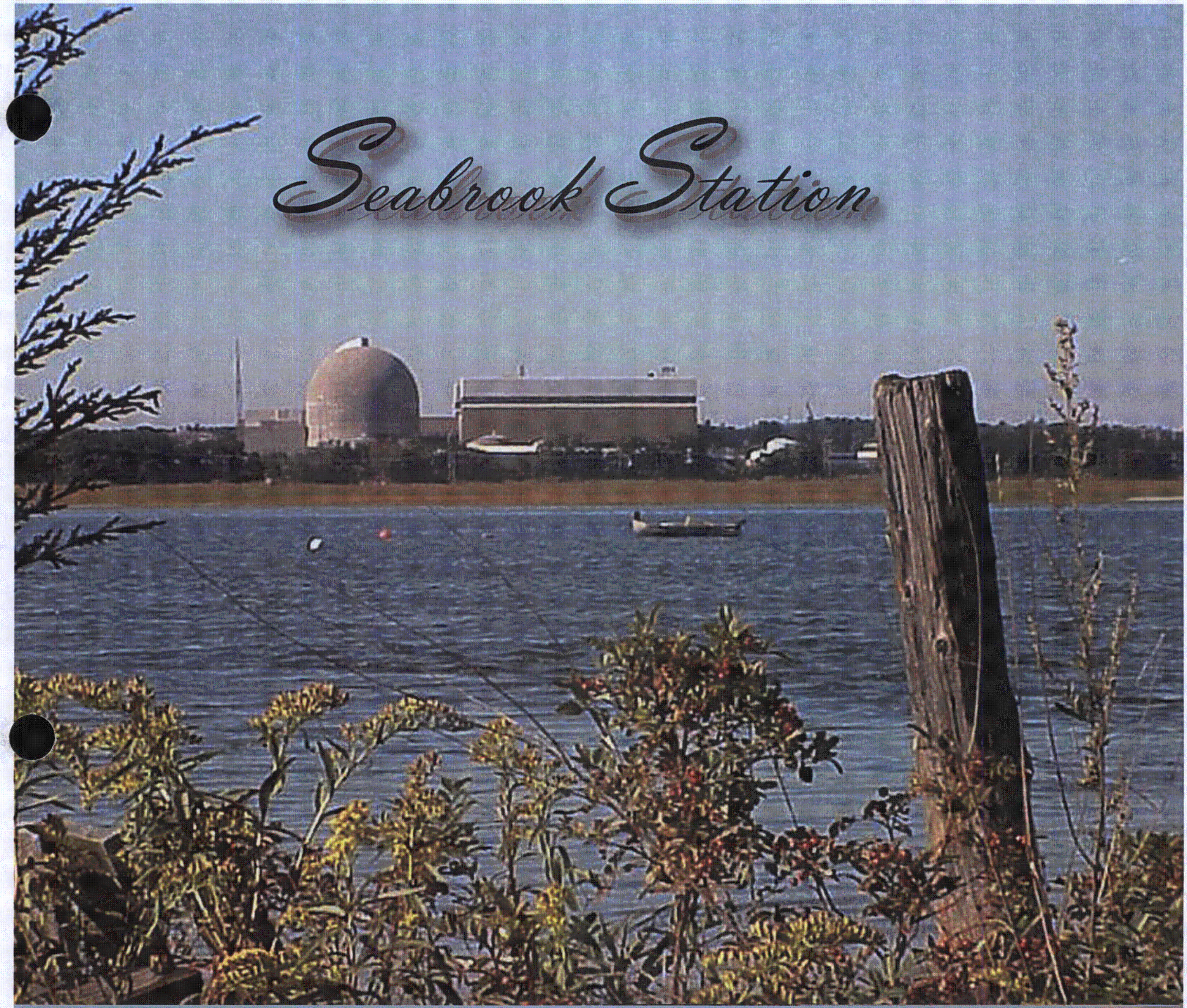
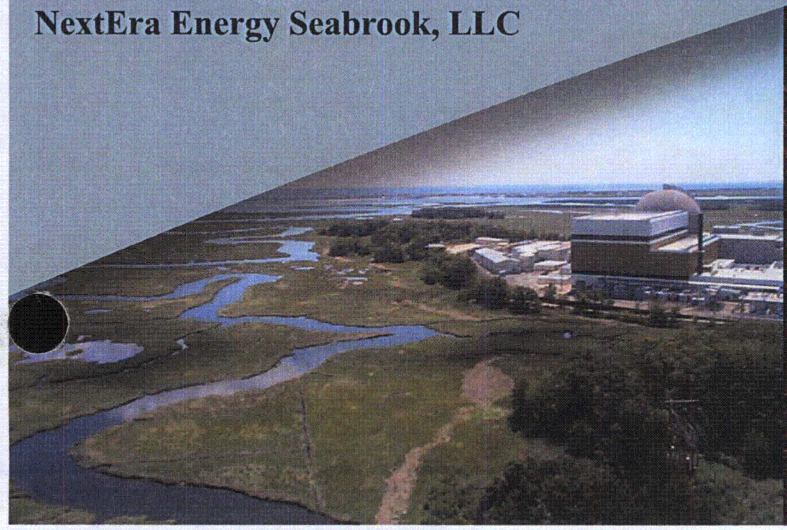
Seabrook Station



Applicant's Environmental Report
Operating License Renewal Stage
Seabrook Station
NextEra Energy Seabrook, LLC



Final
Applicant's Environmental Report –
Operating License Renewal Stage
Seabrook Station
NextEra Energy Seabrook, LLC

Unit 1
Docket No. 05000443
License No. NPF-86

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ACRONYMS AND ABBREVIATIONS

AC	alternating current
AE	adult equivalent
ArcGIS®	geographic information system software
bgs	below grade surface
B.P.	Before present
Btu	British thermal unit
CAIR	Clean Air Interstate Rule
CEQ	Council on Environmental Quality
C_{eq}	Carbon equivalent
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
Committee	Advisory Committee on Historic Preservation
CPUE	Catch per unit effort
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DFS	Dry Fuel Storage
DSM	demand-side management
EEZ	exclusive economic zone
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ESA	Endangered Species Act
FE	Federally Endangered
FES	Final Environmental Statement
FMC	Fishery Management Council
FMP	fishery management plan
FPL-NED	FPL-New England Division
FT	Federally Threatened
ft^3	cubic foot
g	gram
gal	gallon
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437)
GHG	Greenhouse gas
GIS	Geographic Information System
gpd	gallons per day
gpm	gallons per minute
Hg	mercury
IPA	Integrated Plant Assessment
IPE	individual plant examination
IPEEE	individual plant examination for external events
ISO	International Standards Organization

ACRONYMS AND ABBREVIATIONS (CONTINUED)

ISO-NE	Independent System Operator – New England
kV	kilovolt
kWh	kilowatt hour
lb	pound
LOS	level of service
mA	milliampere
MACR	maximum averted cost risk
MAE	Massachusetts Endangered [species]
MAT	Massachusetts Threatened [species]
MGD	million gallons per day
MNHESP	Massachusetts Natural Heritage and Endangered Species Program
mg/L	milligrams per liter
MM	million
MRA	multiple resource area
MTBE	methyl-tert-butyl ether
MSA	Metropolitan Statistical Area
msl	mean sea level
MW	megawatt
MWd/MtU	megawatt-days per metric ton uranium
MWe	megawatts-electric
MWt	megawatts-thermal
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	National Register of Historic Places
NEFMC	New England Fishery Management Council
NEI	Nuclear Energy Institute
NESC®	National Electrical Safety Code®
NGRID	National Grid
NHDRA	New Hampshire Department of Revenue Administration
NHE	New Hampshire Endangered
NHL	National Historic Landmark
NHNHB	New Hampshire Natural Heritage Bureau
NHT	New Hampshire Threatened
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSPS	New Source Performance Standard
NU	Northeast Utilities

ACRONYMS AND ABBREVIATIONS (CONTINUED)

OTEC	Ocean thermal energy conversion
pCi/L	pico Curies per liter
PM	particulate matter
PM_{10}	particulate matter with aerodynamic diameters of 10 microns or less
$PM_{2.5}$	particulate matter with aerodynamic diameters of 2.5 microns or less
PRA	Probabalistic Risk Assessment
PSNH	Public Service Company of New Hampshire
PWR	pressurized water reactor
ROI	region of interest
RPS	Renewable Portfolio Standards
SAMA	severe accidents mitigation alternative
SCM	Site conceptual model
SCR	selective catalytic reduction
SF_6	Sulfur Hexafluoride
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SR	State Road
ug/L	micrograms per liter
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
yr	year

1.0 INTRODUCTION

1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. NextEra Energy Seabrook, LLC operates the Seabrook Station Unit 1, pursuant to NRC Operating License NPF-86. The operating license for Unit 1 will expire on March 15, 2030 (NRC 2008).

NextEra Energy Seabrook has prepared this environmental report in conjunction with its application to the NRC to renew the Seabrook Station operating license, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and
- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Post-construction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

The NRC has defined the purpose and need for the proposed action, the renewal of the operating license for nuclear power plants such as Seabrook Station, as follows:

> "...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" (NRC 1996a).

The renewed operating license would allow an additional 20 years of plant operation beyond the current Seabrook Station licensed operating period of approximately 40 years.

1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew the operating license. Regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled Applicant's Environmental Report - Operating License Renewal Stage. In determining what information to include in the Seabrook Station Environmental Report, NextEra Energy Seabrook has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the Federal Register (NRC 1996a, NRC 1996b, NRC 1996c, NRC 1996d, and NRC 1999a);
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) NUREG-1437 (NRC 1996e and NRC 1999b);
- Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (NRC 1996f);
- Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response (NRC 1996g); and
- Supplement 1 to NRC Regulatory Guide 4.2, Preparation of Supplemental Environmental Report for Applications to Renew Nuclear Power Plant Operating Licenses (NRC 2000).

NextEra Energy Seabrook has prepared Table 1.2-1 to verify conformance with regulatory requirements. Table 1.2-1 indicates the section in which the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a quote of the regulatory language and applicable supporting document language.

Table 1.2-1 Environmental Report Responses to License Renewal Environmental Regulatory Requirements

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(1)		Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible and Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds and Withdrawing Makeup Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages (Plants With Once-through Cooling or Cooling Ponds)
	4.3	Impingement of Fish and Shellfish (Plants With Once-through Cooling or Cooling Ponds)
	4.4	Heat Shock (Plants With Once-through Cooling or Cooling Ponds)

Table 1.2-1 Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Continued)

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality (Plants Using Cooling Ponds At Inland Sites)
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Impacts on Public Health of Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historical and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low-Income Populations

1.3 SEABROOK STATION LICENSEE AND OWNERSHIP

The applicant, NextEra Energy Seabrook owns 88.2 percent of Seabrook Station and is the licensed operator. The remaining portion of Seabrook Station is owned by the following municipal utilities: Massachusetts Municipal Wholesale Electric Company (11.6 percent); Taunton Municipal Lighting Plant (0.1 percent); and Hudson Light & Power Department (0.1 percent) (EIA 2008a). NextEra Energy Seabrook, LLC, a Delaware limited liability company, is a direct, wholly-owned subsidiary of ESI Energy, LLC, which is a direct, wholly-owned subsidiary of NextEra Energy Resources, LLC. NextEra Energy Resources, LLC is in turn, a direct wholly-owned subsidiary of FPL Group Capital, Inc, which is a direct wholly-owned subsidiary of FPL Group, Inc. FPL Group is a public utility holding company incorporated in 1984 under the laws of the state of Florida and is based in Juno Beach, Florida. NextEra Energy Resources, LLC has nearly 90 facilities in operation in 25 states and Canada with approximately 17,000 megawatts of generating capacity (NextEra 2009a).

As the largest renewable energy provider in North America, more than 90 percent of NextEra Energy Resources generation comes from clean or renewable sources (NextEra 2009b). NextEra Energy Resources' extensive clean energy portfolio of wind, solar, clean-burning natural gas, hydroelectric, and nuclear power generation represent its dedication to environmental protection. This commitment flows down to each of NextEra Energy Resources' facilities. This is evident in Seabrook Station's receipt of the ISO 14001 Certification, which is an internationally recognized environmental management standard (FPLE 2008). NextEra Energy Resources and Seabrook Station are also active sponsors of many environmental planning, restoration, outreach, and education projects, such as:

- The Piscataqua Region Estuaries Partnership – an organization working to improve the water quality and to protect and restore important habitats in the Great Bay Estuary, the Hampton/Seabrook Estuary, and the smaller New Hampshire Atlantic estuaries (PREP 2009);
- The Browns River Culvert Project – a project to rebuild a culvert to provide a fresh infusion of tidal flow to a portion of the salt marsh adjacent to Seabrook Station to protect species such as the osprey (FPLG 2008); and
- The New Hampshire Coastal Programs – including support of organizations, such as The Blue Ocean Society for Marine Conservation, Waste Management, and the New Hampshire Department of Environmental Services in efforts to cleanup local beaches (NHDES 2008a).

Public Service Company of New Hampshire (PSNH), the original operator of Seabrook Station, was responsible for operation and maintenance of transmission lines, transmission substations, and associated land rights, contracts, permits, and equipment after the plant's construction (PSNH 1973).

In 1992, PSNH became a wholly owned subsidiary of Northeast Utilities (NU) (Seabrook 2008a). Two of the three 345 kilovolt (kV) transmission lines which connect Seabrook Station to the grid (Scobie Pond 345 kV and Newington 345 kV) are still owned by PSNH; the portion of the third line (Tewksbury 345 kV) that lies within New Hampshire is owned by PSNH and the portion that lies within Massachusetts is now owned by National Grid, an investor-owned, international electricity and gas company (Seabrook 2008a). PSNH maintains all three lines within New Hampshire; National Grid maintains the Tewksbury 345 kV line from the New Hampshire/ Massachusetts border to the line's termination at Ward Hill Substation in Haverhill, Massachusetts. FPL-New England Division (FPL-NED) owns and maintains the 345 kV Seabrook Station Transmission Switchyard (FPL-NED 2008).

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 LOCATION AND FEATURES

Seabrook Station is located in the Town of Seabrook, Rockingham County, New Hampshire, on the western shore of Hampton Harbor, two miles west of the Atlantic Ocean. The Station is approximately two miles north of the Massachusetts state line, 15 miles south of the Maine state line, and 10 miles south of Portsmouth, New Hampshire. This location is latitude +42.898056 and longitude -70.851389 (decimal degrees). There are two metropolitan areas within 50 miles of the site: Manchester, New Hampshire (31 miles west-northwest), and Boston, Massachusetts (41 miles south-southwest). The closest population center (defined in 10 CFR 100 ["Reactor Site Criteria"] as a densely populated center with 25,000 residents or more) is Haverhill, Massachusetts, which is approximately 15 miles southwest of the site (USCB 2007a; USCB 2007b; USCB 2007c). Figures 2.1-1 and 2.1-2 are the 6-mile and 50-mile vicinity maps, respectively.

The site consists of 889 acres divided into two lots. Lot 1, which is owned by the Seabrook Station joint owners, is approximately 109 acres, is mostly developed, and holds most of the operating facility. Lot 2, which is owned by NextEra Energy Seabrook, is approximately 780 acres and consists mainly of natural areas available for wildlife resources (Seabrook 2002). The natural areas are characterized by broad open areas of level tidal marsh veined with man-made linear drainage ditches and tidal creeks. Wooded islands and peninsulas rise from the marsh to elevations of 20 to 30 feet above sea level. The site is on a peninsula of land which is bordered on the north by the Browns River and on the south by Hunts Island Creek. Estuarine marshlands bound the site to the east. It is estimated that approximately 300 acres of the site are upland and 600 acres are marsh/wetland areas. The site boundary is also the exclusion area, as defined in 10 CFR Part 100. There are no residential homes within the 3,000-foot exclusion radius, measured from the center of the Unit 1 Containment Building (Seabrook 2008a). The site boundary/exclusion area is shown in Figure 2.1-3.

The single 1,245 net megawatt-electrical unit is a Westinghouse pressurized water reactor (NextEra 2009c). Two approximately 3-mile-long tunnels bring water to and from the Atlantic Ocean for cooling and other plant systems. No groundwater wells are used for current Seabrook Station operations. Fresh water is purchased from the Town of Seabrook (Seabrook 2008a). Site structures in addition to the Unit 1 Containment Building include the Primary Auxiliary Building, Fuel Storage Building, Waste Processing Building, Control and Diesel Generator Building, Turbine Building, Administration and Service Building, ocean intake and discharge structures, Circulating Water Pump House, and Service Water Pump House. Originally two identical units were to be built on the site, but construction of Unit 2, which was approximately

25 percent complete, was terminated in 1984. The buildings intended for use with Unit 2 are used primarily for storage (Seabrook 2008a) (Figure 2.1-3).

Section 3.1 describes key features of Seabrook Station, including the reactor and containment systems, cooling water system, and transmission system.

The retail industry is the largest industry in the Rockingham County economy (USCB 2008a). An estimated 250 industrial, commercial, and retail companies are located in the Town of Seabrook with Seabrook Station as the largest employer (Town of Seabrook 2008a).

The area is served by state highways, Interstate 95, and US Route 1. Nearby domestic and international airports are Logan International Airport in East Boston, Massachusetts (37 miles from Seabrook Station); Manchester-Boston Regional Airport in Manchester, New Hampshire (30 miles from Seabrook Station); and Portsmouth International Airport/Pease International Tradeport in Newington, New Hampshire (13 miles from Seabrook Station). The Metropolitan Boston Transit Authority provides commuter rail service between Boston and Newburyport, Massachusetts, which is about 6 miles from Seabrook Station. There is also an Amtrak station in Exeter, New Hampshire, which is about 8 miles from Seabrook Station (Amtrak 2008). The New Hampshire State Port Authority provides worldwide bulk and general cargo transport in and out of Portsmouth Harbor, 15 miles from Seabrook Station. (Town of Seabrook 2008a)

Recreation in the area is primarily focused around beaches and associated use activities. The Seabrook Station Science and Nature Center was opened as a visitor's center for the site in 1978. The center offers more than 30 interactive educational exhibits, most of which are hands-on and focus on nuclear energy and the ecosystem surrounding the plant. Two of the exhibits feature live marine life. The visitor's center is surrounded by the Owascoag Nature Trail, a nearly one-mile boardwalk and trail for viewing the marsh and woodland habitats. (FPLE 2008)

The two nearest military installations are the Portsmouth Naval Shipyard in Kittery, Maine and the Pease Air National Guard Base at the Pease International Tradeport in Newington, New Hampshire. Both are near Portsmouth, New Hampshire. The U.S. Coast Guard has two stations near the site: Merrimack River Station is approximately 6 miles to the south-southwest in Newburyport, Massachusetts and Portsmouth Harbor Station is approximately 15 miles to the northeast, in New Castle, New Hampshire (Seabrook 2008a).

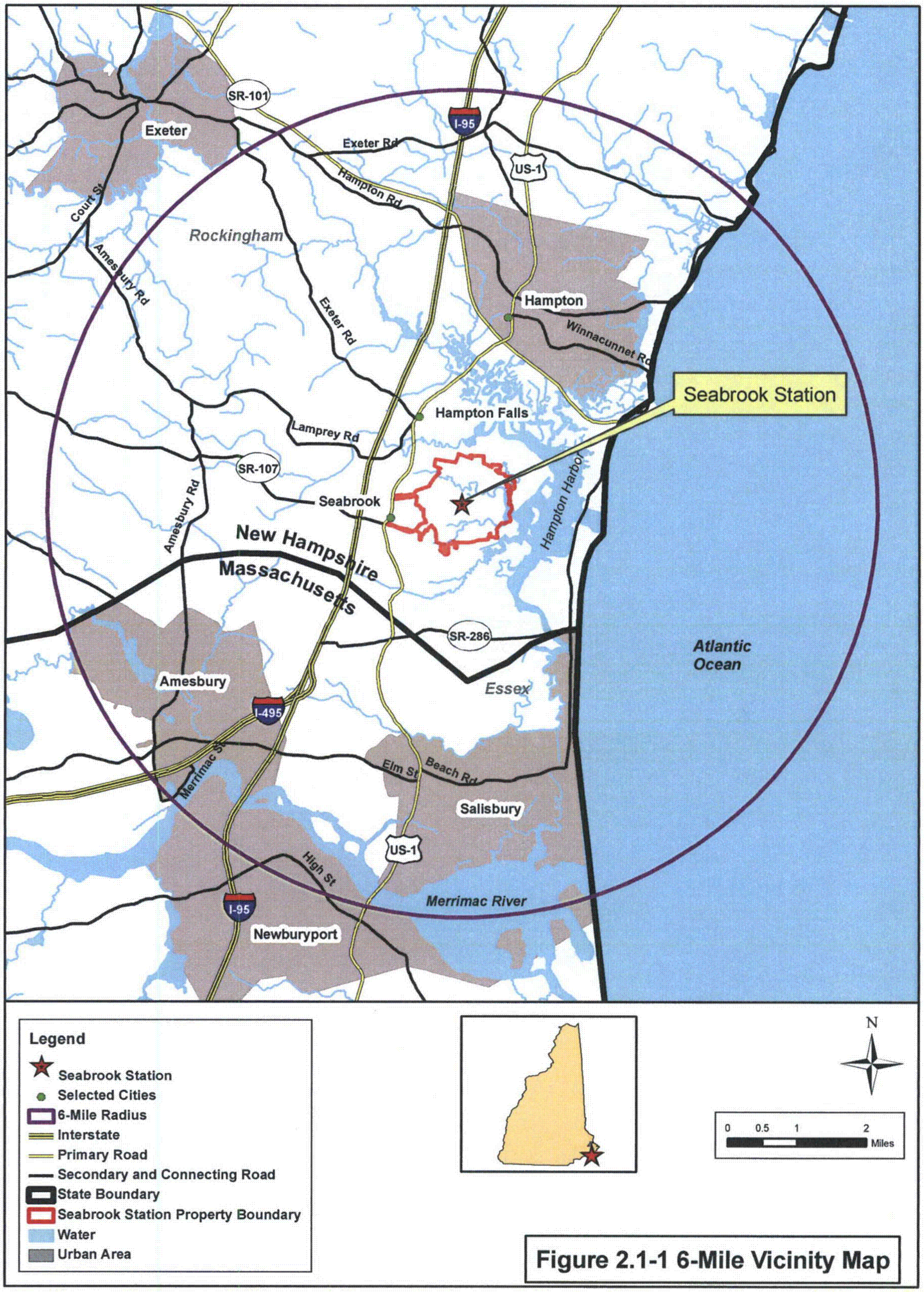

Figure 2.1-1 6-Mile Vicinity Map

Figure 2.1-2 50-Mile Vicinity Map

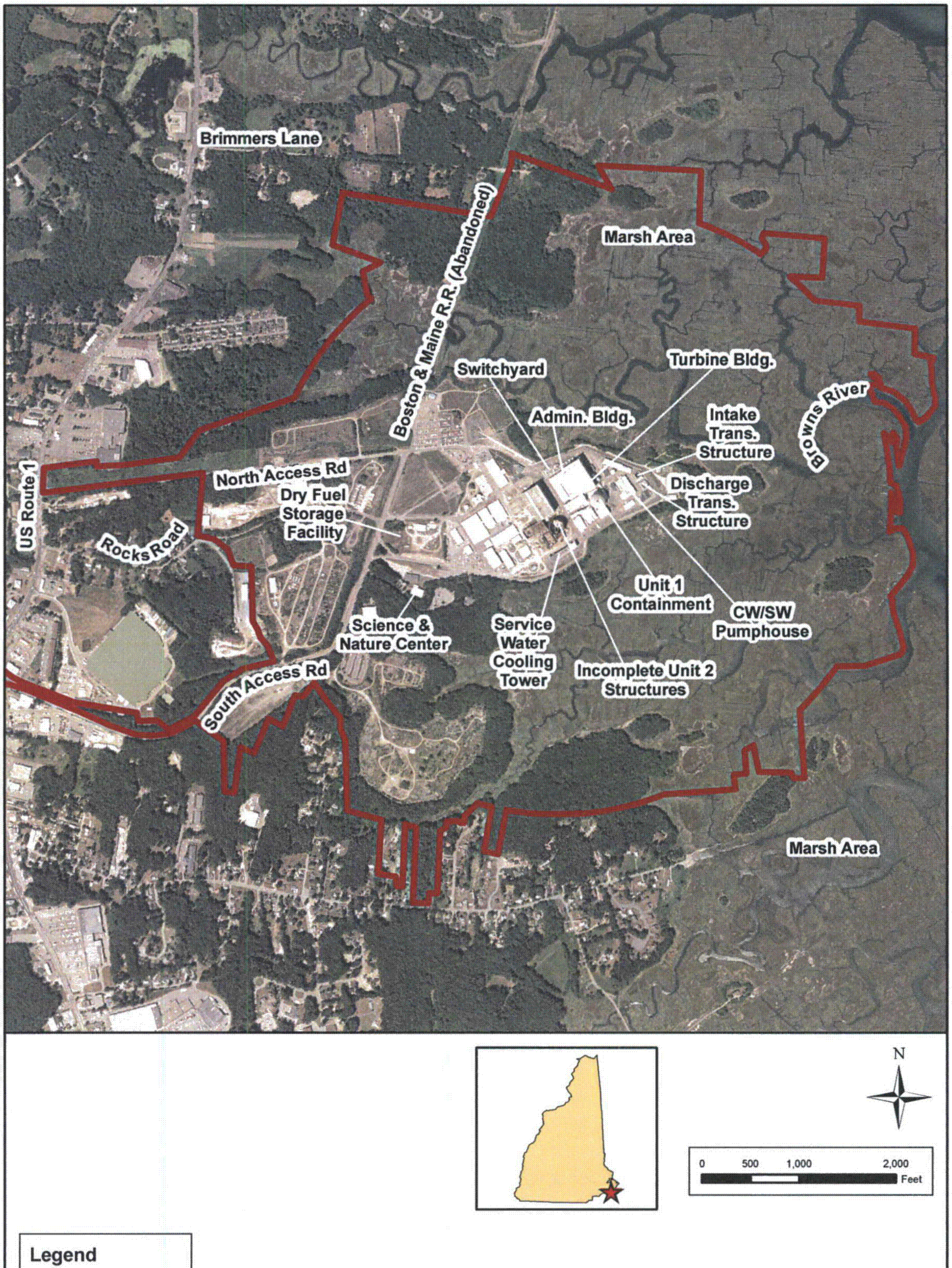

Figure 2.1-3 Seabrook Station Site Boundary

2.2 AQUATIC RESOURCES

NextEra Energy and the previous operator of Seabrook Station, Public Service Company of New Hampshire (PSNH), have monitored water quality and aquatic communities in the plant vicinity since 1974. The monitoring program has been overseen by an advisory panel of scientists and engineers from resource and regulatory agencies, including the New Hampshire Fish & Game Department, New Hampshire Department of Environmental Services, National Marine Fisheries Service, and US EPA Region I. Seabrook Station's 1993 National Pollutant Discharge Elimination System (NPDES) permit stipulated that the panel was "empowered to accept, reject, or modify the facility's biological monitoring program and/or schedules." Seabrook Station's current NPDES permit notes that the Regional Administrator and/or the Director of the EPA will determine the appropriate scope of biological studies, but the advisory panel continues to play an important advisory role.

Monitoring was conducted by PSNH on a limited basis until the late 1970s, when the scale and intensity of monitoring studies were substantially increased. Up to 12 years of preoperational data (1978-1990) and 18 years of operational data (1990-2008) were reviewed in preparing this Environmental Report. Ecological elements monitored over this 30-year period included water quality and nutrients, phytoplankton, zooplankton, ichthyoplankton and fish, macroflora and macrofauna (including estuarine benthos and those from offshore fouling panels), epibenthic crustaceans (*Cancer* spp. crabs and lobsters), softshell clams (adults and larvae), and other bivalve larvae. Over time, some community studies were discontinued because (1) there were sufficient data to eliminate concerns about potential impacts, (2) the natural variability within the community was so high that a plant impact was unlikely to ever be detected, or (3) other components of the monitoring program provided sufficient data to assess the state of the community in question. A summary of the on-going environmental monitoring program is presented in Table 2.2-1, with the monitoring/sampling locations provided in Figure 2.2-1.

2.2.1 PHYSICAL SETTING

The source water body for the Seabrook Station cooling water is the western Gulf of Maine. Seabrook Station has established an extensive water quality (water temperature, salinity and dissolved oxygen) database with data compiled from two offshore sampling stations to document the environmental setting.

The three concrete intake structures for Seabrook Station are located off-shore, about 60 feet below mean lower low water and the general bottom topography of the seabed in this area is relatively flat with a gradual slope to deeper water several miles offshore. The bottom topography in the immediate vicinity of the Seabrook Station intakes is flat with sand overlying bedrock, providing only marginal fish habitat. This sand substrate extends for several hundred feet around each of the intake structures and has remained relatively undisturbed (i.e., sand has not migrated up the sides of the structures). (NAI and ARCADIS 2008)

2.2.2 AQUATIC COMMUNITIES

The fish community in the vicinity of the intakes is typical of the western Gulf of Maine. The groundfish community is monitored using an otter trawl as part of the continuing Seabrook Station environmental monitoring program (Figure 2.2-1). The groundfish community in 2007 was dominated by winter flounder (*Pseudopleuronectes americanus*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), windowpane flounder (*Scophthalmus aquosus*), skates (*Rajidae*), red hake (*Urophycis chuss*), and yellowtail flounder (*Limanda ferruginea*). (NAI 2008)

Catch per unit effort (CPUE) in the trawl monitoring program reached a maximum in 1980 and 1981 when winter flounder and yellowtail flounder dominated the catch. CPUE was lowest in 1995. Since 1995, the monitoring program has shown a trend of increasing CPUE. In the early 1980s, prior to plant start-up, the groundfish community was dominated by yellowtail flounder, longhorn sculpin, winter flounder, and red and white hake (*Urophycis spp.*). In the 1990s and 2000s, CPUE of yellowtail flounder decreased, and CPUE of winter flounder, longhorn sculpin, and skates increased. The changes in the groundfish community were attributed primarily to overfishing of commercially important species and not attributed to the operation of Seabrook Station (NAI 2008).

The index of biomass for principal groundfish and principal flounders calculated by the National Marine Fisheries Service (NMFS) roughly parallels the trends in CPUE seen in the Seabrook Station monitoring program (Sosebee et al. 2006). The index of principal groundfish peaked in 1977 and declined to low values by 1987 and 1988, while the index of principal flounders peaked in the late 1970s and early 1980s, and declined to a low in the late 1980s and early 1990s. Both indices have risen since the 1990s, although the index for principal flounders declined to near record lows in 2005 (the last year data were available). The increase in principal groundfish was due to higher biomass levels of Georges Bank haddock and redfish, species that are not dominant in the Seabrook Station monitoring program. The recent decline in the flounder index was due to declines in yellowtail flounder, American plaice (*Hippoglossoides platessoides*), witch flounder (*Glyptocephalus cynoglossus*), and winter flounder (*Pseudopleuronectes americanus*) (Sosebee et al. 2006), although the CPUE data for winter flounder from the Seabrook Station environmental monitoring program does not reflect this decrease in winter flounder abundance.

The pelagic fish community was monitored in the vicinity of the intakes and discharges using gill nets from 1976 until 1997. Monitoring was discontinued after 1997 when it was decided that the detrimental impacts of gill netting on the community outweighed the value of the data collected. Data from this program indicated that the pelagic community was dominated by Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), pollock (*Pollachius virens*), and blueback herring (*Alosa aestivalis*) (NAI 1998). CPUE of pelagic fish peaked in 1977 and remained at lower and stable levels from 1980 through 1997 (NAI 1998). The NMFS index of biomass for principal pelagic fishes does not show the same annual trends as the Seabrook Station monitoring data, although the dominant species, Atlantic herring and Atlantic mackerel, are the same. The NMFS index declined in the mid 1970s to the lowest levels in the time series of 1965-2005 due to the collapse of the Georges Bank Atlantic herring stock. The index peaked in 1998 and 2000 and has declined slightly since (Sosebee et al. 2006).

Tables 2.2-2 and 2.2-3 present annual loss estimates of Adult Equivalent (AE) fish resulting from entrainment (fish eggs and larvae, Table 2.2-2) and impingement (juvenile and adult fish, Table 2.2-3) attributable to Seabrook Station. For the most recent years (2002-2006) for which AE estimates are available, the Seabrook Station entrainment of fish eggs and larvae was estimated to represent the annual loss of 495,068 adult fish (ARCADIS et al. 2008). Cunner (*Tautogolabrus adspersus*) had the largest annual AE loss estimate, (242,165 adults; 49 percent of total). AE losses of commercial fishes due to egg and larval entrainment were generally less than 2,000 per year. In an earlier study, Saila et al. (1997) estimated that egg and larval entrainment at Seabrook Station represented an annual loss of 3 AE pollock, 226 AE red hake, and 2,009 AE winter flounder. The annual estimated AE loss at Seabrook Station due to entrainment is about 32 percent of the estimated recreational take from the marine waters of New Hampshire (Table 2.2-2). However, 96 percent of the AE loss at Seabrook Station is from cunner and other fish of minimal recreational importance.

The loss of winter flounder due to larval entrainment was estimated by Saila et al. (1997) to be the equivalent of less than the 3-day catch of a small inshore trawler from the New England fishing fleet.

Bivalve larvae (shellfish) entrainment has been monitored at Seabrook Station since 1990. Annual entrainment of bivalve larvae averaged 1.60×10^{13} larvae from 1990 through 2007 (NAI 2008). Although entrainment survival of bivalve larvae has not been studied at Seabrook Station, mortality is assumed to be 100 percent. *Anomia squamula, Mytilus edulis*, and *Hiatella sp.* are typically the most abundant bivalve larvae entrained. *A. squamula* and *Hiatella sp.* are not recreationally or commercially important but *M. edulis*, the blue mussel, is an edible species.

The softshell clam *(Mya arenaria)* is an important recreationally harvested bivalve, and Hampton Harbor contains the most productive clam flats in New Hampshire. Each year, as part of its environmental monitoring program, Seabrook Station conducts a survey of the density of softshell clams on the major clam flats in Hampton Harbor. Annual entrainment estimates of softshell clam larvae averaged 1.97 x 10^{10} from 1991 through 2007 (NAI 2008). While this entrainment estimate appears large, there is little evidence of a strong correlation between softshell clam larval and adult abundances (NAI 2008; LeBlanc and Miron 2006). Post-settlement processes and availability of suitable habitat appear to be more important than larval supply in controlling abundance of softshell clams (Hunt et al. 2003). Estimates of larval mortality in the wild are not known, but are likely very high. Due to the lack of mortality data, AE estimates for softshell clams and other bivalves have not been developed.

Impinged fish and shellfish consisted primarily of young-of-the-year and immature organisms (NAI 2008). No bivalves were impinged and American lobsters (*Homarus americanus*) were the only impinged shellfish enumerated in monitoring. Reliable impingement estimates were first made in 1994, and for the period 1994 through 2007 an annual average of 21,894 fishes and 18 lobsters were impinged under actual operating conditions (NAI 2008). Impingement mortality is assumed to be 100 percent as there is no practical means to return impinged organisms from the Circulating Water Pump House to the offshore marine environment (NAI and ARCADIS 2008). Even if a fish return system was constructed, there probably would not be significant survival due to pressure changes and transit time from the offshore intakes to the Pump House, and then to a theoretical offshore fish return site.

Between 2002 and 2006 Atlantic silverside (*Menidia menidia*; 18 percent), rock gunnel (*Pholis gunellus*; 12 percent) and winter flounder (*Pseudopleuronectes americanus*; 10 percent) were the species most often impinged (NAI 2008). Atlantic silverside and rock gunnel are small non-commercial fishes, and winter flounder is a commercially and recreationally important fish. Impingement during this period was estimated to represent an annual loss of 16,890 adult fishes and 6 lobsters (ARCADIS et al. 2008). Atlantic silverside (4,841; 29 percent of total), rock gunnel (2,665; 16 percent of total), and winter flounder (1,140; 7 percent of total) comprised the largest component of the AE estimate (ARCADIS et al. 2008). AE estimated losses due to impingement of commercial fishes, other than winter flounder, such as cods, hakes, tunas and mackerels, were generally less than 200 per year. In an earlier study, Saila et al. (1997; Table 9) estimated that impingement at Seabrook Station represented an annual loss of 83 AE winter flounder, 136 AE pollock and 219 AE red hake. The estimated AE loss at Seabrook Station due to impingement is about 1 percent of the estimated recreational catch from New Hampshire waters (Table 2.2-3).

Several species of marine mammals and marine turtles have the potential to occur in the vicinity of the intakes and discharge of Seabrook Station. The intakes were originally equipped with bar racks with 17-inch nominal spacing. From 1993 to 1998, approximately 55 seals (four species, but primarily harbor seals [*Phoca vitulina*]) died in the intake tunnels. Seals apparently swam into the intakes, became disoriented, and drowned. In 1999, NMFS issued an incidental, small take exemption for marine mammals from routine operations of the Seabrook Station (NMFS 1999). In August of 1999, after discussions between Seabrook Station and NMFS, modifications were made to the intake structures which reduced the openings between bars to 5-inch nominal spacing to prevent the entrance of harbor seals and other pinnipeds into the intake structures (ARCADIS et al. 2008). Bar openings of this dimension coupled with the estimated water velocity through the bars of 0.71 feet/second at design flow (ARCADIS et al. 2008) have effectively prevented marine mammals from entering the cooling water intake system of the station (NMFS 2002). In May 2004, NMFS determined that Seabrook Station no longer required an incidental take exemption due to the effectiveness of the modification to the intake structures (NMFS 2004). Although the Station has never experienced similar events with marine turtles, the modification is expected to prevent marine turtles from entering the system as well. The thermal discharge from the station is within permit limits and should have no impact on marine mammals or turtles.

2.2.3 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), enacted in 1976 and amended in 1996, mandated the establishment of eight regional Fishery Management Councils (FMCs) to manage fisheries in a newly-designated Exclusive Economic Zone (EEZ) between 3 and 200 miles offshore of the US coast. Regional FMCs were to manage these fisheries through the use of fishery management plans (FMPs) prepared by the Councils and subject to the review and approval of NMFS. FMPs, the contents of which are prescribed in the Magnuson-Stevens Act, include a description of the fishery (or “stock,” which is essentially a population), an analysis of historical fish landings and fishing pressures, and proposed conservation and management measures that would ensure the long-term health and stability of the fishery. Each fishery’s FMP also describes and identifies essential fish habitat (EFH) for the population and actions that would serve to protect and enhance such habitat. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The Magnuson-Stevens Act requires NMFS to assist the regional fishery management councils in the management of EFH in their respective fishery management plans. Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding the potential effects of their actions on EFH, and respond in writing to NMFS or FMC recommendations. In addition, NMFS and the FMC may comment on and make recommendations to any state agency on the agency’s activities which may affect EFH.

The New England Fishery Management Council (NEFMC), one of the eight regional councils established by the Magnuson-Stevens Act, manages fishery resources in the EEZ off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. The management authority of the Council extends to the Gulf of Maine, Georges Bank, and southern New England, and overlaps with the Mid-Atlantic Council for some species in that region. To date, the NEFMC has issued nine fishery management plans: the Northeast Multispecies (Large Mesh/Groundfish) FMP (12 species), the Sea Scallop FMP, the Atlantic Herring FMP, the Northeast Multispecies (Small Mesh/Whiting) FMP (3 species), the Deep-sea Red Crab FMP, the Northeast Skate Complex FMP (7 species), the Atlantic Salmon FMP, the Monkfish FMP, and the Spiny Dogfish FMP. All NEFMC FMPs have been implemented by NMFS; some have been amended a number of times.

Because several of the FMPs address multiple species, the total number of species for which the NEFMC has designated an EFH is 28. Many of these species are found in the western portion of the Gulf of Maine in the general vicinity of Seabrook Station. Table 2.2-4 shows species and life stages for which an EFH has been identified in the western Gulf of Maine.

Table 2.2-1 Summary of the Present Study Design for the Annual Environmental Monitoring Program at Seabrook Station

Program	Parameter	Number of Stations	Sampling Frequency
Water Quality	Discharge Temperature	1 Farfield 1 Nearfield	Continuous
	Water Temperature (Surface and Bottom)	1 Farfield 1 Nearfield (1-m increments)	4/month
	Salinity (Surface and Bottom)	1 Farfield 1 Nearfield (1-m increments)	4/month
	Dissolved Oxygen (Surface and Bottom)	1 Farfield 1 Nearfield (1-m increments)	4/month
	Estuarine water Temperature	1	Weekly at high and low tides
	Estuarine Salinity	1	Weekly at high and low tides
Zooplankton	Bivalve larvae	1 Farfield 1 Nearfield	Paired tows weekly April-Oct
	Macrozooplankton	1 Farfield 1 Nearfield	Paired tows 2/month
Fish	Ichthyoplankton	1 Farfield 1 Nearfield	Paired tows 4/month
	Fish (otter trawl)	2 Farfield 1 Nearfield	Replicate tows 2/month
	Estuarine fish (seine)	3 Farfield	1/month, April-Nov
Macrobenthos	Macroflora and fauna	2 Farfield 2 Nearfield	3/year destructive sampling
	Macroflora and fauna	2 Farfield 2 Nearfield	3/year nondestructive sampling
	Settling organisms (panels)	1 Nearfield 1 Farfield	3/year
Epibenthic Crustaceans	Lobsters and *Cancer* sp. crabs	1 Nearfield 1 Farfield	3/week, June-Nov
	Lobster larvae	1 Nearfield 2 Farfield	1/week, May-Oct
Softshell clams	Adults and spat	Hampton Harbor (Farfield)	Annual population survey
Impingement	Adult fish	1 in-plant	2/week, year round
Entrainment	Ichthyoplankton Bivalve larvae	1 in-plant 1 in-plant	4 diel periods, 1/week, year round 1/week, mid April-Oct

Table 2.2-2 Annual Estimates of Adult Equivalent (AE) Fish Resulting from Entrainment at Seabrook Station and the Estimated Recreational Fish Catch in New Hampshire Waters, 2002-2006.

Species	Total AE Estimate due to Entrainment of Eggs and Larvae[a]	Recreational Catch[b]
Sharks, skates and rays	0	392,899
Cods and hakes		
Atlantic cod	151	271,889
Pollock	21	71,184
Red hake[c]	132	58
Other cods and hakes[d]	670	173,649
Total cods and hakes	974	516,780
Herrings	412	44,089
Sculpins[e]	12,703	8,255
Striped bass	0	296,055
Bluefish	0	50,537
Tunas and mackerels		
Atlantic mackerel	469	161,543
Other tunas/mackerels	0	1,110
Total tunas/mackerels	469	162,653
Cunner	242,165	18,563
Flounders		
Summer flounder	<1	422
Winter flounder	1,862	22,632
Other flounders[f]	1,097	7,095
Total flounders	2,959	30,149
Other fishes	235,386	2,170
Total fishes	**495,068**	**1,552,150**

a. ARCADIS et al. 2008
b. NMFS 2008a
c. AE estimate includes red and white hake.
d. AE estimate includes haddock and silver hake.
e. AE estimate includes shorthorn, moustache and longhorn sculpins.
f. AE estimate includes windowpane, witch flounder, and yellowtail founder.

Table 2.2-3 Annual Estimates of Adult Equivalent (AE) Fish Resulting from Impingement of Fishes at Seabrook Station and the Estimated Recreational Fish Catch in New Hampshire Waters, 2002-2006.

Species	Total AE Estimate due to Impingement of Fishes[a]	Recreational Catch[b]
Sharks, skates and rays	39	392,899
Cods and Hakes		
Atlantic cod	11	271,889
Pollock	121	71,184
Red hake[c]	4	58
Other cods and hakes[d]	61	173,649
Total cods and hakes	197	516,780
Herrings	72	44,089
Sculpins[e]	613	8,255
Striped bass	1	296,055
Bluefish	1	50,537
Tunas and mackerels		
Atlantic mackerel	2	161,543
Other tunas/mackerels	0	1,110
Total tunas/mackerels	2	162,653
Cunner	478	18,563
Flounders		
Summer flounder	0	422
Winter flounder	1,141	22,632
Other flounders[f]	1,015	7,095
Total flounders	2,156	30,149
Other fishes	13,328	2,170
Total fishes	**16,887**	**1,552,153**

a. ARCADIS et al. 2008
b. NMFS 2008a
c. AE estimates include red and white hake.
d. AE estimates include haddock and silver hake.
e. AE estimates include shorthorn, moustache and longhorn sculpins.
f. AE estimates include windowpane, witch flounder, and yellowtail founder.

Table 2.2-4 Essential Habitat in the Seabrook Station Area

Species	Adults	Juveniles	Larvae	Eggs
Atlantic sea scallop	√	√	√	√
Atlantic cod	√	√	√	√
Haddock		√		
American plaice	√	√		
Redfish	√	√	√	√
Yellowtail flounder	√	√		
Pollock		√		
Windowpane flounder	√	√		
Winter flounder	√	√	√	√
Red hake	√	√	√	√
Ocean pout	√	√	√	√
Atlantic halibut	√	√	√	√
Silver hake	√	√	√	√
Little skate	√	√		
Winter skate		√		
Atlantic herring	√	√		
Monkfish	√	√	√	√
Spiny dogfish	√	√		
Atlantic salmon		√		

Source: NMFS 2008b; NMFS 2009a

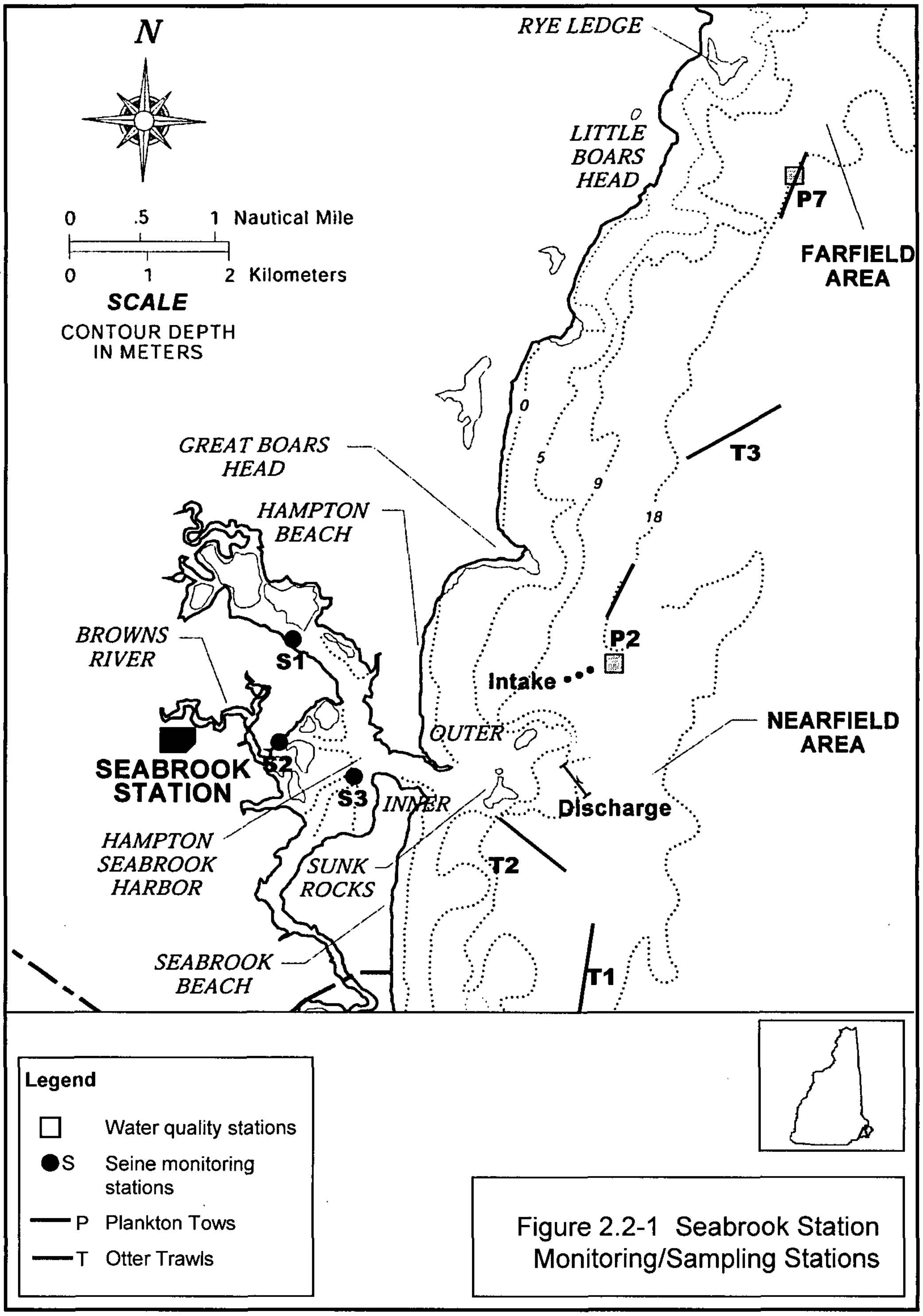

Figure 2.2-1 Seabrook Station Monitoring/Sampling Stations

2.3 GROUNDWATER RESOURCES

The hydrogeology in the general vicinity of the Site consists of a surficial aquifer in glacial and post-glacial unconsolidated deposits, and a bedrock aquifer. The surficial aquifer soils include beach deposits, swamp deposits and glacial drift. The glacial drift comprises till, ice-contact, marine and outwash deposits, and is up to 70 feet thick. The bedrock aquifer, which underlies the unconsolidated materials, is composed of Newburyport quartz diorite and the metamorphosed sediments of the Merrimack group (Seabrook 2008a).

2.3.1 GROUNDWATER SUPPLY AND SOURCES

No major aquifers occur in the vicinity of the Seabrook Station site (Seabrook 2008a). In the vicinity of the site, groundwater occurs in the bedrock and in overlying unconsolidated glacial and more recent deposits. The seaward edge of fresh groundwater does not extend greatly beyond the tidewater margins of Hampton Harbor. The shallow unconsolidated surficial deposits overlying bedrock are the principal aquifers in the area (Seabrook 2008a).

Groundwater in the underlying bedrock is limited to fractures which become less frequent with increasing depth. The effective depth for fractures to transmit water is about 300 feet. The largest quantities of groundwater are obtained from the coarse-grained sediments in the ice-contact deposits which consist primarily of stratified sand and gravel. These are the coarsest, in texture, of all of the local deposits and average about 50 feet in thickness. These deposits are a source of public water supply for the Towns of Seabrook, Salisbury, and Hampton (Seabrook 2008a).

Lesser amounts of groundwater, adequate for meeting the needs of homes, farms, and small industries are available from the outwash deposits. Well yields from them generally do not exceed 100 gpm. In the vicinity of the site, the outwash consists mostly of fine sand, generally less than 25 feet thick (Seabrook 2008a).

Some small wells are developed in the till or beach sands. The till is an assorted mixture of rock particles in a clay and silt matrix and only yields a few gallons per minute. The beach sands of the Hampton and Seabrook Beach areas are limited in their groundwater use. These sand lenses, which can be only several feet thick in some areas, contain freshwater floating on saline water. Recharge to these lenses is through infiltrating precipitation, from the beach areas. These till and beach sand deposits are not considered an important source of water for the region (Seabrook 2008a).

Impermeable marine deposits largely consisting of silt and clay are widely distributed in the area. They are not a source of well water but locally confine groundwater in ice-contact deposits, till, or bedrock (Seabrook 2008a).

There is little apparent difference in the water-bearing properties of the different types of bedrock. Most of the rock wells in the area yield less than 10 gpm (Seabrook 2008a).

Swamp deposits in the tidal marshes yeild brackish or salty water. These deposits are impermeable and are not sources of drinking water (Seabrook 2008a).

2.3.2 GROUNDWATER USAGE

Most water supplies in the area are dependent on groundwater sources. Public supplies in the Towns of Seabrook and Salisbury are taken from wells which tap aquifers in ice-contact deposits. These wells yield from about 300 to 700 gpm (Seabrook 2008a) and the Town of Seabrook wells range from 50 to 500 feet deep (Town of Seabrook 2008c). Most homes and commercial and industrial users in the Town of Seabrook are supplied by the town's 10 municipal water system wells, which are all located at least 2 miles west of the site (Seabrook 2008a). The town's wells supplied approximately 346 million gallons of water during 2007 (Town of Seabrook 2007a). The Salisbury Water Company supplies groundwater to most homes and industries in Salisbury, Massachusetts. Other wells supplying domestic and farm needs are scattered throughout the area, including in the Towns of Hampton Falls and Kensington, which lack public supply systems. In the vicinity of the site, a few private wells supply homes north of Seabrook Station (Seabrook 2008a). The two nearest well fields are approximately 2,000 and 3,000 feet to the west and north of the Site, respectively (RSCS 2009a).

Originally, Seabrook Station installed 15 groundwater wells in the bedrock aquifer at the two well fields located approximately 2,000 and 3,000 feet to the west and north of the site (Seabrook 2008a). Five of the 15 wells were never developed due to insufficient water and 3 of the wells were used only as observation wells. The 7 remaining wells provided groundwater to the Station at a rate of approximately 200 gallons per minute (gpm). The groundwater from these wells supplemented the fresh water supplied at a rate of 35 gpm by the Town of Seabrook and was used for sanitary and non-safety-related purposes (PSNH 1982). In 1986, Seabrook Station ceased using groundwater from the seven site wells and began using water supplied by the Town of Seabrook for all fresh water needs (PUCNH 1991). From 2003 through 2008, Seabrook Station's use of public water ranged from a low of 29 million gallons during 2004 (56 gpm) to a high of 53 million gallons during 2005 (101 gpm). The annual average for this period was 42 million gallons per year (80 gpm) (Seabrook 2003; Seabrook 2004a; Seabrook 2005; Seabrook 2006a; Seabrook 2007a; and Seabrook 2008b). During 2008, Seabrook Station used approximately 47 million gallons of public water (Seabrook 2008b) from the Town of Seabrook or approximately 14 percent of the town's 2007 public water supply (346 million gallons). The area's water supply demand is projected to increase through the year 2020. Additional groundwater wells, surface water sources, and inter-municipal distribution systems are anticipated to meet the region's water demands (Seabrook 2008a, Town of Seabrook 2008b). Local public water supply infrastructure is discussed in Sections 2.9 and 4.15.

2.3.3 PLANT GROUNDWATER QUALITY

In September 1999, elevated tritium concentrations were identified in groundwater sampled from the containment annulus. Seabrook Station evaluated the groundwater in the containment annulus and determined that the tritium concentration in the water in the annulus was at the same concentration as that of the Spent Fuel Pool water. This system water is common to the Spent Fuel Pool, Cask Loading Area and Fuel Transfer Canal. Seabrook surmised that a Spent Fuel Pool system liner leak was draining into the Fuel Storage Building annulus. From there it entered the groundwater, which then seeped into the containment annulus.

Monitoring of the drain collection lines in the Fuel Storage Building indicated that the tritiated water was leaking at a rate of approximately 0.1 gallon per day (gpd). After the drain collection lines were cleaned of debris, leakage increased over 2 years to about 30 to 40 gpd. Cleaning the drain collection lines had restored their design function; water from the Spent Fuel Pool system liner leak now drained down the liner and into the drain collection lines, rather than into the Fuel Storage Building annulus. Once the drain collection lines were restored, the water level in the Fuel Storage Building annulus receded. As part of the mitigation of the leak, a non-metallic liner was applied to the stainless steel liner. In addition, the containment annulus was drained. A periodic preventive maintenance task was established to verify and maintain that the Spent Fuel Pool drain collection lines are clear of debris.

2.3.3.1 Groundwater Withdrawal

In 2000/2001, a dewatering system was installed in the Primary Auxiliary Building and containment area of Unit 1, as part of the tritium mitigation and includes:

- A dewatering pump in the containment enclosure area
- A dewatering point in the Primary Auxiliary Building, adjacent to the Spent Fuel Pool
- A dewatering point in the Emergency Feed Water Pump House I, north of Unit 1 containment
- A dewatering point in the Residual Heat Removal B-Equipment vault on the northwest side of Unit 1 containment
- Dewatering points in the B Electrical Tunnel

The five dewatering points withdraw approximately 3,195 gpd of groundwater from the Unit 1 area.

In 2000, tritium concentrations were reported in the Primary Auxiliary Building monitoring well at concentrations up to 84,000 picocuries per liter (pCi/L). In 2003, tritium concentrations in the containment enclosure area ranged up to 3,560,000 pCi/L. Since a non-metallic liner was added to the Cask Handling and Fuel Transfer Canal in 2004, tritium concentrations have significantly decreased at both locations. The 2009 average tritium concentrations in the Primary Auxiliary Building and containment enclosure area were 4,525 pCi/L and 4,745 pCi/L, respectively (RSCS 2009a).

Tritium concentrations in groundwater extracted from the Residual Heat Removal B-Equipment vault and the Emergency Feedwater Pump House historically have been lower than the Primary Auxiliary Building and containment enclosure area concentrations. The 2009 average tritium concentrations in the Residual Heat Removal B-Equipment vault and the Emergency Feedwater Pump House were 602 pCi/L and 2,645 pCi/L, respectively (RSCS 2009a). The dewatering effort in the B Electrical Tunnel was initiated recently, and the 2009 average tritium concentration was 1,154 pCi/L.

In addition to the Unit 1 dewatering system to mitigate tritium contamination, approximately 32,000 gpd of groundwater is pumped from the Unit 2 containment building area to control the flow of groundwater into the Unit 2 containment (RSCS 2009b).

The Unit 1 and Unit 2 dewatering systems discharge to the site's underground stormwater drainage system, which discharges to the Atlantic Ocean (Seabrook 2008a; Seabrook 2008c). The stormwater drainage system is monitored as part of Seabrook Station's Radiological Effluent Monitoring Program.

2.3.3.2 Groundwater Monitoring Program

In 2004, Seabrook Station implemented a groundwater monitoring program in accordance with the Nuclear Energy Institute (NEI) Industry Ground Water Protection Initiative. Twenty-two monitoring wells have been installed at the site as part of the groundwater monitoring system. Fifteen of the monitoring wells were installed in 2004, four were added in 2007/ 2008 and three additional wells were added in 2009. The monitoring well network includes wells screened in both the surficial and bedrock aquifers, and wells located up-gradient, down-gradient, cross-gradient and at selected locations relative to the tritium-contaminated groundwater adjacent to Unit 1 (RSCS 2009a). Monitoring well details are presented in Table 2.3-1, and the well locations are shown in Figure 2.3-1.

Between 2004 and 2009, tritium in groundwater was reported in the surficial aquifer at concentrations ranging from 617 pCi/L to 2,930 pCi/L. Prior to June

2008, the tritium distribution at the site was limited to the area around Unit 1 and monitoring well SW-1 in the surficial aquifer. In June 2008, tritium was reported in monitoring wells SD-1 and BD-2, which are approximately 75 feet southwest of SW-1, at concentrations ranging up to 2,360 pCi/L and 1,880 pCi/L, respectively (RSCS 2009b). All tritium concentrations in shallow and deep groundwater at the site have been reported at concentrations well below the U.S. Environmental Protection Agency's (EPA) drinking water standard of 20,000 pCi/L.

Since 2001, Seabrook Station has been monitoring methyl- tert-butyl ether (MTBE) in shallow groundwater near the Vehicle Maintenance Building as a result of a historical release in the area. Since 2001, MTBE in shallow groundwater near the Vehicle Maintenance Building has decreased from 27,000 micrograms per liter (µg/L) to 25 µg/L. Seabrook will continue monitoring the MTBE until concentrations fall below the MTBE New Hampshire Ambient Groundwater Quality Standard of 13 µg/L (Haley and Aldrich 2009).

2.3.3.3 Site Conceptual Model

In 2008, Seabrook Station developed a Site Conceptual Model (SCM) in accordance with the NEI Industry Ground Water Protection Initiative. Objectives of the SCM included evaluation of groundwater elevations and groundwater flow in the surficial and bedrock aquifers and the distribution of tritium in the aquifers.

Groundwater level data collected from the monitoring wells indicate that, in general, groundwater in the surficial aquifer flows east to the tidal marsh. Groundwater elevations in the shallow aquifer range from 17.45 feet mean sea level (msl) in the northwestern portion of the site to 7.87 feet msl along the eastern side of the site. The easterly flow direction is consistent with the tidal marsh adjacent to the eastern boundary of the site and Browns River to the north and east.

The groundwater gradient is much steeper in the western portion of the site, relative to the eastern portion. The change in gradient across the site is likely related to the presence of subsurface structures. A groundwater depression inferred near monitoring well SW-3 is related to the Unit 2 groundwater withdrawal system which reverses the hydraulic gradient along the southern boundary of the site (RSCS 2009a).

As with the surficial aquifer, groundwater in the bedrock flows to the east. Groundwater elevations range from 17.63 feet msl in the northwestern portion of the site to 8.90 feet msl along the southeastern boundary of the site. The easterly bedrock groundwater flow is consistent with the regional setting with Hampton Harbor and the tidal flats located to the east. The flow direction is also consistent with the structural characteristics of the bedrock.

Results of the SCM indicate that tritium is limited to the Unit 1 containment area, and no offsite migration of tritium in groundwater has been observed. The current groundwater withdrawal system in the Unit 1 containment area is providing hydraulic containment for tritium in groundwater at the Station.

Currently, tritium in groundwater at the Station does not present an environmental or health risk to onsite or offsite receptors. As discussed in Section 2.3.2, most homes and commercial and industrial users in the Town of Seabrook are supplied by the town's 10 municipal water system wells, which are at least 2 miles west of the site.

The two nearest domestic wells are located approximately 2,000 and 3,000 feet to the west and north of the site, respectively, and are hydraulically up-gradient.

Table 2.3-1 Monitoring Well Details

Well ID*	Aquifer	Well Depth (feet bgs)
SC-1 BD-1	Shallow Deep	14.5 101
SD-1 BD-2	Shallow Deep	14.5 100
SD-2 BD-3	Shallow Deep	11 171
SD-3 BD-4	Shallow Deep	10 174
SU-1 BU-1	Shallow Deep	15 46
SW-1	Shallow	22
SW-2	Shallow	16.5
SW-3	Shallow	20
SU-10 BU-10	Shallow Deep	30.3 102
SU-11 BU-11	Shallow Deep	16.7 42
TW-1	Shallow	10
TW-2	Shallow	6
TW-3	Shallow	6
SD-4	Shallow	12
BD-5	Deep	167

Note:
* Wells listed in groups of two are shallow/deep well pairs
bgs = below grade surface

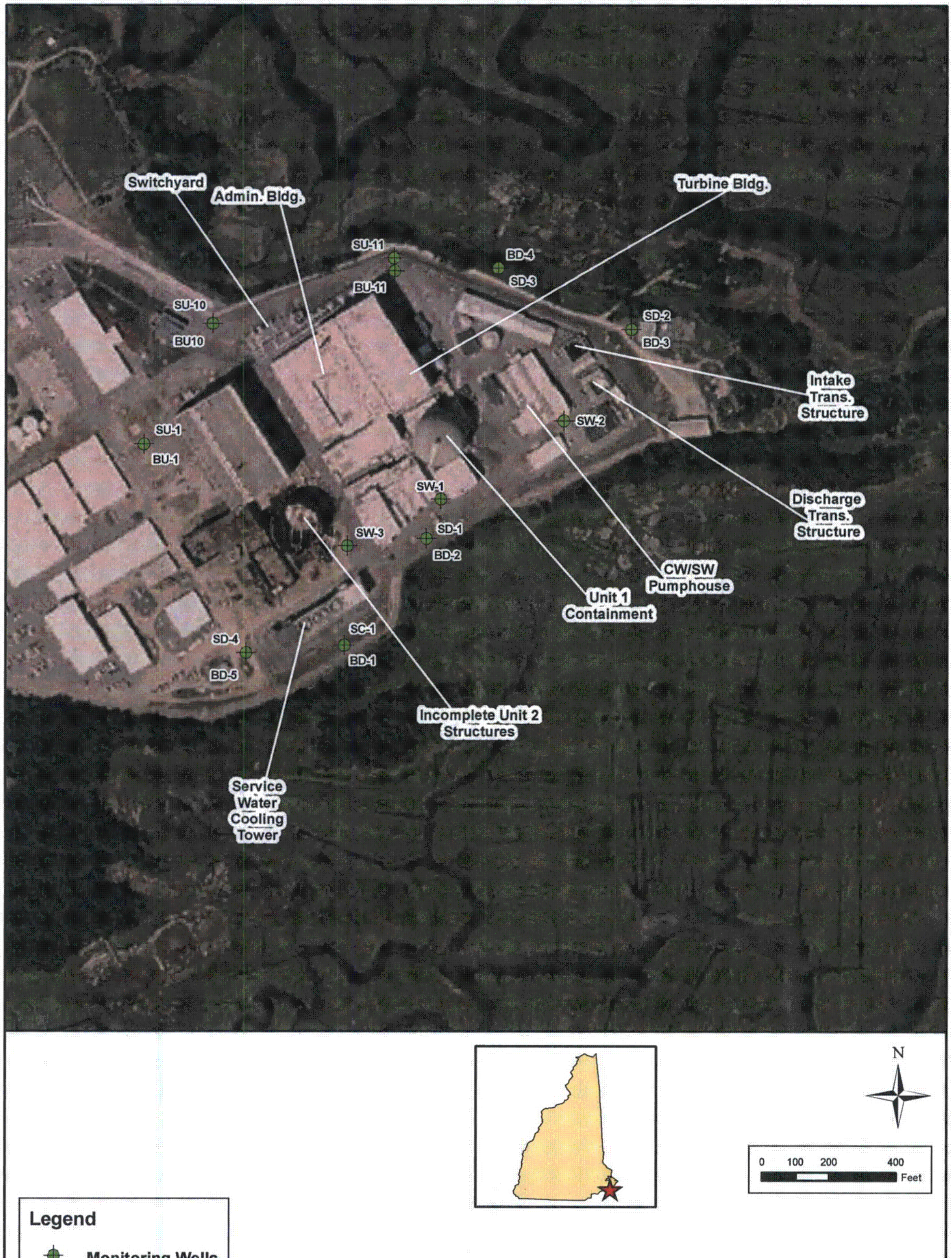

Figure 2.3-1 Monitoring Well Map

2.4 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

Seabrook Station and its transmission lines are within the Lower New England ecoregional section of New Hampshire (Sperduto and Nichols 2004) that in turn lies within the Eastern Broadleaf Forest ecoregion (Bailey 1995). The Lower New England ecoregion comprises three subsections, and Seabrook Station and its infrastructure are in two of these subsections. The Station is in the Gulf of Maine Coastal Lowland and the transmission lines extend across the Gulf of Maine Coastal Plain. The Gulf of Maine Coastal Lowland is a narrow zone along the coast, characterized by low topographic relief underlain by metamorphic bedrock. Soils are mostly sandy and coarse textured, although silt and clay soils of marine origin are common in lower landscape positions. Tidal marshes, dunes, beaches, and rocky coastline are unique features of this region (Sperduto and Nichols 2004). Soils within the Gulf of Maine Coastal Plain are moderately deep tills deposited by glaciers, and are underlain by both igneous and metamorphic bedrock. Glacial drumlins are common in this subsection, producing a characteristic rolling topography. The Merrimack River valley, filled with glacial outwash and glacial lake deposits, is a distinctive feature of this subsection (Sperduto and Nichols 2004).

The climate of the ecoregion as a whole is typified by a strong annual temperature cycle, with cold winters and warm summers, and year-round precipitation that promotes lush vegetative growth. Prior to European settlement, the landscape was dominated by deciduous and mixed forests that formed a dense, continuous canopy. Due to the sandy, glacially-influenced soils, the dominant forest types in the Gulf of Maine subsections are pine-oak cover types, and Atlantic white cedar swamps developed on mesic sites (Bailey 1995). Currently, the area surrounding Seabrook Station and its transmission facilities is dominated by second-growth native forests, low- to moderate-density residential and industrial development, and some remnants of the agricultural uses that dominated the landscape at the initial turn of the 20th century.

Mammal species native to southern New Hampshire that are known to be present in and around the Seabrook Station property include whitetail deer (*Odocoileus virginianus)*, raccoon (*Procyon lotor)*, squirrels *(Sciurus* spp., *Glaucomys* spp.), native mice (*Peromyscus* spp.), voles (*Microtus* spp.), and shrews (*Blarina* spp.). Birds that adapt well to human-altered landscapes, such as blue jays (*Cyanocitta cristata*), black-capped chickadees (*Poecile atricapillus*), and robins (*Turdus migratorius*), are abundant, and interior forest species such as black-and white warblers (*Mniotilta varia*) and ovenbirds (*Seiurus aurocapilla*) are also present in larger forest stands. Representative reptiles include eastern painted turtles (*Chrysemys picta*) and garter snakes (*Thamnophis sirtalis*), and the most common amphibians include wood frogs (*Rana sylvatica*) and American toads (*Bufo americana*) (AEC 1974).

The Seabrook Station site is on a triangular promontory of uplands surrounded by a tidal salt marsh. The vegetation between the mean low and high tide lines of the marsh is composed of nearly pure stands of smooth cordgrass (*Spartina alterniflora*). In areas subject to less regular flooding, extending from the mean high tide line to the limits of the spring tide, salt meadow cordgrass (*Spartina patens*) was dominant prior to construction. Since that time, common reed (*Phragmites australis)* has become dominant. On higher ground, stands of black-grass (*Juncus gerardi*) appear as dense grasslands. Clumps of switchgrass (*Panicum virgatum*) occur in a narrow band along the upper reaches of the marsh, gradually merging with upland vegetation. Upland vegetation communities not occupied by the footprint of Seabrook Station facilities consist of a hardwood-red cedar cover at the marsh edge, which is dominated by eastern red cedar (*Juniperus virginiana*), black oak (*Quercus veluntina*) and black cherry (*Prunus serontina*). The rock ledges adjacent to the marsh are dominated by an oak-hickory cover, which consists of red, white, and black oaks (*Q. rubra, Q. alba, Q. veluntina*) and hickories, especially shagback hickory (*Carya ovata*). Hardwood-conifer associations, dominated by the previously listed oaks, white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*), are found elsewhere, and include a hemlock-dominated ravine (AEC 1974).

Wildlife species in the vicinity of Seabrook Station are typical of the Gulf of Maine lowlands. However, outside of the marsh, they are restricted to those species that coexist well with humans, due to the restricted amount of natural habitat remaining between the coastline and the US Route 1 corridor. The salt marsh and coastal/beach habitats are also heavily influenced by human activities, but continue to provide important habitat for a wide variety of avian species, especially during migration periods.

As described in Section 3.1.5, three transmission lines operating at 345 kV were constructed to deliver Seabrook Station's electrical output to the New England transmission grid. The first line runs north 18 miles from Seabrook Station to Newington Station, in Newington, New Hampshire. Immediately north of Seabrook Station, this corridor crosses the salt marsh on a previously existing rail bed, then generally following the I-95 corridor thereafter. A second line runs west for approximately 60 miles to the Scobie Pond Substation in Derry, New Hampshire. In the Town of Kingston, New Hampshire, this corridor was routed around an Atlantic white cedar swamp, a habitat designated as an exemplary natural community by the Nature Conservancy. A third line extends approximately 39 miles south and southwest from Seabrook Station to the Tewksbury Substation, in Tewksbury, Massachusetts (NRC 1982, PSNH 1973). These corridors run through a variety of common natural and man-influenced habitats, and the common plant and animal species present along these transmission corridors are similar to those described above. The early successional habitat created by vegetation management practices along transmission corridors is an unusual natural feature in a predominantly forested landscape. Transmission corridors can be important habitat for species that depend on open, brushy cover. The transmission corridors also intersect with aquatic and wetland habitats in numerous locations, including perennial and intermittent streams, shrub swamps, marshes, and vernal pools. The transmission corridor vegetation practices maintain early successional vegetation in these habitats, in turn influencing the species most likely to be present. None of the three corridors cross any Federal parks, New Hampshire or Massachusetts State parks, or New Hampshire wildlife management areas. The Tewksbury corridor crosses portions of the Crane Pond Wildlife Management Area, a 2,123 acre area under the jurisdiction of the Massachusetts Division of Fisheries and Wildlife (MADCR 2009, MADFG 2008, NHDPR 2008, NPS 2009a, NPS 2009b).

2.5 THREATENED AND ENDANGERED SPECIES

On-site ecological surveys conducted for the construction of Seabrook Station consisted of an early and late growing season botanical survey, a bird survey, and a mammal survey. These field surveys and a review of pertinent literature revealed no occurrences of rare, threatened, or endangered species or their habitats, as listed by USFWS in 1973, at the Seabrook Station site (PSNH 1973).

Table 2.5-1 indicates protected animal and plant species that are known to occur in counties within which Seabrook Station and its associated transmission lines are located (and that are collectively referred to as the "project area" throughout this section), and identifies their status. These consist of species that are federally listed as endangered or threatened and that have potential to occur in the vicinity of the Seabrook Station site or along the transmission corridors; and species listed by the State of New Hampshire or the Commonwealth of Massachusetts that have potential to occur in the vicinity of the Seabrook Station site or along the transmission corridors, based on habitat affinities. In New Hampshire, the transmission corridors cross portions of Hillsborough and Rockingham Counties. In Massachusetts, the transmission corridor crosses portions of Essex and Middlesex Counties. Special-status species shown in Table 2.5-1 as occurring in these counties were taken from county records maintained by the U.S. Fish and Wildlife Service (USFWS) (USFWS 2008a, USFWS 2008b), the NMFS (NMFS 2009b), the New Hampshire Natural Heritage Bureau (NHNHB) (NHNHB 2008) and the Massachusetts Natural Heritage and Endangered Species Program (MNHESP) (MNHESP 2008a). NextEra Energy Seabrook has written to the USFWS, NMFS, the NHNHB, and the MNHESP requesting information on listed species and sensitive habitats in the area of Seabrook Station or along associated transmission corridors (See Attachment C).

2.5.1 AQUATIC SPECIES

Federally-Listed Species

The federally-endangered shortnose sturgeon (*Acipenser brevirostrum*) has the potential to occur in the vicinity of the cooling water intakes and discharge. Shortnose sturgeon populations have declined due to pollution, overfishing, and as a result of by-catch losses in gill nets from the American shad fishery. Shortnose sturgeon spawn in the upper estuaries of large rivers on the eastern seaboard, and adults move downstream to the lower estuary. However, they rarely undertake extensive marine movements and have only a very small potential to be found in the vicinity of the intakes and discharges of Seabrook Station (NMFS 2009d). No shortnose sturgeons have been impinged through the offshore intakes during the 18 years of monitoring since commercial operation began (NAI 2008).

The federally-threatened loggerhead turtle (*Caretta caretta*) is named for its relatively large head, which supports powerful jaws enabling it to feed on hard-shelled prey such as whelks and conch. Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Loggerheads are the most abundant species of sea turtle in US coastal waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to Argentina. During the summer, nesting occurs primarily in the subtropics. Although the major nesting concentrations in the US are from North Carolina through southwest Florida, some minimal nesting occurs outside of this range, westward to Texas and northward to southern Virginia (NMFS 2009e).

The federally-threatened green turtle (*Chelonia mydas*) is unique among sea turtles in that it is herbivorous, feeding primarily on seagrasses and algae. The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands. In US Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico. The breeding populations in Florida and along the Pacific coast of Mexico are listed as endangered; elsewhere the species is listed as threatened (NMFS 2009e).

The federally-endangered hawksbill turtle's (*Eretmochelys imbricata*) head is elongated and tapers to a point, with a beak-like mouth that gives the species its name and allows it to reach into holes and crevices of coral reefs to find sponges, its primary food source. Hawksbill turtles are circumtropical. Within the U.S., hawksbills are most common in Puerto Rico and its associated islands and in the US Virgin Islands. In the continental US, the species is recorded from all the Gulf States and along the east coast as far north as Massachusetts but sightings north of Florida are rare. In 1998, NMFS designated critical habitat for hawksbill turtles to include the coastal waters surrounding Mona and Monito Islands, Puerto Rico (NMFS 2009e).

The federally-endangered Kemp's ridley seaturtle (*Lepidochelys kempii*) is the smallest marine turtle in the world. Adults typically use habitats with muddy or sandy bottoms where prey can be found. Their diet consists of mainly crabs but may also include fish, jellyfish, and an array of mollusks. Kemp's ridleys are distributed throughout the Gulf of Mexico and US Atlantic seaboard, from Florida to New England. There is only one confirmed Kemp's ridley arribada (a mass nesting of turtles), in Tamaulipas, Mexico, where nearly 95 percent of worldwide Kemp's ridley nesting occurs. Nesting also occurs in Veracruz, Mexico, and Texas, US, but on a much smaller scale. Occasional nesting has been documented in North Carolina, South Carolina, and the Gulf and Atlantic coasts of Florida (NMFS 2009e).

The federally-endangered leatherback turtle (*Dermochelys coriacea*) is commonly known as pelagic but also forages in coastal waters. This species' nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and

West Africa. The US Caribbean, primarily Puerto Rico and the US Virgin Islands, and southeast Florida support minor nesting colonies and represents the most significant nesting activity in the United States. Adult leatherbacks tolerate a wide range of water temperatures, and have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine (NMFS 2009e).

State-Listed Species

The Atlantic sturgeon (*Acipenser oxyrynchus;* listed as endangered by Massachusetts) was historically present in American Atlantic waters from the St. Croix River in Maine to the St. Johns River in Florida, but overfishing, habitat degradation and loss, and by-catch losses from other fisheries have reduced population levels. This species spawns in the freshwater of rivers just above the head of tide in the spring; after spawning adults move to the lower estuary. Juveniles will also migrate downstream and may move into coastal marine waters. Tagging data indicate that immature Atlantic sturgeon travel widely once they emigrate from their natal rivers (NMFS 2009c). During these marine movements, Atlantic sturgeons have the potential to encounter the cooling water intakes and discharge of Seabrook Station. One Atlantic sturgeon was captured by the Seabrook Station gill net monitoring program prior to 1987 (NAI 1988). However, the Atlantic sturgeon is a strong-swimming fish closely associated with the bottom. It is not likely that any would be impinged through the offshore intakes, the bottoms of which are 11 feet from the ocean floor, and in fact this has not occurred in 18 years of monitoring since commercial operation began (NAI 2008).

2.5.2 TERRESTRIAL SPECIES

Federally-Listed Species

The federally-threatened piping plover (*Charadrius melodus*) is a small shorebird that breeds along the Atlantic coast from Newfoundland to North Carolina, as well as along the Great Lakes and on river sandbars in the upper Great Plains (USFWS 1996). They winter along the Atlantic and Gulf coasts from North Carolina to Mexico (USFWS 1996). The USFWS has not designated any portions of the Atlantic coast in New Hampshire or Massachusetts as critical habitat for the piping plover (USFWS 2001). Although piping plovers are known to nest in the Town of Seabrook (NHDFG 2008a), this species is dependent on coastal beach habitat and does not use salt marsh habitat (USFWS 1996). Suitable nesting or foraging habitat does not occur at Seabrook Station or along the transmission corridors in either state.

The northeastern breeding population of the federally-endangered roseate tern (*Sterna dougallii*) nests on rocky islands along the Atlantic coast from the southern shore of Long Island north to Nova Scotia. The wintering grounds of this small seabird are not well known, but include the northern coasts of South America and the open ocean (USGS 1995). The USFWS has not designated any critical habitat for this species (USFWS 2008c). This species is primarily pelagic, but may occasionally join the common terns that use the salt marsh habitat surrounding Seabrook Station for foraging. Suitable nesting or foraging habitat does not occur at any of the upland areas at Seabrook Station or along the transmission corridors. Activities at Seabrook Station are unlikely to affect the foraging habitat available in the surrounding salt marsh.

The federally-threatened small whorled pogonia (*Isotria meleoloides*) is a slender, perennial orchid known to occur in all four counties traversed by the transmission corridors. This species occurs in very small populations that are widely distributed from southern Maine and New Hampshire south through Virginia, to northern Georgia and eastern Tennessee, with outlying populations occurring in a number of states west to Michigan and Illinois (USFWS 2008d). In the New England portion of its range, the small whorled pogonia occurs on wooded slopes with very stony fine sandy loam soils where water movement is restricted by underlying fragipan layers. It is usually found in locations with filtered light, rather than deep shade, and the overstory is predominantly deciduous (MNHESP 2009a). No populations are known on or around the Seabrook Station site and all of the transmission corridors are unlikely to provide suitable habitat.

State-Listed Species

New Hampshire and Massachusetts endangered Blanding's turtles (*Emydoidea blandingii*) range from 7 to 9 inches in length and have yellow speckles that often run together to form streaks on the carapace. Blanding's turtles use a variety of wetland and terrestrial habitats and may travel extensively among them. Preferred wetland habitats are those with permanent shallow water and emergent vegetation, such as marshes, swamps, bogs, and ponds. Slow rivers and streams may serve as mechanisms for dispersal between wetlands. Additionally, this species also uses terrestrial habitats extensively for nesting and travel among wetlands. Sun-warmed soils are essential for successful nesting and preferred nesting sites include disturbed soils, pastures, transmission corridors, roadsides, and yards. Blanding's turtles hibernate in shrub swamps, ponds, and vernal pools (NHDFG 2008b). Suitable habitat conditions for this species are likely to occur in some portions of the transmission corridors, and Blanding's turtles have the potential to be present in these locations. There are no known occurrences of this species in the New Hampshire portion of the project area, based on the records contained in NHNHB's database (NHNHB 2009). A check of the MNHESP database indicates that this species is known to occur in the vicinity of the transmission corridor in the Towns of West Newbury, Groveland, Georgetown, Boxford, Methuen, and Dracut, Massachusetts (MNHESP 2009b).

New Hampshire threatened spotted turtles (*Clemmys guttata*) range from 3-5 inches in size, and can be recognized by numerous yellow spots covering a dark carapace. Spots can also be found on the head and limbs. This species uses wetlands with shallow, permanent water bodies and emergent vegetation. Marshes, vernal pools, wet meadows, swamps, ponds, and slow-moving streams and rivers all provide suitable habitats for spotted turtles. Spotted turtles use terrestrial habitat extensively while searching for suitable nesting sites, traveling among wetland habitats, and during periods of inactivity when summer temperatures are high. From June to July, eggs are laid in open meadows, fields, or other disturbed habitats, which may include transmission corridors. Spotted turtles hibernate under tree or shrub roots in wetlands or vernal pools (NHDFG 2008c). Suitable habitat conditions for this species are likely to occur in some portions of the transmission line corridors, and spotted turtles have the potential to be present in these locations. A check of the NHNHB database indicates that this species is known to occur in the vicinity of the transmission corridor in the town of Kensington, New Hampshire (NHNHB 2009).

The New Hampshire endangered eastern hognose snake (*Heterodon platyrhinos*) is a thick-bodied snake measuring 20-35 inches. This species has a characteristic upturned snout and keeled dorsal scales, and is marked with light and dark blotches that vary in color from brown to red and orange. There is also a dark phase in which the body is almost uniform in grayish-black color. The eastern hognose snake requires sandy, gravely soils that occur in open fields, river valleys, pine forests, and upland hillsides. Open cover types, like those found along transmission corridors are needed to provide basking opportunities. During summer eastern hognose snakes lay eggs a few inches underground or under woody debris. This species hibernates in mammal burrows, under woody debris, or under trash piles (NHDFG 2008d). Suitable habitat conditions for this species are likely to occur in some portions of the transmission corridors, and hognose snakes have the potential to be present in these locations. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened black racer (*Coluber constrictor*) is a slender black snake measuring 36-60 inches. This species is glossy black on the top and bottom with a white throat and chin. Young racers are patterned with brown or reddish patches on a lighter base of gray. They are found in a variety of habitats including dry brushy pastures, power line corridors, rocky ledges, and woodlands. They have large home ranges and require large patches of suitable habitat. During summer, black racers lay eggs underground in loose soil or under rotting wood or stumps. They hibernate in rock crevices or mammal burrows, sometimes communally (NHDFG 2008e). Suitable habitat conditions for this species are likely to occur in some portions of the transmission corridors, and black racers have the potential to be present in these locations. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered New England cottontail (*Sylvilagus transitionalis*) is a medium-sized rabbit, dependent on thick brush and dense second growth vegetation for food and shelter from predators. Currently, this species is known to be present in the New Hampshire counties, but not the Massachusetts counties, that are part of the project area, (USFWS 2008a, USFWS 2008b). Although this species is no longer known to be present in the Town of Seabrook (NHNHB 2008), it was observed at the Seabrook Station site during the 1973 wildlife surveys conducted for the construction of Seabrook Station and was noted as "well known by local residents" (PSNH 1973).

Unlike the eastern cottontail, which has been introduced to the New England states, the New England cottontail cannot survive in open fields or in the sparser undergrowth that occurs under taller canopy trees. The dense growth that occurs in transmission corridors between management cycles provides ideal habitat for this species, and the extensive nature of the transmission grid provides an opportunity for individuals to disperse. Because this rabbit's required habitat is lost to succession in the absence of active management, this species requires a means of dispersal to find new habitat patches for the population to survive over the long term. Changing land use in southern New England has led to a large-scale loss of suitable habitat due to development and regrowth of forests (Arbuthnot 2008). There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened and Massachussetts endangered bald eagle (*Haliaeetus leucocephalus*) was removed from the list of species protected by the federal Endangered Species Act in 2007 (USFWS 2009a). This large raptor preys primarily on waterfowl and fish and, therefore, is usually associated with large rivers, lakes, and coastal areas. The majority of nest sites are within a half-mile of such water bodies, and wintering areas are usually located immediately upon a shoreline. Bald eagle nests are large, with diameters up to 6 feet. Nest trees are usually large-diameter trees characterized by open branching and stout limbs. Winter roost trees are also large in diameter with a branching structure that offers both accessible perching areas and protection from the elements. In southern New England, white pines are commonly used for nesting and roosting (NHDFG 2005). Bald eagles have been periodically observed near Seabrook Station and along the transmission corridors, and an active nest is present in the Town of West Newbury, Massachusetts.

The Massachusetts endangered golden-winged warbler (*Vermivora chrysoptera*) is a small song bird that occupies a wide variety of early successional or disturbed habitats including abandoned farmland, shrubby fields, successional forest, pine barrens, utility rights-of-way, alder swamps, tamarack bogs, and beaver wetlands. The common features of these habitats are patches of dense herbaceous growth and shrubs, as well as scattered trees within the territory and, often, a forested perimeter. This species is a neotropical migrant, and is declining in the northeastern U.S., due to loss of habitat and competition and hybridization with blue-winged warblers (MNHESP 2008b). Suitable habitat conditions for this species are likely to occur in some portions of the transmission corridors, and golden-winged warblers may be present in these locations. There are no known occurrences of this species in the project area, based on the records contained MNHESP's database (MNHESP 2009b).

New Hampshire threatened and Massachusetts endangered peregrine falcons (*Falco peregrinus*) were removed from the list of species protected by the federal Endangered Species Act in 1999 (MNHESP 2007). This crow-sized raptor hunts other birds on the wing, nesting on high cliffs in natural settings and on tall buildings and bridges on urban settings. The nest consists of a simple, unlined scrap on a ledge. There is no suitable nesting habitat on or around the Seabrook Station site or the transmission corridors. However, peregrines range widely while hunting, and may be found anywhere there are birds to hunt. Coastal areas with large concentrations of smaller-sized seabirds provide excellent hunting opportunities (MNHESP 2007). Seabrook Station and portions of the transmission corridors are located well within the hunting range of known nests of this species. Birds from known nests in Portsmouth and Manchester New Hampshire, and Boston, Lawrence, and Lowell, Massachusetts, may hunt within the project area.

Massachusetts threatened purple needlegrass (*Aristida purpurascens*), a medium-sized herb with long, sharp-pointed seeds, occurs in sandplain and heathland habitats, and transmission line corridors are specifically noted to provide potential habitat (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in MNHESP's database (MNHESP 2009b).

Massachusetts endangered Eaton's beggar-ticks (*Bidens eatonii*) is an herbaceous plant with simple leaves that is found exclusively in wetlands associated with estuaries (Magee and Ahles 2007). Suitable habitat conditions may occur where the transmission corridor crosses tidally influence portions of the Merrimack River, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in MNHESP's data base (MNHESP 2009b).

The New Hampshire endangered hairy-fruited sedge (*Carex trichocarpa*) may form monotypic stands of medium height. It occurs in wet meadows and marshes (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered inflated sedge (*Carex bullata*) bears spikes of seeds in swollen sacks. It occurs in wooded swamps, bogs, and wet meadows (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered Walter's sedge (*Carex striata var. brevis*) occurs along pond margins (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The Massachusetts endangered Parker's pipewort (*Ericaulon parkeri*) is an herbaceous plant of tidal flats and shallow waters (Magee and Ahles 2007). Suitable habitat conditions may occur where the transmission corridor crosses tidally influence portions of the Merrimack River, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in MNHESP's data base (MNHESP 2009b).

The New Hampshire threatened hackberry (*Celtis occidentalis*), a tree when full grown, occurs in rich, moist to dry woods, and on sand barrens (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The Massachusetts threatened Engelmann's umbrella-sedge (*Cyperus engelmannii*) grows to medium heights and occurs in wet areas, especially pond margins, which vary from open to wooded (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened dwarf huckleberry (*Gaylussacia dumosa*) is a low shrub, and occurs in bogs and barrens (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened fringed gentian (*Gentianopsis crinita*), a small herb that only becomes conspicuous when its blue blossoms appear, occurs in wet meadows, woods, and along stream borders (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered featherfoil (*Hottonia inflata*), an annual herbaceous plant, occurs along the edges of ponds, pools, and ditches (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered long-leaved bluets (*Houstonia longifolia*) is a small sparsely flowered herb with scanty foliage that occurs in fields and open woods (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered hairy stargrass (*Hypoxis hirsuta*) is a small herb with shiny yellow flowers. It occurs in fields and open woods (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened slender blue flag (*Iris prismatica*) occurs in wet meadows, ponds, bogs and wooded swamps in micro sites where herbaceous vegetation is relatively sparse (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered slender bush-clover (*Lespedeza virginica*) a spindly, medium-sized herb, occurs in dry open woods and barrens (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered Northern blazing star (*Liatris scariosa var. novae-angliae*), an herb that bears pinkish-purple blossoms in late summer, occurs in open woods clearings and barrens on sandy soils (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened pale green orchid (*Platanthera flava var. herbiola*) is a small orchid associated with relatively open spots in wet meadows, woods, and floodplains (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered American plum (*Prunus americana*), a shrub-sized woody plant, occurs in most woods and woodland edges, stream sides, and roadsides (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The Massachusetts endangered estuary arrowhead (*Sagittaria montevidensis ssp.*) is an aquatic plant that prefers the margins of brackish ponds, estuaries and tidewater marshes (Magee and Ahles 2007). Suitable habitat conditions may occur where the transmission corridor crosses tidally influenced portions of the Merrimack River, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in MNHESP's data base (MNHESP 2009b).

The New Hampshire threatened large bur-reed (*Sparganium eurycarpum*), named for its broad, flat blades and spiky, globose seed-heads, occurs in marshes, mudflats, and shallow waters (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened sand dropseed (*Sporobolus cryptandrus*), an herbaceous plant with a low, sprawling habit, occurs in dry sandy fields, on shorelines, and in waste places (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire endangered orange horse-gentian (*Triosteum aurantiacum*), a low, broad-leaved herb, occurs in woods and thickets (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The New Hampshire threatened bird's-foot violet (*Viola pedata*), a small herb with pale lavender flowers and deeply lobed leaves, occurs in dry sandy fields, open woods, and barrens (Magee and Ahles 2007). Suitable habitat conditions may occur in some portions of the transmission line corridors, and this species may occur in those habitats. There are no known occurrences of this species in the project area, based on the records contained in NHNHB's database (NHNHB 2009).

The Massachusetts endangered coppery emerald (*Somatochlora georgiana*) is a large dragonfly, which is brownish in color. It is a strong flier that rarely perches. In Massachusetts, if has been observed breeding in a small, sluggish stream flowing through a white cedar swamp, but is most often encountered away from breeding habitats, in open habitats such as forest clearings and dirt roads, feeding in swarms with other species of this genus (MNHESP 2008c). MNHESP records indicate that this species has been recorded in the vicinity of the transmission corridor in the towns of West Newbury, MA (MNHESP 2009b); however MNHESP does not divulge the precise locations of species records for non-project specific inquiries.

The Massachusetts threatened arrow clubtail (*Stylurus spiniceps*) is a large dragonfly with yellow to green markings on a brown body and bright green eyes. It breeds in medium to large, swift flowing rivers with sandy bottoms, and occasionally in lakes. Adults hunt primarily in riparian habitats and adjacent uplands (MNHESP 2008d). MNHESP records indicate that this species has been recorded in the vicinity of the transmission corridor in the towns of West Newbury, MA (MNHESP 2009b); however MNHESP does not divulge the precise locations of species records for non-project specific inquiries.

Table 2.5-1 Threatened and Endangered Species Recorded in the Counties Associated with the Seabrook Station and Transmission Lines

Species	Common Name	Federal Status[a]	State Status[a]	Counties
		Fish		
Acipenser brevirostrum	Shortnose sturgeon	FE	NHE MAE	Rockingham, NH Essex, MA
Acipenser oxyrynchus	Atlantic sturgeon	---	MAE	Rockingham, NH Essex, MA
		Reptiles		
Caretta caretta	Loggerhead turtle	FT	MAT	Atlantic Ocean
Chelonia mydas	Green turtle	FT	MAT	Atlantic Ocean
Eretmochelys imbricata	Hawksbill turtle	FE	MAE	Atlantic Ocean
Lepidochelys kempii	Kemp's ridley turtle	FE	MAE	Atlantic Ocean
Dermochelys coriaceae	Leatherback turtle	FE	MAE	Atlantic Ocean
Emydoidea blandingii	Blanding's turtle	---	NHE MAE	Hillsborough, NH Rockingham, NH Essex, MA Middlesex, MA
Heterodon platirhinos	Eastern hognose snake	---	NHE	Rockingham, NH
Clemmys guttata	Spotted turtle	---	NHT	Hillsborough, NH Rockingham, NH
Coluber constrictor	Black racer	---	NHT	Rockingham, NH
		Mammals		
Sylvilagus transitionalis	New England cottontail	---	NHE	Hillsborough, NH Rockingham, NH
		Birds		
Charadrius melodus	Piping plover	FT	NHE MAE	Rockingham, NH Essex, MA
Sterna dougallii	Roseate tern	FE	NHE MAE	Rockingham, NH
Haliaeetus leucocephalus	Bald eagle	---	NHT MAE	Rockingham, NH Essex, MA
Falco peregrinus	Peregrine falcon	---	NHT MAE	Rockingham, NH Essex, MA
Vermivora chrysoptera	Golden-winged warbler	---	MAE	Essex, MA
		Plants		
Isotria meleoloides	Small-whorled pogonia	FT	NHT MAE	Hillsborough, NH Rockingham, NH Essex, MA Middlesex, MA
Aristida purpurascens	Purple needlegrass	---	MAT	Essex, MA

Table 2.5-1 Threatened and Endangered Species Recorded in the Counties Associated with the Seabrook Station and Transmission Lines (Continued)

Species	Common Name	Federal Status[a]	State Status[a]	Counties
Bidens eatonii	Eaton's beggar-ticks	---	MAE	Essex, MA
Carex bullata	Inflated sedge	---	NHE	Hillsborough, NH
Carex striata var. brevis	Walter's sedge	---	NHE	Rockingham, NH
Carex trichocarpa	Hairy-fruited sedge	---	NHE	Rockingham, NH
Celtis occidentalis	Hackberry	---	NHT	Rockingham, NH
Cyperus engelmannii	Engelmann's umbrella-sedge	---	MAT	Essex, MA
Ericaulon parkeri	Parker's pipewort	---	MAE	Essex, MA
Gaylussacia dumosa	Dwarf huckleberry	---	NHT	Hillsborough, NH Rockingham, NH
Gentianopsis crinita	Fringed gentian	---	NHT	Rockingham, NH
Hottonia inflata	Featherfoil	---	NHE	Rockingham, NH
Houstonia longifolia	Long-leaved bluets	---	NHE	Rockingham, NH
Hypoxis hirsuta	Hairy stargrass	---	NHE	Hillsborough, NH
Iris prismatica	Slender blue flag	---	NHT	Rockingham, NH
Lespedeza virginica	Slender bush-clover	---	NHE	Hillsborough, NH
Liatris scariosa var. novae-angliae	Northern blazing star	---	NHE	Rockingham, NH
Platanthera flava var. herbiola	Pale green orchid	---	NHT	Rockingham, NH
Prunus americana	American plum	---	NHE	Rockingham, NH
Sagittaria montevidensis ssp.	Estuary arrowhead	---	MAE	Essex, MA
Sparganium eurycarpum	Large bur-reed	---	NHT	Rockingham, NH
Sporobolus cryptandrus	Sand dropseed	---	NHT	Rockingham, NH
Triosteum aurantiacum	Orange horse-gentian	---	NHE	Rockingham, NH
Viola pedata	Bird's-foot violet	---	NHT	Hillsborough, NH Rockingham, NH
Invertebrates (Dragonflies)				
Somatochlora georgiana	Coppery emerald	---	MAE	Essex, MA
Stylurus spiniceps	Arrow clubtail	---	MAT	Essex, MA

a. FE = Federal Endangered, FT = Federal Threatened, NHE = New Hampshire Endangered, NHT = New Hampshire Threatened, MAE = Massachusetts Endangered, MAT = Massachusetts Threatened

Source: USFWS 2008a, USFWS 2008b, NMFS 2009c, NMFS 2009d; NMFS 2009e, NHNHB 2008, NHNHB 2009, MNHESP 2008a, MNHESP 2009b, and MNHESP 2009c.

2.6 DEMOGRAPHY

2.6.1 REGIONAL DEMOGRAPHY

The Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996e). Sparseness measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: NRC 1996e.

Proximity measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: NRC 1996e.

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	2	3	4
Sparseness	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area | Medium Population Area | High Population Area

Source: NRC 1996e.

NextEra Energy Seabrook used 2000 census data from the U.S. Census Bureau (USCB) (Tetra Tech 2009a) and geographic information system software (ArcGIS®) to determine most demographic characteristics in the Seabrook Station vicinity. NextEra Energy Seabrook estimated that 448,637 people live within 20 miles of Seabrook Station, for a population density of 535 persons per square mile (Tetra Tech 2009a). Applying the GEIS sparseness criteria, the 20-mile population falls into the least sparse category, Category 4 (greater than or equal to 120 persons per square mile within 20 miles).

To calculate the proximity measure, NextEra Energy Seabrook estimated that 4,157,215 people live within 50 miles of Seabrook Station, for a population density of 887 persons per square mile (Tetra Tech 2009a). Applying the GEIS proximity measures, the 50-mile population is classified as Category 4 (greater than or equal to 190 persons per square mile). Therefore, according to the GEIS sparseness and proximity matrix, Seabrook Station with a sparseness rank of 4 and a proximity rank of 4 (a score of 4.4) is in a high population area.

Seabrook Station is in the Town of Seabrook, New Hampshire which had a year 2000 population of 7,934 (USCB 2000a). Boston, Massachusetts (41 miles south-southwest), Lowell, Massachusetts (29 miles west-southwest), Cambridge, Massachusetts (38 miles south-southwest) and Manchester, New Hampshire (31 miles west-northwest), are the largest population centers within the 50-mile radius, with 2000 populations of 589,141; 105,167; 101,355; and 107,006, respectively (USCB 2000b).

All or parts of 15 counties and sections of two Metropolitan Statistical Areas (MSAs) and two Micropolitan Statistical Areas (MiSAs) are within 50 miles of the Seabrook Station (Figure 2.1-2). The MSAs are Boston-Cambridge-

Quincy, Massachusetts - New Hampshire, and Portland-South Portland, Maine, and the MiSAs are Concord, New Hampshire, and Laconia, New Hampshire (USCB 2007d).

Seabrook Station is in the Boston-Cambridge-Quincy MSA. Between 1990 and 200, the population of the Boston-Cambridge-Quincy, Massachusetts - New Hampshire MSA increased from 4,133,895 to 4,391,344, an increase of 6.2 percent. During the same decade, the population of the Portland-South Portland, Maine MSA increased from 441,257 to 487,568, an increase of 10.5 percent, the population of the Concord, New Hampshire MiSA increased from 120,005 to 136,225, an increase of 13.5 percent, and the population of the Laconia, New Hampshire MiSA increased from 49,216 to 56,325, an increase of 14.4 percent (Table 2.6-1; USCB 2003).

Because approximately 67 percent of the employees at Seabrook Station reside in Rockingham or Strafford Counties, New Hampshire (Table 2.6-2), these counties have the greatest potential to be socioeconomically affected by license renewal at Seabrook Station. Table 2.6-3 shows population estimates and decennial growth rates for these two counties. Growth rates for New Hampshire are provided for comparison.

From 1980 to 1990, New Hampshire, and Rockingham and Strafford Counties, all had positive population growth rates. From 1990 to 2000, Rockingham County's population growth (12.8 percent) was slightly higher than both New Hampshire's (11.4 percent) and Strafford County's (7.6 percent).

2.6.2 MINORITY AND LOW-INCOME POPULATIONS

The NRC performed environmental justice analyses for previous license renewal applications and concluded that a 50-mile radius (Figure 2.1-2) could reasonably be expected to contain potential environmental impact sites and that the state was appropriate as the geographic area for comparative analysis. NextEra Energy Seabrook has adopted these parameters for quantifying the minority and low-income populations that may be affected by Seabrook Station operations.

NextEra Energy Seabrook used 2000 census data from the USCB with ArcGIS® to determine the minority characteristics by block group. If any part of a block group was located within 50 miles of Seabrook Station, then NextEra Energy Seabrook included that entire block group in the analysis. The 50-mile radius includes 3,282 block groups (Table 2.6-4).

2.6.2.1 Minority Populations

The NRC's Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a "minority" population as: American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, Black Races, and Hispanic Ethnicity (NRC 2004b). Additionally, the NRC's guidance requires that:

(1) all other single minorities are to be treated as one population and analyzed;

(2) multi-racial populations are to be analyzed; and

(3) the aggregate of all minority populations is to be treated as one population and analyzed. The guidance indicates that a minority population exists if either of the following two conditions exists:

- The minority population in the census block group or environmental impact site exceeds 50 percent.
- The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

For each of the 3,282 block groups within the 50-mile radius, NextEra Energy Seabrook calculated the percent of the block group's population represented by each minority. If any block group minority percentage exceeded 50 percent, then the block group was identified as containing a minority population. NextEra Energy Seabrook selected New Hampshire, Maine, and Massachusetts, depending on which state the block groups fell within, as the geographic areas for comparative analysis for block groups located within the 50-mile radius, and calculated the percentages of each minority category within each state (Table 2.6-4). If any block group percentage exceeded the corresponding state percentage by more than 20 percent, then a significant minority population was determined to exist.

Table 2.6-4 presents the number of block groups in each county in the 50-mile radius that exceed the threshold for minority populations. Figures 2.6-1 through 2.6-6 display the minority block groups within the 50-mile radius.

Two hundred and seventeen block groups within the 50-mile radius have black races populations that meet the NRC criteria for a minority population. These block groups, shown in Figure 2.6-1, are concentrated in Boston, more than 40 miles from the Seabrook Station site.

Sixty-eight block groups within the 50-mile radius have Asian populations that meet the NRC criteria for a minority population. The majority of the block groups are more than 30 miles away, around the Boston and Lowell urban areas, as shown in Figure 2.6-2.

One block group within the 50-mile radius has a Native Hawaiian or Other Pacific Islander population that meets the NRC criteria for a minority population. This block group is shown in Figure 2.6-3.

One hundred and seven block groups within the 50-mile radius are designated as Other Race populations that meet the NRC criteria for a minority population. These block groups are shown in Figure 2.6-4.

Four hundred and eighty-three block groups within the 50-mile radius have Aggregate Minority populations that meet the NRC criteria for a minority population. These block groups are shown in Figure 2.6-5.

Two hundred and nineteen block groups within the 50-mile radius have Hispanic Ethnicity populations that meet the NRC criteria for a minority population. These block groups, shown in Figure 2.6-6, are located primarily in the Chelsea, Fort Devens, Haverhill, Lawrence, Lowell, Lynn, and Boston urban areas. The closest block groups are approximately 14 miles from Seabrook Station, within the Haverhill urban area.

No block groups, within the 50-mile radius, have American Indian or Alaskan Native populations or Multi-Racial populations that meet the NRC criteria for a minority population.

2.6.2.2 Low-Income Populations

The NRC's guidance defines low-income population based on statistical poverty thresholds (NRC 2004b) if either of the following two conditions is met:

- The low-income population in the census block group or the environmental impact site exceeds 50 percent.
- The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

NextEra Energy Seabrook divided the number of USCB low-income households in each block group by the total households for that block group to obtain the percentage of low-income households per block group. Table 2.6-4 and Figure 2.6-7 illustrate the low-income block groups in the 50-mile radius, based on the NRC's criteria. One hundred eighty block groups within the 50-mile radius meet the NRC's criteria for low-income households.

Table 2.6-1 Population and Growth Rates for Surrounding Metropolitan and Micropolitan Statistical Areas

	Boston-Cambridge-Quincy, MA-NH MSA		Portland-South Portland, ME MSA		Concord, NH MiSA		Laconia, NH MiSA	
	Population	Percent Growth	Population	Percent Growth	Population	Percent Growth	Population	Percent Growth
1990[a]	4,133,895	N/A	441,257	N/A	120,005	N/A	49,216	N/A
2000[a]	4,391,344	6.2	487,568	10.5	136,225	13.5	56,325	14.4
2007	4,482,857[b]	2.1	513,102[b]	5.2	148,274[c]	8.8	61,048[c]	8.4

[a] USCB 2003
[b] USCB 2008c
[c] USCB 2008b

Table 2.6-2 Residential Distribution of Seabrook Station Employees, September, 2008

County and State of Residence	Number of Employees	Percent of Total
Androscoggin, ME	2	0.18
Aroostook, ME	1	0.09
Belknap, NH	11	1.01
Berkshire, MA	1	0.09
Bristol, MA	1	0.09
Carroll, NH	4	0.37
Cheshire, NH	2	0.18
Coos, NH	1	0.09
Cumberland, ME	12	1.10
Essex, MA	85	7.78
Franklin, MA	1	0.09
Grafton, NH	2	0.18
Hampden, MA	1	0.09
Hillsborough, NH	39	3.57
Kennebec, ME	10	0.91
Lincoln, ME	5	0.46
Merrimack, NH	26	2.38
Middlesex, MA	27	2.47
Norfolk, MA	2	0.18
Oxford, ME	1	0.09
Penobscot, ME	3	0.27
Plymouth, MA	1	0.09
Providence, RI	1	0.09
Rockingham, NH	516	47.21
Sagadahoc, ME	4	0.37
Strafford, NH	219	20.04
Suffolk, MA	4	0.37
Worcester, MA	9	0.82
York, ME	102	9.33
Total	**1093**	**100**

Shading indicates a county within the socioeconomic region of interest.

Table 2.6-3 Decennial Populations and Growth Rates for New Hampshire Counties with the Most Seabrook Station Employees, and for New Hampshire

	Rockingham		Strafford		New Hampshire	
	Population	Percent Growth	Population	Percent Growth	Population	Percent Growth
1970[a]	138,951	N/A	70,431	N/A	737,681	N/A
1980[a]	190,345	37.0	85,408	21.3	920,610	24.8
1990[a]	245,845	29.1	104,233	22.0	1,109,252	20.4
2000[b]	277,359	12.8	112,233	7.6	1,235,786	11.4
2007[c]	296,543	6.9	121,581	8.3	1,315,828	6.5

[a] USCB 1995
[b] USCB 2000c
[c] USCB 2007e
NA = Not applicable

Table 2.6-4 Block Groups within 50 Miles of Seabrook Station with Minority or Low-Income Populations

State	County	County Number	Number of Block Groups	Black	American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Some Other Race	Multi-Racial	Aggregate	Hispanic	Low-Income House-holds
Maine	York	31	132	0	0	0	0	0	0	0	0	2
Massachusetts	Essex	9	544	1	0	0	0	54	0	83	88	31
Massachusetts	Middlesex	17	1054	15	0	27	0	0	0	81	17	18
Massachusetts	Norfolk	21	297	4	0	13	0	0	0	12	0	2
Massachusetts	Plymouth	23	38	0	0	0	0	0	0	0	0	0
Massachusetts	Suffolk	25	631	196	0	28	1	51	0	304	106	115
Massachusetts	Worcester	27	15	1	0	0	0	0	0	1	1	0
New Hampshire	Belknap	1	16	0	0	0	0	0	0	0	0	0
New Hampshire	Carroll	3	7	0	0	0	0	0	0	0	0	0
New Hampshire	Hillsborough	11	242	0	0	0	0	2	0	2	7	7
New Hampshire	Merrimack	13	66	0	0	0	0	0	0	0	0	0
New Hampshire	Rockingham	15	166	0	0	0	0	0	0	0	0	1
New Hampshire	Stafford	17	74	0	0	0	0	0	0	0	0	4
		Totals:	3282	217	0	68	1	107	0	483	219	180
Maine Percentages				0.53	0.56	0.71	0.03	0.23	0.99	3.05	0.73	11.5
Massachusetts Percentages				5.41	0.24	3.75	0.04	3.73	2.3	15.46	6.75	9.79
New Hampshire Percentages				0.73	0.24	1.29	0.03	0.6	1.07	3.96	1.66	6.85

Highlighted counties are completely contained within the 50-mile radius.
Table entries denote numbers of census block groups, except on lines indicated as "percentages".
Source: Tetra Tech 2009a

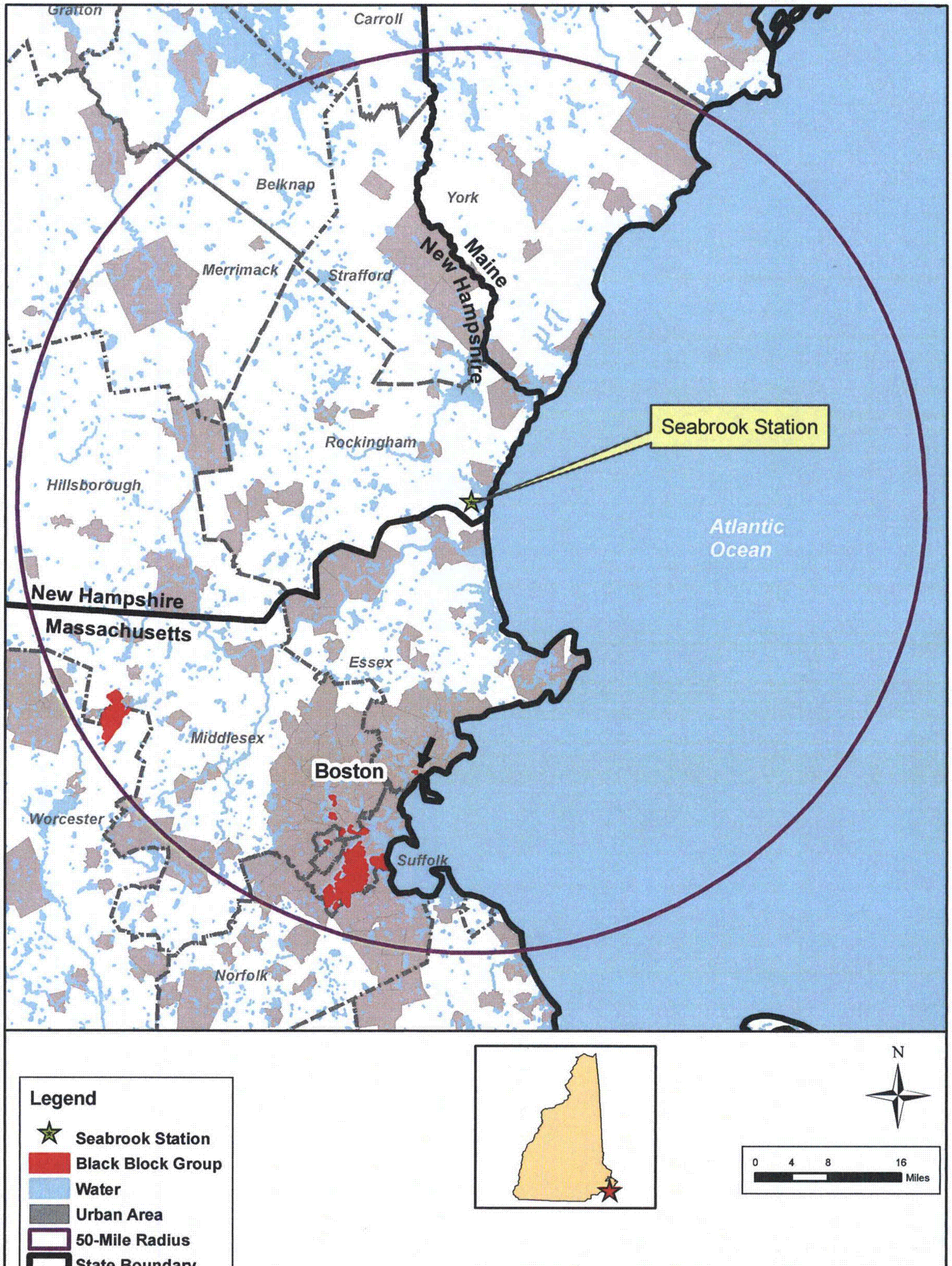

Figure 2.6-1 Black Races Population Map

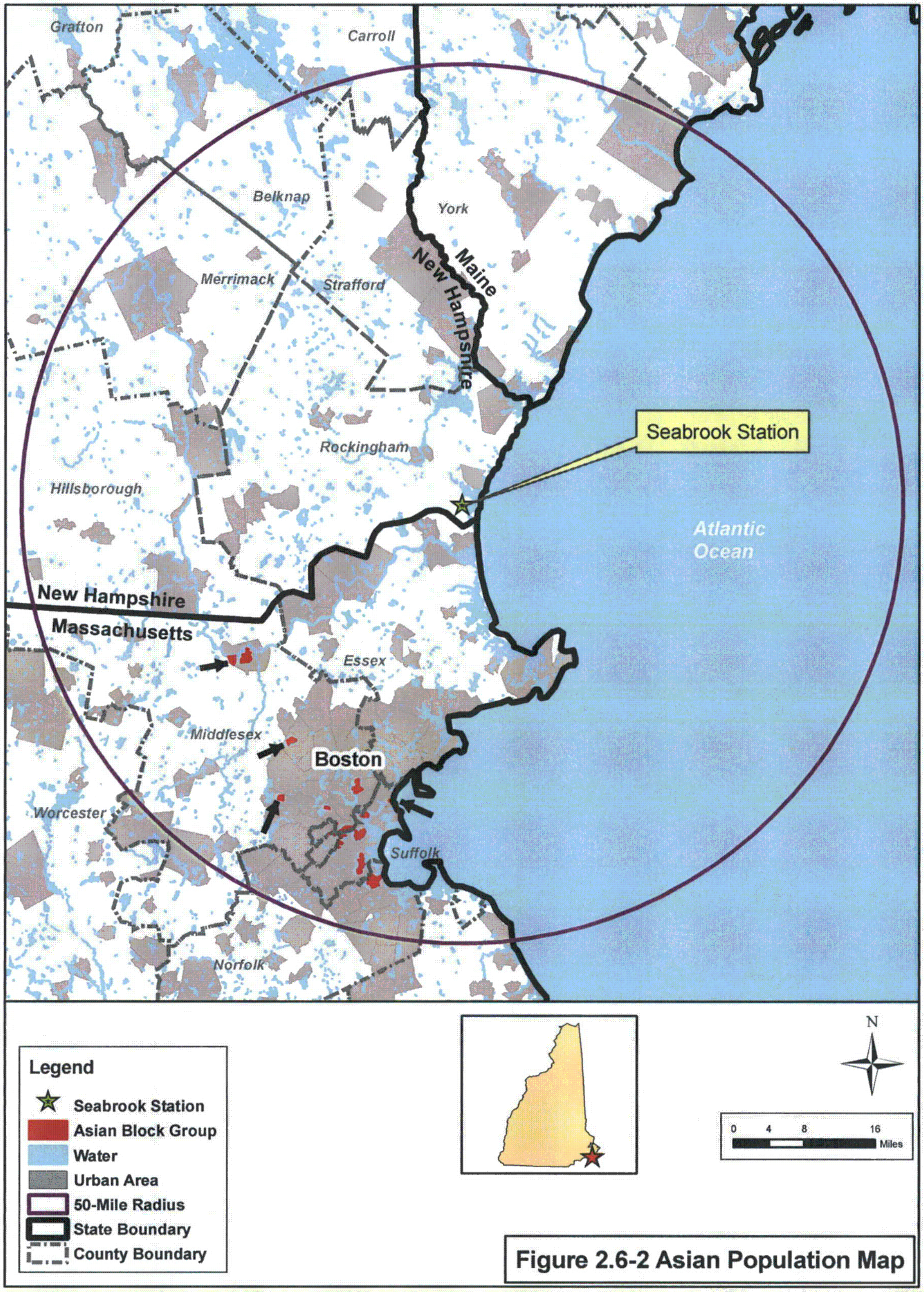

Figure 2.6-2 Asian Population Map

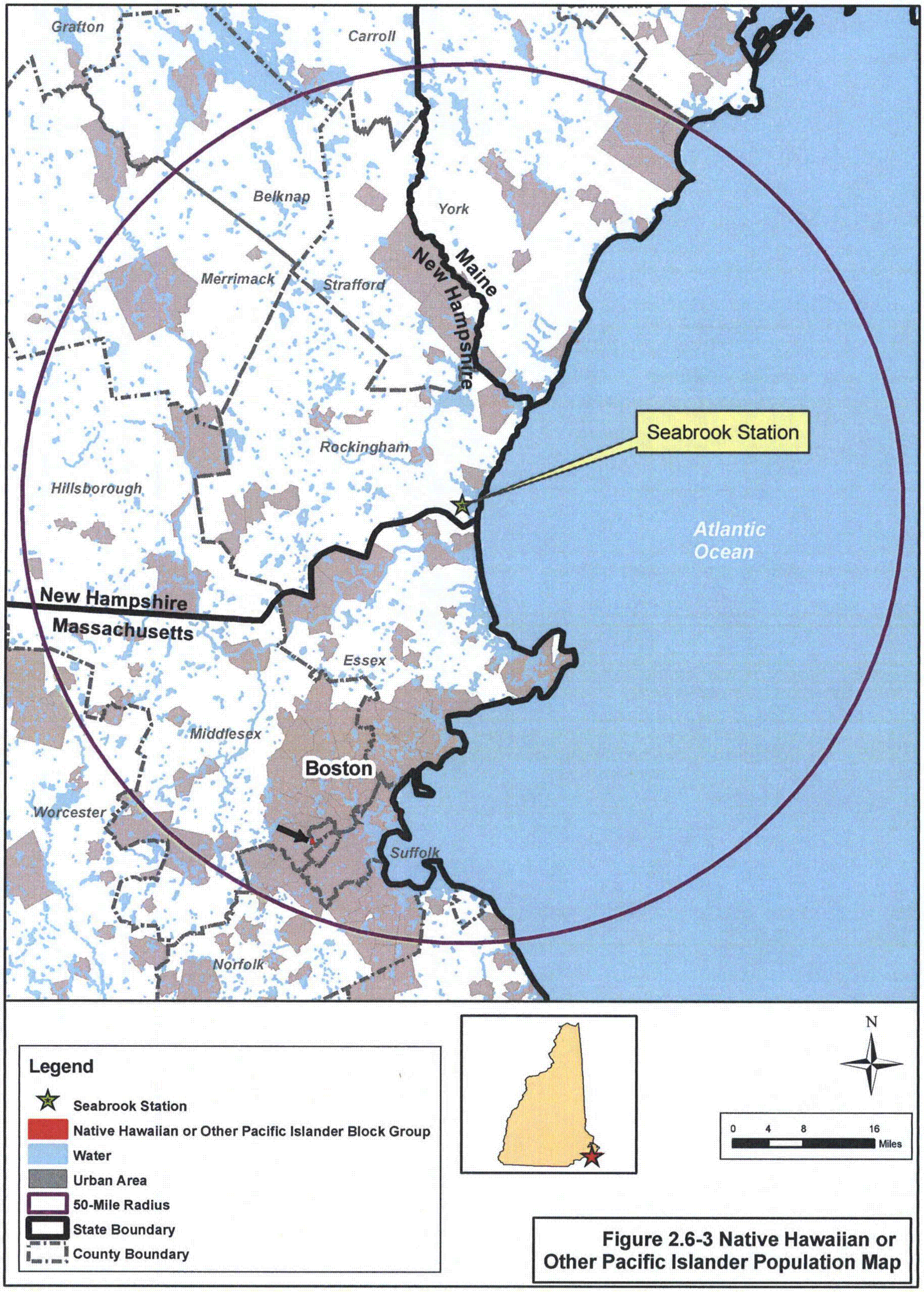

Figure 2.6-3 Native Hawaiian or Other Pacific Islander Population Map

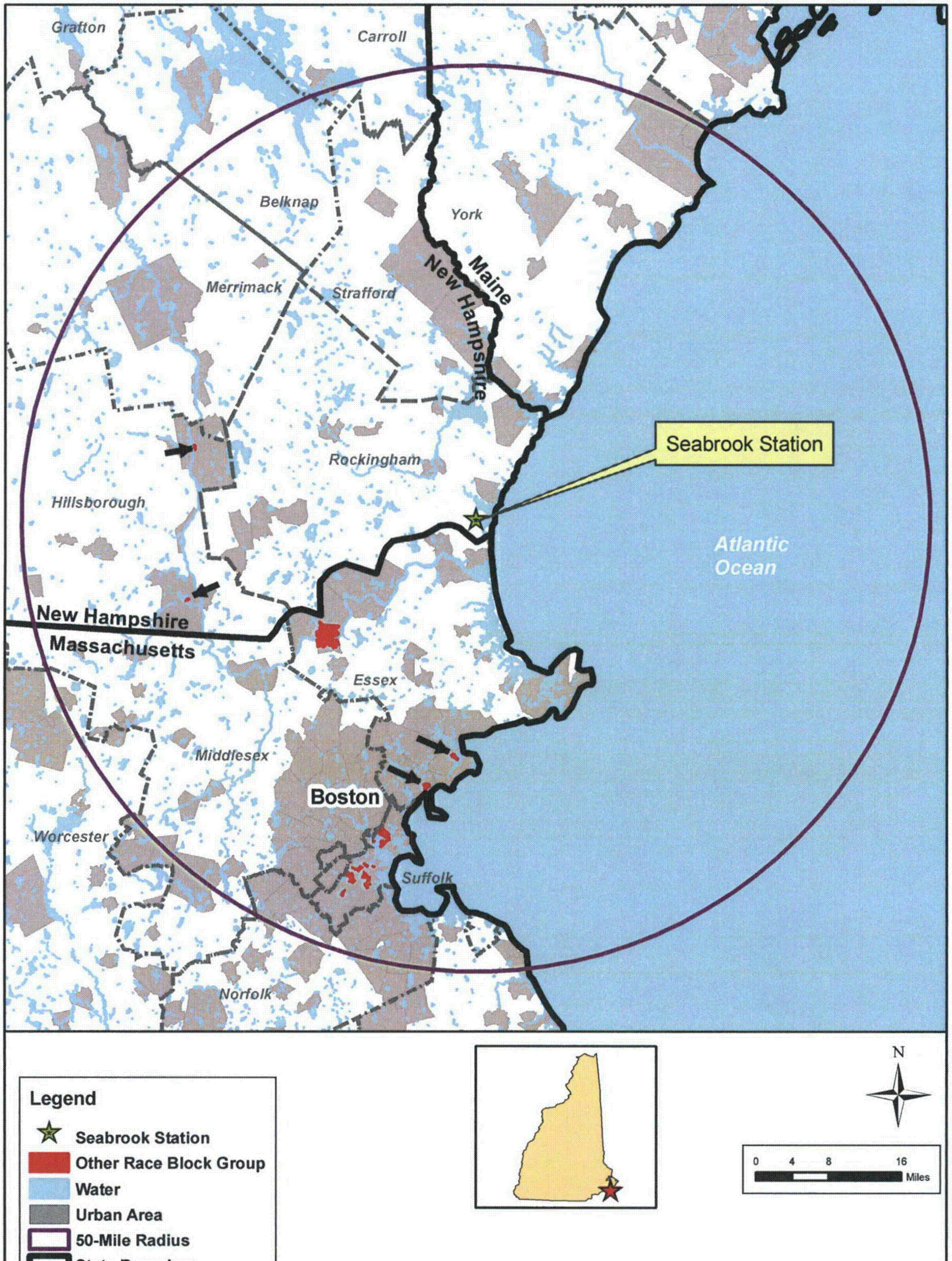

Figure 2.6-4 Other Race Population Map

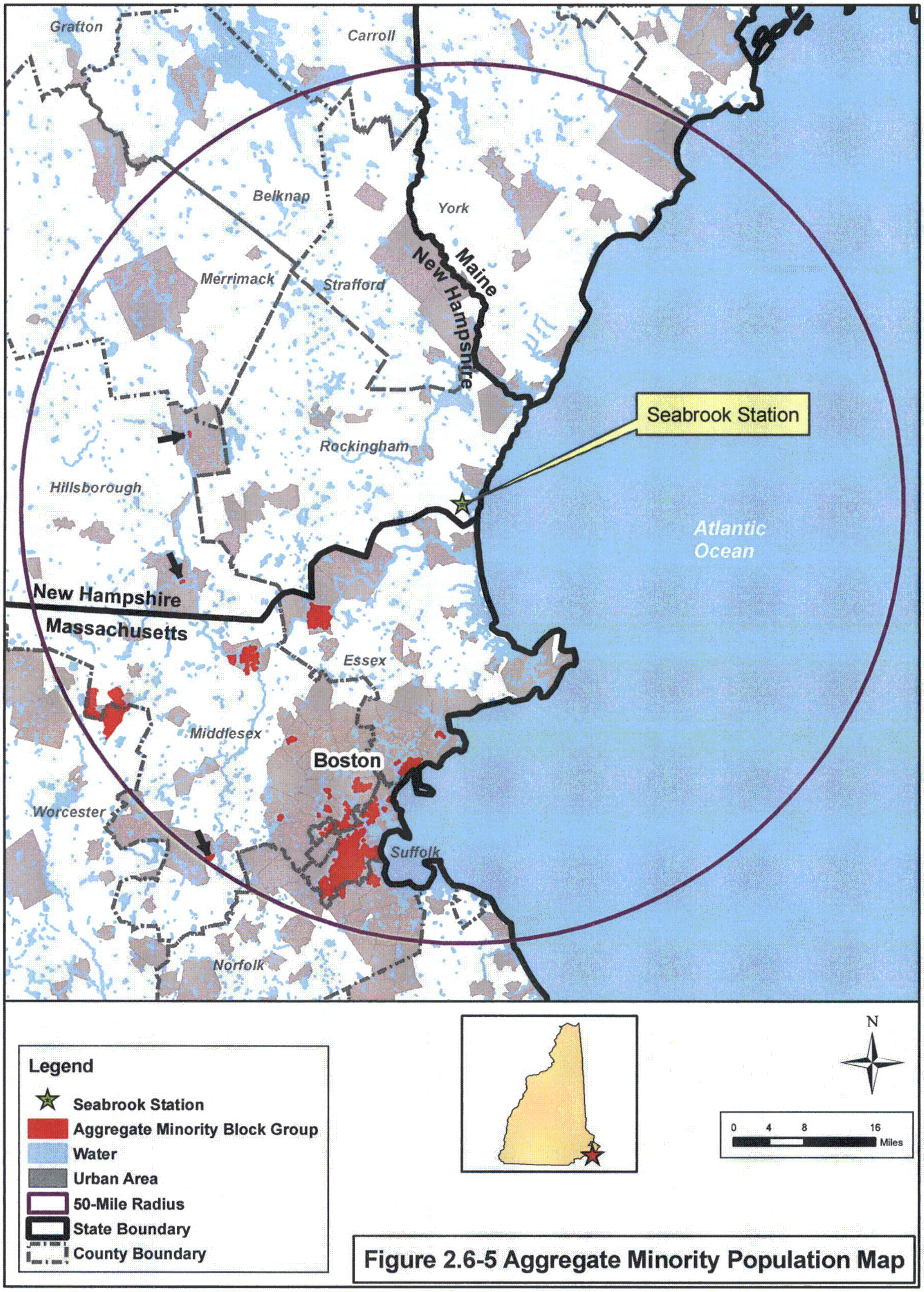

Figure 2.6-5 Aggregate Minority Population Map

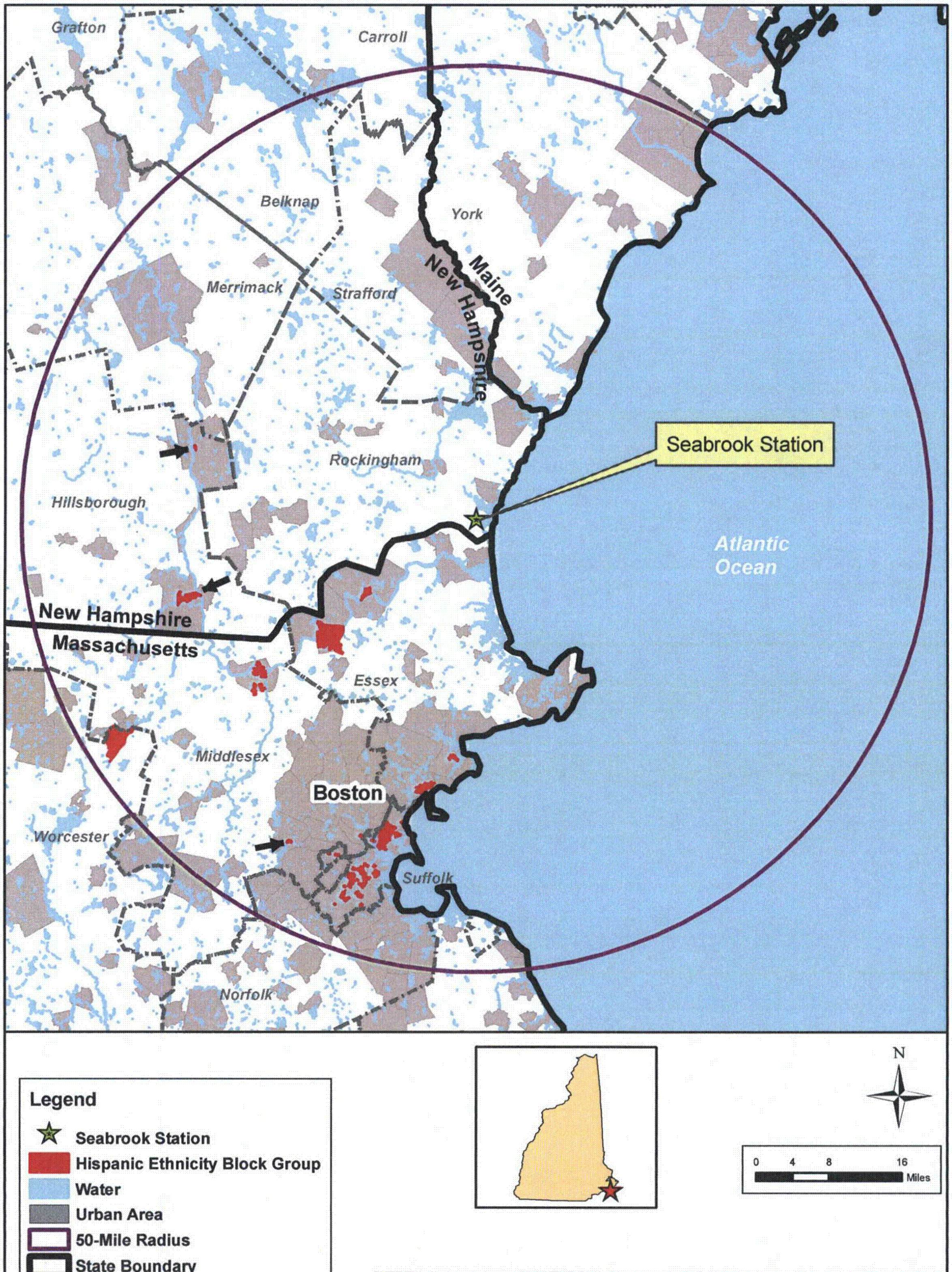

Figure 2.6-6 Hispanic Ethnicity Population Map

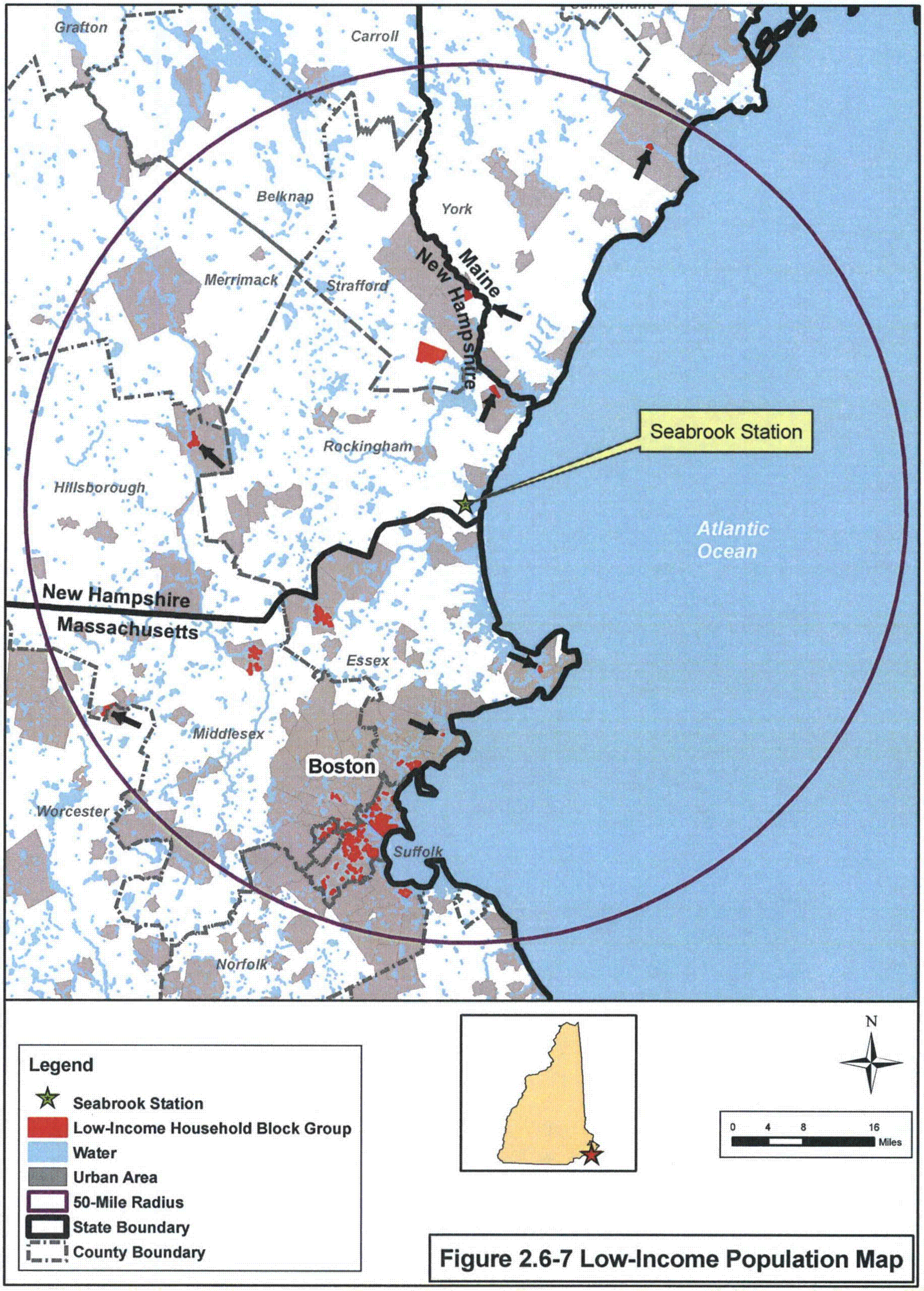

Figure 2.6-7 Low-Income Population Map

2.7 TAXES

The owners of Seabrook Station pay annual property taxes to seven taxing entities: Seabrook (town), East Kingston (town), Kingston (town), Hampton (town), Hampton Falls (town), Newington (town), and New Hampshire (state). East Kingston, Kingston, Hampton, Hampton Falls, and Newington will not be included in this analysis because the Station's 2008 tax payments to these towns were minimal compared to these towns' net tax commitments[1] (Table 2.7-1). Therefore, the focus of this analysis will be on the remaining two entities: the Town of Seabrook and the State of New Hampshire.

From 2003 through 2008, the Town of Seabrook's net tax commitments were between $23.2 and $32.0 million annually (Table 2.7-2). Each year, the Town of Seabrook collects these taxes, retains a portion for operations, and disburses the remainder to the local school system, Rockingham County, and the state of New Hampshire (NHDRA 2008a). For the years 2003 through 2008, Seabrook Station's property taxes represented 29.6 to 42.5 percent of the Town of Seabrook's net tax commitment (Table 2.7-2).

Each year, utilities in the state of New Hampshire pay a "Utility Property Tax", pursuant to state statute RSA 83-F (NHDRA Undated). The majority, if not all, of the Utility Property Tax revenues are added to the state's Education Trust Fund. The Property Appraisal Division of the New Hampshire Department of Revenue Administration (NHDRA) appraises the utility property for this tax. The rate is $6.60 per $1,000 of utility property value (NHDRA Undated). From 2003 through 2008, the NHDRA collected between $282 and $384 million annually in Education Trust Fund revenues (Table 2.7-3). For the years 2003 through 2008, Seabrook Station's utility property taxes have represented 1.2 to 2.0 percent of the state's Education Trust Fund revenues (Table 2.7-3).

The State of New Hampshire's electric utility industry is deregulated (see Chapter 7) and this is not expected to change. Therefore, Seabrook Station's property taxes are expected to continue to be primarily based on the tax rate and the market value of the station property over the license renewal period.

[1] A "net tax commitment" is a taxing entity's levy or tax bill. In New Hampshire, property tax collections must be within one-half of a percent of the net tax commitment.

Table 2.7-1 Seabrook Station Tax Payments Compared with East Kingston, Kingston, Hampton, Hampton Falls, and Newington Net Tax Commitments, 2008

Town	Seabrook Property Tax Payments ($)	Net Tax Commitment for the Towns ($)	Seabrook Payments as Percent of Town's Net Tax Commitment
East Kingston	3,139	6,652,787	<1%
Hampton	504,455	49,175,832	1%
Hampton Falls	72,149	7,804,082	<1%
Kingston	870	14,501,267	<1%
Newington	649	6,685,711	<1%

Source: NextEra 2009d; NHDRA 2009a

Table 2.7-2 Town of Seabrook Tax Information

Year	Seabrook Property Tax Payments ($)	Town of Seabrook's Net Tax Commitment ($)	Seabrook Payments as Percent of Town's Net Tax Commitment
2003	9,734,012	25,972,265	37.5%
2004	7,809,505	23,225,879	33.6%
2005	7,439,760	25,169,483	29.6%
2006	9,103,912	26,966,949	33.8%
2007	9,709,631	28,722,320	33.8%
2008	13,589,935	32,002,616	42.5%

Sources: NextEra 2009d; NHDRA 2008b

Table 2.7-3 New Hampshire Department of Revenue Administration Education Trust Fund Utility Property Tax Information

Year	Seabrook Property Tax Payments ($)	NHDRA Education Trust Fund Revenues ($)	Seabrook Payments as Percent of NHDRA Education Trust Fund Revenues
2003	3,616,741	282,495,534	1.3
2004	3,988,828	289,071,911	1.4
2005	4,009,624	304,732,913	1.3
2006	4,277,710	360,775,854	1.2
2007	5,809,354	383,781,559	1.5
2008	7,649,709	380,267,108	2.0

Sources: NHDRA 2008b; NHDRA 2009b; and NHDRA 2009c

2.8 LAND USE

This section focuses on Rockingham County and, more specifically, the Town of Seabrook because Seabrook Station owners pay the majority of their property taxes to the Town of Seabrook (Section 2.7).

Rockingham County

Rockingham County is located in southeast New Hampshire along the Atlantic Ocean. It is bounded by Maine to the northeast, Strafford County to the north, Merrimack County to the northwest, Hillsborough County to the west, Massachusetts to the south, and the Atlantic Ocean to the east (Figure 2.1-2).

Rockingham County encompasses 465,855 acres, including water and wetlands. Table 2.8-1 presents the acreages of Rockingham County's current land uses. Figure 2.8-1 depicts the locations of the various land uses.

Town of Seabrook

The Town of Seabrook is in southeast Rockingham County, adjacent to the Atlantic Ocean. It is bounded by Hampton Falls to the north, Kensington and South Hampton to the west, the Commonwealth of Massachusetts to the south, and the Atlantic Ocean to the east (Figure 2.1-2).

The Town of Seabrook encompasses 5,978 acres, including water and wetlands (Town of Seabrook 2008a). Table 2.8-2 presents the acreages of the Town of Seabrook's land uses in 1974, 1990, and 2000. As Table 2.8-2 indicates, developed land increased by 669 acres from 1974 to 2000 and forested land decreased by 588 acres over the same period. The other land uses remained relatively constant over the 26-year period. In 2000, developed land was the largest land use (39.6 percent) in the town. Water and wetlands comprised roughly a quarter of the town's total area. Forest land also comprised about a quarter of the town's total area.

Zoning maps developed by the Town of Seabrook indicate that the major land uses west of Interstate 95 are either rural or industrial (Town of Seabrook 2008b; Town of Seabrook 2005). Local planners want to encourage more industrial development in this area (Town of Seabrook 2008b).

To the east of Interstate 95, the major land uses are residential, industrial, commercial, or conservation (Town of Seabrook 2008b; Town of Seabrook 2005). Most of the commercial development occurs along Lafayette Road (US Route 1), and Collins Street. Planners want to direct future commercial development to Lafayette Road only. Most of the residential areas are located east and west of the commercial areas along Lafayette Road and along the beachfront. The conservation land includes the water and wetlands of the Hampton Harbor Estuary. The industrial land is primarily located in and around the Seabrook Station site. With the exception of Seabrook Station, local planners want to gradually phase out most of the industrial development east of Interstate 95 (Town of Seabrook 2008b; Town of Seabrook 2005).

The Town of Seabrook has several land management tools to guide development: the Seabrook Master Plan, the Seabrook Zoning Ordinance, and various regulations pertaining to floodplains, subdivisions, site plans, etc. (Town of Seabrook 2005). Within the last 10 years, the Town of Seabrook updated its municipal water system. This enabled the expansion of residential, commercial, and industrial development. The town employs zoning to encourage growth in areas where public facilities, such as water and sewer systems, exist or are scheduled to be built and to promote the preservation of the town's open spaces and natural vegetation (Town of Seabrook 2008b). The town has no formal growth control measures (Town of Seabrook 2008b).

The Master Plan indicates that the town's major concerns for the future include compatibility of land uses, natural resource protection, cultural resource protection, affordable housing, pollution prevention, sewage disposal, conservation of agricultural land, open space, and forest land, and transportation management (Town of Seabrook 2008b).

Table 2.8-1 Rockingham County Land Use, 1998

Land Use	Acreage	Percentage of Total Acreage
Agriculture	16,318	3.5%
Auxiliary Transportation	2,116	0.5%
Farmsteads	255	0.1%
Forested	296,535	63.7%
Industrial/Commercial	10,274	2.2%
Mixed Urban	2,550	0.5%
Open	16,277	3.5%
Railroads	348	0.1%
Recreational	2,403	0.5%
Residential	72,362	15.5%
Roads	8,551	1.8%
Water	22,827	4.9%
Wetlands	15,039	3.2%
Total	**465,855**	**100.0%**

Source: UNH 2003

Table 2.8-2 Town of Seabrook Land Use; 1974, 1990, and 2000

Land Use	1974 Acreage	Percentage of Total	1990 Acreage	Percentage of Total	2000 Acreage	Percentage of Total
Roads and Rail	51	0.9%	60	1.0%	81	1.4%
Developed	1,699	28.4%	2,156	36.1%	2,368	39.6%
Forested	2,118	35.4%	1,731	29.0%	1,530	25.6%
Wetlands	1,394	23.3%	1,375	23.0%	1,365	22.8%
Water	320	5.4%	318	5.3%	318	5.3%
Beaches	67	1.1%	67	1.1%	67	1.1%
Open Space	329	5.5%	271	4.5%	249	4.2%
Total	5,978	100.0%	5,978	100.0%	5,978	100.0%

Source: Town of Seabrook 2008b

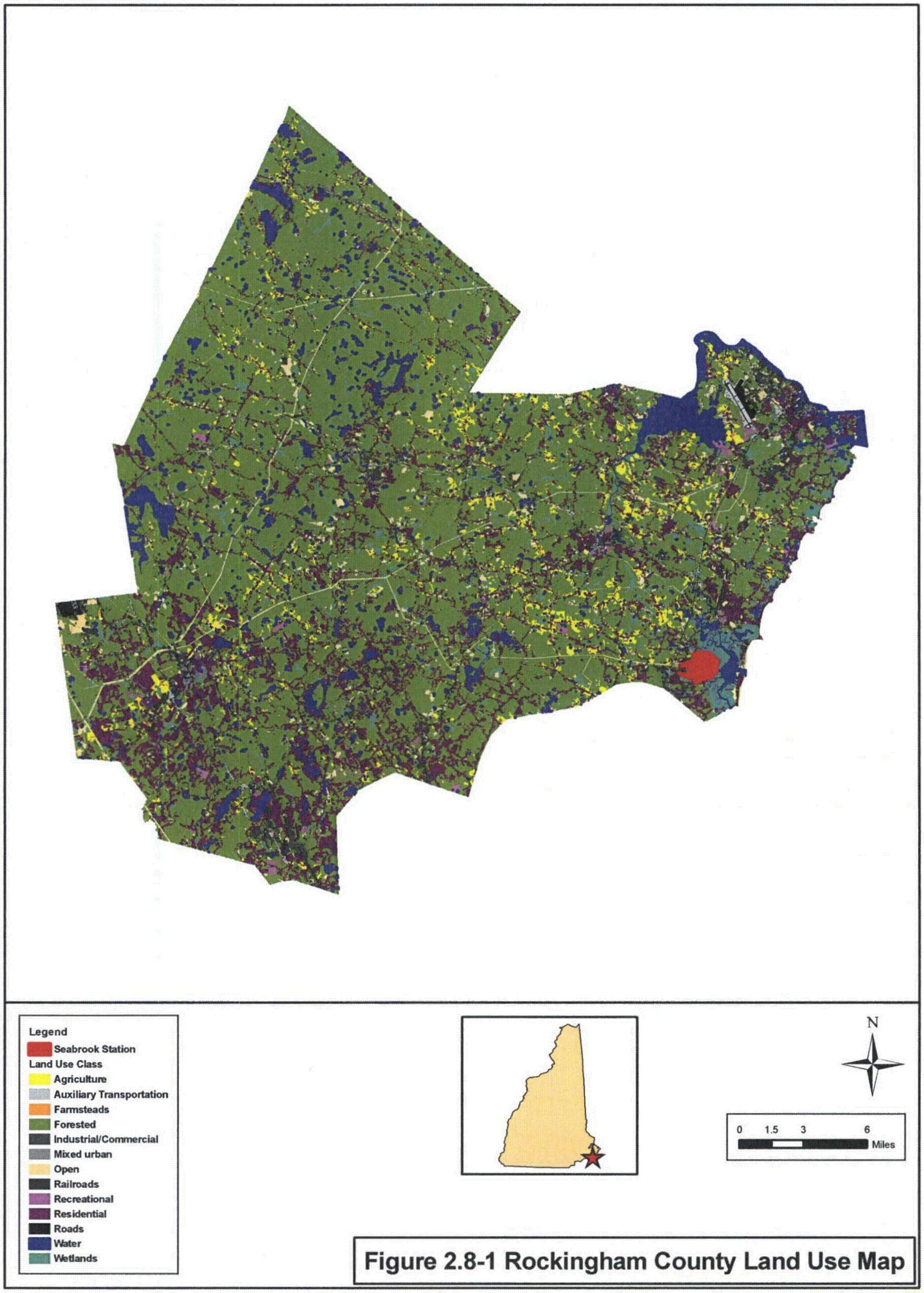

Figure 2.8-1 Rockingham County Land Use Map

2.9 SOCIAL SERVICES AND PUBLIC FACILITIES

2.9.1 PUBLIC WATER SUPPLY

Because Seabrook Station obtains all fresh water from the Town of Seabrook Water Department (Section 2.3) and most station employees reside in Rockingham and Strafford counties, the analysis of public water supply systems is limited to Rockingham and Strafford counties. Tables 2.9.1-1 and 2.9.1-2 present capacity data for the community public water suppliers in each county.

In Rockingham County, there are eight major public water suppliers. The largest of these is the Portsmouth Water Works, owned and operated by the City of Portsmouth, and serving a population of 33,000. The Portsmouth Water Work's service area includes consumers in the Towns of Portsmouth, Durham, Greenland, Madbury, New Castle, Newington, and Rye (Portsmouth 2003).

Portsmouth's water supplies are drawn from both surface and groundwater. Surface water is supplied by the Bellamy Reservoir. Groundwater is supplied by nine wells. The City's water distribution system includes approximately 150 miles of pipe in two pressure zones. The City also owns and operates six water distribution storage facilities. A seventh facility is connected to the City's system, but is owned and operated by the New Hampshire Air National Guard. The total volume of all seven storage facilities is 11.51 million gallons (Portsmouth 2003).

The City has developed and initiated the two-phase "Water System Master Plan". In the first phase, the City investigated its distribution and pumping systems and future water demand. Results of this phase indicated that future demand may exceed supply and planners recommended distribution system improvements, such as water line upgrades and replacements, and conservation efforts to mitigate possible shortages. (Portsmouth 2003)

In Phase 2, the City conducted a more in-depth assessment of future supply and demand and outlined actions that would need to be taken to ensure sufficient supply, production, and treatment capacity. Recommended actions included construction of a new water treatment facility, new source development, pumping system upgrades, operational modifications to optimize combined use of groundwater and surface water, and operational changes to improve distribution system efficiency. (Portsmouth 2003)

Seabrook Station obtains water from the Town of Seabrook Water Department. Between 2003 and 2008, Seabrook Station obtained an average of 0.1 million gallons of water per day (MGD) from the Town of Seabrook Water Department. As of 2009, the Town's maximum permitted capacity is 2.5 MGD (Table 2.9.1-1). The Town's average daily use is 0.9 MGD, including the amount consumed by Seabrook Station (Table 2.9.1-1). The Town of Seabrook's water supply demand is projected to increase through the year 2020. Additional groundwater wells, surface water sources, and inter-municipal distribution systems are anticipated to meet the region's water demands (Seabrook 2008a, Town of Seabrook 2008b).

In Strafford County, there are four major public water suppliers. The largest of these is the City of Dover Water Department, owned and operated by the City of Dover, and serving a population of 28,000 (Table 2.9.1-2). The City's water supply operations are funded by user fees (City of Dover 2000). The City's supply is from groundwater, although water is withdrawn from the Bellamy and Isinglass Rivers at certain times of the year to supplement the recharge of the Pudding Hill and Hoppers Aquifers. The existing system consists of eight deep, gravel-packed wells, two water treatment plants, and a 4-million-gallon storage tank (City of Dover 2000). Currently, large system expansions are not planned, although new sources are being explored. The primary focus is on system upgrades and on-going maintenance (City of Dover 2000).

2.9.2 TRANSPORTATION

The local road system is shown on Figure 2.1-1. The major roadways in the area are Interstate 95 (I-95) which traverses north-south through the area west of the Town of Seabrook, US Route 1 (US 1), State Road 107 (SR 107), State Road 286 (SR 286), State Road 101 (SR 101), and State Road 88 (SR 88). I-95 becomes a toll road north of its intersection with SR 107 and is also known as Blue Star Memorial Highway. US 1 traverses north-south through the Town of Seabrook and is also known as Lafayette Road in the town. SR 107 enters the Town of Seabrook from the west and has intersections with I-95 and US 1. SR 286 is an east-west connection along the southern end of the town linking I-95 with the coast. SR 101 traverses east-west connecting the coast, through Hampton, to Manchester and is also known as Exeter-Hampton Expressway. SR 88 is a northwest-southeast connection north of the Town of Seabrook linking US 1 with the Town of Exeter and is also known as Exeter Road.

Seabrook Station has two active access roads, the North Access Road and the South Access Road. These roads are owned by NextEra Energy Seabrook. The North Access Road originates at US 1 and traverses directly east to the northern end of Seabrook Station. This road provides a secondary egress from the site during peak traffic hours, and is opened for the additional traffic associated with refueling outages. The South Access Road is the main access road to Seabrook Station. The South Access Road connects with the intersection of US 1 and SR 107, west of the Station.

Employees commuting to Seabrook Station from the north or south use I-95 or US 1 to reach the area. Those traveling on I-95 could exit at the SR 107 interchange and continue on SR 107 to Seabrook Station's South Access Road. Travelers on US 1 would travel north or south to the intersection with SR 107 and then east on South Access Road. Employees commuting to

Seabrook Station from the west could travel on SR 107 to reach the area and then continue on South Access Road to Seabrook Station where SR 107 terminates into the access road. Employees commuting from the Manchester or Exeter areas could travel east on SR 101 or southeast on SR 88 to connect with US 1.

US 1 is heavily traveled and was characterized as Level of Service E and F[2] based on 2006 peak hour traffic data (NHDOT 2007). Annual Average Daily Traffic count for 2007 for US 1 south of the SR 107 was 26,000 vehicles (NHDOT 2008). SR 107 is also heavily traveled. The 2007 Annual Average Daily Traffic count for SR 107 west of US 1 was 24,000 vehicles (NHDOT 2008). Seasonal beach traffic is heavy, but does not coincide with plant outage activities. Traffic data are not available for SR 107 east of US 1.

[2] Roadway traffic is classified by the ability of the drivers to maneuver, and the maintenance of the traffic flow. Movement on roads with a Level of Service (LOS) A is described as free-flowing at or above the posted speed limit. LOS B may limit lane changes, but does not reduce speed. LOS C and D are progressively more congested. LOS E provides marginal service and LOS F indicates that capacity has been exceeded.

Table 2.9.1-1 Rockingham County Public Water Suppliers

Water System Name	Population Served	Primary Water Source Type	Average Daily Use (MGD)	Maximum Daily Capacity (MGD)
Aquarion Water Company of New Hampshire	19,000	Groundwater	1.5	5.0
Derry Water Department	15,000	Purchased Surface Water	1.5	3.0
Exeter Water Department	11,000	Surface Water	1.1	2.0
Newmarket Water Works	5,000	Surface Water	0.5	0.7
Portsmouth Water Works	33,000	Surface Water	4.0	8.0
Rye Water District	3,900	Groundwater	0.3	1.5
Salem Water Department	18,000	Surface Water	0.6	2.5
Seabrook Water Department	14,000	Groundwater	0.9	2.5

Sources: EPA 2008a; Tetra Tech 2009b
MGD = million gallons per day

Table 2.9.1-2 Strafford County Public Water Suppliers

Water System Name	Population Served	Primary Water Source Type	Average Daily Use (MGD)	Maximum Daily Capacity (MGD)
City of Dover Water Department	28,000	Groundwater	2.5-3.0	4.2
Rochester Water Department	20,000	Surface Water	2.0-2.6	4.6
Somersworth Water Works	12,000	Surface Water	2.0-3.0	3.0
UNH/Durham Water System	16,000	Surface Water	1.0	2.1

Sources: EPA 2008a; Tetra Tech 2009b
MGD = million gallons per day

2.10 METEOROLOGY AND AIR QUALITY

Seabrook Station is located in the Town of Seabrook, Rockingham County, New Hampshire, approximately 2 miles west of the Atlantic Ocean. The climate in New Hampshire is influenced by distance from the relatively-mild ocean waters, elevations, and types of terrain. The terrain varies from hilly to mountainous except along the coast. The climate is affected by three air masses: cold, dry air from the north; warm, moist air from the Gulf of Mexico and the Gulf Stream; and damp air from the Atlantic Ocean. New Hampshire experiences more storm systems than many sections of the United States. The three air masses and frequent storm systems often bring abrupt changes in temperature, moisture, sunshine, and wind direction and speed. Generally, New Hampshire's weather is classified as variable. (NCDC 2008)

Seabrook Station's proximity to the ocean influences its weather, with less variability in temperature, more rainfall, and less snow than further inland. Extremes of temperature are uncommon due to the proximity of the Atlantic Ocean. During the winter, arctic air masses produce low minimum temperatures, but the frequency and persistence of such extreme values along the coast is less than for locations farther inland. Winter temperatures at the site are moderated by the proximity of the ocean water, which is relatively warm compared to winter air temperatures. For this reason, a good proportion of winter storm precipitation falls in the form of rain or wet snow. During the spring and summer, a sea breeze usually moderates temperatures so they don't reach high extremes at the site. Relative humidity is generally moderate at the site and is lowest in late winter or early spring and highest in late summer or early fall. (Seabrook 2008a)

Precipitation in the Seabrook area is generally evenly distributed throughout the year, with mean monthly amounts between approximately 3 and 5 inches. At the Station site, annual precipitation is about 43 inches. Summer rainfall is caused primarily by thunderstorms and convective shower activity. During the colder months, intense coastal storms or northeasters move along the New England coast, usually affecting coastal locations with heavy rain or snow and, on occasion, ice storm conditions. Occasionally during the summer or fall, a storm of tropical origin will cause substantial rainfall and high winds in the vicinity of the site. Snow falls in the site area as early as November and as late as April. The site can expect an annual snowfall of about 72 inches. (Seabrook 2008a)

Attachment F contains meteorological information relevant to the severe accident mitigation alternatives analysis.

Under the Clean Air Act, EPA has established National Ambient Air Quality Standards (NAAQS), which specify maximum concentrations for carbon monoxide, particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}), particulate matter with aerodynamic diameters of 2.5 microns or less ($PM_{2.5}$), ozone, sulfur dioxide (SO_2), lead, and nitrogen dioxide (NO_2).

Areas of the United States with air quality as good as or better than the NAAQS are designated by EPA as attainment areas. Areas having air quality that is worse than the NAAQS are designated by EPA as non-attainment areas. Those areas that were previously designated non-attainment and subsequently re-designated to attainment after meeting the NAAQS are maintenance areas. States with maintenance areas are required to develop an air quality maintenance plan as an element of the State Implementation Plan.

Rockingham County, New Hampshire is part of the Merrimack Valley-Southern New Hampshire Interstate Air Quality Control Region (40 CFR 81.81). Within New Hampshire, Hillsborough, Merrimack, Rockingham, and Strafford Counties are designated as partial non-attainment areas with for the 8-hour ozone NAAQS and the cities of Manchester and Nashua are designated as maintenance areas for the carbon monoxide NAAQS. The Town of Seabrook, New Hampshire, in Rockingham County, is designated as a non-attainment area under the 8-hour ozone NAAQS. All other counties in New Hampshire are considered attainment areas (40 CFR 81.330).

In November 2008, the EPA issued a final rule that strengthens the primary and secondary standards for lead (40 CFR Parts 50, 51, 53, and 58, National Ambient Air Quality Standards for Lead). Areas currently designated as non-attainment for lead are not affected by the new rule, but additional non-attainment areas could be designated under the new standards. (EPA 2008b)

The Clean Air Act, as amended, established Mandatory Class I Federal Areas where visibility is an important issue. There are two Class I areas in New Hampshire; the Great Gulf Wilderness Area, 97 miles north of Seabrook Station and the Presidential Range-Dry River Wilderness Area, 86 miles north of Seabrook Station (40 CFR 81.419). Class I areas are also in northern Maine, over 150 miles northeast of Seabrook Station and southwestern Vermont, over 100 miles west of Seabrook Station (40 CFR 81.413, 40 CFR 81.431). No Class I areas are in Massachusetts. No Class I areas are within a 50-mile radius of Seabrook Station.

Seabrook Station has a Clean Air Act Title V Operating Permit issued by the New Hampshire Department of Environmental Services. Under the permit, Seabrook Station is authorized to operate two auxiliary boilers, four large diesel-powered emergency generating units, a number of small emergency generating units, and a diesel-engine driven air compressor (NHDES 2006). Seabrook Station also has several small diesel-powered pumps and motors that are operated infrequently.

Sulfur hexafluoride (SF_6) is contained in the 345 kV switchyard breakers and bus ducts at Seabrook Station and escapes in small amounts into the surrounding air. These emissions are regulated under New Hampshire Air

Toxic rules and subject to emission inventory reporting requirements under Seabrook Station's Title V Permit (Seabrook 2008d). Although emissions of SF_6 are not currently subject to federal regulations, Seabrook Station, through FPL-New England Division, has partnered with the EPA's voluntary SF_6 Emission Reduction Partnership (EPA 1999). In this program, partners agree to (EPA 2008c):

- Estimate current annual SF_6 emissions
- Annually inventory emissions of SF_6 using an emissions inventory protocol
- Establish a strategy for replacing older, leakier pieces of equipment
- Implement SF_6 recycling
- Ensure that only trained and knowledgeable personnel handle SF_6
- Submit annual progress reports.

NRC has begun including a discussion of potential impacts from greenhouse gases emitted from the nuclear fuel cycle in license renewal supplemental EISs. NextEra Energy Seabrook reviewed NRC's discussion and a number of authoritative lifecycle analyses of greenhouse gas (GHG) emissions from nuclear and other electricity-generating technologies to evaluate carbon dioxide and other GHG emissions associated with Seabrook Station license renewal. The results of this review are described below.

Several studies provide qualitative discussions of the potential for nuclear power to ameliorate GHG emissions. Examples of these studies include Hagen et al. 2001; IAEA 2000; Keepin 1988; MIT 2003; NEA 2002; NIRS/WISE 2005; and Schneider 2000. While these studies sometimes reference and critique the rationale contained in the existing quantitative estimates of GHGs produced by the nuclear fuel cycle, their conclusions are generally based on other factors such as safety, cost, waste generation, and political acceptability. Therefore, these studies are not directly applicable to the evaluation of the GHG emissions associated with license renewal of Seabrook Station.

A number of studies provide technical lifecycle analyses and quantitative estimates of the amount of GHGs generated by nuclear and other power generation technologies. Examples of these studies include AEA 2006; Andseta et al. 1998; Dones 2007; Fritsche 2006; Fthenakis and Kim 2007; Mortimer 1990; POST 2006; Spadaro et al. 2000; Storm van Leeuwen and Smith 2005; and Weisser 2007. Comparison of these quantitative studies is difficult because the assumptions and components of the lifecycles (i.e., reactor types, energy sources used in mining and processing fuel, capacity factors, fuel quality) included within each study vary widely. Also, these studies are inconsistent in how they define the lifecycle; some include plant construction, decommissioning, and resource extraction (uranium ore, fossil fuel) while others include one or two of these activities. Similarly, the scope of these studies is inconsistent with license renewal because license renewal does not include construction or decommissioning. For example, Storm van Leeuwen and Smith (2005) present comparisons of GHG emissions from nuclear versus natural gas that incorporate GHG emissions associated with nuclear plant construction and decommissioning in the values used for comparison. Renewing the license for Seabrook Station would not involve GHG emissions associated with construction because the facility already exists, nor would it involve additional GHG emissions associated with facility decommissioning, because decommissioning must occur whether the facility license is renewed or not. In many of these studies, the contribution of GHG emissions from facility construction and decommissioning cannot be separated from the other lifecycle GHG emissions that would be associated with Seabrook Station license renewal. Therefore, these studies overestimate the GHG emissions that would be attributable to renewal of the Seabrook Station operating license.

NextEra Energy Seabrook found that the estimates and projections of the carbon footprint of the nuclear power lifecycle provided in the various studies vary widely, and considerable debate exists regarding the relative impacts on GHG emissions of nuclear and other electricity-generating technologies. Nevertheless, the studies indicate a consensus that nuclear power produces fewer GHG emissions than fossil-fuel-based electricity-generating technologies. Based on the literature review, lifecycle GHG emissions from the complete nuclear fuel cycle currently range from 2.5 to 55 grams (g) of carbon equivalents per kilowatt hour (Ceq/kWh). The comparable lifecycle GHG emissions from the use of coal range from 264 to 1250 g Ceq/kWh, and GHG emissions from the use of natural gas range from 120 to 780 g Ceq/kWh. The studies also provided estimates of GHG emissions from five renewable energy sources, based on current technology. These estimates included solar-photovoltaic (17 to 125 g Ceq/kWh), hydroelectric (1 to 64.6 g Ceq/kWh), biomass (8.4 to 99 g Ceq/kWh), wind (2.5 to 30 g Ceq/kWh), and tidal (25 to 50 g Ceq/kWh). The range of these estimates is very wide, but the general conclusion is that the GHG emissions from the nuclear fuel cycle are of the same order of magnitude as those for renewable energy sources.

Based on the literature review described above, NextEra Energy Seabrook concludes that GHG emissions associated with renewal of the Seabrook Station operating license would be similar to the lifecycle GHG emissions from renewable energy sources and lower than those associated with fossil-fuel-based energy sources.

2.11 HISTORIC AND ARCHAEOLOGICAL RESOURCES

2.11.1 REGIONAL HISTORICAL CONTEXT

Prehistoric

New Hampshire's prehistory is divided into several broad chronological periods based on information collected from archaeological deposits, not only in New Hampshire, but across New England. Due to the paucity of definitive occupation dates for many recovered sites, the chronological framework is very broad and has vast gaps for each cultural period (Bunker 1994).

The Paleo-Indian Period is dated to 11,000 to 9,000 before present (B.P.) and marks the earliest known human occupation of New Hampshire. This period is represented primarily by diagnostic artifacts, namely fluted projectile points. During this period, the population likely was very small, relied on hunting and gathering for subsistence, was very mobile, and fashioned tools from a variety of lithic sources, including cherts from distant locations. The distribution of known sites suggests that Paleo-Indian peoples settled near streams, wetlands, lakes, and high river terraces. The diversity of resources in these settings would have been attractive to a mobile population. (Bunker 1994)

The Archaic Period extends from 9,000 to 3,000 B.P. and is divided into Early, Middle, and Late phases. The Archaic Period is believed to represent a transition from a highly mobile lifestyle to one that becomes gradually more settled. As projectile point styles and materials changed, ground stone tools as well as tools of wood and bone were introduced. People likely practiced a variety of subsistence practices, focusing on hunting, fishing, plant gathering, and shellfish collecting. During the Early Archaic, quartz was the primary stone tool material. The Middle Archaic shows increased usage of volcanic stone tool materials that were transported as cores or preforms to locations where they were reduced to bifacial forms, although quartz continued to be used. The Late Archaic saw increased use of ground stone tools, cobble tools, and large implement blades. This phase also saw the introduction of steatite for the manufacture of stone bowls. Quartz and volcanic materials continued to be used for tools, though the materials appear to be brought in from greater distances during this phase. Settlement early on appears to be focused on lake shores and river terraces, particularly those associated with major falls. During the Middle Archaic, river tributaries, secondary perennial streams, and high terraces away from main rivers were increasingly utilized. The Late Archaic Period sites are found along both major and minor water features, with a strong riverine orientation. Increased culture contact during the Late Archaic is evidenced by artifact diversity, an influx of exotic stone tool materials, and the practice of ceremonial ritualism. (Bunker 1994)

The Woodland Period is dated from 3,000 to 400 B.P. and is marked by the debut of ceramics into the indigenous toolkit. People continued their reliance on hunting, fishing, plant gathering, and shellfish collection, with domesticated plants playing only a very minor role late in the period. The Early, Middle, and

Late phases of the Woodland period are demarcated on the basis of ceramic style and technology, as well as typological difference in formal stone tools. Regional interaction among groups throughout the Woodland Period is evidenced by ceramic decorative techniques and the use of diverse stone tool materials, with stones from non-local sources strongly represented in the archaeological record. Woodland sites are found along streams, rivers, and the coast. The appearance of large storage features at prominent riverine and coastal locations in the Late Woodland may coincide with population growth, nucleation, or increased sedentism. (Bunker 1994)

The Contact Period extends from 400 to about 200 B.P. and marks the end of prehistory with the arrival of European traders, fishermen, explorers, and surveyors. The archaeological assemblage includes items of both Native and European origin, the latter often being transformed to suit Native needs. By the mid-1600s, contacts had extended far into the interior. The Native population neared extinction during this period from war and disease. While Contact Period sites are very ephemeral, other sources indicate that trading centers, villages, and forts were located along the coast and along major rivers. Sheltered locations and isolated hilltops were selected for habitation, perhaps to escape the pressures of war, disease, or land acquisition as Europeans encroached. (Bunker 1994)

Historic

European interest in New Hampshire dates from the 1500s, when French and English ships explored the coast of North America. By 1600, Englishmen were fishing off the New England coast seasonally, using the Isles of Shoals for shelter and to dry their catch. New Hampshire's first permanent European settlements occurred at Odiorne Point in present-day Rye and on Dover Point in 1623. By 1640, New Hampshire's seacoast was divided among four towns: Dover, Portsmouth, Exeter, and Hampton. Inhabitants of these towns chose to be part of Massachusetts for much of the 1600s, but in 1680, New Hampshire became a separate province (NHDHR 2009a).

The Seabrook area was first settled in 1638, when it was a part of Hampton. It was part of Hampton Falls when that town separated from Hampton in 1726. The Town of Seabrook was incorporated as a separate town in 1768, and named after the Seabrook River. Early residents of Town of Seabrook included the family of Meshech Weare, who became the first governor of New Hampshire. The boundary between Hampton and the Town of Seabrook was subject to periodic dispute for nearly two centuries, and was finally settled by court decision in 1953 (NHES 2008).

The people of New Hampshire made their living through a combination of fishing, farming, cutting and sawing timber, shipbuilding, and coastal trade. By the 1700s, the provincial capital of Portsmouth had become a thriving commercial port, exporting timber products and importing everything from food to European finery. As the English population expanded landward, a series of wars between the English and French occurred, with the Natives predominantly siding with the French. By the 1740s, New Hampshire's Indian population had been forced out of the province entirely (NHDHR 2009a).

By the American Revolution, the life of the New Hampshire seacoast populations revolved around sawmills, shipyards, warehouses, and established villages and town centers. Wealthy merchants built substantial homes, purchased the finest luxuries, and invested their capital in trade and land speculation. At the other end of the social scale, there was the permanent class of day laborers, mariners, indentured servants, and slaves. In the central and western parts of the province, the inhabitants were farmers. Their small towns included a few sawmills and gristmills, taverns, a meetinghouse, and perhaps a store or school (NHDHR 2009a).

During the 1800s, the seacoast declined as the commercial center. Towns located along major rivers in the interior prospered by turning to textile manufacturing. Manchester and Nashua in the Merrimack Valley became major textile manufacturing centers and took over as the social, political, and economic center of the state. Concord's central location and diversified economy made it well-suited to serve as the new state capital. During this time, the traditional family farms could not compete with farms in the Midwest and much of the farming population left their holdings to work in the booming manufacturing economy to the south. Some of New Hampshire's rural areas, especially in the northern part of the state, turned to commercial logging. Railroads were built into once inaccessible areas and log drives followed rivers into Massachusetts. By the 1870s, New Hampshire's railroad network was largely complete and remaining farmers found a ready market for dairy, produce, poultry, and other perishable products that were shipped daily to Boston and Portland via the new rail lines. These same railroads to the urban centers also brought tourists back to New Hampshire. By the late 1800s, the tourist economy was flourishing, with the construction of grand hotels, summer homes, and rustic cottages. These tourists eventually bought up the old hill farms for summer homes (NHDHR 2009a).

At the beginning of the 20th century, New Hampshire was a leading producer of textiles, machinery, wood products, and paper. Meanwhile, as the remaining hill farms struggled, tourism was providing some relief for rural areas. By the end of the First World War, New Hampshire's old textile mills could not compete with the South's newer cotton mills. Mill towns were as economically depressed as the farm towns. Manufacturing centers responded by attracting new industries, in particular shoes and electronics, and rural towns took advantage of the growing popularity of the automobile to attract larger numbers of tourists. Tourism was further assisted by the increasing national interest in antiques and handcrafts, as well as the new fascination with alpine skiing. These economic trends continued through the 1940s and 1950s (NHDHR 2009a).

By the 1960s, the urban sprawl of Boston spilled over into southern New Hampshire, aided by the new interstate system, a favorable tax structure, and good living conditions. The introduction of high-tech industries, the continued growth of tourism, and the associated proliferation of service industry jobs helped New Hampshire become a state of high average wages and very low unemployment during the 1970s and 1980s (NHDHR 2009a).

2.11.2 INITIAL CONSTRUCTION AND OPERATION

The Environmental Report (ER) prepared by Public Service Company of New Hampshire (PSNH) in 1973 for the Seabrook Station construction permit mentions four historic landmarks within the 6-mile radius area considered for the current ER. These are a historic marker in the Town of Seabrook, a gristmill and dam in Hampton Falls, and two historic markers in Hampton (PSNH 1973). It also states that there are no known or expected points of archaeological significance on or near the site (PSNH 1973). It concludes that none of the historic sites identified will be affected by the plant (PSNH 1973).

In October and November 1973, the applicant retained a consultant (Charles Bolian of the University of New Hampshire) to conduct an archaeological survey of the Seabrook Station site. He did a surface reconnaissance and selected test excavations in areas that appeared to have archaeological deposits. Five sites were identified. Three of the sites, field numbers 1, 3, and 4, were determined to be within the area planned for construction disturbance. These three sites comprise the Rocks Road Site (formal state number NH47-20). Site 2 was just south of the area planned for disturbance and Site 5 was east of the area of disturbance near an existing transmission line (PSNH 1973). All five sites were prehistoric, and Site 4 had a European contact period component as well (see additional discussion in Section 2.11.3). A report of the reconnaissance survey prepared by Bolian was included as an appendix to the ER for the construction stage. A one-page addendum prepared by PSNH was attached to the front of the survey report. The addendum describes four additional areas identified by PSNH on the Seabrook Station site, but outside the construction areas, that exhibit similar characteristics to the archaeological sites found by Bolian (PSNH 1973). This is the only mention of these four additional sites in the available literature.

The 1974 Final Environmental Statement (FES) for construction of Seabrook Station reports that an archaeological survey carried out by a consultant to the applicant indicated that several prehistoric archaeological sites would be severely disturbed or destroyed by the proposed construction of the plant. It states that the applicant indicated a desire to cooperate with preservation or excavation of the resources prior to station construction, and that the State Historic Preservation Officer and Archaeological Society of New Hampshire would be consulted in the final evaluation. The only other identified impacts to historic or archaeological resources were that impacts on nearby historic sites would be primarily aesthetic. (AEC 1974)

The 1982 ER for the operating license mentions that one historic site had been added to the National Register of Historic Places (National Register) since the ER for the construction stage had been prepared, the Governor Meshech Weare House in Hampton Falls, and that the Seabrook Station was not visible from this landmark (PSNH 1982).

The 1982 FES for operation of Seabrook Station also mentions the addition of the Weare house to the National Register. It also reports that the State Historic Preservation Officer notified the applicant that local citizens in South Hampton were developing information with regard to two proposed historic districts for the state's consideration for inclusion in the National Register. These districts are described as being along the path of the approved transmission corridor. The 1982 FES also reports that three archaeological sites (NH47-20 [Rocks Road], NH47-21 [Hunt's Island], and NH47-22 [Marsh]), located on the plant site, had been excavated by the University of New Hampshire, and that three others, two located off-site and one on-site, would not be impacted by the operation and maintenance of the plant (NRC 1982). The discrepancy regarding the number of known sites enumerated among the documents is not explained in the 1982 FES. The FES goes on to state that operation and maintenance activities are not expected to affect any cultural resources in or eligible for the National Register (NRC 1982).

2.11.3 OTHER CULTURAL RESOURCE ACTIVITIES AT SEABROOK STATION

In October and November 1973, an archaeological survey was conducted for the plant site by a consultant to the applicant. This survey identified five archaeological sites on the plant site (Robinson and Bolian 1987). Three of the sites (numbers 1, 3, and 4) were determined to be within the area of proposed construction and were excavated in 1974 and 1975 by the University of New Hampshire, with the assistance of avocational archaeologists and volunteers. These three sites are collectively known as the Rocks Road Site. The Rocks Road Site was a prehistoric site that was occupied intermittently from the Late Archaic through Historic Periods (a span of over 4,000 years), with major occupations in the Middle Woodland and Contact Period (Robinson and Bolian 1987).

Of particular importance, four prehistoric burials were identified and excavated from the site (Robinson and Bolian 1987). Burials number 3 and number 4 were found in the same burial pit and comprised the teeth and mandibles of two children aged 5 to 10 years old, gender unknown. Burial number 2 included the partial leg bones and teeth of someone in their 30's, gender unknown.

Burial number 1 attracted the most attention as it was mostly complete. Two separate studies of the remains were conducted. The first, conducted in 1981 by the University of New Hampshire, identified the burial as dating from 650 to 630 B.P. (Late Woodland Period) (Hecker 1981). The remains were determined to be of a Native American male, age 35 to 38 years old at death, with a stature of approximately 5 feet 5 inches (Hecker 1981). Trauma and pathology of the mandible was identified (Hecker 1981). The second study, conducted in 1994 by the New Hampshire Division of Historic Resources, and likely done to meet the inventory requirements promulgated by the Native American Graves Protection and Repatriation Act (NAGPRA), also identified the individual as a Native American male, age 35 to 45 years, with a stature of 5 feet 4 inches. This study concluded that the individual suffered a fractured mandible in his late 20s to early 30s, with permanent dislocation of the left mandibular joint. The study surmised that this trauma likely led to the later pathology of the mandible (Sorg 1994).

The remains of all four individuals were transferred to the New Hampshire Division of Historical Resources for curation in 1999 (NPS 2002). The Notice of Inventory Completion for the human remains from the Rocks Road Site was published in the Federal Register in 2002 (NPS 2002). The Notice reports that this portion (Seabrook Station region) of New Hampshire is within the aboriginal and historic homeland of the Western Abenaki, Eastern Abenaki, and the Wampanoag native groups. The Notice states the determination of the New Hampshire Division of Historical Resources that there is a relationship of shared group identity between the human remains and the Abenaki Nation of Missisquoi.

A Notice of Intent to Repatriate Cultural Items was published in the Federal Register in May 2008 (NPS 2008). This Notice reports that the Rocks Road Site human remains were repatriated to the Abenaki Nation of Missisquoi following the Notice published in 2002. While the 2002 Notice stated that no associated funerary objects were present with the four burials (NPS 2002), the 2008 Notice states that after repatriation, cultural items associated with the burials were discovered by the University of New Hampshire among its collections (NPS 2008). The 2008 Notice states the determination of the University of New Hampshire that there is a shared group identity between the funerary objects and the Abenaki Nation of New Hampshire and the Cowasuck Band of Pennacook-Abenaki People, and that unless another group contacts them, disposition of the funerary objects to these groups would occur after June 30, 2008 (NPS 2008). As discussed in Section 2.11.4, the funerary objects were repatriated.

2.11.4 CURRENT STATUS

As of January 2009, the National Register of Historic Places listed 111 properties in Rockingham County, New Hampshire (NPS 2009c), and 444 properties in Essex County, Massachusetts (NPS 2009d). Of these, 10 properties in Rockingham County and 9 in Essex County are within 6 miles of Seabrook Station. Table 2.11-1 lists the 19 properties within 6 miles of the Station. Two National Historic Landmarks are within the 6-mile radius of the Station (Table 2.11-1, NPS 2009e).

The New Hampshire Division of Historical Resources maintains the State Register of Historic Places. There is one listed property within the 6-mile radius of Seabrook Station, Marelli's Market at Lafayette Road in Hampton (NHDHR 2009b).

Massachusetts maintains a listing of state archaeological and historic landmarks, local landmarks, and local historic districts. There is one such property within the 6-mile radius of Seabrook Station, the Rocky Hill Meetinghouse at Portsmouth Road and Elm Street in Amesbury (MHC 2009).

None of the designated national, state, or local properties discussed above are located within or adjacent to the Seabrook Station property. The archaeological survey conducted in 1973 located five archaeological sites on the station property. The three sites that were determined to be located within the construction area of the station were excavated in 1974 and 1975. Prehistoric human remains discovered during excavation were repatriated in accordance with NAGPRA in 2002. Funerary objects associated with the burials were repatriated in 2008. The other two sites were determined to be outside the construction area of disturbance and did not receive any additional treatment. Four additional areas were identified by PSNH in 1973 as archaeological sites on the Seabrook Station site, but outside the proposed construction area. There is no record of any additional treatment of these four sites.

Table 2.11-1 Properties Listed in the National Register of Historic Places that Fall within a 6-Mile Radius of Seabrook Station

Property	Location
New Hampshire Properties	
Benjamin James house	186 Towle Farm Road, Hampton
Reuben Lamprey homestead	416 Winnacunnet Road, Hampton
Unitarian Church	Exeter Road, Hampton Falls
Governor Meshech Weare house	Exeter Road, Hampton Falls
Captain Jonathan Currier house, part of South Hampton MRA	Hilldale Avenue, South Hampton
Highland Road Historic District, part of South Hampton MRA	Highland and Woodman Roads, South Hampton
Jewell Town District, part of South Hampton MRA	W. Whitehall Road and Jewell Street, South Hampton
Smith's Corner Historic District, part of South Hampton MRA	Chase Road, South Hampton
Town Center Historic District, part of South Hampton MRA	Main and Hilldale Avenues and Jewell Street, South Hampton
Woodman Road Historic District, part of South Hampton MRA	Woodman Road, South Hampton
Massachusetts Properties	
Amesbury and Salisbury Mills Village Historic District	Boardman, Water, Main, and Pond Streets, Amesbury
Amesbury Friends Meetinghouse	120 Friend Street, Amesbury
Lowell's Boat Shop, NHL	459 Main Street, Amesbury
Rocky Hill Meetinghouse and Parsonage	Portsmouth Road and Elm Street, Amesbury
Walker Body Company Factory	Oak Street at River Court, Amesbury
John Greenleaf Whittier house, NHL	86 Friend Street, Amesbury
Newburyport Harbor Front Range Light	Station, Newburyport
Newburyport Historic District	Plummer, State, and High Streets, Newburyport
Ann's Diner	11 Bridge Road, Salisbury

MRA = multiple resource area; NHL = National Historic Landmark
NPS 2009c, NPS 2009d, and NPS 2009e

2.12 KNOWN OR REASONABLY FORESEEABLE PROJECTS IN THE SEABROOK STATION VICINITY

Seabrook Station is in the Town of Seabrook, Rockingham County, New Hampshire, approximately 40 miles north of Boston and 10 miles south of Portsmouth, New Hampshire.

Industries in the Seabrook Vicinity

The "Envirofacts Warehouse" online database provided by the EPA lists a total of 4079 EPA-regulated facilities in Rockingham County, New Hampshire. The list included 196 industries that produce and release air pollutants; 68 facilities that reported toxic releases; 3943 facilities that reported hazardous waste activities; and 67 facilities that are permitted to discharge to waters of the United States (EPA 2008d). There are 17 Superfund sites in Rockingham County, but only 1 site, Gruhn Engine Repair in the town of Hampton Falls, is within the 6-mile radius of the Seabrook Station (EPA 2008d).

A search of the Envirofacts Warehouse for Essex County, Massachusetts, identified a total of 2200 EPA-regulated facilities in Essex County. The list of regulated facilities included 20 industries that produce and release air pollutants; 166 facilities have reported toxic releases; 1903 facilities have reported hazardous waste activities; and 93 facilities are permitted to discharge to waters of the United States (EPA 2009a). There are 42 Superfund sites in Essex County, but only 1 site, the Bailey Pond Parcel in the Town of Amesbury, is within the 6-mile radius of the Seabrook Station (EPA 2009a).

Within 6 miles of Seabrook Station, there is one manufacturing facility, Loctite Adhesive, and several distribution and retail centers (NHES 2008). The Town of Seabrook solid waste transfer facility is on property adjacent to the Seabrook Station site. The permitted solid waste site (NH Site ID 50876) is open to residents for waste disposal and recycling (NHDES 2008b; Town of Seabrook 2000).

Federal Facilities in the Vicinity of Seabrook Station

No federal facilities are within the 6-mile radius of Seabrook Station.

Two military bases in the area: the Pease Air National Guard Base and the Portsmouth Naval Shipyard. The Pease Air National Guard Base is at the Pease International Tradeport in Newington, New Hampshire. Currently about 1,000 Air National Guardsmen are associated with the Pease facility. At any one time, about 250 people are on the base (Haberman 2008). Portsmouth Naval Shipyard, one of four naval shipyards in the nation, is on Seavey Island near Portsmouth. The Shipyard has three dry docks and is capable of docking all active classes of submarines including the Los Angeles, Trident, and Virginia classes. Portsmouth Naval Shipyard employs approximately 3,900 civilian employees and 89 naval officers and enlisted personnel (Portsmouth 2003).

Two U.S. Coast Guard stations are in the area: the Portsmouth Harbor Coast Guard Station and the Merrimack River Station. The Portsmouth Harbor Coast Guard Station is on New Castle Island, at the mouth of the Piscataqua River. The Station employs 28 active duty personnel and 18 reservists, whose primary mission is water-based search and rescue (Norris 2009). The Merrimack River Station is near Newburyport, Massachusetts (Seabrook 2008a; USCG 2008). The Station has 33 unit members (King 2009).

Electric Generating Facilities in the Vicinity of Seabrook Station

The only electric generating facility in the 6-mile radius of Seabrook Station is the 12 megawatt (MW) power plant for Foss Manufacturing Company, which is in Hampton and burns a combination of natural gas and oil. There are four other electric generating facilities in Rockingham County, New Hampshire. The 171-MW Schiller Station near Portsmouth has four units. Two of the units produce electricity by burning a combination of coal and oil, one unit burns jet fuel, and one unit burns wood chips. The 414-MW Newington Station and the 605-MW Newington Power Facility in Newington, and the 900-MW Granite Ridge Power Plant near Londonderry produce electricity by burning natural gas, oil, or a combination of the two. (EIA 2007a)

There are 11 electric generating facilities in Essex County, Massachusetts. One, the 805-MW Salem Harbor Power Station, produces electricity by burning a combination of coal and oil. Two facilities owned by the City of Marblehead, the 1.1-MW Commercial Street Power Plant and the 5.4-MW Wilkins Station burn oil to generate electricity. Four facilities, the 12.2-MW High Street Station in Ipswich; the 65-MW Waters River Plant and the 6.7-MW power plant for the Eastman Gelatine Corporation, in Peabody; and the 57-MW power plant for the General Electric Aircraft Engine plant, in Lynn, burn a combination of natural gas and oil to generate electricity. Three facilities, the 46-MW Covanta Haverhill Plant near Haverhill, the 40.3-MW Wheelabrator North Andover plant near North Andover, the 53.7-MW Wheelabrator Saugus plant near Saugus, produce electricity by burning municipal waste. The 14.8-MW Lawrence Hydroelectric Plant in Lawrence is also located in Essex County. (EIA 2007a)

Dry Fuel Storage Facility at Seabrook Station

Seabrook Station has dry horizontal storage modules for radioactive spent nuclear fuel at the site. The modules are licensed under and operated in accordance with 10 CFR 72, Subpart K, "General License for Storage of Spent Fuel at Power Reactors." (Seabrook 2008e) The dry fuel storage facility was designed and sited to allow expansion for plant operation through the year 2050 (Seabrook 2007b).

Planned Projects in the Vicinity of Seabrook Station

The East Coast Greenway is an urban shared-use trail system envisioned to extend 3000 miles from Maine to Florida. Much of the non-motorized trail will make use of former railway beds (REDC 2008). A section of the Greenway is proposed to run through the Seabrook Station property.

3.0 PROPOSED ACTION

NRC

"...The report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures.... This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment...." 10 CFR 51.53(c)(2)

NextEra Energy Seabrook, LLC proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating license for Seabrook Station for an additional 20 years. Renewal of the operating license would give the owners of Seabrook Station, the State of New Hampshire, and the electric power consumers within the ISO New England (ISO-NE) interconnect the option of relying on Seabrook Station to meet future electricity needs. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 GENERAL PLANT INFORMATION

General information about Seabrook Station is available in several documents. In 1982, the NRC published the Final Environmental Statement Related to the Operation of Seabrook Station (NRC 1982). The Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996e) describes Seabrook Station features and, in accordance with NRC requirements, NextEra Energy Seabrook maintains the Updated Final Safety Analysis Report for Seabrook Station (Seabrook 2008a), which also describes Seabrook Station features. NextEra Energy Seabrook has referred to each of these documents while preparing this environmental report for license renewal.

3.1.1 REACTOR AND CONTAINMENT SYSTEMS

Seabrook Station is a single unit pressurized water reactor plant. Originally two identical units were planned, but construction of Unit 2, which was approximately 25 percent complete, was terminated in 1984. Unit 1 commenced regular full power operation on August 19, 1990. (Seabrook 2008a)

The four-loop closed-cycle pressurized water nuclear reactor was designed by Westinghouse Electric Company and the turbine-generator was designed by General Electric. The remainder of the unit was designed and constructed by United Engineers and Constructors. The reactor is housed in a double containment consisting of a cylindrical, carbon steel-lined, reinforced concrete shell which is surrounded by a reinforced concrete, cylindrical containment building. (Seabrook 2008a)

Seabrook Station fuel is slightly enriched (less than 5 weight percent) uranium dioxide enclosed in zirconium alloy fuel rods. Each fuel assembly contains 264 fuel rods and the number of fuel assemblies in the complete core is 193 (Seabrook 2008a). Peak burnup for 18-month core operation is 21,500 megawatt days per metric ton uranium.

The unit was originally designed, analyzed, and licensed for a rated core power of 3,411 megawatts-thermal (MWt) and a net electrical rating of 1,198 megawatts-electric (MWe) (1,209 gross MWe) (NRC 1996e; NRC 2005). In 2005, the rated power was increased to 3,587 MWt (License Amendment 101) and the average net electric output became 1,221 MWe (NRC 2005; Seabrook 2009b). In 2006, the rated power level was increased again (License Amendment 110) to 3,648 MWt (NRC 2006b). Seabrook Station reports a monthly average nuclear steam supply system thermal output of 3,646 MWt and a corresponding average net electric output of 1,245 MWe (Seabrook 2009b).

Engineered safeguards are designed to mitigate the consequences of postulated accidents and provide protection to the public and plant personnel against the release of radioactive products from the reactor system, particularly as the result of a loss-of-cooling accident. These safeguards localize, control, mitigate, and terminate such accidents to hold exposure levels below the applicable limits of 10 CFR 100. Figure 2.1-3 shows the plant layout.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

At Seabrook Station, the Circulating Water and the Service Water Systems draw from and discharge to the Atlantic Ocean. Fresh water is purchased from the Town of Seabrook and sanitary waste water is discharged back to the town system. The following subsections describe water systems at Seabrook Station.

3.1.2.1 Circulating Water System

Seabrook Station employs a once-through heat dissipation system designed to remove waste heat from the plant. The Circulating Water System provides cooling water to the main condensers to remove the heat that is rejected by the turbine cycle and auxiliary system. Water for this system is carried from the Atlantic Ocean to the plant through a 17,000-foot long intake tunnel drilled through the underlying bedrock. It is returned to the ocean through a 16,500-foot long discharge tunnel. Both tunnels are concrete-lined with a 19-foot finished inside diameter. Below the plant the tunnels are 240 feet below mean sea level, ascending at a 0.5 percent grade to approximately 160 feet below the ocean's surface at the point where they connect to the intake and discharge shafts offshore. (Seabrook 2008a) The intake and discharge system is shown in Figure 3.1-1.

The 17,000-foot long intake tunnel is hydraulically connected to the ocean by way of three concrete shafts. These shafts, each separated by a minimum of 103 feet, are approximately 7,000 feet off of the Hampton Beach shoreline in 60 feet of water. A concrete intake structure is mounted below the surface on the top of each intake shaft to minimize fish entrapment by reducing the intake velocity. These intakes were modified in 1999 with additional vertical bars to mitigate seal takes (NMFS 2002). The 16,500-foot long discharge tunnel is hydraulically connected to the ocean via 11 concrete shafts which are 5,000 feet off the Seabrook Beach shoreline. These shafts are 70 feet deep and about 100 feet apart. A double-nozzle fixture is attached to the top of each shaft to increase the discharge velocity and diffuse the heated water (Seabrook 2008a).

Water is drawn through the inlet tunnel into the intake transition structure by three circulating water pumps. Eleven-foot diameter butterfly valves direct the water flow from the transition structure to the Circulating Water Pump House. The water then passes through three traveling screens for debris removal before it is pumped to the main condensers. The debris is collected and disposed of as waste; none is returned to the ocean through plant discharge. The water passes from the condensers to the discharge transition structure and is released to the discharge tunnel. (Seabrook 2008a)

Fouling is minimized in the intake structures and tunnel with the continuous injection of low-level chlorination solutions into the circulating water at various locations. The Circulating Water Pump House, pipes, and condensers can be dewatered, inspected, and cleaned as needed (Seabrook 2008a). Water treatment chemicals (e.g., sodium hypochlorite) are used in accordance with National Pollutant Discharge Elimination System (NPDES) permit limits (EPA 2002a).

During normal operations, the Circulating Water System provides a continuous flow of approximately 390,000 gallons per minute (gpm) to the main condenser and 21,000 gpm to the Service Water System. The NPDES permit currently limits discharge flow from the Seabrook Station Circulating Water System to 720 million gallons per day (MGD) (EPA 2002a).

3.1.2.2 Service Water System

The Service Water System transfers heat from various primary and secondary sources in the plant to the Atlantic Ocean. Service water is supplied directly from the intake transition structure into a common bay in the Service Water Pump House (Figure 2.1-3). Service water pumps draw water from this bay to supply 100 percent of the flow required to dissipate plant heat loads during normal full power operation. This system is separated from the circulating water portion of the building by a seismic reinforced concrete wall. Bio-fouling control is provided with continuous low-level chlorination and two in-line basket-type strainers to remove shells and mussels. (Seabrook 2008a)

A standby mechanical draft evaporative cooling tower (Service Water Tower) and 7-day makeup water reservoir, located southwest of the Unit 1 Containment Building (Figure 2.1-3), are available for service water make-up in the event of restricted water flow to the Service Water Pump House. Reserve water is taken from the Atlantic Ocean and stored in the Service Water Tower. In the unlikely event that the normal supply of cooling water from the Atlantic Ocean is unavailable, emergency makeup water to the tower would be taken from the domestic water supply system or from the Browns River via a portable pump. (Seabrook 2008a)

3.1.2.3 Plant Groundwater Use

As stated in Section 2.3, site groundwater is no longer used at Seabrook Station, but 15 wells still exist on the site. Most of these wells are located in the Town of Hampton Falls and were built in anticipation of use during construction of Seabrook Station. All pumps have been removed and there are no plans to utilize these wells in the future. Seabrook monitors these wells and annually provides status updates to the State of New Hampshire Public Utilities Commission. (Seabrook 2008a)

3.1.2.4 Domestic Water Supply and Sanitary Wastewater

Fresh water supply comes from the Town of Seabrook's water main, which is supplied by 10 wells located at least 2 miles and hydraulically upgradient from Seabrook Station (Seabrook 2008a). The town's wells supplied approximately 346 million gallons of water during 2007 (Town of Seabrook 2007a). From 2003 through 2008, Seabrook Station's use of public water ranged from a low of 2.9 million gallons per month during 2004 (56 gpm) to a high of 5.3 million gallons per month during 2005 (101 gpm). The monthly average for this period was 4.2 million gallons per month (80 gpm) (Seabrook 2003, Seabrook 2004a, Seabrook 2005, Seabrook 2006a, Seabrook 2007a, and Seabrook 2008b). During 2008, Seabrook Station used approximately 47 million gallons of public water per month (Seabrook 2008b) from the town of Seabrook or approximately 14 percent of the town's 2007 public water supply (346 million gallons). The fresh water system is designed for a peak demand of 375 gpm with an average demand of 16.6 gpm. The Sanitary Water System is designed for a peak flow of 30 gpm with an average daily flow of about 5 gpm (Seabrook 2008a). Fresh water that is not discharged to the Sanitary Water System is used by plant systems and discharged through the Circulating Water System.

Seabrook Station discharges wastewater to the municipal Wastewater Treatment Facility in the Town of Seabrook (Seabrook 2008a). Seabrook Station is permitted (Town of Seabrook Permit SEA1003) to discharge a maximum process flow of 2,263 gallons per day (gpd). The permitted maximum regulated flow, which includes process and sanitary flow, for normal operations is 23,533 gpd. The daily maximum permitted sanitary and regulated flow increases to 28,730 gpd during outage periods to accommodate the increase in staffing (Town of Seabrook 2007b). According to the town's NPDES permit (Permit #NH0101303), the average design flow of the municipal Wastewater Treatment Facility is 1.8 MGD (EPA 2008e).

3.1.3 RADIOACTIVE WASTE SYSTEM

The radioactive waste systems are designed to collect, process, and dispose of potentially radioactive wastes produced during the operation of the plant. These wastes are grouped as liquid, gaseous, or solid.

3.1.3.1 Liquid Radioactive Waste System

The Liquid Waste System stores and processes non-recoverable, radioactive liquid waste from various sources throughout the plant. Liquid waste is processed using a combination of filtration and demineralization. Processed liquid is evaluated in test tanks to ensure it meets discharge limits prior to pumping to the Station's NPDES-permitted Discharge Transition Structure. Solid wastes generated from liquid waste processing (spent filters and media) are transferred to liners and packaged for shipment offsite. The station initially installed evaporators for liquid waste processing, but never used them. The evaporators are being evaluated for long-term lay-up or abandonment to avoid generating large quantities of solid waste and unnecessarily complex operating requirements. (Seabrook 2008a)

3.1.3.2 Gaseous Radioactive Waste System

The Radioactive Gaseous Waste System has gas chiller compressors that feed the chilled gas to iodine guard beds before the gas enters the drying train. After passing through charcoal and particulate filtration media, the gas is released to the atmosphere via the Primary Auxiliary Building normal ventilation cleanup exhaust unit. Liquid drainage from the system is collected and pumped into the primary drain tank.

The gaseous effluents from the treatment systems are continuously monitored and the discharges are terminated if the effluents exceed pre-set radioactivity levels (Seabrook 2008a). All releases have been within regulatory limits (Seabrook 2009c).

3.1.3.3 Solid Radioactive Waste System

The Solid Waste Management System processes wet and dry solid wastes using primarily the spent resin sluice and waste solids systems. Spent ion exchange resins from plant demineralizers are sluiced to the spent resin sluice tanks. The waste solids system transfers resins from the sluice tanks to liners which are packaged for shipment offsite. Spent filters removed from plant systems are placed directly into liners and after a drying period are packaged for shipment offsite. Dry Active Waste is normally directly packaged for shipment offsite in boxes and/or cargo containers (Sea-Land). (Seabrook 2008a)

The Station also has installed waste concentration systems for evaporator bottoms and an asphalt solidification system that could be used for solid waste processing (Seabrook 2008a). Neither of these systems has ever been used and both are being evaluated for long-term lay-up or abandonment to avoid excessive waste generation and reduce operational complexity.

NRC Class A radioactive wastes (primarily Dry Active Waste, as well as some resins and filters) are shipped to offsite facilities for further processing or direct disposal. Currently, Seabrook Station Class A wastes are disposed in a licensed radioactive waste landfill owned and operated by EnergySolutions in Clive, Utah. The Clive Utah disposal facility is not licensed to accept NRC Class B and C wastes.

In the past, NRC Class B and C wastes (primarily primary system resins and filters) were shipped to the Barnwell Low Level Radioactive Waste Disposal Facility disposal facility in South Carolina, either directly or through waste processors. On July 1, 2008, the Barnwell facility closed to all facilities that are not in a state that is a member of the Atlantic Interstate Low Level Radioactive Waste Management Compact. New Hampshire is not a member of the Compact. The Barnwell facility is closed to Seabrook Station.

The Station has sufficient capacity within the waste processing building for approximately seven years of Class B and C waste storage, if needed. Contractual agreements are in place for Studsvik (a waste vendor in Erwin, Tennessee) to process and take title to Seabrook Station's Class B and C waste through a state of Tennessee-licensed attribution model. If Seabrook Station is unable to access waste disposal capacity for Class B and C waste, Seabrook Station would ship Class B and C resins and filters to Studsvik. Studsvik would volume reduce and take title to the wastes for long-term storage at Waste Control Specialists in Andrews County, Texas and ultimate disposal as Studsvik's waste.

All radioactive shipments have been made in accordance with NRC, U.S. Department of Transportation, and state regulations.

3.1.3.4 Mixed Waste

"Mixed waste" refers to waste that contain both radioactive and hazardous constituents. During outage 13, 40 tons of mixed waste were generated from the steam generator chemical cleaning process. Chemical cleaning of steam generators in future refueling outages may generate similar quantities of mixed waste. Additionally, a small volume of mixed waste is generated in NPDES analyses for oil & grease. Mixed wastes are stored in a low level radioactive waste storage facility. When sufficient quantities are amassed, the mixed waste is shipped to offsite facilities for further processing or direct disposal.

3.1.4 NONRADIOACTIVE SOLID WASTE

Seabrook Station generates nonradioactive solid waste such as office trash, kitchen waste, and packaging waste and industrial solid waste such as uncontaminated, used equipment and maintenance waste. These waste streams are collected by a vendor (Waste Management, Inc.) for disposal in the Turnkey Landfill in Rochester, New Hampshire. Seabrook Station also collects certain materials for recycling such as paper, cardboard, universal waste, and asphalt.

Seabrook Station is a Full Quantity Generator for Nonradioactive Hazardous Waste in the State of New Hampshire and has a federal classification of Small Quantity Generator. Annually, approximately 4,000 to 5,000 pounds of hazardous wastes are collected and stored in appropriate satellite areas and disposed of by licensed vendors. These wastes include waste paint, waste solvents, expired laboratory chemicals and, microfilm processing waste. (NHDES 2005a; NHDES 2008c; Seabrook 2004b)

3.1.5 TRANSMISSION FACILITIES

The Seabrook Station 345 kV switchyard, owned by FPL-New England Division (a regulated subsidiary of FPL Group), is adjacent to the plant on the north side of the property (Figure 2.1-3) (FPL-NED 2008). From here, three 345 kV transmission lines connect Seabrook Station to the New England electric grid. These lines deliver power to three substations: at Scobie Pond, near Derry, New Hampshire; at Tewksbury, Massachusetts; and at Newington, New Hampshire. These three lines are described in both the Final Environmental Statement for Construction (AEC 1974) and the Final Environmental Statement for Operation (NRC 1982). Figure 3.1-2 is a map of the transmission system which is described below.

- Scobie Pond 345 kV Line – single circuit line which runs westward from Seabrook Station in a 245- to 255-foot corridor shared with the Tewksbury line for approximately 5 miles. After 5 miles, the Tewksbury line splits off and the Scobie Pond line corridor is reduced to 170 feet wide. The Scobie Pond line runs an additional approximately 25 miles, to its termination at Scobie Pond Substation in Derry, New Hampshire. This line is owned and operated by Public Service Company of New Hampshire (PSNH).
- Tewksbury 345 kV Line – single circuit line which runs westward from Seabrook Station in a 245- to 255-foot corridor shared with the Scobie Pond line for approximately 5 miles. After 5 miles, this line veers south in a 170-foot corridor for approximately 20 miles, where it connects to the Ward Hill Substation in Ward Hill, Massachusetts and then continues for approximately 15 additional miles where it terminates at the Tewksbury Substation. The New Hampshire portion of this line is owned and operated by PSNH and the Massachusetts portion by National Grid.
- Newington 345 kV Line – single circuit line which runs north in a 170-foot corridor for approximately 4.5 miles to the Timber Swamp Substation at Hampton, New Hampshire and continuing approximately 13.5 miles additional to its termination at the Newington Generating Station. This line is owned and operated by PSNH. (Seabrook 2008a; PSNH 1973)

The transmission lines include approximately 86 miles of corridor with approximately 1,061 acres of right-of-way in New Hampshire and 662 acres of right-of-way in Massachusetts for the specific purpose of connecting Seabrook Station to the transmission system. Portions of the transmission lines constructed for Seabrook Station share or parallel existing rights-of-way. The original land use of the rights-of-way was mostly forested. (PSNH 1973)

All Seabrook Station transmission lines were designed and constructed in accordance with industry standards that were current when the lines were built. Ongoing surveillance and maintenance of Seabrook Station-related transmission facilities by PSNH ensures continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13. Section 4.13 examines the conformance of the lines to National Electrical Safety Code requirements on line clearance to limit shock from induced currents.

Because the Town of Seabrook's Master Plan encourages that the site remain a power-generation facility when Seabrook Station is decommissioned (Section 2.8), it is expected that all transmission lines would remain in use. In the event that a new power-generation facility does not replace Seabrook Station, these transmission lines (beyond the short ties that connect the switchyard to the Station) would still be an integral part of the larger transmission system and would be maintained indefinitely.

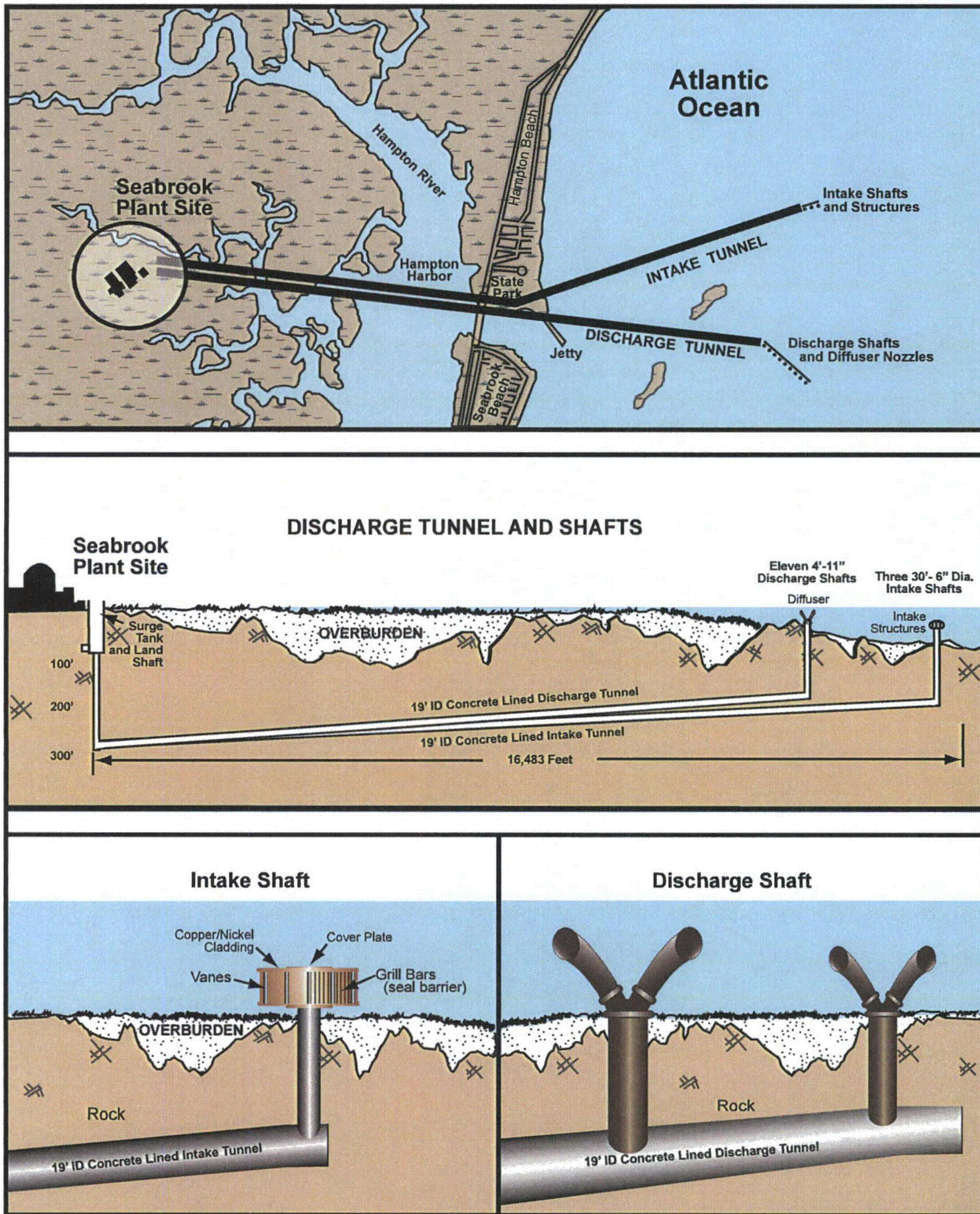

Figure 3.1-1 Discharge Tunnel and Shafts Diagram

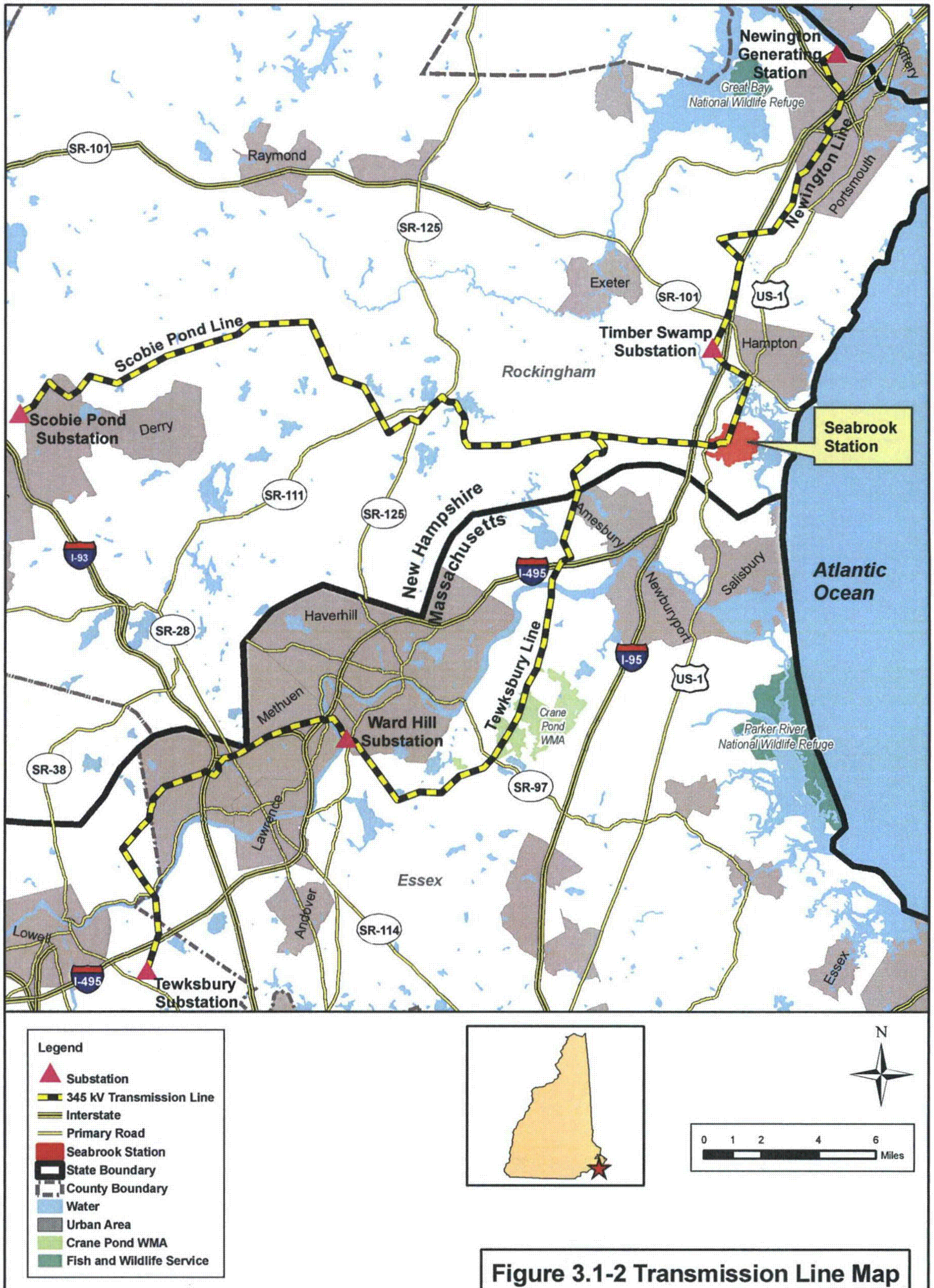

Figure 3.1-2 Transmission Line Map

3.2 REFURBISHMENT ACTIVITIES

NRC

"The report must contain a description of ... the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment...." 10 CFR 51.53(c)(2)

"...The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories...(2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." (NRC 1996e, Section 2.6.3.1)

NextEra Energy Seabrook has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (NRC 1996e). The NRC's requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

In turn, the NRC's regulations for implementing the National Environmental Policy Act require environmental reports to describe in detail and assess the environmental impacts of refurbishment activities such as planned modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The GEIS (NRC 1996e) provides helpful information on the scope and preparation of refurbishment activities to be evaluated in this environmental report. It describes major refurbishment activities that utilities might perform for license renewal that would necessitate changing administrative control procedures and modifying the facility. The GEIS analysis assumes that an applicant would begin any major refurbishment work shortly after the NRC grants a renewed license and would complete the activities during five outages, including one major outage at the end of the 40th year of operation. The GEIS refers to this as the refurbishment period.

GEIS Table B.2 lists license renewal refurbishment activities that the NRC anticipated utilities might undertake. In identifying these activities, the GEIS intended to encompass actions that typically take place only once, if at all, in the life of a nuclear plant. The GEIS analysis assumed that a utility would undertake these activities solely for the purpose of extending plant operations beyond 40 years, and would undertake them during the refurbishment period. The GEIS indicates that many plants will have undertaken various refurbishment activities to support the current license period, but that some plants might undertake such tasks only to support extended plant operations.

While the GEIS anticipated refurbishment activities, none are planned at Seabrook Station. The Seabrook Station IPA conducted under 10 CFR 54 has not identified the need to undertake any refurbishment or replacement actions to maintain the functionality of important systems, structures, or components during the Seabrook Station license renewal period or any other facility modifications associated with license renewal. NextEra Energy Seabrook has included the IPA as part of this application.

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

"The report must contain a description of ... the applicant's plans to modify the facility or its administrative control procedures...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment...." 10 CFR 51.53(c)(2)

"...The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item." NRC 1996e, Section 2.6.3.1, pg. 2-41. ("SMITTR" is defined in NRC 1996e, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at Seabrook Station. These programs are described in the Application for Renewed Operating License, Seabrook Station, Attachment B. Other than implementation of the programs and inspections identified in the IPA, there are no planned modifications of Seabrook Station administrative control procedures associated with license renewal.

3.4 EMPLOYMENT

Current Workforce

NextEra Energy Seabrook employs approximately 1,093 permanent and long-term contract employees at Seabrook Station, a one-unit facility. Approximately 67 percent of the employees live in Rockingham and Strafford Counties in New Hampshire. The remaining employees are distributed across 27 other counties, with numbers ranging from 1 to 102 employees per county (see Section 2.6).

Seabrook Station is on an 18-month refueling cycle. During refueling outages, site employment increases above the permanent workforce by as many as 800 people for approximately 30 days of temporary duty. This number of outage workers falls within the range of 200 to 900 workers per reactor unit reported in the GEIS for additional maintenance workers (NRC 1996e).

License Renewal Incremental Employment

Performing the license renewal activities described in Section 3.3 could necessitate increasing the Seabrook Station staff workload by some increment. The size of this increment would be a function of the schedule within which NextEra Energy Seabrook must accomplish the work and the amount of work involved. Because NextEra Energy Seabrook has determined that no refurbishment is needed (Section 3.2), the analysis of license renewal employment increment focuses on programs and activities for managing the effects of aging (Section 3.3).

The GEIS (NRC 1996e) assumes that the NRC would renew a nuclear power plant license for a 20-year period, plus the duration of the current license, and that the NRC would issue the renewal approximately 10 years prior to the initial license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining life of the plant, sometimes during full-power operation (NRC 1996e), but mostly during normal refueling and the 5- and 10-year in-service inspection and refueling outages (NRC 1996e).

NextEra Energy Seabrook has determined that the GEIS scheduling assumptions are reasonably representative of Seabrook Station incremental license renewal workload scheduling. Many Seabrook Station license renewal SMITTR activities would have to be performed during outages. Although some Seabrook Station license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the plant.

The GEIS estimates that the additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service inspection and refueling outage. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts...."

NextEra Energy Seabrook has identified no need for significant new aging management programs or major modifications to existing programs. NextEra Energy Seabrook anticipates that existing "surge" capabilities for routine activities, such as outages, would enable NextEra Energy Seabrook to perform the increased SMITTR workload without increasing Seabrook Station staff. Additionally, NextEra Energy Seabrook has the ability to draw on fleet resources to support any incremental work. Therefore, NextEra Energy Seabrook has no plans to add outage or non-outage employees to support Seabrook Station operations during the license renewal term.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE ACTION AND MITIGATING ACTIONS

NRC

"The report must contain a consideration of alternatives for reducing impacts...for all Category 2 license renewal issues...." 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers...the environmental effects of the proposed action...and alternatives available for reducing or avoiding adverse environmental effects." 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

The environmental report shall discuss the "...impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance...." 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2)

"The information submitted...should not be confined to information supporting the proposed action but should also include adverse information." 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

Chapter 4 presents an assessment of the environmental consequences associated with the renewal of the Seabrook Station operating license. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). The NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- 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 characteristic;
- a single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- 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.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, the NRC designated the issue as Category 2. The NRC requires plant-specific analyses for Category 2 issues.

Finally, the NRC designated two issues (Issues 60 and 92) as NA, signifying that the categorization and impact definitions do not apply to these issues. In accordance with 10 CFR 51, chronic effects from electromagnetic fields (Issue 60), is not addressed in this environmental report. For environmental justice (Issue 92), NextEra Energy Seabrook, LLC has included minority and low-income demographic information in Section 2.6.2.

NRC rules do not require analyses of Category 1 issues that the NRC resolved using generic findings (10 CFR 51) as described in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996e). An applicant may reference the generic findings of GEIS analyses for Category 1 issues. Attachment A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

CATEGORY 1 AND NA LICENSE RENEWAL ISSUES

NRC

> **"The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(i)**
>
> **"...[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal...." (NRC 1996a, pg. 28483)**

NextEra Energy Seabrook has determined that 15 of the 69 Category 1 issues do not apply to Seabrook Station because they are specific to design or operational features that are not found at the facility. Because NextEra Energy Seabrook is not planning any refurbishment activities, seven additional Category 1 issues related to refurbishment do not apply. Attachment A, Table A-1 lists the 69 Category 1 issues, indicates whether or not each issue is applicable to Seabrook Station, and if inapplicable, provides the NextEra Energy Seabrook basis for this determination. Attachment A, Table A-1 also includes references to supporting analyses in the GEIS where appropriate.

NextEra Energy Seabrook has reviewed the NRC findings at 10 CFR 51 (Table B-1) and has not identified any new and significant information that would make the NRC findings, with respect to Category 1 issues, inapplicable to Seabrook Station. Therefore, NextEra Energy Seabrook adopts by reference the NRC findings for these Category 1 issues.

"NA" License Renewal Issues

The NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, NextEra Energy Seabrook included these issues in Attachment A, Table A-1. The NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, the NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). NextEra Energy Seabrook has included environmental justice demographic information in Section 2.6.2 and an impact analysis in Section 4.21.

CATEGORY 2 LICENSE RENEWAL ISSUES

NRC

> **"The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(ii)**
>
> **"The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues...." 10 CFR 51.53(c)(3)(iii)**

The NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address the Category 2 issues, beginning with a statement of the issue. Six Category 2 issues apply to operational features that Seabrook Station does not have. In addition, four Category 2 issues apply only to refurbishment activities. If the issue does not apply to Seabrook Station, the section explains the basis for inapplicability.

For the 11 Category 2 issues that NextEra Energy Seabrook has determined to be applicable to Seabrook Station, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for Seabrook Station and, if applicable, discuss potential mitigative alternatives to the extent required. NextEra Energy Seabrook has identified the significance of the impacts associated with each issue as either SMALL, MODERATE, or LARGE, consistent with the criteria that the NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 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. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

In accordance with National Environmental Policy Act practice, NextEra Energy Seabrook considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small require less mitigative action than impacts that are large).

4.1 WATER USE CONFLICTS (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A SMALL RIVER WITH LOW FLOW)

NRC

> **"...If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 3.15×1012 ft3/year (9×1010 m3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided." 10 CFR 51.53(3)(ii)(A)**
>
> **"The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13.**

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are already a concern at two closed-cycle plants (Limerick and Palo Verde) and may be a problem in the future at other plants. In the GEIS, the NRC notes two factors that may cause water use and availability issues to become important for some nuclear power plants that use cooling towers. First, some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Second, consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (NRC 1996e).

As discussed in Section 3.1.2, Seabrook Station uses a once-through cooling system that withdraws cooling water from the Atlantic Ocean and discharges to the same body of water. Therefore, this issue does not apply because Seabrook Station does not use cooling tower technology for the circulating water system or cooling ponds and it does not withdraw cooling water from a small river.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFESTAGES

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations...or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from...entrainment." 10 CFR 51.53(c)(3)(ii)(B)

"...The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

The NRC made impacts on fish and shellfish resources from entrainment a Category 2 issue, because it could not assign a single significance level to the issue. The impacts of entrainment are SMALL at many plants, but they may be MODERATE to LARGE at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996e). Information that must be considered includes:

(1) type of cooling system (whether once-through or cooling pond) and

(2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

This issue is applicable to Seabrook Station license renewal because the station has a once-through heat dissipation system. Section 3.1.2 describes the system and Section 2.2 describes the aquatic resources in the vicinity and Seabrook Station monitoring of those resources.

The U.S. Environmental Protection Agency (EPA) administers the National Pollutant Discharge Elimination System (NPDES) program in New Hampshire and issued the first Seabrook Station NPDES permit and each permit renewal. The current NPDES permit became effective on April 1, 2002, and constitutes the current CWA 316(b) determination for Seabrook Station. NextEra Energy Seabrook applied for renewal of Seabrook Station's NPDES permit in 2006, in a timely manner, and the EPA has not yet acted on this application. Thus the Station continues to operate under the 2002 permit.

Appendix B contains the permit, including the following statement from Part I.A.2.d:

> "The Regional Administrator has determined that the Cooling Water Intake System, as presently designed, employs the best technology available for minimizing adverse environmental impact."

For this reason, NextEra Energy Seabrook concludes that the impacts of entrainment of fish and shellfish in early life stages at Seabrook Station are SMALL, will remain SMALL throughout the license renewal, term and warrant no additional mitigation.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

> **"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations...or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from...impingement...." 10 CFR 51.53(c)(3)(ii)(B)**
>
> **"...The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 26**

The NRC made impacts on fish and shellfish resources from impingement a Category 2 issue, because it could not assign a single significance level to the issue. The impacts of impingement are SMALL at many plants, but they may be MODERATE to LARGE at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996e). Information that must be considered includes:

(1) type of cooling system (whether once-through or cooling pond) and

(2) status of CWA Section 316(b) determination or equivalent state documentation.

This issue is applicable to Seabrook Station license renewal because the station has a once-through heat dissipation system. Section 3.1.2 describes the system and Section 2.2 describes the aquatic resources in the vicinity and Seabrook Station monitoring of those resources.

The EPA administers the NPDES program in New Hampshire and issued the first Seabrook Station NPDES permit and each renewal. The current NPDES permit became effective April 1, 2002 and constitutes the current CWA 316(b) determination for Seabrook Station. Nextera Energy Seabrook applied for renewal of Seabrook Station's NPDES permit in 2006, in a timely manner, and the EPA has not acted on this application. Thus the Station continues to operate under the 2002 permit.

Attachment B contains the permit, including the following statement from Part I.A.2.d:

> "The Regional Administrator has determined that the Cooling Water Intake system, as presently designed, employs the best technology available for minimizing adverse environmental impact."

For this reason, NextEra Energy Seabrook concludes that the impacts of impingement of fish and shellfish at Seabrook Station are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

4.4 HEAT SHOCK

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act...316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock..." 10 CFR 51.53(c)(3)(ii)(B)

"...Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

The NRC made impacts on fish and shellfish resources from heat shock a Category 2 issue, 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 (NRC 1996e). Information to be determined includes:

(1) type of cooling system (whether once-through or cooling pond) and

(2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, Seabrook Station has a once-through heat dissipation system that withdraws water from the Atlantic Ocean through offshore submerged intake structures. Heated effluent is discharged to the Atlantic Ocean through diffusers located offshore in open water at a depth of about 60 feet. The thermal plume rises rapidly to the surface through the diffusers. The designed rapid dilution of the thermal plume, coupled with the open water nature of the discharge area, ensures that:

(1) zones of passage for fish are not blocked,

(2) spawning of indigenous populations are not interfered with,

(3) the balanced indigenous population of the receiving water is not changed,

(4) the thermal plume does not contact surrounding shorelines, and

(5) Section 1707 of the State of New Hampshire Surface Water Quality Regulations is complied with.

The 2002 NPDES permit contains limitations on the temperature rise across the condensers and requires continuous (every 15 minutes) thermal plume monitoring. The permit states that:

> "The thermal component of the discharge from Seabrook Station shall not cause a monthly mean temperature rise of more than 5°F in the 'near field jet mixing region.' For the purposes of this paragraph the 'near-field jet mixing region' means that portion of the receiving waters within 300 feet of the submerged diffuser in the direction of the discharge."
>
> "Permit compliance with this requirement shall be demonstrated by comparing the temperature difference between sampling Point DS, (inside the mixing region) and sampling point T7 (reference sampling station)."

Seabrook Station has never violated these permit conditions (NAI 2008) and there is no evidence of heat shock to any fish or shellfish in the receiving waters (NAI 2008). Continued monitoring of the fish and shellfish community has not indicated any impacts to these communities (NAI 2008).

In regard to NPDES Permit NH0020338, the EPA Regional Administrator determined that:

> "...the current biological and hydrological monitoring data shows that a once-through cooling system for Seabrook Station satisfies the thermal requirements and will ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the near shore Atlantic Ocean. In making the determination the Regional Administrator has taken into account the length of time and nature of the discharge (approximately ten years and about 560 Million Gallons per Day of heated effluent)."
>
> "The thermal limits proposed in the draft permit constitute a Section 316(a) thermal discharge variance. The post-operational phase of the biological monitoring program will continue in order to assure the EPA and the State that the continued operations of Seabrook Station do not significantly impact the local biological community."

Seabrook Station is able to operate at full power in the once-through mode while meeting the thermal requirements of its NPDES permit with ample margin and there have been no demonstrated adverse impacts due to the thermal discharge. Therefore, NextEra Energy Seabrook concludes that heat shock impacts are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING > 100 GPM OF GROUNDWATER)

NRC

"If the applicant's plant...pumps more than 100 gallons (total onsite) of ground water per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"...Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 33

The NRC made this groundwater use conflict a Category 2 issue because overuse of an aquifer could exceed the natural recharge. Locally, a withdrawal rate of more than 100 gallons per minute (gpm) could create a cone of depression that could extend offsite. This could inhibit the withdrawal capacity of nearby offsite users.

As described in Section 2.3, the Seabrook Station does not use site groundwater as potable or process water. However, Seabrook Station does pump groundwater at a rate of approximately 24 gpm for the dewatering of shallow groundwater in the vicinity of plant facilities (Section 2.3.3.1). Therefore, the issue of groundwater use conflicts (plants using more than 100 gpm of groundwater) does not apply.

4.6 GROUND WATER USE CONFLICTS (PLANTS USING COOLING TOWERS WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

> **"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×1012 ft3 / year...[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)**
>
> **"...Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34**

The NRC made this groundwater use conflicts a Category 2 issue because consumptive use of water withdrawn from small rivers could adversely impact aquatic life, downstream users, and groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create an adverse cumulative impact if there were additional large consumptive users withdrawing water from the same river. Cooling towers and cooling ponds lose water through evaporation, which is necessary to cool the heated water before it is discharged to the environment.

As discussed in Section 3.1.2, Seabrook Station is an open-cycle plant that withdraws cooling water from the Atlantic Ocean and discharges to the same body of water. Therefore this issue does not apply because Seabrook Station does not use cooling tower technology for normal operation or cooling ponds and it does not withdraw water from a small river.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

"If the applicant's plant uses Ranney wells...an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"...Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35

The NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

This issue of groundwater use conflicts does not apply to Seabrook Station because the plant does not use Ranney wells. As Section 3.1.2 describes, Seabrook Station draws its cooling water from the Atlantic Ocean and, as indicated in Section 2.3, Seabrook Station does not use groundwater as potable or process water.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"...Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses...." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 39

The NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to Seabrook Station because the plant does not use cooling water ponds and is not an inland site. As Section 3.1.2 describes, Seabrook Station employs a once-through cooling system that withdraws from and discharges to the Atlantic Ocean.

4.9 IMPACT OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

The environmental report must contain an assessment of "...the impacts of refurbishment and other license renewal-related construction activities on important plant and animal habitats...." 10 CFR 51.53(c)(3)(ii)(E)

"...Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 40

"...If no important resources would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant...." (NRC 1996e)

The NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996e). Aspects of the site and project to be ascertained are:

(1) the identification of important ecological resources,

(2) the nature of refurbishment activities, and

(3) the extent of impacts to plant and animal habitats.

The issue of impacts of refurbishment on terrestrial resources is not applicable to Seabrook Station because, as discussed in Section 3.2, NextEra Energy Seabrook has no plans for refurbishment or other license renewal-related construction activities at Seabrook Station.

4.10 THREATENED OR ENDANGERED SPECIES

NRC

"All license renewal applicants shall assess the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened and endangered species in accordance with the Endangered Species Act." [10 CFR 51.53(c)(3)(ii)(E)]

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Issue 49

The NRC made impacts to threatened and endangered species a Category 2 issue because the status of species is subject to change, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996e) to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of the nuclear plant during the license renewal term.

4.10.1 AQUATIC SPECIES

Two fish species, the federally-listed shortnose sturgeon and the state-listed Atlantic sturgeon, have a small potential to be present in the waters at Seabrook Station's cooling water intakes and discharges. Five federally-listed marine turtles, the loggerhead turtle, the green turtle, the hawksbill turtle, the Kemp's ridley turtle, and the leatherback turtle, also have a small potential to be present in those waters. No other federal- or state-listed species are likely to be present. Seabrook Station monitoring programs have never identified impingement of marine turtles or shortnose or Atlantic sturgeons (NAI 2008). Operation of the intakes will not change as a result of license renewal and the ecology of these species, as discussed in Section 2.5, is unlikely to bring them into contact with the intakes as they currently operate. The discharges, as discussed in Section 2.2, are not known to have any effect on the marine environment. Therefore, NextEra Energy Seabrook concludes that impacts to threatened or endangered aquatic species are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

No refurbishment is planned for Seabrook Station and thus there would be no impacts to protected aquatic species.

4.10.2 TERRESTRIAL SPECIES

The habitats at Seabrook Station or its affiliated transmission corridors are unlikely to be suitable for any of the three federally-listed species known to be present in any of the four counties in the project area. Based on the habitat types in the project area, 8 vertebrates, 23 plants, and 2 invertebrates with State threatened or endangered status were identified as having the potential to be present, and were reviewed in Section 2.5.

Current operations of Seabrook Station do not adversely affect any listed terrestrial species or its habitat (see Section 2.5). FPL-NED maintains the switchyard at Seabrook Station, and NextEra Energy Seabrook, LLC maintains the Seabrook Station property. Vegetation management along the three transmission line rights-of-way in New Hampshire is performed by Public Service of New Hampshire (PSNH). National Grid maintains the Tewksbury line after it crosses into Massachusetts. Northeast Utilities, PSNH's parent company, and National Grid are committed to work with their contract transmission maintenance personnel and appropriate federal and state agencies to develop and implement restrictions and safeguards that protect threatened or endangered species and their habitats during maintenance of transmission line rights-of-way (NUS 2007, NGRID 2009). No refurbishment is planned and plant operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Even if Seabrook Station's operating license is not renewed, Seabrook-associated transmission lines would continue to be maintained (see Section 3.1.5) to support the regional electric grid. Therefore, no adverse impacts to threatened or endangered terrestrial species from current or future operations are anticipated.

Resource agencies contacted by NextEra Energy Seabrook (Attachment C) indicated that license renewal is unlikely to affect any protected species as long as current transmission corridor vegetation management practices and policies are followed. Furthermore, PSNH and National Grid have no plans to refurbish or alter current operations and maintenance practices and resource agencies contacted evidenced no serious concerns about license renewal impacts. Therefore, NextEra Energy Seabrook concludes that impacts to threatened or endangered species are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

4.11 AIR QUALITY DURING REFURBISHMENT (NONATTAINMENT AND MAINTENANCE AREAS)

NRC

"...If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended...." 10 CFR 51.53(c)(3)(ii)(F)

"...Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50

The NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the air quality status at the location of each site and the number of workers expected to be employed during a refurbishment outage (NRC 1996e). Information needed would include:

(1) the air quality attainment status of the plant-site area and

(2) the number of additional vehicles as a result of refurbishment activities.

Air quality during refurbishment is not applicable to Seabrook Station because, as discussed in Section 3.2, NextEra Energy Seabrook has no plans for refurbishment.

4.12 MICROBIOLOGICAL ORGANISMS

NRC

"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15 × 1012ft3/year (9 × 1010m3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

"...These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically...." 10 CFR 51, Subpart A, Table B-1, Issue 57

The NRC made impacts on public health from thermophilic organisms a Category 2 issue because insufficient data exist on facilities using cooling ponds, lakes, or canals that discharge to small rivers.

The issue of thermophilic organisms does not apply to Seabrook Station because the plant does not use a cooling pond, lake, or canals that discharge to a small river. As described in Section 3.1.2, Seabrook Station uses a once-through heat dissipation system that withdraws from and discharges to the Atlantic Ocean.

4.13 ELECTRIC SHOCK FROM TRANSMISSION-LINE INDUCED CURRENTS

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines ". ...[i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced currents." 10 CFR 51.53(c)(3)(ii)(H)

"Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 59

The NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC; IEEE 2006) criteria, the NRC could not determine the significance of the electrical shock potential. In the case of Seabrook Station, the Final Environmental Statement for operations (NRC 1982) makes the following statement:

> "The staff has determined that the applicant's transmission system design incorporates minimum conductor-to-ground clearances (ER-OL Response to Staff Question 290.2) that will not result in induced currents due to electrostatic effects exceeding the 5 milliampere (mA) level used as a shock criterion in the National Electrical Safety Code (NESC)."

Because this NRC conclusion was based on design rather than as-built information and was not accompanied by analysis, this section provides a current analysis of the plant's transmission lines' conformance with the NESC standard where-as-built data were available. The PSNH-operated Scobie Pond line, Newington line, and New Hampshire portion of the Tewksbury line had as-built data available and the data were used in the following analysis to verify the NRC's conclusion outlined above. National Grid considers information regarding the Massachusetts portion of the Tewksbury line as critical infrastructure information and as-built data were not made available. However, the Massachusetts portion of the Tewksbury line was analyzed during original construction and it is similar to the New Hampshire portion of the line.

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged". A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, the magnitude of which depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line and its height and geometry,
- the size of the object on the ground, and
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground[1]. The clearance must limit the induced current[2] due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, ground fault circuit interrupters used in residential wiring are set at 4 to 6 milliamperes.

As described in Section 3.1.3, there are three 345-kV lines that were specifically constructed to distribute power from Seabrook Station to the electric grid. Where the data were available, Seabrook Station calculated the electric field strength and the induced current for each line's limiting case (i.e., that configuration along the line where the potential for current-induced shock would be greatest).

These calculations were made using the EzEMF computer code. Input parameters included the design features of the limiting-case scenario, the NESC requirement that line sag be determined at 120°F conductor temperature, and the maximum vehicle size under the lines as a tractor-trailer truck. (NESC; IEEE 2006)

The analysis determined that the PSNH-owned lines that connect to Seabrook Station have the capacity to induce up to 3.6 milliamperes. None of the transmission lines has the capacity to induce

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[1] Part 2, Rules 232C1c and 232D3c.

[2] The NESC and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.

5 milliamperes in a vehicle parked beneath the lines (Tetra Tech 2009c). The PSNH lines are a large fraction (63 percent) of the total miles of transmission lines that connect to Seabrook Station and have results that are well under the 5 milliampere standard. PSNH believes that the PSNH lines are representative of all lines that connect to Seabrook Station because they were constructed at the same time and to the same standards. Therefore, these transmission line designs conform to the NESC provisions for preventing electric shock from induced current and verify that the NRC's conclusion in the Final Environmental Statement for operations is true. Furthermore, even under the No Action alternative these lines will likely continue to operate after Seabrook Station is decommissioned and therefore the proposed action has no effect on the induced current impacts of the transmission lines.

The transmission service providers' surveillance and maintenance procedures provide assurance that design ground clearances will not change. These procedures include routine ground inspections, which include, but are not limited to, determining the effectiveness of right-of-way herbicides and checking for encroachments, dead or diseased trees that might fall on the transmission lines, broken conductors, broken or leaning structures or signs of trees burning, any of which would be evidence of clearance problems. Problems noted during any inspection are brought to the attention of the appropriate organization(s) for corrective action. (NGRID 2005)

NextEra Energy Seabrook's assessment under 10 CFR 51 concludes that electric shock impacts are SMALL, will remain SMALL throughout the license renewal term, and warrant no mitigation.

4.14 HOUSING IMPACTS

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability..." 10 CFR 51.53(c)(3)(ii)(I)

"...Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development...." 10 CFR 51, Subpart A, Table B-1, Issue 63

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs...." (NRC 1996e)

The NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that the NRC could not predict for all plants at the time of GEIS publication (NRC 1996e). Local conditions that need to be ascertained are:

(1) population categorization as small, medium, or high and

(2) applicability of growth control measures.

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. As described in Section 3.2, NextEra Energy Seabrook does not plan to perform refurbishment at the Seabrook Station. NextEra Energy Seabrook concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. Accordingly, the following discussion focuses on impacts of continued Seabrook Station operations on local housing availability.

Sections 2.6 and 2.8 indicate that Seabrook Station is located in a high population area that is not subject to growth control measures that limit housing development. Using the NRC regulatory criteria, Seabrook Station license renewal housing impacts would be expected to be SMALL. NextEra Energy Seabrook has determined that no additional workers would be needed to support Seabrook Station operations during the license renewal term (Section 3.4). Therefore, NextEra Energy Seabrook concludes that housing impacts are SMALL, will remain SMALL throughout the license renewal term, and warrant no mitigation.

4.15 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

NRC

The environmental report must contain "...an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(I)

"An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996e)

The NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996e). Local information needed would include:

(1) a description of water shortages experienced in the area, and

(2) an assessment of the public water supply system's available capacity.

The NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. Seabrook Station obtains all fresh water from the Town of Seabrook (Section 2.3). Section 2.9.1 describes the public water supply systems in the area, their production capacities, and current average daily use. Currently, plant usage does not stress resource capacity.

As discussed in Section 3.4, NextEra Energy Seabrook has no plans to increase Seabrook Station staffing due to refurbishment or plant aging management activities. Also, NextEra Energy Seabrook has identified no operational changes during the Seabrook Station license renewal term that would increase plant water use. Therefore, NextEra Energy Seabrook concludes that impacts to the public water supply are SMALL, will remain SMALL throughout the license renewal term, and warrant no mitigation.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on...public schools (impacts from refurbishment activities only) within the vicinity of the plant...." 10 CFR 51.53(c)(3)(ii)(I)

"...Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors...." 10 CFR 51, Subpart A, Table B-1, Issue 66

"...[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service....Large impacts are associated with project-related enrollment increases above 8 percent...." (NRC 1996e)

The NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996e). Local factors to be ascertained include:

(1) project-related enrollment increases, and

(2) status of the student/teacher ratio.

The issue of education impacts from refurbishment is not applicable to Seabrook Station because, as discussed in Section 3.2, NextEra Energy Seabrook has no plans for refurbishment at Seabrook Station.

4.17 OFFSITE LAND USE

4.17.1 OFFSITE LAND USE - REFURBISHMENT

NRC

The environmental report must contain "...an assessment of the impact of the proposed action on... land-use... (impacts from refurbishment activities only) within the vicinity of the plant...." 10 CFR 51.53(c)(3)(ii)(I)

"...Impacts may be of moderate significance at plants in low population areas...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"...[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles...." (NRC 1996e)

The NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land-use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include:

(1) plant-related population growth,

(2) patterns of residential and commercial development, and

(3) proximity to an urban area with a population of at least 100,000 (NRC 1996e).

The issue of offsite land-use impacts from refurbishment is not applicable to Seabrook Station because, as discussed in Section 3.2, NextEra Energy Seabrook has no plans for refurbishment at Seabrook Station.

4.17.2 OFFSITE LAND USE - LICENSE RENEWAL TERM

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on...land-use...." 10 CFR 51.53(c)(3)(ii)(I)

"Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"...[I]f plant-related population growth is less than five percent of the study area's total population, off-site land-use changes would be small...." (NRC 1996e, Section 3.7.5, pg. 3-21)

"...[I]f 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. This is most likely to be true where the community has no pre-established patterns of development (i.e., land use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development." (NRC 1996e)

The NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and detrimental by others. Therefore, the NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996e). Site-specific factors to consider in an assessment of land-use impacts include:

(1) the size of plant-related population growth compared to the area's total population,

(2) the size of the plant's tax payments relative to the community's total revenue,

(3) the nature of the community's existing land-use pattern, and

(4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996e).

Population-Related Impacts

Based on the GEIS case-study analysis, the NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be SMALL. Population growth caused by license renewal would represent a much smaller "percentage of the local area's" total population than the percent change represented by operations-related growth (NRC 1996e). NextEra Energy Seabrook estimates that no additional workers would be needed to support

Seabrook Station operations during the license renewal term (Section 3.4), therefore, NextEra Energy Seabrook agrees with the NRC conclusion that population-driven land use impacts would be SMALL. Mitigation would not be warranted.

Tax-Revenue-Related Impacts

Determining tax-revenue-related land use impacts is a two-step process. First, the significance of the plant's tax payments on taxing jurisdictions' tax revenues is evaluated. Then, the impact of the tax contribution on land use within the taxing jurisdiction's boundaries is assessed.

The NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue (NRC 1996e).

The NRC defined the magnitude of land-use changes as follows (NRC 1996e):

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

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

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

The NRC further determined that, "...[I]f 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 patterns of development or has not provided adequate public services to support and guide development in the past." (NRC 1996e)

Section 2.7 indicates that Seabrook Station's property tax payments represent a large (29.6 to 42.5) percent of the Town of Seabrook's net tax commitment. Using the NRC's criteria, Seabrook Station's tax payments would be expected to cause large land-use changes in the town. In order to test this hypothesis, NextEra Energy Seabrook has reviewed past and current land use patterns in the town to determine whether there have been large changes that might be attributable to Seabrook Station's tax payments.

As stated in Section 2.8, the Town of Seabrook has been experiencing an increase in developed land and a decrease in open space, forested land, and wetlands. Developed land has increased from 28 percent of the town's 5,978 acres in 1974 to 36 percent in 1990 and 40 percent in 2000. As Table 4.17-1 shows, this increase represents average annual increases of 1.3 percent for 26 years. Because land use surveys are performed at different times for different jurisdictions, it is difficult to perform precise comparisons between jurisdictions. Nevertheless, Table 4.17-1 provides for comparison land use change data for Rockingham County, the county in which Seabrook Station is located, and Strafford County, the adjacent county, for the 24-year period from 1974 to 1998. During this time, the annual land development rate for Rockingham County was 2.6 percent and Strafford County was 1.9 percent. Thus, the rate of land use change (1.3 percent) within the Town of Seabrook is half the rate of the Rockingham County (2.6 percent) and 68 percent of the rate in Strafford County. The Town of Seabrook receives tax payments from Seabrook Station but Rockingham and Strafford Counties do not. There appears to be little correlation between Seabrook Station tax payments and rates of land use conversion in the surrounding area.

Therefore, based on the small absolute rate of development for the town and the relatively small rate when compared to the larger county jurisdictions, it is difficult to conclude that the Town of Seabrook has experienced large land use changes, regardless of the presence of Seabrook Station. This may be because the town had pre-established patterns of development and had adequate public services to support and guide development.

As stated in Section 2.8, the Town of Seabrook has several land management tools to guide development: the Seabrook Master Plan, the Seabrook Zoning Ordinance, and various regulations pertaining to floodplains, subdivisions, site plans, etc. For example, the town employs housing density limits to encourage growth in areas where public facilities, such as water and sewer systems, exist or are scheduled to be built and to promote the preservation of the communities' open spaces and natural vegetation.

Therefore, NextEra Energy Seabrook concludes that tax-driven land use impacts are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

Property Values

NextEra Energy Seabrook considered whether the presence of Seabrook Station has a depressing effect on property values that would be continued during the license-renewal term. The NRC considered this question for seven nuclear plants in its GEIS and found no depressed property values resulting from construction and operation or license renewal of these plants (NRC 1996e). Published literature on the subject comes to varying conclusions. Some analyses show a depressing effect (Blomquist 1974, Clark and Nieves 1994, Folland and Hough 2000, Sheppard 2007). Some analyses demonstrate no effects (Gamble and Downing 1982, Nelson 1981, Rephann undated). The Nuclear Energy Institute (NEI) has analyzed economic benefits of several nuclear plants and found that property (housing) values are enhanced by the presence of nuclear plants, a conclusion that aligns with NRC (1996e) and other analyses (Bezdek and Wendling 2006; Clark et al. 1997; Farrell and Hall 2004; Metz et al. 1997; NEI 2003, NEI 2004a, NEI 2004b, NEI 2004c, NEI 2004d, NEI 2005a, NEI 2005b, NEI 2006a and NEI 2006b).

The analyses showing depressing effects on property values are of two types. Blomquist and Sheppard are the first type, addressing effects from a single plant. The Blomquist analysis was based on a 27-MW fossil-fueled plant that began operation in 1949 and, as of 1970, was located in a residential neighborhood. Blomquist found that, within 11,500 feet of the plant, increasing the distance from the plant by 10 percent was associated with an increase in property value of 0.9 percent.

For several reasons, it would be invalid to apply the Blomquist methodology and findings to Seabrook Station. First, Blomquist noted that his findings are based on a rather special instance where the power plant is physically isolated as the sole disamenity factor and where the community is composed of primarily single-family residences. The area within 11,500 feet of Seabrook Station is a mixture of single-family and multiple-family residences, motels, shopping centers, manufacturing and service facilities, salt marsh, rivers and a bay, the Atlantic coast, and an interstate highway. There are no residences within 3,000 feet of the station. Clearly there are many potential disamenities and amenities within the Seabrook Station area that would make the Blomquist findings suspect, as applied to the station.

Second, nuclear plants in general, and Seabrook Station in particular, have much higher assessed values than would a small, old, fossil-fired plant and, therefore, contribute a greater portion of local property tax revenues (Section 2.7). Many studies have shown that these contributions can allow the local taxing jurisdiction to function using lower property tax rates which, in turn, can increase the value of property located within that jurisdiction. Thus, it would be much more likely for there to be a compensatory increase in property values in the case of Seabrook Station than in the case of the fossil plant.

Third, Seabrook Station employs more than 1,000 workers, with periodic, temporary increases to more than 1,800. A small fossil-fired plant might employ 100 workers. Blomquist includes, within the value of land, a component attributable to the time it would take to commute to work. The closer the residence to the workplace, the more travel time is saved, an attribute that would have a positive impact on the value of the property. The more people who would commute to a location for work, the more demand there would be for land within commuting distance, a factor that would also have a positive impact. Because many more people would commute to Seabrook Station than to a small fossil-fired plant, the potential commutation travel savings component of land value could be much higher for Seabrook Station.

Sheppard is based on the Blomquist findings and, as such, should not be applied to Seabrook Station. Sheppard also applied the findings to rental properties, something that Blomquist expressly declined to do. Finally, Sheppard suggests that the impact of job accessibility should not be counted because alternative uses of nuclear plant property following decommissioning would likely include employment. NextEra Energy Seabrook notes, however, that few alternative uses would provide the number of workers, the high salaries, and the high property and sales tax contributions that Seabrook Station does.

The second type of analysis employs a regional approach that combines nation-wide property value estimates with proximity to nuclear power plants, among other data, to identify depressing effects by the plants. The scale of the methodologies undertaken by these analyses makes rebuttal difficult but the findings make acceptance difficult, too. Findings that nuclear power plants have a strong negative influence on local economies within a 1,000-square-mile area (Clark and Nieves 1994), or on farm property values within 60 miles (Folland and Hough 2000) do not appear to be reasonable. Unfortunately, the papers do not include sufficient detail about their data and methodology to allow independent analysis.

Finally, NextEra Energy Seabrook notes that, in both types of analysis, authors conclude that the presence of a nuclear power plant negatively affects property values when, at best, the analyses purport to show a correlation between the variables. Even if the existence of a general correlation were accepted, the existence of contradictory plant-specific evidence in other analyses would make application to Seabrook Station problematic.

Conclusion

NextEra Energy Seabrook has evaluated the analyses that show depressing effects on property values and concluded that they apply methodologies that are not appropriate at Seabrook Station or arrive at conclusions that appear to defy logic and plant-specific observations while containing insufficient detail to allow independent analysis. NextEra Energy Seabrook finds the analyses showing no, or positive, effects more persuasive. The mere presence of numerous contradictory analyses implies that, at best, depressing effects are speculative. Therefore, NextEra Energy Seabrook concludes that impacts to property values in the vicinity of Seabrook Station, if any, would be SMALL and positive, and warrant no mitigation.

Table 4.17-1 Area Land Development

	Town of Seabrook		Rockingham County		Stafford County	
Year	Acres Developed[a]	Annual Change[b]	Acres Developed[c]	Annual Change[b]	Acres Developed[a]	Annual Change[c]
2000	2,368	1.3%	NA	NA	NA	NA
1998	NA	NA	98,418	2.6%	33,616	1.9%
1990	2,156	NA	NA	NA	NA	NA
1974	1,699	NA	53,205	NA	21,450	NA

NA = Not applicable
a. Source: Table 2.8-2.
b. Average annual change since 1974.
c. Source: Zankel et al. 2006

4.18 TRANSPORTATION

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"...Transportation impacts...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...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "...Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "...Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished...." (NRC 1996e)

The NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which the NRC could not forecast for all facilities (NRC 1996e). Local road conditions to be ascertained are:

(1) level of service conditions, and

(2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no major refurbishment is planned and no refurbishment impacts to local transportation are anticipated. NextEra Energy Seabrook does not anticipate hiring additional staff for continued operations during the renewal term. Seasonal beach traffic is heavy, but does not coincide with plant outage activities. Therefore, NextEra Energy Seabrook concludes that impacts to transportation are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

The environmental report must contain an assessment of ". . . whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996e)

The NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO) (NRC 1996e).

As described in Section 2.11, there were five archaeological resources identified during the 1973 reconnaissance survey of the plant site. Three of these resources, with field numbers 1, 3, and 4 were determined to be in the area of planned disturbance. These three resources together comprise the Rocks Road Site (formal state number NH47-20) and were excavated in 1974 and 1975. Four sets of human remains were recovered from this site and were eventually repatriated under the Native American Graves Protection and Repatriation Act. The remaining two resources found on-site were located outside of the area designated for disturbance and no further work was conducted on them. In an addendum attached to the 1973 survey report, PSNH indicated that four additional resources were located on-site, but outside the area designated for construction disturbance. There is no record of any treatment of these four resources.

The 1982 FES for operation reports that three archaeological sites (NH47-20 [Rocks Road], NH47-21 [Hunt's Island], and NH47-22 [Marsh]), located on the plant site, had been excavated by the

University of New Hampshire, and that three others, two off-site and one on-site, would not be impacted by the operation and maintenance of the plant (NRC 1982). It is unknown why the number of remaining on-site resources described in the 1982 FES differs from the 1973 archaeological survey report. The 1982 FES goes on to state that operation and maintenance activities are not expected to affect any cultural resources in or eligible for the National Register (NRC 1982).

NextEra Energy Seabrook knows of two archaeological resources on the plant site, site numbers 2 and 5 from the 1973 reconnaissance survey. There are national, state, and locally-designated historic resources located within 6 miles of the Station; however, none are adjacent to or within the Station property. NextEra Energy Seabrook is not aware of any historic or archaeological resources that have been affected by Seabrook Station operations, including operation and maintenance of transmission lines. NextEra Energy Seabrook is aware of the potential for discovery of cultural resources during land-disturbing activities based on the results of pre-operational archaeological exploration. NextEra is developing procedures to protect any archaeological resources, if discovered, on the Seabrook Station site.

No refurbishment activities or construction of license renewal-related facilities are planned at Seabrook Station during the license renewal term. Operations and maintenance activities over the license renewal term are not expected to affect historic or cultural resources. Therefore, NextEra Energy Seabrook concludes that impacts to historic or archaeological resources are SMALL, will remain SMALL throughout the license renewal term, and warrant no additional mitigation.

NextEra Energy Seabrook has consulted with the New Hampshire and Massachusetts SHPOs regarding this conclusion. The New Hampshire and Massachusetts SHPOs concur that license renewal and associated operation and maintenance activities would have no effect on historic or archaeological resources. Copies of the correspondence are presented in Attachment D.

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS

NRC

The environmental report must contain a consideration of alternatives to mitigate severe accidents "...if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environment assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"...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...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

This section summarizes NextEra Energy Seabrook's analysis of alternative ways to mitigate the impacts of severe accidents at Seabrook Station. A detailed description of the Severe Accident Mitigation Alternatives (SAMA) analysis is provided in Attachment F.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in the release or a potential for the release of radioactive material to the environment. The NRC categorizes accidents as "design basis" or "severe." Design basis accidents are those for which the risk is great enough that the NRC requires plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that the NRC considers too unlikely to warrant design controls.

The NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, the NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes:

(1) potential SAMAs,

(2) benefits, costs, and net value of implementing potential SAMAs, and

(3) sensitivity of analysis to changes in key underlying assumptions.

SAMA Analysis

Seabrook Station maintains a probabilistic risk assessment (PRA) model to use in evaluating the most significant risks of core damage and the resulting radiological release from the containment structure. For the SAMA analysis, NextEra Energy Seabrook used the Seabrook Station PRA model output as input to an NRC-approved methodology that calculates economic costs and dose to the public from hypothesized releases from the containment structure to the environment. Then, using NRC analysis techniques, NextEra Energy Seabrook calculated the monetary value of the unmitigated severe accident risk for Seabrook Station. The result represents the monetary value of the base risk of dose to the public and worker, offsite and onsite economic costs, and replacement power. This value became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base risk value could be rejected as being not cost-beneficial. The following list summarizes the steps of this process:

- Seabrook Station PRA Model – Use the Seabrook Station PRA model, which includes both internal and external events, as the basis for the analysis.
- Level 3 PRA Analysis – Use Seabrook Station Level 1 and 2 PRA output and site-specific meteorology, demographic, economic, land use, and emergency response data as input in performing a Level 3 PRA using the MELCOR Accident Consequence Code System (MACCS2) Version 1.13.1.
- Baseline Risk Monetization – Use the analysis techniques specified in NEI 05-01, Revision A, to calculate the monetary value of the unmitigated Seabrook Station severe accident risk. This becomes the maximum averted cost-risk (MACR) that is possible.
- Phase I SAMA Analysis – Identify potential SAMA candidates based on the Seabrook Station PRA, Individual Plant Examination (IPE), Individual Plant Examination for External Events (IPEEE), and documentation from the industry and the NRC. Screen out Phase I SAMA candidates:
    1) that are not applicable to the Seabrook Station design or are of low benefit in pressurized water reactors (PWRs) such as Seabrook Station
    2) that have already been implemented at Seabrook Station or whose benefits have been achieved at Seabrook Station using other means
    3) whose estimated cost exceeds the possible MACR
- Phase II SAMA Analysis – Calculate the risk reduction attributable to each remaining SAMA candidate, in dollars, and compare to its implementation cost to identify the net cost-benefit. PRA insights are also used to screen SAMA candidates in this phase.

- Sensitivity Analysis – Evaluate how changes in the SAMA analysis assumptions might affect the cost-benefit evaluation.
- Conclusions – Summarize results and identify conclusions.

Using this process, NextEra Energy Seabrook incorporated industry, NRC, and plant-specific information to create a list of 191 SAMAs for consideration. Seventy-four candidate SAMAs passed the Phase I screening and were evaluated in the Phase II screening. Phase II screening identified two SAMAs that are potentially cost-beneficial for Seabrook Station. The two SAMAs candidates are described below.

SAMA 157 – provide an independent AC power source to use as a battery charger (i.e., use a portable generator to charge the station battery). Implementation of SAMA 157 would involve the purchase of a portable 480V AC generator, installation of connections to allow for use of the generator, development of a procedure for use, and training for personnel. This would reduce the core damage frequency of long-term station blackout sequences and extend battery life to allow additional time for recovery.

SAMA 165 – the reactor water storage tank would be filled from fire water during containment injection. The 6 inch reactor water storage tank flush flange would be modified to have a 2-1/2 inch female fire hose adapter with an isolation valve. Implementation of this SAMA involves installation of a permanent hose connection on the flush flange for the reactor water storage tank, development of procedures for use, and training of personnel. This could enhance long-term containment injection sequences that would benefit from reactor water storage tank make-up. Installing a permanent valve connection would make alignment of fire water to the reactor water storage tank more efficient.

Neither of these SAMAs is aging-related. Therefore, they need not be implemented as part of license renewal pursuant to 10 CFR 54. NextEra Energy Seabrook is further evaluating these SAMA candidates and has not made a decision as to whether or not to implement them.

Sensitivity Analyses

NextEra Energy Seabrook performed several sensitivity analyses to evaluate how the SAMA analysis would change if certain key parameters were changed. The sensitivity analyses include:

- an evaluation of plant risk certainty using an uncertainty factor which incorporates a ratio of the 95th percentile value of the core-damage frequency to the mean value of the core damage frequency;
- changes in evacuation speed;

- use of a three percent discount rate; and use of a 41-year evaluation period.

The results of the sensitivity analyses did not identify any additional candidate SAMAs with a positive cost-benefit for Seabrook Station.

Conclusion

The SAMA analysis identified two SAMA candidates that are potentially cost-beneficial:

- SAMA 157 – use of a portable generator to charge station battery, and
- SAMA 165 – install hose adapter and valve to enhance alignment efficiency of fire water to the refueling water storage tank.

Neither of these SAMA candidates is aging-related and therefore, does not need to be implemented as part of license renewal pursuant to 10 CFR 54. These SAMA candidates will be added to Seabrook Station's Long Range Plan, prioritized and considered along with the need for other plant improvements.

NextEra Energy Seabrook did not identify any cost-effective, aging-related, severe accident mitigation alternatives.

4.21 ENVIRONMENTAL JUSTICE

Environmental justice was not reviewed in the GEIS. However, Executive Order 12898, issued in 1994, requires a federal agency to identify and address disproportionately high and adverse impacts on low-income and minority populations that may result from the agency's actions.

In Chapter 4 of this environmental report, NextEra Energy Seabrook evaluated the environmental impacts of renewing Seabrook's operating license for an additional 20 years, and determined that all impacts would be SMALL. NextEra also located the minority and low-income populations within a 50-mile radius of Seabrook (see Section 2.6.2). All minority or low-income populations are at least 15 miles from the site. Any impacts would decrease with increasing distance from the site.

Because all impacts from an additional 20 years of operations at Seabrook would be SMALL, and because all minority or low-income populations are 15 miles or more from Seabrook, there will be no disproportionately high and adverse impacts to minority or low-income populations.

4.22 CUMULATIVE IMPACTS

NextEra Energy Seabrook considered the potential cumulative impacts of Seabrook Station's operations during the license renewal term. The geographic area affected by cumulative impacts depends on the resource being impacted.

To establish cumulative impacts, the impacts of the proposed action are combined with past, present and reasonably foreseeable actions and could include individually minor but collectively significant actions taking place over a period of time. For the purposes of this analysis, past actions are those related to the resources at the time of plant licensing and construction, present actions are those related to the resources during current operations, and future actions are those actions that are reasonably foreseeable through the end of the plant operations, which would include the 20-year license renewal term. It is possible that a SMALL impact, when considered in combination with the impacts of other actions on an affected resource could result in MODERATE or LARGE impacts to the affected resource.

NextEra Energy Seabrook evaluated the impacts of Seabrook Station operations as well as the impacts of the known or reasonably foreseeable projects in the Seabrook Station vicinity and based on those impacts, determined that certain resources should be addressed cumulatively. The following resources were considered appropriate for cumulative impacts analysis because of the potential for impacts on the resource when considered in combination with other known or reasonably foreseeable projects: human health due to radiation, aquatic resources, groundwater consumption, traffic, taxes and land use, and air quality. These resources are affected by many activities, and therefore, have the greatest potential to have significant cumulative impacts imposed on them.

The principal facilities with impacts that have the potential to be collectively significant when combined with impacts of Seabrook Station are identified in Section 2.12, Known or Reasonably Foreseeable Projects in the Seabrook Station Vicinity.

4.22.1 CUMULATIVE IMPACTS TO HUMAN HEALTH DUE TO RADIATION

The GEIS determined that public and occupational radiation doses at all licensed nuclear plants are well below design objectives and regulations, and are expected to remain so throughout license renewal terms. The NRC established radiation doses to individuals and the population as Category 1 issues.

Radiological dose limits for protection of the public and workers have been developed by the EPA and NRC to address the cumulative impacts of acute and long-term exposure to radiation and radioactive material. The dose limits are codified in 10 CFR 20 and 40 CFR 190.

In addition to the nuclear-fueled power-generation facility, Seabrook Station includes a Dry Fuel Storage (DFS) facility. Seabrook Station releases no measurable quantities of radiation to surface water. Seabrook Station releases very small quantities of radioactivity to the air. Tritium is present in the groundwater adjacent to Unit 1 containment, but monitoring indicates that no off-site migration has occurred. NextEra Energy Seabrook identified no other facilities in the 10-mile radius of the plant which could release radioactivity into the air. The nearest nuclear power plants, Vermont Yankee and Pilgrim, are more than 50 miles from Seabrook Station. Portsmouth Naval Shipyard, approximately 12 miles northeast of Seabrook Station maintains the US nuclear submarine fleet, and could be the source of a radioactive release to the air.

In 2008, the maximum whole body dose to the hypothetically maximally-exposed individual from Seabrook Station operations (including the DFS) was 0.0136 millirem from all exposure pathways. EPA limits annual whole-body doses to members of the public from all pathways to 25 millirem, as set forth in 40 CFR 190. In 2008, the maximum dose to the hypothetical individual attributable to Seabrook Station was 0.05 percent of the regulatory limit. (Seabrook 2009c)

An internet search identified 12 hospitals in Rockingham and Essex Counties. Each of these facilities is licensed to handle radioactive isotopes used in medical treatments. Patients receive radiation treatments and undergo tests involving the injection or ingestion of radioactive solutions. Regulations limit the amounts that can be administered and released to very low concentrations. Because these solutions are used in treatments, some radiation is released through waste water treatment systems to surface waters that may be sources of potable water. Seabrook Station discharges wastewater to the Town of Seabrook's wastewater treatment facility which discharges to the Atlantic Ocean, but other towns in the vicinity discharge to freshwater. Because Seabrook Station does not discharge radioactivity to potable waters there are no cumulative impacts to human health due to radiation from potable water sources.

Cumulative impacts to human health due to radiation are SMALL and are expected to remain SMALL throughout the license renewal term.

4.22.2 CUMULATIVE IMPACTS TO AQUATIC RESOURCES

Section 2.2 describes the aquatic environment affected by Seabrook Station. Section 3.1 describes Seabrook Station's water use. Seabrook Station withdraws from and discharges condenser cooling water to the Atlantic Ocean. NextEra Energy Seabrook is not aware of any other facilities within 6 miles of Seabrook Station that withdraw water from or discharge thermal effluent to the ocean.

Seabrook Station has monitored aquatic communities since before the plant became operational in 1990. Monitoring assesses nearfield and farfield water quality and populations of selected organisms, including soft-shell clams, crustaceans, zooplankton, fish, and macroinvertebrates other than clams and crustaceans. As expected with biological systems, populations vary among years, however, variations are observed throughout the study area, not just between nearfield and farfield communities, and thus are attributable to regional factors, not the operation of Seabrook Station. (NAI 2008)

Seabrook Station is permitted by the Town of Seabrook to discharge wastewater to the Town of Seabrook's wastewater treatment facility. Discharges from Seabrook Station are considered in the wastewater facility's NPDES-permitted discharges.

Because observed population variations are not the result of Seabrook Station operations, and because no other facilities withdraw from or discharge to the Atlantic Ocean in the vicinity of Seabrook Station, cumulative impacts to the aquatic resources are SMALL, and are expected to remain SMALL throughout the license renewal term.

4.22.3 CUMULATIVE IMPACTS TO GROUND WATER

Section 2.3 describes the ground-water resources in the vicinity of Seabrook Station. Seabrook Station no longer uses groundwater from its well fields for any water supply, but does continue to pump groundwater at a rate of approximately 24 gpm for dewatering around site buildings. Seabrook Station's fresh water is supplied by the Town of Seabrook's well systems. Seabrook Station uses approximately 14 percent of the Town of Seabrook's public water supply. Seabrook Station's usage is considered in the Town of Seabrook's permitted withdrawals.

The area's water supply demand is expected to increase at least through the year 2020. Additional groundwater wells, surface water sources, and inter-municipal distribution systems are anticipated to meet the region's water demand. The local area governments are sponsoring studies to determine the best method for meeting the anticipated water demand. However, NextEra Energy Seabrook does not anticipate Seabrook Station requiring more potable water from the Town of Seabrook. Further, NextEra Energy Seabrook does not anticipate additional staff moving their families into the area and has no plans for refurbishment or other major construction projects during the license renewal term, which might require additional permanent staff and increase demand on the public water system. Therefore, any projected increased water demand would not be a result of continued Seabrook Station operations.

Cumulative impacts on local groundwater could be MODERATE or LARGE, depending on the increased demand, and the amount of groundwater needed to meet that demand. However, because Seabrook Station's impacts to groundwater are SMALL, and the Station will not need additional quantities of groundwater during the license renewal term, its impacts are expected to remain SMALL throughout the license renewal term.

4.22.4 CUMULATIVE IMPACTS TO AIR QUALITY

Section 2.10 describes the air quality of the Merrimack Valley-Southern New Hampshire Interstate Air Quality Control Region. Hillsborough, Merrimack, Strafford and Rockingham Counties are designated as partial non-attainment areas for 8-hour ozone air quality standards. Manchester and Nashua are designated as maintenance areas for carbon monoxide air quality standards. The Town of Seabrook is a non-attainment area under the 8-hour ozone standards.

Seabrook Station has a Clean Air Act Title V permit for two auxiliary boilers, large diesel-powered emergency generating units, smaller emergency generating units, and a diesel-engine-driven air compressor. The Station also has several small diesel-powered pumps and motors.

Sulfur hexafluoride (SF_6) is contained in the switchyard breakers and bus ducts and escapes in small amounts into the surrounding air. These emissions are regulated under New Hampshire Air Toxic rules and subject to emission inventory reporting requirements under Seabrook Station's Title V Permit. Seabrook Station has partnered with EPA's voluntary SF_6 Emission Reduction Partnership to reduce SF_6 emissions, though these emissions are not currently subject to federal regulations.

Because the Merrimack Valley-Southern New Hampshire Interstate Air Quality Control Region is designated as a partial non-attainment or maintenance area for some air quality pollutants, cumulative impacts to air quality could be considered MODERATE. Except for the intermittent use of the permitted equipment, Seabrook does not release regulated air pollutants therefore, Seabrook Station's incremental contribution to cumulative impaired air quality would be SMALL and would remain SMALL throughout the license renewal term.

4.22.5 CUMULATIVE IMPACTS OF TAXES AND LAND USE

Section 2.7 describes the tax payments made by the owners for the Seabrook Station. New Hampshire's electric utility industry is deregulated, and expected to remain deregulated. Therefore

Seabrook Station's property taxes are expected to be based primarily on the tax rate and the market value of the station property over the license renewal term. Between 2003 and 2008, Seabrook Station property taxes represented between 29.6 and 42.5 percent of the Town of Seabrook's net tax commitment. Annually, utilities in New Hampshire pay a "Utility Property Tax", most of which is added to the state's Education Trust Fund. Between 2003 and 2008, Seabrook Station's property taxes represented 1.2 to 2.0 percent of the Education Trust Fund.

Seabrook's contribution to the tax revenues of the Town of Seabrook are LARGE and are expected to remain LARGE throughout the license renewal term. Seabrook Station's contribution to the state's Education Trust Fund are SMALL and are expected to remain SMALL throughout the license renewal term.

Tax revenues affect land use indirectly, for example by funding infrastructure projects that encourage development. The Town of Seabrook has a master plan that direct the town's vision for land use which is based on anticipated revenues. Because Seabrook Station taxes are a large component of the town's tax base, it indirectly supports land use changes in the town. If Seabrook Station no longer paid property taxes to the Town of Seabrook, the town could have to revise its master plan implementation schedule to accommodate the reduced revenues. The effects of Seabrook Station's tax payments on land use are LARGE and would be LARGE during the license renewal term. If Seabrook Station's operating license was not renewed, the impacts on land use would be LARGE and adverse. NextEra Energy Seabrook is not aware of any other planned or anticipated projects that would provide tax revenues similar to those provided by Seabrook Station.

When combined with the impact of other potential activities, such as residential development and population growth in the area surrounding the plant, impacts on taxes and land use from Seabrook Station license renewal would not produce a noticeable incremental change in any adverse impact measures.

4.22.6 CUMULATIVE IMPACTS ON TRAFFIC

NextEra Energy does not anticipate adding additional staff to Seabrook Station during the license renewal term, however, Seabrook Station employs approximately 1,100 permanent employees and hosts approximately 800 temporary workers for approximately 30 days during outages, which recur every 18 months. Outages do not occur in summer when seasonal beach traffic increases traffic congestion.

Traffic in the vicinity of Seabrook Station is congested. The level of service (LOS) along US1 is characterized as E or F based on traffic counts. LOS E provides marginal service and LOS F indicates that capacity has been exceeded.

Seabrook Station employees commute to work during daily shift changes but are not commuting at other times of the day. Because the LOS indicates exceeded capacity on US1, the cumulative impacts of traffic can be described as LARGE and would be expected to remain so, particularly during the summer beach season. However, Seabrook Station's incremental cumulative impact on traffic in the area occurs over short durations and is therefore considered SMALL and is expected to remain SMALL throughout the license renewal term.

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

"The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations at 10 CFR 51 prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, the NRC has resolved most of the environmental issues generically (Category 1) and only requires an applicant's analysis of the remaining issues (Category 2).

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of Category 1 issues, the regulations [10 CFR 51.53(c)(3)(iv)] do require that an applicant identify any new and significant information of which the applicant is aware that would negate any of the generic findings that the NRC has codified or evaluated in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996e). The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. The NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of GEIS conclusions (NRC 1996g).

NextEra Energy Seabrook, LLC expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses of a particular environmental issue and that leads to an impact finding different from that codified in the regulation.

The NRC regulations do not define the term "significant", though for the purpose of its review, NextEra Energy Seabrook used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. The NRC requires license renewal applicants to provide the NRC with input, in the form of an environmental report, that the NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment

(40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). NextEra Energy Seabrook expects that moderate or large impacts, as defined by the NRC, would be significant. Chapter 4 presents the NRC's definitions of MODERATE and LARGE impacts.

The new and significant assessment process that NextEra Energy Seabrook used during preparation of this license renewal application includes:

(1) interviews with NextEra Energy Seabrook, NextEra Energy Duane Arnold, and NextEra Energy Resources, LLC staff with various responsibilities including environmental, engineering, radiological waste, chemistry, industrial health and safety, communications, operations support, regarding information related to the conclusions in the GEIS as they relate to Seabrook Station;

(2) review of NextEra Energy Resources and NextEra Energy Seabrook's environmental management systems to ensure that current programs consider management of potential impacts or provide mechanisms for Seabrook Station staff to become aware of new and significant information;

(3) review of correspondence with state and federal regulatory agencies to determine whether the agencies had concerns about the continued operation of Seabrook Station;

(4) review of documents related to environmental issues at Seabrook Station and regional environs;

(5) credit for oversight provided by inspections of plant facilities and environmental monitoring operations by state and federal regulatory agencies;

(6) review of other licensees' environmental reports, audits, and industry initiatives; and

(7) independent review of plant-related information through NextEra Energy Seabrook contracts with industry experts on license renewal environmental impacts.

As part of its investigation for new and significant information, NextEra Energy Seabrook evaluated information about tritium in the groundwater adjacent to Unit 1. As described in Section 2.3.3, in September 1999, elevated tritium concentrations were monitored in ground water that was seeping into the Unit 1 containment annulus. The source of the tritium was determined to be a leak from the Cask Loading Area/Transfer canal connected to the Spent Fuel Pool.

Based on that evaluation, NextEra Energy Seabrook concluded that changes in groundwater quality as a result of the tritium incursion are not significant and would not preclude current or future uses of groundwater for the following reasons:

- In 2000/2001, dewatering systems were installed in the fuel building, PAB and containment area of Unit 1. Tritium is limited to the Unit 1 containment area, and no offsite migration of tritium in groundwater has been observed. The groundwater withdrawal system in the Unit 1 containment area is providing hydraulic containment of the tritium. Additionally, approximately 32,000 gpd of groundwater is pumped from the Unit 2 containment building which slows the flow of groundwater off site by reversing the hydraulic gradient along the southern boundary of the site (RSCS 2009b).
- Tritium in groundwater at the site does not present an environmental or health risk to onsite or offsite receptors. Between 2004 and 2009, tritium concentrations were reported in the surficial aquifer at concentrations ranging from 617 pCi/L to 2,930 pCi/L. All tritium concentrations in groundwater at the site have been reported at concentrations well below the EPA's drinking water standard of 20,000 pCi/L.
- The tritium plume is contained on Seabrook Station property. As discussed in Section 2.3.2, most homes and commercial and industrial users in the Town of Seabrook are supplied by the town's 10 municipal water system wells, which are at least 2 miles west of the site.
- There is no human exposure pathway, and, therefore, no threat to public or occupational health or safety.

For these reasons NextEra Energy Seabrook considers the tritium in the groundwater adjacent to Unit 1 to be new but not significant information. Therefore, the conclusion in the GEIS that impacts of radiation exposures to the public during the license renewal term (issue 61) would be SMALL remains unchanged.

NextEra Energy Seabrook's assessment did not identify any new and significant information regarding the Seabrook Station environment or operations that would (1) make any generic conclusion codified by the NRC for Category 1 issues not applicable to Seabrook Station, (2) alter regulatory or GEIS statements regarding Category 2 issues, or (3) suggest any other measures of license renewal environmental impact.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

NextEra Energy Seabrook, LLC has reviewed the environmental impacts of renewing the Seabrook Station operating license and has concluded that all impacts would be SMALL and would not require mitigation. This environmental report documents the basis for NextEra Energy Seabrook's conclusion. The section in Chapter 4 entitled "Category 1 and NA license renewal issues" incorporates by reference the U.S. Nuclear Regulatory Commission (NRC) findings for the 47 Category 1 issues that apply to Seabrook Station, all of which have impacts that are SMALL (Attachment A, Table A-1). The remainder of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be SMALL. Table 6.1-1 identifies the impacts that Seabrook Station license renewal would have on resources associated with Category 2 issues.

Table 6.1-1 Environmental Impacts Related to License Renewal at Seabrook Station

No.	Issue	Environmental Impact
		Surface Water Quality, Hydrology, and Use (for all plants)
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	NONE. This issue does not apply because Seabrook Station does not use cooling ponds or cooling towers for the circulating water system, and it does not withdraw makeup water from a small river.
		Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)
25	Entrainment of fish and shellfish in early life stages	SMALL. Seabrook Station has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize entrainment.
26	Impingement of fish and shellfish	SMALL. Seabrook Station has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize impingement.
27	Heat shock	SMALL. Seabrook Station discharges meets the thermal requirements of its NPDES permit and there have been no demonstrated impacts due to the thermal discharge.
		Groundwater Use and Quality
32	Groundwater use conflicts (potable and service water; plants that use > 100 gpm)	NONE. This issue does not apply at Seabrook Station because groundwater is not used for potable or service water and the dewatering pumping rate is less than 100 gpm. Fresh water is obtained from the Town of Seabrook.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	NONE. This issue does not apply because Seabrook Station does not use cooling towers or cooling ponds for the circulating water system, and it does not withdraw makeup water from a small river.
35	Groundwater use conflicts (Ranney wells)	NONE. This issue does not apply because Seabrook Station does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	NONE. This issue does not apply because Seabrook Station is not at an inland site and does not use cooling ponds.
		Terrestrial Resources
40	Refurbishment impacts	NONE. No impacts are expected because NextEra Energy Seabrook has no plans to undertake refurbishment.

Table 6.1-1 Environmental Impacts Related to License Renewal at Seabrook Station (Continued)

No.	Issue	Environmental Impact
		Threatened or Endangered Species
49	Threatened or endangered species	SMALL. Three terrestrial and six aquatic federally-listed species occur in the general vicinity of Seabrook Station, but none are known to be affected by plant operation. Five aquatic and 24 terrestrial species are state-listed in New Hampshire. Eight aquatic and 13 terrestrial species are state-listed in Massachusetts. None are known to be affected by plant operations. No critical habitats are in the vicinity of Seabrook Station. NextEra Energy Seabrook has no plans to change plant operations and the owners of the Seabrook Station transmission lines have no plans to change their maintenance practices affecting these resources. Resource agencies contacted by NextEra Energy Seabrook expressed no concerns about continued plant operation on the threatened or endangered species in the vicinity.
		Air Quality
50	Air quality during refurbishment (non-attainment and maintenance areas)	NONE. No impacts are expected because NextEra Energy Seabrook has no plans to undertake refurbishment.
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	NONE. This issue does not apply because Seabrook Station does not use lakes or canals, or cooling towers or cooling ponds for the circulating water system, and it does not discharge to a small river.
59	Electromagnetic fields, acute effects (electric shock)	SMALL. The largest modeled induced current under the Seabrook Station lines is substantially less than the 5-milliampere limit. Therefore, the Seabrook Station transmission lines conform to the National Electrical Safety Code provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	SMALL. The NRC concluded that housing impacts would be small in medium and high population areas having no growth control measures. Seabrook Station is located in a high population area with no growth control measures.
65	Public services: public utilities	SMALL. NextEra Energy Seabrook has no plans to increase plant water use or employment for license renewal purposes.
66	Public services: education (refurbishment)	NONE. No impacts are expected because NextEra Energy Seabrook has no plans to undertake refurbishment.
68	Offsite land use (refurbishment)	NONE. No impacts are expected because NextEra Energy Seabrook has no plans to undertake refurbishment.

Table 6.1-1 Environmental Impacts Related to License Renewal at Seabrook Station (Continued)

No.	Issue	Environmental Impact
69	Offsite land use (license renewal term)	SMALL. No plant-induced changes to offsite land use are expected from license renewal. Impacts from continued operation would be positive.
70	Public services: transportation	SMALL. Seasonal beach traffic is heavy, but does not coincide with planned plant outage activities. Local planning officials monitor, and will continue to monitor, any traffic problems to expand road systems as necessary. The increase in traffic flow as a result of license renewal, if any, would not likely cause impacts.
71	Historic and archeological resources	SMALL. No construction is planned on-site or in the transmission corridors during the license renewal term. Consultation with the New Hampshire State Historic Preservation Office and the Massachusetts Historical Commission **(TBD)** concluded that license renewal would have no effect on historic or archaeological resources.
		Postulated Accidents
76	Severe accidents	SMALL. The analysis did not identify any cost-effective, aging-related, severe accident mitigation alternatives.

6.2 MITIGATION

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts...for all Category 2 license renewal issues..." 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers and balances...alternatives available for reducing or avoiding adverse environmental effects..." 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

Impacts of license renewal are SMALL and would not require mitigation. Current operations include monitoring activities that would continue during the license renewal term. NextEra Energy Seabrook performs routine monitoring to ensure the safety of workers, the public, and the environment. The monitoring programs ensure that the plant's permitted emissions and discharges are within regulatory limits and any unusual or abnormal emissions/discharges would be quickly detected, mitigating potential impacts. Consistent with permit and license requirements, Seabrook Station will continue to perform monitoring to ensure the continued protection of workers, the public, and the environment.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss any "...adverse environmental effects which cannot be avoided should the proposal be implemented..." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference the NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Attachment A, Table A-1).

NextEra Energy Seabrook examined 11 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Small numbers of adult and juvenile fish are impinged on the cooling water intake system traveling screens. The impingement numbers are very small in relation to recreational and commercial takes of important species.
- Fish larvae and eggs, and bivalve larvae are entrained in the cooling water intake system.

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

The environmental report shall discuss any "...irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented..." 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

Continued operation of Seabrook Station for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is used in the reactor and is converted to radioactive waste;
- land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and sanitary wastes generated from normal industrial operations;
- elemental materials that will become radioactive; and
- materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

The environmental report shall discuss the "...relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the Seabrook Station site was established with the decision to construct the plant. The Final Environmental Statement related to Seabrook Station (AEC 1974; NRC 1982) evaluated the impacts of constructing and operating Seabrook Station in Rockingham County, New Hampshire. Short-term use of natural resources would include the use of land and water. Most of the Seabrook Station site was uncultivated marshland and scrubland prior to construction. The local planning commission had designated the land for industrial use (PSNH 1973). The main plant area and education center required clearing of about 40 acres. Construction areas required another 55 acres (PSNH 1973). Construction of the intake and discharge tunnels took place underground and any above ground acreage needed for construction support was included in the 40 acres previously described. The majority of the lengths of the three 345 kV transmission lines built to connect Seabrook Station to the regional grid were not constructed in existing rights-of-way; however, using best management practices, the new rights-of-way were enhanced to benefit wildlife habitats (PSNH 1973). Today, approximately 600 acres of the 889-acre Seabrook Station property is marshland that provides habitat for estuarine wildlife and would be protected for an additional 20 years with license renewal.

The Master Plan for the Town of Seabrook reflects a plan for the site to continue to host a power generation facility following the decommissioning of Seabrook Station (Town of Seabrook 2008b). However, if the entire property were not used for this purpose after decommissioning, some environmental disturbances would cease and some restoration of the natural habitat would occur. If the area was returned to a natural state, several parcels would revert back to the original owners, including New Hampshire Fish and Game Department and The Audubon Society of New Hampshire (NAEC 2002). In addition, post 9-11 Coast Guard restrictions placed on the Brown's River would be removed, restoring full recreational use of the Brown's River. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impact. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an additional 20 years would not increase the short-term productivity impacts described here or the long-term productivity of the site.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

The environmental report shall discuss "Alternatives to the proposed action..." 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2).

"...The report is not required to include discussion of need for power or economic costs and benefits of... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2).

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable..." (NRC 1996e).

"...The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996c)

Chapter 7 evaluates alternatives to renewal of the Seabrook Station operating license. The chapter identifies actions that NextEra Energy Seabrook, LLC might take and associated environmental impacts, if the NRC does not renew the plant's operating license. The chapter also addresses actions that NextEra Energy Seabrook has considered, but would not take, and discusses the basis for determining that such actions would be unreasonable.

The alternatives discussed in this chapter are divided into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, NextEra Energy Seabrook relied on the NRC decision-making standard for license renewal:

> "...the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable." [10 Code of Federal Regulations (CFR) 51.95(c)(4)].

NextEra Energy Seabrook has determined that the environmental report would support NRC decision-making as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal that are already identified as having a greater environmental impact than the proposed action. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). NextEra Energy Seabrook believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, the same definitions of SMALL, MODERATE, and LARGE presented in the introduction to Chapter 4 are used in this chapter.

7.1 NO-ACTION ALTERNATIVE

The "no-action alternative" refers to a scenario in which the NRC does not renew the Seabrook Station operating license. Components of this alternative include replacing the generating capacity of Seabrook Station and decommissioning the facility, as described below.

Seabrook Station is a generator of electricity in New Hampshire owned 88.2 percent by NextEra Energy Seabrook; 11.6 percent by the Massachusetts Municipal Wholesale Electric Company; 0.1 percent by the Taunton Municipal Lighting Plant; and 0.1 percent by the Hudson Light & Power Department. The Energy Information Administration reports that Seabrook Station provided approximately 10.76 terawatt-hours of electricity during 2007 (EIA 2008a) to residential and other consumers in the New England region. In 2008, the Station provided 9.35 terawatt-hours of electricity (EIA 2009). The power is sufficient to supply the electricity used by over 900 thousand homes and would be unavailable to customers in the event the Seabrook Station operating license is not renewed (FPLE 2008).

Seabrook Station is the only operating nuclear plant in New Hampshire and is the largest reactor in New England. Seabrook Station provides 4.0 percent of ISO-NE's (Independent System Operator New England's) total generating capacity and 8.2 percent of its actual generation. NextEra Energy Seabrook assumes that any alternative would be unreasonable if it did not include replacing the capacity of Seabrook Station. Replacement could be accomplished by:

(1) building new generating capacity,

(2) purchasing power from the wholesale market, or

(3) reducing power requirements through demand reduction.

Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

Under the no-action alternative, NextEra Energy Seabrook would continue operating Seabrook Station until the existing license expires, then initiate immediate decontamination and dismantlement activities as required by the State of New Hampshire. The Generic Environmental Impact Statement (GEIS) (NRC 1996e) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. The NRC-evaluated decommissioning options include immediate decontamination and dismantlement, or safe storage of the stabilized and defueled facility for a period of time, followed by additional decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. The New Hampshire-Nuclear Decommissioning Financing Committee has based decommissioning costs and funding on the decommissioning of Seabrook

Station at the end of its licensed operating life (New Hampshire 2009). The GEIS describes decommissioning activities based on an evaluation of the 1,175 MWe Trojan Nuclear Plant (the "reference" pressurized-water reactor). Seabrook Station is rated at 1,245 MWe net. Seabrook Station has 6 percent more capacity, however, with respect to decommissioning activities, this difference is not considered significant. Therefore, the GEIS description is applicable to decommissioning activities that NextEra Energy Seabrook would conduct at Seabrook Station.

As the GEIS notes, the NRC has evaluated environmental impacts from decommissioning. The NRC-evaluated impacts include impacts of occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. The NRC indicated in the NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1 (NRC 2002) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are less than the same effects resulting from reactor operations. NextEra Energy Seabrook adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

NextEra Energy Seabrook notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. Seabrook Station will have to be decommissioned regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years. The NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. NextEra Energy Seabrook adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small incremental environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of generation replacement options that are part of the no-action alternative. Section 7.2.2 analyzes the impacts from these options.

NextEra Energy Seabrook concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (NRC 1996e) and in the decommissioning generic environmental impact statement (NRC 2002). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

The power produced in New Hampshire is not limited to use within the state. New Hampshire is a net exporter of electric power, using less electricity than is generated within the state. The ISO-NE region relies on electricity drawn from New Hampshire to help meet power requirements throughout the region. The ISO-NE Interconnection is a regional network that coordinates the movement of wholesale electricity in all or parts of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. In 2007, the ISO-NE region had a net import of 6.1 terawatt-hours, representing 4.6 percent of the region's net energy load (ISO-NE 2008a).

The current mix of power generation options within the ISO-NE region is one indicator of what NextEra Energy Seabrook considers to be feasible alternatives. Figure 7.2-1 illustrates the 2007 electric industry generating capacity and energy output by fuel type for the ISO-NE region. In 2007, electric generators connected to the ISO-NE network had a total generating capacity of 30,879 MW (FERC 2009a). As shown in Figure 7.2-1, this capacity includes units fueled by natural gas (40.0 percent), oil (22.1 percent), nuclear (14.9 percent), coal (9.1 percent), pumped storage (5.5 percent), hydroelectric (5.4 percent) and non-hydro renewables/miscellaneous (3.0 percent) (ISO-NE 2007). In 2007, the electric industry in the ISO-NE region provided 130.7 terawatt-hours of electricity (ISO-NE 2008a). As shown in Figure 7.2-1, power generation in the ISO-NE region was dominated by natural gas (42.2 percent), followed by nuclear (28.3 percent), coal (15.1 percent), other renewables (6.0 percent), hydroelectric (4.9 percent), oil (2.2 percent) and pumped storage (1.3 percent) (ISO-NE 2008a). The entire ISO-NE region is a net importer of electric power, using more electricity than is generated within the region. In 2007, 12.2 terawatt-hours (gross) were imported into the ISO-NE region and 6.1 terawatt-hours (gross) were exported. Therefore the net result is 6.1 terawatts-hours imported (ISO-NE 2008a).

Comparison of generating capacity with actual utilization of this capacity indicates that coal, gas, and nuclear are used by ISO-NE substantially more relative to their ISO-NE capacity than oil-fired generation. This condition reflects the relatively low fuel cost and base-load suitability for nuclear power and coal-fired plants, and relatively higher use of oil-fired units to meet peak loads. While gas-fired units are typically used to meet peak loads, use of natural gas to meet base-load requirements in New Hampshire is increasing as a result of its lower emission levels and the relative ease of siting new natural gas-fired power plants (EIA 2008b). Also, a comparison of the capability of and energy production from petroleum and gas-fired facilities demonstrates a strong local preference for gas firing over oil firing, likely due to the higher cost and greater air emissions associated with oil firing. Energy production from hydroelectric sources is similarly preferred from a cost standpoint, but capacity is limited and utilization can vary substantially depending on water availability.

7.2.1 ALTERNATIVES CONSIDERED

Technology Choices

For the purposes of this environmental report, alternative generating technologies were evaluated to identify candidate technologies that would be capable of replacing Seabrook Station's nominal net base-load capacity of 1,245 MWe. NextEra Energy Seabrook accounted for the fact that Seabrook Station is a base-load generator and that any feasible alternative to Seabrook Station would also need to be able to generate base-load power. NextEra Energy Seabrook assumed that the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont comprise the region of interest (ROI) for purposes of this analysis.

Based on these evaluations, it was determined that new plant systems capable of replacing the capacity of Seabrook Station are limited to a new nuclear plant, a supercritical pulverized coal-fired plant, or a combined-cycle natural gas-fired plant for base-load operation. This conclusion is supported by the generation utilization information presented in the introduction to Section 7.2 that identifies natural gas and coal as the most heavily used non-nuclear generating fuel type in the region.

NextEra Energy Seabrook chose to evaluate a supercritical pulverized boiler in lieu of conventional, ultra-supercritical, circular fluidized bed, or coal gasification boilers because the supercritical option is commercially mature, widely used throughout the world, and more economical. The steam systems used in the current generation of pulverized coal boilers are generally designated as subcritical (or conventional), supercritical, or ultra-supercritical, based on the pressure and temperature of the steam.

NextEra Energy Seabrook would use natural gas as the primary fuel in its combined-cycle turbines because of the economic and environmental advantages of gas over oil. Manufacturers now have large standard sizes of combined-cycle gas turbines that are economically attractive and suitable for high-capacity base-load operation. NextEra Energy Seabrook chose to evaluate combined-cycle turbines in lieu of simple-cycle turbines because the combined-cycle option is more economical. The benefits of lower operating costs for the combined-cycle option outweigh its higher capital costs. It should also be noted that Town of Seabrook Master Plan recommends that a gas-fired electrical generating plant be constructed when Seabrook Station is decommissioned, which also supports analyzing a gas-fired power plant as an alternative (Town of Seabrook 2008b).

Mixture

The NRC noted in Section 8.1 of the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, it would be impractical to analyze all the combinations. Therefore, the NRC determined that alternatives evaluation should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996e). Consistent with the NRC determination, NextEra Energy Seabrook has not evaluated mixes of generating sources. The impacts from nuclear, coal- and gas-fired generation presented in this chapter would bound the impacts from any combination of the three technologies.

Regulatory Background

Nationally, the electric power industry has been undergoing a transition from a regulated industry to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states. Over the past few years, states within the ISO-NE region (Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island) have transitioned to competitive wholesale and retail markets. Vermont is not restructuring its electric power industry.

In 1996, New Hampshire enacted House Bill 1392, which required the New Hampshire Public Utilities Commission to allow its customers retail choice through a pilot program which later indicated a 15 to 20 percent savings. In 2001, New Hampshire enacted House Bill 489 which extended the period of transition service of the Public Service Company of New Hampshire (PSNH). PSNH customer rates were reduced by 10 percent (EIA 2007b). Similarly, in May 1997 Maine enacted Legislation Docket 1804 which allowed retail competition by March of 2000 and required a 30 percent renewable energy source generation (EIA 2008c). In 1998, Connecticut enacted House Bill 5005, which allowed 35 percent of its consumers to choose among competitive generation suppliers by January 2000 and all of its customers by July 2000 (EIA 2008d). The Rhode Island Utilities Act of 1996 (House Bill 8124), called for a July 1997 start date for retail choice phase-in (EIA 2007c). In November of 1997, Massachusetts enacted House Bill 5117 to restructure its electric power industry. Under the law, retail access and rate cuts were required by March 1998, with an additional rate cut a year and half later (EIA 2007d).

In May 2007, New Hampshire enacted the Renewables Portfolio Standards (RPS), which requires all retail electric suppliers in New Hampshire to acquire renewable energy certificates amounting to 23.8 percent of retail electricity by 2025. Of this, 16.3 percent of the target is to come from sources installed after January 1, 2006 and the remaining 7.5 percent is to come from existing resources (DSIRE 2008). The RPS divides renewables in New Hampshire into four classes. Class I consists of energy produced from solar technologies (not meeting Class II requirements), photovoltaic technologies (not meeting Class II requirements), wind energy, hydroelectric, geothermal technologies, wave or tidal action, and methane gas from landfills or a sustainable biomass facility all beginning operation after January 1, 2006. Class II consists of electricity from new solar technology operations after January 1, 2006. Class III consists of existing biomass and methane facilities generating less than or equal to 25 megawatts of electricity prior to January 1, 2006. Class IV consists of hydroelectricity technologies, producing less than or equal to 5 megawatts of capacity, in operation prior to January 1, 2006. Massachusetts, Connecticut, Maine, and Rhode Island all established similar RPS programs. While Vermont does not have an RPS, it did pass legislation in 2008 to create renewable energy resource goals (ISO-NE 2008a).

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1), nuclear generation (Section 7.2.1.2), and purchased power (Section 7.2.1.3) as reasonable alternatives to Seabrook Station license renewal. Section 7.2.1.4 discusses reduced demand (referred to as demand side management) and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.5 discusses other alternatives that NextEra Energy Seabrook has determined are not reasonable and the bases for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

NextEra Energy Seabrook analyzed locating hypothetical new coal- and gas-fired units at an existing NextEra Energy power plant site and at an undetermined greenfield site. NextEra Energy Seabrook concluded that Seabrook Station is the preferred site for new construction because this approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads, parking areas, and office buildings. The addition of a new cooling tower could be required due to U.S. Environmental Protection Agency (EPA) regulatory changes, but some components of the cooling system would still be used and water would still be withdrawn and discharged to the Atlantic Ocean.

It must be emphasized, however, that these are hypothetical scenarios. NextEra Energy Seabrook does not have plans for such construction at Seabrook Station or any other site in New England.

Gas-Fired Generation

For purposes of this analysis, NextEra Energy Seabrook assumed development of a modern natural gas-fired combined-cycle plant with design characteristics similar to those being developed elsewhere in the ISO-NE region, and with a generating capacity similar to Seabrook Station.

One unit with a nominal net capacity of 1245 MWe could be assumed to replace the total 1245 MWe Seabrook Station nominal net capacity. However, NextEra Energy Seabrook's experience indicates that, although custom-sized gas-fired units can be built, using standard sizes is more economical. For example, standard-sized units include gas-fired combined-cycle units of 415-MWe net capacity (Chase 2000; GE Energy 2009). Three 415-MWe units would be comparable to the Seabrook Station net capacity. Therefore, in this analysis, the hypothetical plant would comprise three pre-engineered 415-MWe natural gas-fired combined-cycle systems for a total of 1,245 MWe (GE Energy 2009). NextEra Energy Seabrook assumes that the representative plant would be located at the Seabrook Station site, which offers potential advantages of existing infrastructure (e.g., transmission, roads, and technical and administrative support facilities).

The characteristics of this plant and other relevant resources were used to define the gas-fired alternative. Table 7.2-1 presents the basic characteristics for the gas-fired alternative.

Coal-Fired Generation

For purposes of this analysis, NextEra Energy Seabrook assumed the coal-fired alternative would be composed of three 415-MWe supercritical coal-fired boilers for a total of 1,245 MWe. NextEra Energy Seabrook assumes that the hypothetical plant would be located at the Seabrook Station site, which offers potential advantages of existing infrastructure (e.g., transmission, roads, and technical and administrative support facilities). The NRC evaluated coal-fired generation alternatives for Vermont Yankee Nuclear Power Station (NRC 2007). NextEra Energy Seabrook reviewed the NRC's analysis, believes it to be sound, and notes that it analyzed less generating capacity than the 1,245 MWe discussed in this analysis. In defining the coal-fired alternative to Seabrook Station, NextEra Energy Seabrook used input specific to the site and New Hampshire and has scaled from the NRC analysis done for the Vermont Yankee plant where appropriate.

Table 7.2-2 presents the basic coal-fired alternative emission control characteristics. The emissions control assumptions are based on the technologies recognized by the EPA for minimizing emissions and estimated emissions are based upon the EPA's published removal efficiencies (EPA 1998). For the purpose of analysis, NextEra Energy Seabrook assumed that coal and limestone (calcium carbonate) would be delivered to the site via rail.

7.2.1.2 Construct and Operate New Nuclear Reactor

Since 1997, the NRC has certified four new standard designs for nuclear power plants under 10 CFR 52, Subpart B. These designs are the U.S.

Advanced Boiling Water Reactor (10 CFR 52, Appendix A), the System 80+ Design (10 CFR 52, Appendix B), the AP600 Design (10 CFR 52, Appendix C), and the AP1000 Design (10 CFR 52, Appendix D). All of these designs are light-water reactors. The NRC evaluated new nuclear generation capacity as an alternative for the Vermont Yankee Nuclear Power Station (NRC 2007). NextEra Energy Seabrook has reviewed the NRC analysis and believes it to be sound. In defining the Seabrook Station new nuclear reactor alternative, NextEra Energy Seabrook has used site- and New Hampshire-specific input and has scaled from the NRC analysis, where appropriate to evaluate the construction of a one-unit nuclear facility as an alternative to Seabrook Station.

7.2.1.3 Purchased Power

As noted in Section 7.2.1, electric industry restructuring initiatives in New Hampshire and other states in the ISO-NE region are designed to promote competition in energy-supply markets by facilitating participation by generation companies. ISO-NE has implemented market rules to appropriately anticipate and meet electricity demands in the resulting wholesale electricity market. As an additional facet of this restructuring effort, retail customers in the region now may choose among any company with electric generation to supply their power. In view of these conditions, NextEra Energy Seabrook assumes for purposes of this analysis that adequate supplies of electricity would be available, and that purchased power would be a reasonable alternative to meet the Station's load requirements in the event the existing operating license for Seabrook Station is not renewed.

The source of this purchased power may reasonably include new generating facilities developed elsewhere in the ISO-NE region. The technologies that would be used to generate this purchased power are speculative. NextEra Energy Seabrook assumes that the generating technology used to produce purchased power would be one of those that the NRC analyzed in the GEIS. For this reason, NextEra Energy Seabrook is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative. Of these technologies, facilities fueled by coal and combined-cycle facilities fueled by natural gas are the most cost effective for providing base-load capacity.

NextEra Energy Seabrook anticipates that additional transmission infrastructure could be needed in the event purchased power must replace Seabrook Station capacity. From a local perspective, loss of Seabrook Station could require construction of new transmission infrastructure to ensure local system stability. From a regional perspective, ISO-NE's inter-connected transmission system is highly reliable, and the market-driven process for adding capacity in the region is expected to have a positive impact on overall system reliability.

7.2.1.4 Demand Side Management

Historically, state regulatory bodies have required regulated utilities to institute programs designed to reduce demand for electricity. Demand side management (DSM) programs included energy conservation and load management measures. In a deregulated market, electric power generators generally are not required to retain an extensive conservation and load management incentive program, which allows them to offer competitively-priced power.

In New Hampshire, the ISO-NE promotes and advances DSM in the retail electric market. It began in 2003 with implementation of the demand response program. It is now managed using demand resources, installed measures (i.e., products, equipment, systems, services, practices, and strategies) that result in additional and verifiable reductions in end-use demand on the electricity network during specific performance hours. Demand resources include a combination of demand response and other demand resources (e.g., energy efficiency, load management, and distributed generation). Demand response is a specific type of demand resource in which electricity consumers modify their electric energy consumption in response to incentives based on wholesale market prices. Other demand resources tend to reduce end-use demand on the electricity network across many hours but usually not in direct response to changing hourly wholesale price incentives. (ISO-NE 2008b)

Since New England's demand-resource program began in 2003, it has seen tremendous growth. The monthly average enrollment in demand-resource programs in 2006 was 650 MW which increased by 103 percent in 2007 to 1,324 MW. The program increased by 430 percent between January 2005 and December 2007. Since beginning, the ISO-NE's demand-resource management has added a variety of programs and participants, resulting in increased demand-response capabilities. During 2007, New Hampshire had 74.7 MW of participation in the demand-response program while the whole ISO-NE region had 1,694 MW (ISO-NE 2008b).

It is expected that the entire ISO-NE's demand-resource program will continue to expand in the future. But as a practical matter, it would be extremely hard to increase energy savings from demand reductions by an additional 1,245 MWe to replace the Seabrook Station generation capability. Also, NextEra Energy Seabrook is a merchant generator and does not have a retail customer base in the ISO-NE region. It does not have a DSM program in the ISO-NE region or the ability to implement such a program. Further, DSM measures would not serve NextEra Energy Seabrook's business purposes as a merchant generator. For these reasons, NextEra Energy Seabrook does not consider DSM to represent a reasonable alternative to renewal of the Seabrook Station operating license.

7.2.1.5 Other Alternatives

This section identifies alternatives that NextEra Energy Seabrook has determined are not reasonable for replacing Seabrook Station and the bases for these determinations. In performing this evaluation, NextEra Energy Seabrook accounted for the fact that Seabrook Station is a base-load generator and that any feasible alternative to Seabrook Station would also need to be able to generate base-load power. NextEra Energy Seabrook assumed that the New England states (i.e., Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont) comprise the ROI for purposes of this analysis. In performing this evaluation, NextEra Energy Seabrook relied heavily upon the NRC's GEIS (NRC 1996e).

Wind

Wind power, due to its intermittent nature, is not suitable for base-load generation, as discussed in Section 8.3.1 of the GEIS. Wind power systems produce power only when the wind is blowing at a sufficient velocity and duration. While recent advances in technology have improved wind turbine capacity, average annual capacity factors for wind power systems are relatively low (20 to 40 percent) compared to a 90 to 97 percent industry average for a base-load plant such as a nuclear plant (EERE 2008a; NRRI 2007). The average capacity factor for wind power systems in the ROI is 22.1 percent (EERE 2008a). In conjunction with energy storage mechanisms, wind power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit wind power to serve as a large base-load generator (Schainker 2008).

The energy potential in wind is expressed by wind generation classes ranging from 1 (least energetic) to 7 (most energetic). Current wind technology can operate economically on Class 4 sites with the support of the federal production tax credit of 2.1 cents/kWh (AWEA 2008a), but utility-scale applications in Class 3 wind regimes require further technical development . In the ROI, the primary areas of good wind energy resources are the Atlantic coast and exposed hilltops, ridge crests, and mountain summits. Offshore wind resources are abundant (EERE 2008b) but the technology is not sufficiently demonstrated at this time. Only 1,077 MW of offshore wind capacity has been installed worldwide (EERE 2008a). In the United States, at least 35 offshore wind energy projects are in various stages of development and permitting. They range from 20 MW to 940 MW, though the 940 MW project is in preliminary stages of development. Nine of these projects are in the ROI (Offshore Wind 2009). Cape Wind recently received the required state and local permits to construct 130 wind turbines (420 MW) in Nantucket Sound, Massachusetts. The Minerals Management Service, which has the authority to review and approve offshore wind projects, issued a favorable Final Environmental Impact Statement in January 2009. The Record of

Decision as well as completion of the federal permitting process is expected in the near future (Cape Wind 2009).

Based on American Wind Energy Association estimates (AWEA 2008b), the ROI has the technical potential (the upper limit of renewable electricity production and capacity that could be brought online, without regard to cost, market acceptability, or market constraints) for roughly 10,989 MWe of land-based wind power capacity. The full exploitation of wind energy is constrained by a variety of factors including land availability and land-use patterns, surface topography, infrastructure constraints, environmental constraints, wind turbine capacity factor, wind turbine availability, and grid availability. By 2008, a total of 55.53 MWe of wind energy had been developed in the ROI. Projected new capacity in various stages of planning or permit review within the ROI includes an additional 60 MWe of wind energy (AWEA 2008b). NextEra Energy is the leading generator of wind power in North America with over 7,500 MWe net capacity throughout the US (NextEra 2009e).

Wind farms generally consist of 10 to 50 turbines in the range of 1-3 MWe (EERE 2008a). Estimates based on existing installations indicate that a utility-scale wind farm would be spread over 30 to 50 acres per MWe of installed capacity (McGowan and Connors 2000). However, the actual area occupied by turbines, substations, and access roads may occupy 3 percent to 5 percent of the wind farm's total acreage (McGowan and Connors 2000). Thus the remaining area is available for other uses. When the wind farm is located on land already used for intensive agriculture, the additional impact to wildlife and habitat will likely be minor, while disturbance caused by wind farms in more remote areas may be more significant. Replacement of Seabrook Station generating capacity (1,245 MWe) with wind power, assuming a capacity factor of 30 percent, would require a large greenfield site about 23,280 acres (233 square miles) in size, of which approximately 5,760 acres (9 square miles) would be disturbed and unavailable for other uses.

The scale of this technology is too small to directly replace a power plant the size of Seabrook Station; capacity factors are low (20 to 40 percent), and the extensive land requirement (23,280 acres) with the desired wind regimes is limiting. Therefore, NextEra Energy Seabrook has concluded that wind power is not a reasonable alternative to Seabrook Station license renewal.

Solar

By its nature, solar power (photovoltaic and thermal) is intermittent and not suitable for base-load generation. As discussed in Section 8.3.2 of the GEIS, solar power systems produce power only when sunlight is available. The average annual capacity factors for solar power systems are relatively low (16 to 50 percent) compared to a 90 to 97 percent industry average for a base-load plant such as a nuclear plant (NRRI 2007). In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator (Schainker 2008). Even without consideration of storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to high costs per kilowatt of capacity (EERE 2006a).

While NextEra Energy is the leading generator of solar power in North America with over 145 MWe net capacity throughout California, solar power is not a technically feasible alternative for base-load generating capacity in the ROI (NextEra 2009e). The ROI receives 3 to 5 kilowatt hours of solar radiation per square meter per day compared with 5.5 to 7.5 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (EERE 2008c).

Finally, land requirements for solar plants are high. Estimates based on existing installations indicate that utility-scale plants would occupy at least 2.5 acres per MWe for photovoltaic and 4.9 acres per MWe for solar thermal systems (EERE 2004). Utility-scale solar plants have been used mainly in regions that receive high concentrations of solar radiation such as the western U.S. A utility-scale solar plant located in the ROI would occupy about 3.3 acres per MWe for photovoltaic and 9.9 acres per MWe for solar thermal systems. Therefore, replacement of Seabrook Station generating capacity with solar power would require dedication of about 23,040 acres (36 square miles) for photovoltaic and 27,520 acres (43 square miles) for solar thermal systems, and both would have large environmental impacts at a greenfield site.

NextEra Energy Seabrook has concluded that, due to the high cost of both generation and storage technologies, limited availability of sufficient incident solar radiation, and the amount of land needed, solar power is not a reasonable alternative to Seabrook Station license renewal.

Hydropower

About 1,647 MWe of utility generating capacity (excluding pumped storage) in the ROI comes from hydropower (ISO-NE 2008c). NextEra Energy supports hydropower and operates 360 MWe net capacity in the ROI (NextEra 2009e). The total amount of undeveloped hydropower that could feasibly be utilized in the ROI is approximately 1,071 MWe. This capacity is distributed over 4,653 different sites. The unpredictability of permitting many of these locations and the major capital investment would suggest development potential at a small fraction of these sites. In addition, this capacity is less than that needed to replace the 1,245 MWe capacity of Seabrook Station. There are no undeveloped sites in the ROI that would be environmentally suitable for a single hydroelectric facility similar in generation size to Seabrook Station (EERE 2006b).

As the GEIS points out in Section 8.3.4, the percentage of United States generating capacity provided by hydropower is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. A small number of hydropower projects, totaling 12.9 MWe, are being considered in the ROI (FERC 2009b). The largest of these projects is 3.7 MWe. Even if they were built, these small hydropower projects could not replace the 1,245 MWe generated at Seabrook Station. Also, there are numerous dams being removed within the New England area for various reasons including the restoration of natural infrastructure such as migrating fish habitat (American Rivers 2008; USFWS 2009b).

The GEIS estimates that hydroelectric power plants have a land use requirement of 1,000,000 acres (1,550 square miles) per 1,000 MWe (NRC 1996e). Based on this estimate, replacement of Seabrook Station's generating capacity would require flooding approximately 1,237,760 acres (1,934 square miles), resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

NextEra Energy Seabrook has concluded that, due to the lack of suitable sites in the ROI for a large hydroelectric facility and the large amount of land needed, hydropower is not a reasonable alternative to Seabrook Station license renewal.

Tidal, Ocean Thermal Energy, and Wave

The most developed technologies to harness electrical power from the ocean are tidal power, ocean thermal energy, and wave power conversion. These technologies are still in the early stages of development and are not commercially available to replace a large base-load generator such as Seabrook Station.

Tidal power technologies extract energy from the diurnal flow of tidal currents caused by the gravitational pull of the moon. Unlike wind and wave power, tidal streams offer entirely predictable output. All coastal areas consistently experience two high and two low tides over a period of approximately 25 hours. However, because the lunar cycle is longer than a 24-hour day, the peak outputs differ by about an hour each day, and so tidal energy cannot be guaranteed at times of peak demand (Feller 2003).

Tidal power technologies consist of tidal turbines and barrages. Tidal turbines are similar in appearance to wind turbines and are mounted on the seabed. They are designed to exploit the higher energy density, but lower velocity, of tidal flows compared to wind. Tidal barrages are similar to hydropower dams in that they are dams with gates and turbines installed along the dam. When the tides produce an adequate difference in the level of the water on opposite sides of the dam, the gates are opened and water is forced through turbines, which turns a generator.

For those tidal differences to be harnessed into electricity, the difference in water height between the high and low tides must be at least 16 feet. There are only about 40 sites on the Earth with tidal ranges of this magnitude (EERE 2008d). Sites with adequate tidal differences within the United States are only available in Maine and Alaska (CEC 2008). Several tidal energy projects, totaling 578.6 MWe, are being considered in the ROI (FERC 2009b). The largest of these projects is 300 MWe. Even if they were built, these tidal energy projects could not replace the 1,245 MWe generated at Seabrook Station.

Ocean thermal energy conversion (OTEC) technology capitalizes on the fact that water temperature decrease with depth. As long as the temperature between the warm surface water and the cold deep water differs by about 20°C (36°F), an OTEC system can produce a significant amount of power. The temperature gradient off of the coast of the ROI is less than 18°C (32°F) and, so is not a good resource for OTEC technology (NREL 2008).

Wave energy conversion takes advantage of the kinetic energy in the ocean waves (which are mainly caused by interaction of wind with the surface of the ocean). Wave energy offers an irregular, oscillatory, low-frequency energy source that must be converted to a 60-Hertz frequency before it can be added to the power grid (CEC 2008). Wave energy resources are best between 30 and 60 degrees latitude in both hemispheres and the potential tends to be greatest on western coasts (RNP 2007).

NextEra Energy Seabrook believes that ocean technology has not matured sufficiently to support production for a facility the size of Seabrook Station, and NextEra Energy Seabrook has concluded that, due to cost and production limitations, tidal, ocean thermal energy, and wave technologies are not reasonable alternatives to Seabrook Station license renewal.

Geothermal

Geothermal energy is a proven resource for power generation. Geothermal power plants use naturally heated fluids as an energy source for electricity production. To produce electric power, underground high-temperature reservoirs of steam or hot water are tapped by wells and the steam rotates turbines that generate electricity. Typically, water is then returned to the ground to recharge the reservoir.

Geothermal energy can achieve capacity factors of 93 percent and can be used for base-load power where this type of energy source is available (NRRI 2007). Widespread application of geothermal energy is constrained by the geographic availability of the resource. In the U.S., high-temperature hydrothermal reservoirs occur in the western continental U.S., Alaska, and Hawaii. The ROI has low to moderate temperature resources that can be tapped for direct heat or for geothermal heat pumps, but electricity generation is not feasible with these resources (GHC 2008; EERE 2008c). Therefore, NextEra Energy Seabrook concludes that geothermal is not a reasonable alternative to Seabrook Station license renewal.

Wood Energy

About 640 MWe of utility generating capacity in the ROI comes from wood or biomass waste fueled boilers (NEEDS 2006). As discussed in the GEIS (NRC 1996e), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem.

According to the National Renewable Energy Laboratory, the ROI produces approximately 7.8 million dry tons of wood waste annually (consisting of forest mill, and urban wood residues) (NREL 2005). Assuming the fuel has a nominal heat content of 9.961 million Btu per dry ton and a thermal conversion efficiency of 25 percent, the annual power potential of the ROI would be 19.5 million MW-hours (EIA 2008f; NRC 1996e). This is the equivalent to a 2,473 MWe base-load (90 percent capacity factor) power plant which is nearly double the 1,245 MWe capacity of Seabrook Station. The largest existing wood waste power plants in operation are 40 to 50 MWe in size. There is one power plant, Schiller Station, near Portsmouth, New Hampshire, that utilizes a 50-MWe wood burning unit (EIA 2007a).

The costs of using wood waste as a fuel are highly variable. Costs can be very low if they are a byproduct of another process, as is the case with mill residues. Costs become higher if the wood must be collected and transported, as is the case with crop residues and urban wood residues. Crop and urban wood residues would be inadequate fuel sources for base-load applications because they would be difficult to harvest, haul, store and handle. Also, wood has a low heat content that makes it unattractive for base-load applications.

Further, as discussed in Section 8.3.6 of the GEIS (NRC 1996e), construction of a wood-fired plant would have a similar environmental impact to that for a coal-fired plant, although facilities using wood waste for fuel would be built on a smaller scale. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and ash waste disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood is also difficult to handle and has high transportation costs.

NextEra Energy Seabrook has concluded that, due to the lack of an environmental advantage, low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to Seabrook Station license renewal.

Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS (NRC 1996e), the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment and stricter environmental emission controls.

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. Combusting waste usually reduces its volume by approximately 90 percent (EPA 2010). The remaining ash is buried in landfills (EPA 2009b). It is unlikely that many landfills will convert waste to energy due to the numerous obstacles and factors that may limit the growth in waste-to-energy power generation. Chief among them are environmental regulations and public opposition to siting waste-to-energy facilities near feedstock supplies. There is an existing municipal waste combustor near Seabrook Station, the Covanta Haverhill Energy from Waste Facility. It is a 49 MWe municipal waste combustor that began commercial operation in 1989 and is approximately 17 miles to the southwest of Seabrook Station (CE 2009).

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired 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 Seabrook Station license renewal.

NextEra Energy Seabrook has concluded that, due to the high costs and lack of environmental advantages other than reducing landfill volume, burning municipal solid waste to generate electricity is not a reasonable alternative to Seabrook Station license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), gasifying energy crops (including wood waste), and utilizing the methane from biodegradation of landfill or livestock waste. As discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as Seabrook Station.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air).

These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

NextEra Energy Seabrook has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to Seabrook Station license renewal.

Petroleum

The ROI has several petroleum (oil)-fired power plants (ISO-NE 2008c). The percentage of power generated by oil-fired electricity plants decreased from 27 to 3.6 percent between 1990 and 2006 in the ROI (EIA 2007e). Oil-fired operation has become more expensive than nuclear or coal-fired operation, and future increases in petroleum prices are expected to make this increasingly so.

Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS (NRC 1996e) estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Building an oil-fired plant with a net capacity equal to Seabrook Station would require about 149 acres. This is 37 percent more acreage than the 109 acres needed for the Seabrook Station facility, as described in Section 2.1. Additionally, operation of oil-fired plants would have impacts on the aquatic environment and air that would be similar to those from a coal-fired plant.

NextEra Energy Seabrook has concluded that, due to the high costs and lack of obvious environmental advantage, oil-fired generation is not a reasonable alternative to Seabrook Station license renewal.

Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. Although more than 900 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generation capacity in 2008 was about 175 MWe (Adamson 2008). The largest stationary fuel cell power plant ever built is the 50 MWe POSCO facility in Korea (FC2000 2008). Even so, fuel cell power plants typically generate much less (2 MWe or lower) power (NRRI 2007).

One of the major barriers to full commercialization of stationary fuel cells is the product cost. Current large stationery fuel cell designs are approximately $3,000 per kW (Samuelsen 2008). To make fuel cells more competitive with other generating technologies, the Department of Energy formed the Solid State Energy Conversion Alliance, with the goal of producing new fuel cell technologies at a cost of $400/kW or lower by 2010. (DOE 2006)

NextEra Energy Seabrook believes that this fuel cell technology has not matured sufficiently to support production equivalent to a facility the size of Seabrook Station. NextEra Energy Seabrook has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to Seabrook Station license renewal.

Delayed Retirement

As the NRC noted in Section 8.3.13 of the GEIS (NRC 1996e), extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. NextEra Energy Seabrook is unaware of any retired plants or plans to retire any plants in the ROI.

Nationally, fossil plants slated for retirement tend to be ones that are old enough to have difficulty in meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent restrictions, delaying retirement in order to compensate for a plant the size of Seabrook Station would appear to be unreasonable without major construction to upgrade or replace plant components. NextEra Energy Seabrook concludes that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives. For these reasons, the delayed retirement of non-nuclear generating units is not considered a reasonable alternative to Seabrook Station license renewal.

7.2.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This section evaluates the environmental impacts of alternatives that NextEra Energy Seabrook has determined to be reasonable alternatives to Seabrook Station license renewal: gas-fired generation, coal-fired generation, and purchased power.

7.2.2.1 Gas-Fired Generation

The NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS (NRC 1996e), focusing on combined-cycle plants. Section 7.2.1.1 presents NextEra Energy Seabrook's reasons for defining the gas-fired generation alternative as a three-unit combined-cycle plant at Seabrook Station. Construction of a gas-fired unit would impact land-use and could impact ecological, aesthetic, and cultural resources, but construction on an existing power plant site would minimize any impacts to these resources. Human health effects associated with air emissions would be of concern. Gas-fired generation facilities use much less water than nuclear power plants, therefore, aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generator. The following subsections describe the effects of combined-cycle gas-fired generation in greater detail.

Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NO_x), a regulated pollutant, during combustion. A natural-gas-fired plant would also emit small quantities of sulfur oxides (SO_x), particulate matter, and carbon monoxide (CO), all of which are regulated pollutants. In addition, a natural-gas-fired plant would produce carbon dioxide (CO_2), a greenhouse gas. Control technology for gas-fired turbines focuses on NO_x emissions. From data published by the EPA (EPA 2000a), the emissions from the natural gas-fired plant equal in electric output to Seabrook Station are estimated to be:

SO_x = 19 tons per year

NO_x = 317 tons per year

CO = 66 tons per year

CO_2 = 3,200,000 tons per year

Filterable Particulate Matter = 55 tons per year [all particulates from natural gas combustion are particulates with diameters less than 2.5 microns ($PM_{2.5}$)]

In 2006, New Hampshire was ranked 34th nationally in sulfur dioxide (SO_2) emissions and 46th nationally in NO_x emissions from electric power plants (EIA 2007f). The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. NextEra Energy Seabrook would need to obtain SO_2 credits to operate a fossil-fuel-fired plant.

In 2003, the EPA began implementing the NO_x SIP (State Implementation Plan) Call regulation that required 22 states, including Connecticut, Massachusetts and Rhode Island, to reduce their NO_x emissions to address regional transport of ground-level ozone across state lines (EPA 2008f). In 2005, EPA issued the Clean Air Interstate Rule (CAIR), which was overturned by a U.S. Court of Appeals in July 2008. In December 2008, the court remanded the rule to EPA without vacatur, meaning the rule will remain in effect while EPA works toward promulgating a revision that is consistent with the court's July 2008 opinion (US Court of Appeals 2008). As it currently stands, the CAIR permanently caps emissions of SO_2 and NO_x in 28 eastern states, including New Hampshire, and the District of Columbia using a cap and trade program. The EPA had already allocated emission allowances for SO_2 to sources subject to the Acid Rain Program. These allowances will be used in the CAIR model SO_2 trading program. EPA will provide emission allowances for NO_x to each state, according to the state budget for the model NO_x trading program. Sources have the choice of installing pollution control equipment, switching fuels, or buying excess allowances from other sources that have reduced their emissions. NextEra Energy Seabrook would have to obtain enough SO_2 and NO_x credits to cover its annual emissions which would likely mean purchasing credits from other sources.

The area of New Hampshire where Seabrook Station is located is a non-attainment area under the 8-hour ozone standard; therefore, a new fossil-fuel-fired plant at the existing NextEra Energy Seabrook Station site also would have limitations on NO_x emissions in conjunction with the CAIR limitations. In addition, the New Hampshire Governor signed the New Hampshire Climate Change Action Plan in March 2009, which set the goal of reducing greenhouse gas emissions of 80 percent below 1990 levels by 2050 (NHDES 2009a). Replacing the generating capacity of Seabrook Station with a gas-fired plant would hinder the State of New Hampshire reaching this goal.

Currently, Rockingham County, New Hampshire, is an attainment area for the $PM_{2.5}$ and PM_{10} National Ambient Air Quality Standards (NAAQS). Since 1989, the PM_{10} standard has not been exceeded in any part of New Hampshire. Since 1999, monitored values for $PM_{2.5}$ in Rockingham County have remained below the standard, though values remain close to the level of the standard for both annual and 24-hour periods (NHDES 2009b). Replacing the generation capacity of Seabrook Station with a gas-fired plant could increase $PM_{2.5}$ levels over the standard, which could result in the county becoming a non-attainment area for $PM_{2.5}$.

NO_x effects on ozone levels, SO_2 allowances, NO_x credits, and $PM_{2.5}$ emissions could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, the emissions are still substantial. NextEra Energy Seabrook concludes that emissions from the gas-fired alternative could noticeably alter local air quality. Air quality impacts would therefore be MODERATE.

Waste Management

The GEIS concludes that the solid waste generated from this type of facility would be minimal (NRC 1996e). The only noteworthy waste would be from spent SCR used for NO_x control. NextEra Energy Seabrook concludes that gas-fired generation waste management impacts would be SMALL.

Other Impacts

Construction of the gas-fired alternative on an existing plant site would impact the construction site and the supporting utility corridors. NextEra Energy Seabrook estimates that 44 acres on the previously disturbed Seabrook Station site would be needed for a plant site (assumes no cooling towers would be required to meet current EPA guidance), and impacts to land use and terrestrial resources would be SMALL. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be noticeable but SMALL with appropriate controls.

A new gas pipeline would likely be required to supply the fuel for the gas turbine generators in this alternative. To the extent practicable, NextEra Energy Seabrook would route the pipeline along existing, previously disturbed, right-of-ways to minimize impacts. Unavoidable impacts would occur in rights-of-ways crossing water bodies and marshland. A new pipeline of approximately 20-inch diameter would require a 100-ft-wide corridor. This new construction may also necessitate an upgrade of the State-wide pipeline network. Impacts to land use would be SMALL.

NextEra Energy Seabrook estimates an average construction workforce of 548 employees with a peak of 991 workers. Socioeconomic impacts from the construction workforce would be minimal, if worker relocation is not required, which would be the case if, like Seabrook Station, the site is near metropolitan areas such as Boston, Cambridge, and Lowell, Massachusetts, and Manchester, New Hampshire. NextEra Energy Seabrook estimates an operational workforce of 47 for the gas-fired alternative. This is a sizable reduction in operating personnel compared to Seabrook Station's 1,093 operational personnel. Because NextEra Energy Seabrook is the Town of Seabrook's largest employer, the loss of the operational and temporary personnel would impact various aspects of the local community including employment, taxes, housing, offsite land use, economic structure, and public services (NRC 1996e). NextEra Energy Seabrook believes these impacts would be MODERATE in the high population area surrounding Seabrook Station.

Impacts to aquatic resources and water quality would be similar to, but about one third smaller than, the impacts of Seabrook Station due to the gas-fired plant's use of the cooling water withdrawals from and discharges to the Atlantic Ocean. These impacts could be offset by the possible construction of cooling towers and the concurrent shutdown of Seabrook Station. NextEra Energy Seabrook considers that impacts to water resources would be SMALL. The stacks and boilers would have visual impacts but would be consistent with the industrial nature of the site. Impacts to cultural resources would be unlikely because the site has been surveyed with potentially affected cultural resources removed, and previously disturbed by the construction of Seabrook Station.

7.2.2.2 Coal-Fired Generation

The NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996e). The NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. The NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that NextEra Energy Seabrook has defined in Section 7.2.1.1 would be located at the Seabrook Station site.

Air Quality

A coal-fired plant would emit SO_2, NO_x, particulate matter, mercury (Hg), and CO, all of which are regulated pollutants. In addition, a coal-fired plant would produce CO_2, a greenhouse gas. As Section 7.2.1.1 indicates, NextEra Energy Seabrook has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Using data published by the Energy Information Administration (EIA 2008e, EIA 2007f) and the EPA (EPA 1998), the coal-fired alternative emissions are estimated to be as follows:

SO_2 = 4,238 tons per year

NOx = 865 tons per year

CO = 865 tons per year

CO_2 = 9,530,000 tons per year

Hg = 0.14 tons per year

Particulates:

PM_{10} (particulates having a diameter of less than 10 microns) = 26 tons per year

$PM_{2.5}$ (particulates having a diameter of less than 2.5 microns) = 7 tons per year

The discussion in Section 7.2.2.1 of regional air quality is applicable to the coal-fired generation alternative. In addition, the NRC noted in the GEIS that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. The NRC also mentioned global climate change and acid rain as potential impacts. In 2004 and 2005, the EPA issued a series of rules that removed coal-fired power plants from the Clean Air Act list of sources of hazardous air pollutants, including mercury. These rules were overturned by a U.S. Court of Appeals in February 2008. While the future is unclear, EPA likely will have to promulgate a new rule to address limits on mercury emissions.

NextEra Energy Seabrook concludes that federal legislation and large-scale issues, such as global climate change and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_2 emission allowances, mercury emission allowances, NO_x credits, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are now or likely will be in the future regulatorily-imposed mitigation measures. As such, NextEra Energy Seabrook concludes that the coal-fired alternative would have MODERATE to LARGE impacts on air quality; the impacts would be noticeable and greater than those of the gas-fired alternative.

Waste Management

NextEra Energy Seabrook concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume about 3.5 million tons of coal with an ash content of 6.63 percent. After combustion, 43 percent of this ash, approximately 99,291 tons per year, would be marketed for beneficial reuse. The remaining ash, approximately 130,000 tons per year, would be collected and disposed of onsite. In addition, approximately 114,000 tons of scrubber sludge would be disposed of on site each year (based on annual limestone usage of about 139,000 tons). NextEra Energy Seabrook estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 148 acres, or 74 acres during the 20-year license renewal term.

NextEra Energy Seabrook believes that proper siting, current waste management practices, and current waste monitoring practices would prevent waste disposal from destabilizing any resources. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, NextEra Energy Seabrook believes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be noticeable, but would not destabilize any important resource, and further mitigation would not be warranted.

Other Impacts

NextEra Energy Seabrook estimates that construction of the power block for a coal-fired plant would require 172 acres and ash disposal would require an additional 148 acres of land and associated terrestrial habitat over 40 years, or 74 acres over the 20-year license renewal term. Because much of this construction would be on previously disturbed land, impacts to land use and ecological resources would be SMALL to MODERATE.

Delivery of coal and limestone by barge would not be feasible because the plant site is more than a mile inland, the expense of constructing the facilities (a barge slip, an offloading facility and a conveyor system to the coal yard), and the effect on the terrestrial and aquatic habitats along the waterfront as well as aqueous habitat. Seabrook has assumed that construction of a new rail line would be needed for coal and limestone deliveries under this alternative.

NextEra Energy Seabrook estimates an average construction workforce of 996 employees with a peak of 1,924 workers. Socioeconomic impacts from the construction workforce would be minimal, if worker relocation is not required, which is assumed for a site near a large metropolitan area. NextEra Energy Seabrook estimates an operational workforce of 169 workers for the coal-fired alternative. This is a sizable reduction in operating personnel compared to Seabrook Station's 1,093 personnel, and the impact on the local community employment, taxes, housing, off-site land use, and public services could be significant. Because NextEra Energy Seabrook is the Town of

Seabrook's largest employer, reduction in workforce would result in adverse socioeconomic impacts characterized as MODERATE.

Impacts to aquatic resources and water quality would be similar to impacts of Seabrook Station, due to the new plant's use of the cooling water from and discharge to the Atlantic Ocean, but could be offset by the construction of cooling towers and concurrent shutdown of Seabrook Station; therefore NextEra Energy Seabrook concludes that impacts to aquatic resources would be SMALL. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of on site. The stacks and boilers would increase the adverse visual impact, especially to the local beaches. However, these impacts are consistent with the industrial nature of the site. Impacts to cultural resources would be unlikely because the site has been surveyed with potentially affected cultural resources removed, and previously disturbed by the construction of Seabrook Station. Impacts to aesthetic resources and cultural resources would be SMALL.

7.2.2.3 Construct and Operate New Nuclear Reactor

As discussed in Section 7.2.1.2, under the new nuclear reactor alternative NextEra Energy Seabrook would construct and operate a single unit nuclear plant using one of the four NRC certified standard designs for nuclear power plants.

Air Quality

Air quality impacts would be minimal. Air emissions are primarily from non-facility equipment and diesel generators and are comparable to those associated with the continued operation of Seabrook Station. Overall, emissions and associated impacts would be considered SMALL.

Waste Management

High level radioactive wastes would be similar to those associated with the continued operation of Seabrook Station. Low level radioactive waste impacts from a new nuclear plant would be slightly less, but similar to those generated by the continued operation of Seabrook Station. The overall impacts are characterized as SMALL.

Other Impacts

NextEra Energy Seabrook estimates that construction of the power block and auxiliary facilities would affect approximately 623 to 1,245 acres of land and associated terrestrial habitat. Although most of this construction would be on previously disturbed land, numerous off site locations would be needed for construction laydown due to the lack of available land on site. Areas previously used for construction of Seabrook Station have been developed and new sites would have to be located. Therefore, impacts at the Seabrook

Station site would be SMALL to MODERATE, but impacts to the local area due to changes in land use would be MODERATE. For the purposes of analysis, impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of on site.

NextEra Energy Seabrook estimates a peak construction work force of 4,788 persons and a permanent workforce comparable to Seabrook Station's current workforce. The surrounding communities would experience moderate to large demands on housing and public services during construction. After construction, the communities could be adversely impacted by the loss of jobs as construction workers moved on. Socioeconomic impacts during construction could be MODERATE and temporary. Long-term job opportunities would be comparable to continued operation of Seabrook Station; therefore NextEra Energy Seabrook concludes that the socioeconomic impacts during operation would be SMALL.

NextEra Energy Seabrook's assessment under 10 CFR 51 concludes that human health and electric shock impacts would be comparable to continued operation of Seabrook Station would be of SMALL.

Impacts to aquatic resources and water quality would be similar to impacts of Seabrook Station, due to the plant's use of the existing cooling water system that withdraws from and discharges to the Atlantic Ocean, and could be offset by the construction of cooling towers and concurrent shutdown of Seabrook Station. As concluded in Chapter 4, impacts to aquatic resources and water quality from current operations are SMALL.

NextEra Energy Seabrook estimates that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.4 Purchased Power

As discussed in Section 7.2.1.2, NextEra Energy Seabrook assumes that the generating technology used under the purchased power alternative would be one of those that the NRC analyzed in the GEIS. NextEra Energy Seabrook is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they likely would originate from a power plant located elsewhere in the ROI. NextEra Energy Seabrook believes that imports from outside the ISO-NE region would not be required. However, the replacement capacity, wherever located in the ROI, would have similar environmental impacts as those described above on a regional basis.

As also indicated in Section 7.2.1.2, new transmission lines would likely be essential for New Hampshire to meet the growing demand for electricity. Long-term power purchases, therefore, would require the construction of additional transmission capacity. Additions and changes to the present transmission network would occur on previously undisturbed land either along existing transmission line rights-of-way or along new transmission corridors. NextEra Energy Seabrook concludes that the land use impact of such transmission line additions would be SMALL to MODERATE. In general, land use changes would be so minor that they would neither destabilize nor noticeably alter any important land use resources. Given the potential length of new transmission corridors into New Hampshire, it is reasonable to assume that, in some cases, land use changes would be clearly noticeable, which is a characteristic of an impact that is MODERATE.

NextEra Energy Seabrook believes that impacts associated with the purchase of power, including those to socioeconomics, waste management and aesthetics would be SMALL to MODERATE; the impacts could be noticeable, but would not destabilize any important resource, and further mitigation would not be warranted. Impacts to air quality could be SMALL to LARGE, depending on the technologies used to replace the power.

Table 7.2-1 Gas-Fired Alternative

Characteristic	Basis
Plant size = 1,245 MWe ISO rating net combined cycle consisting of three 415-MWe systems with heat recovery steam generators	Manufacturer's standard size gas-fired combined-cycle plant (GE Energy 2009)
Plant size = 1,297 MWe ISO rating gross	Based on 4 percent onsite power usage
Number of Units = 3	Assumed
Fuel type = natural gas	Assumed
Fuel heating value = 1,043 Btu/ft^3	2006 value for gas used in New Hampshire (EIA 2007e)
Annual gas consumption = 5.6 X 10^{10} ft^3	Calculated (Tetra Tech 2009d)
Fuel SOx content = 0.00066 lb/MMBtu	(EPA 2000a; INGAAF 2000)
NOx control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NOx emissions (EPA 2000a)
Fuel NOx content = 0.0109 lb/MMBtu	Typical for large selective catalytic reduction-controlled gas-fired units with water injection (EPA 2000b)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas-fired units (EPA 2000b)
Fuel PM10 content = 0.0019 lb/MMBtu	(EPA 2000a)
Heat rate = 5,690 Btu/kWh	Average of all Units (GE Energy 2009)
Capacity factor = 0.90	Assumed based on performance of modern base-load plants

Note: The difference between "net" and "gross" is electricity consumed onsite for plant operations.
The heat recovery steam generators do not contribute to air emissions.

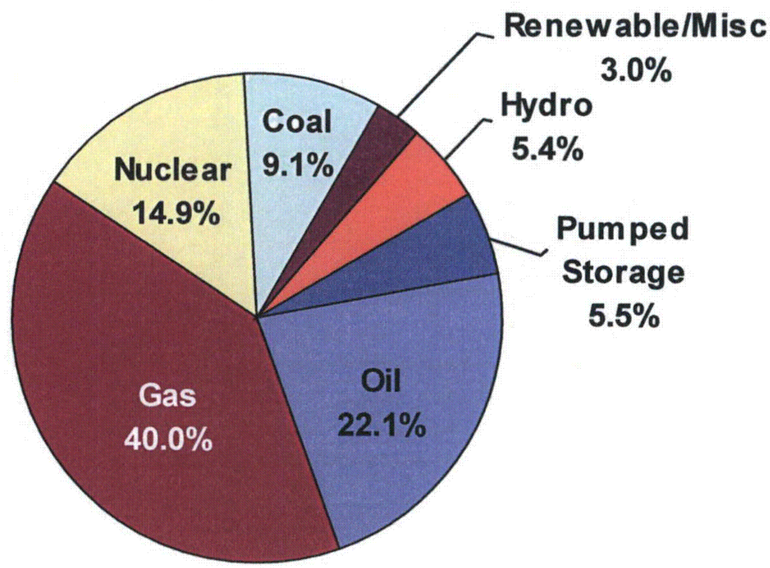
Btu = British thermal Unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
lb = pound
MM = million
MWe = megawatt electrical
NOx = nitrogen oxides
PM_{10} = particulates having diameter of 10 microns or less
SOx = oxides of sulfur

Table 7.2-2 Coal-Fired Alternative

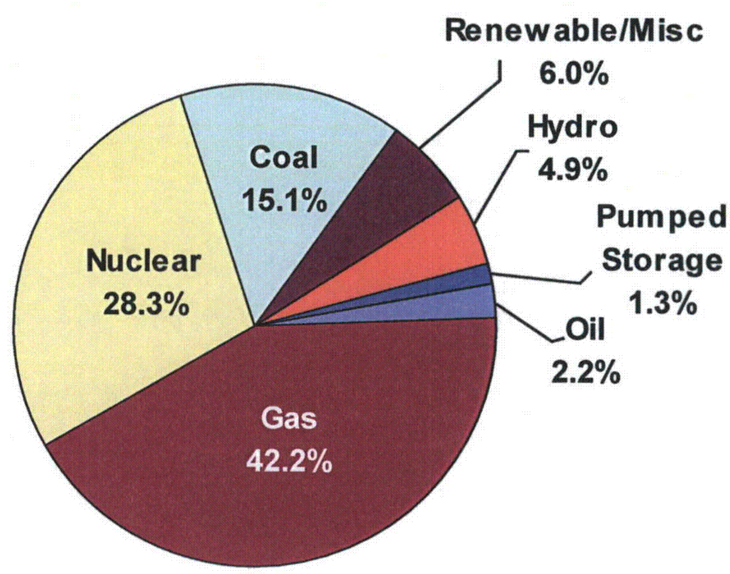
Characteristic	Basis
Plant size = 1,245 MWe ISO rating net consisting of three 415-MWe (net) units	Size set equal to gas-fired alternative
Plant size = 1,324 MWe ISO rating gross	Based on 6 percent onsite power usage
Number of Units = 3	Assumed
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998)
Fuel type = bituminous, pulverized coal	Typical for coal used in New Hampshire
Fuel heating value = 13,196 Btu/lb	2006 value for coal used in New Hampshire (EIA 2007e)
Fuel ash content by weight = 6.63 percent	2006 value for coal used in New Hampshire (EIA 2007e)
Annual Coal Consumption = 3.46 X 10^6 tons	Calculated (Tetra Tech 2009d)
Fuel sulfur content by weight = 1.29 percent	2006 value for coal used in New Hampshire (EIA 2007e)
Uncontrolled NOx emission = 10.0 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998)
Heat rate = 8,740 Btu/kWh	Estimated heat rate of supercritical coal-fired boilers going online in 2025 (EIA 2008e)
Capacity factor = 0.90	Typical for large coal-fired units
NOx control = low NOx burners, over-fire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NOx emissions (EPA 1998)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998)
SOx control = Wet scrubber - limestone (95 percent removal efficiency)	Best available for minimizing SOx emissions (EPA 1998)

Note: The difference between "net" and "gross" is electricity consumed onsite for plant operation.

Btu = British thermal Unit
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
NSPS = New Source Performance Standard
lb = pound
MWe = megawatt electrical
NOx = nitrogen oxides
SOx = oxides of sulfur



Generating Capacity (2007)



Energy Output By Fuel Type (2007)

Figure 7.2-1 ISO-NE Region Generation and Capacity

8.0 COMPARISON OF ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts of Seabrook Station license renewal and Chapter 7 analyzes impacts of reasonable alternatives. Table 8.0-1 summarizes environmental impacts of the proposed action (license renewal) and the reasonable alternatives, for comparison purposes. The environmental impacts compared in Table 8.0-1 are those that are either Category 2 issues for the proposed action or are issues that the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996e) identified as major considerations in an alternatives analysis. For example, although the NRC concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8.0-1 includes a comparison of the air impacts from the proposed action to those of the alternatives. Table 8.0-2 is a more detailed comparison of the alternatives.

Table 8.0-1 Impacts Comparison Summary

Impact	Proposed Action (License Renewal)	No-Action Alternatives: Base (Decommissioning)	With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	SMALL	MODERATE to LARGE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL to MODERATE	MODERATE	MODERATE	MODERATE
Waste Management	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

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, any important attribute of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resources. (10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3)

Table 8.0-2 Impacts Comparison Detail

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Alternative Descriptions			
Seabrook Station license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current Seabrook Station license. Adoption by reference of bounding decommissioning description in GEIS (NRC 1996e)	New construction at the existing site (Section 7.2.1.2)	New construction at the existing site (Section 7.2.1.1)	New construction at the existing site (Section 7.2.1.1)	Would involve construction of new generation capacity in the ISO-NE region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.3)
		Construction of new rail line	Construction of new rail line	Construct 20-inch diameter gas pipeline in a 100-ft wide corridor. May require upgrades to existing pipelines	Construct new transmission lines to interconnect to the ISO-NE region
		Single unit nuclear plant using one of the four NRC certified standard designs for nuclear power plants	Three 415-MWe (gross) [400 MWe (net)] tangentially fired, dry-bottom units producing a combined total of 1,245 MWe net; capacity factor 0.90	Three pre-engineered 415-MWe (gross) [400 MWe (net)] gas-fired combined-cycle systems with heat recovery steam generators, producing combined total of 1,245 MWe; capacity factor: 0.90	

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Modify intake/discharge system	Modify intake/discharge system	Modify intake/discharge system	
			Pulverized bituminous coal, 13,196 Btu/lb; 8,740 Btu/kWh; 6.63% ash; 1.29% sulfur; 10 lb/ton nitrogen oxides; 3.46×10^6 tons coal/yr	Natural gas, 1,043 Btu/ft^3; 5,690 Btu/kWh; 0.00066 lb SO_X/MMBtu; 0.0109 lb NO_X/MMBtu; 5.6×10^{10} ft^3 gas/yr	
			Low NO_X burners, over-fire air and selective catalytic reduction (95% NO_X reduction efficiency)	Selective catalytic reduction with steam/water injection	
			Wet scrubber – lime/limestone desulfurization system (95% SO_X removal efficiency); 139,235 tons lime/yr		
			Fabric filters 99.9% particulate removal efficiency)		
1,093 permanent and long-term contract employees at Seabrook Station (Section 3.4)		1,093 workers (Section 7.2.2.3)	169 workers (Section 7.2.2.2)	47 workers (Section 7.2.2.1)	

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Land Use Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996e)	SMALL to MODERATE – 623 to 1,245 acres required for construction of the power block and associated facilities at Seabrook Station location. Off site locations needed for storage during construction (Section 7.2.2.3)	SMALL to MODERATE –172 acres required for the power block and associated facilities at Seabrook Station location; 74 acres for ash disposal during 20-year license renewal term (Section 7.2.2.2)	SMALL–44 acres for facility at Seabrook Station location (Section 7.2.2.1). New gas pipeline would be built to connect with existing gas pipeline corridor	SMALL to MODERATE – Most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3) Adopting by reference GEIS description of land use impacts from alternate (NRC 1996e)
		Water Quality Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 4 and 7, 9-12, and 37). No Category 2 issues apply (Section 4.1, Issue 13; Section 4.5, Issue 33; Section 4.6, Issue 34; Section 4.7, Issue 35; and Section 4.8, Issue 39).	SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to Seabrook Station by using cooling water and discharge to the Atlantic Ocean. (Section 7.2.2.3)	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to Seabrook Station by using cooling water and discharge to the Atlantic Ocean. (Section 7.2.2.2)	SMALL – Water demands would be one third of those from operation of Seabrook Station. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996e)

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	Base (Decommissioning)	With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Air Quality Impacts			
SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 51). One Category 2 issue does not apply (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issue 88)	SMALL – Air emissions are primarily from non-facility equipment and diesel generators and are comparable to those associated with the continued operation of Seabrook Station (Section 7.2.2.3)	MODERATE to LARGE – 4,238 tons SO_X/yr 865 tons NO_X/yr 865 tons CO/yr 9,530,000 tons CO_2/yr 7 tons $PM_{2.5}$/yr 26 tons PM_{10}/yr 0.14 tons mercury/yr (Section 7.2.2.2)	MODERATE – 19 tons SO_X/yr 317 tons NO_X/yr 66 tons CO/yr 3,200,000 tons CO_2/yr 55 tons $PM_{2.5}$/yr (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996e)
		Ecological Resource Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 15-24, and 45-48). One Category 2 issue does not apply (Section 4.9, Issue 40). Entrainment and impingement mitigation measures are already in place and there are no demonstrated adverse impacts (Section 4.2, Issue 25; Section 4.3, Issue 26). Thermal requirements of NPDES permit are being met and no demonstrated impacts due to the thermal discharge (Section 4.4, Issue 27).	SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 90)	SMALL to MODERATE –623 to 1245 acres of land would be required for the construction of the power block and associated facilities at Seabrook Station location. Off site locations needed for storage during construction; some would be previously undisturbed land and associated terrestrial habitat (Section 7.2.2.3)	SMALL to MODERATE –172 acres of the existing site could be required for the power block and associated facilities at Seabrook Station location. 74 acres of the existing site could be required for ash/sludge disposal during 20-year license renewal term. (Section 7.2.2.2)	SMALL – Pipeline would be routed along existing rights-of-way to minimize impacts (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996e)

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
Threatened or Endangered Species Impacts					
SMALL – NextEra Energy Seabrook, FPL New England Division, PSNH, and NGRID have no plans to alter current operations and maintenance practices and there are no current impacts to threatened or endangered species. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996e)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts					
SMALL – Adopting by reference Category 1 issues (Attachment A, Table A-1, Issues 58, 61, 62). One Category 2 issue does not apply (Section 4.12, Issue 57). Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 86)	SMALL – Adopting by reference GEIS conclusion that risks would be comparable to continued operation of an existing nuclear plant (NRC 1996e)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996e)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996e)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996e)

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**With New Nuclear Power**	**With Coal-Fired Generation**	**With Gas-Fired Generation**	**With Purchased Power**
		Socioeconomic Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 64, 67). Two Category 2 issues findings are not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Location in high population area with no growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Plant property tax payment represents more than 20 percent of the taxes paid to the Town of Seabrook and less than 10 percent of other taxing entities' net tax commitments. No population growth is expected (Section 4.17.2, Issue 69). Public utilities and transportation would not be affected because no additional employees are expected (Section 4.15, Issue 65; and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 91)	SMALL – Long-term job opportunities would be comparable to continued operation of Seabrook Station (Section 7.2.2.3)	MODERATE – Reduction in permanent workforce at Seabrook Station could adversely affect surrounding counties. (Section 7.2.2.2)	MODERATE – Reduction in permanent workforce at Seabrook Station could adversely affect surrounding counties. (Section 7.2.2.1)	MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996e)

Table 8.0-2 Impacts Comparison Detail (Continued).

		No-Action Alternatives			
Proposed Action (License Renewal)	Base (Decommissioning)	With New Nuclear Power	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Waste Management Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Attachment A, Table A-1, Issue 87)	SMALL – Radioactive wastes would be similar to those associated with the continued operation of Seabrook Station. (Section 7.2.2.3)	MODERATE –130,000 tons of coal ash and 114,000 tons of scrubber sludge annually would require 74 acres during 20-year license renewal term. (Section 7.2.2.2)	SMALL – The only noteworthy waste would be from spent selective catalytic reduction (SCR) used for NOx control. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies. (NRC 1996e)
		Aesthetic Impacts			
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996e)	SMALL – Visual impacts would be comparable to those from existing Seabrook Station facilities. (Section 7.2.2.3)	SMALL – Steam turbines and stacks would be comparable to those from existing Seabrook Station facilities. (Section 7.2.2.2)	SMALL– Steam turbines and stacks would be comparable to those from existing Seabrook Station facilities. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies. (NRC 1996e)

Table 8.0-2 Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives: With New Nuclear Power	No-Action Alternatives: With Coal-Fired Generation	No-Action Alternatives: With Gas-Fired Generation	No-Action Alternatives: With Purchased Power
Cultural Resource Impacts					
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71). No new facilities are planned.	SMALL – Not an impact evaluated by GEIS. (NRC 1996e)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.3)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.2)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. (Section 7.2.2.1)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies. (NRC 1996e)

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, any important attribute of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resources. (10 CFR 51, Subpart A, Appendix B, Table B 1, Footnote 3).

All particulate emissions for the gas-fired alternative are $PM_{2.5}$.

Btu = British thermal unit
CO = carbon monoxide
CO_2 = carbon dioxide
ft^3 = cubic foot
gal = gallon
GEIS= Generic Environmental Impact Statement (NRC 1996e)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
MWe = megawatt-electric
NGRID = National Grid
NOX = nitrogen oxides
ISO-NE = regional electric distribution network
$PM_{2.5}$ = particulates having diameter less than 2.5 microns
PM_{10} = particulates having diameter less than 10 microns
PSNH = Public Service Company of New Hampshire
SHPO = State Historic Preservation Officer
SOX = sulfur oxides
yr = year

9.0 STATUS OF COMPLIANCE

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection...." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9.1-1 lists environmental authorizations for current Seabrook Station operations. In this context "authorizations" includes any permits, licenses, approvals, or other entitlements. NextEra Energy Seabrook expects to continue renewing these authorizations during the current license period and through the license renewal period. Based on the new and significant information identification process described in Chapter 5, NextEra Energy Seabrook concludes that Seabrook Station is in compliance with applicable environmental standards and requirements.

Table 9.1-2 lists additional environmental authorizations and consultations related to NextEra Energy Seabrook's renewal of the Seabrook Station license to operate. As indicated, NextEra Energy Seabrook anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 THREATENED OR ENDANGERED SPECIES

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency actions are not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. USFWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and USFWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, NextEra Energy Seabrook has chosen to invite comment from both federal and state agencies regarding potential effects that Seabrook Station license renewal might have on threatened and endangered species. Attachment C includes copies of NextEra Energy Seabrook correspondence with USFWS, NMFS, the New Hampshire Natural Heritage Bureau, and the Massachusetts

Division of Fisheries and Wildlife. The USFWS response indicated that the proposed action (license renewal) is not likely to adversely affect any species proposed for federal listing, any species currently listed as threatened or endangered, or any designated critical habitat.

9.1.3 COASTAL ZONE MANAGEMENT PROGRAM COMPLIANCE

The Federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program [16 USC 1456(c)(3)(A)]. The National Oceanic and Atmospheric Administration has promulgated implementing regulations indicating that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provide its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the Act (NRC 2004b). This guidance acknowledges that New Hampshire has an approved coastal zone management program (NRC 2004b). Seabrook Station is within the New Hampshire coastal zone (NHDES 2005b). Concurrent with submitting the Applicant's Environmental Report – Operating License Renewal Stage to the NRC, NextEra Energy Seabrook submitted a copy of the Environmental Report, including the Coastal Zone Consistency Certification (Attachment E of this document) to the New Hampshire Department of Environmental Services in fulfillment of the regulatory requirement for submitting a copy of the coastal zone consistency certification to the state.

9.1.4 HISTORIC PRESERVATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking, prior to issuing the license, to take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation (Council) an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Council review (36 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, NextEra Energy Seabrook has chosen to invite comment by the New Hampshire SHPO and the Massachusetts SHPO. Attachment D includes copies of NextEra Energy Seabrook's letters to the New Hampshire Division of Historic Resources, State Historic Preservation Office, the Massachusetts Historical Commission, State Historic Preservation Office, and the SHPO's responses, which indicated that the 20-year license renewal has

"No potential to cause effects to historic resources" in New Hampshire, and that the Massachusetts Historical Commission "has no concerns."

9.1.5 WATER QUALITY (401) CERTIFICATION

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state or EPA, if the state does not have such authority, that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). The NRC has indicated in its Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants (GEIS) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification (NRC 1996e). The Section 401 certification for Seabrook Station was issued to Public Service Company of New Hampshire by the New Hampshire Water Supply and Pollution Central Committee on May 13, 1985. The NPDES permit for Seabrook Station provides continuing assurance of compliance with the standards and requirements established under the Clean Water Act. Attachment B contains the current Seabrook Station NPDES permit and a letter from the State of New Hampshire certifying the proposed NDPES permit prior to its original issuance.

9.1.6 MARINE MAMMALS

The Marine Mammal Protection Act (16 USC 1361 et seq.) provides for the incidental take of protected species. In 1999, the NMFS issued an incidental, small take authorization for seals at Seabrook Station because seals had been entrapped in the station's intake system (50 CFR 216.130 – 216.137; NMFS 1999). Later in 1999 the station modified the intake to prevent seals from entering the system (Section 2.2.2). In 2002, NMFS noted that the station's annual report indicated that no seals had been entrapped since the modification (NMFS 2002). NMFS has not renewed the authorization, which was effective through June 30, 2004.

Table 9.1-1 Environmental Authorizations for Current[a] Seabrook Station Operations

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
		Federal and State Requirements			
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	NPF-86 (NRC 2008)	Issued: 03/15/1990 Expires: 3/15/2030	Operation of Seabrook Station
U.S. Environmental Protection Agency, Region 1	Clean Water Act (33 USC Section 1251 et seq.)	NPDES Permit	NH0020338 (EPA 2002a and Seabrook 2006b)	Issued: 04/01/2002 Expired: 04/01/2007 Renewal application submitted: 09/25/2006	Discharges to Atlantic Ocean from cooling tunnel
U.S. Environmental Protection Agency, Region 1	Clean Water Act (33 USC Section 1251 et seq.)	NPDES Storm Water Multi-Sector General Permit for Industrial Activities	Notice of Intent #NHR05A729 (EPA 2002b)	Issued: 9/29/2008 Expires: 9/29/2013	Storm water
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration	49 USC 5108, Transportation registration; 49 CFR 107, Subpart G, Hazardous material shipper/carrier registration	Hazardous Materials Certificate of Registration	061109 003 013RT (USDOT 2009)	Issued: 6/15/2009 Expires: 6/30/2012	Transportation of hazardous materials.
Town of Seabrook	Article IV of Municipal Sewer System Ordinance	Permit to Discharge	SEA1003 (Town of Seabrook 2007b and Town of Seabrook 2010)	Issued: 03/21/2007 Expires: 03/20/2010 Renewal application submitted: 01/18/2010	Industrial wastewater discharge to Town's Publically Owned Treatment Works (POTW)
New Hampshire Department of Environmental Services, Waste Management Division	New Hampshire Code of Administrative Rules Env-A 1205	Certificate of Compliance	021207930308A (NHDES 2008d)	Issued: 03/20/2008 Expires:12/11/2010	Stage I/II Gasoline Vapor Recovery System
New Hampshire Department Environmental Services, Air Resources Division	Federal Clean Air Act (42 USC 7401), 40 CFR 70, and New Hampshire Code of Administrative Rules, ENV-A 610	Title V General Permit	GSP-EG-225 (NHDES 2008e)	Issued: 7/2/2008 Expires:04/30/2013	Air Emissions from Internal Combustion Emergency Generator (EG#1)

Table 9.1-1 Environmental Authorizations for Current[a] Seabrook Station Operations (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
		Federal and State Requirements			
New Hampshire Department Environmental Services, Air Resources Division	Federal Clean Air Act (42 USC 7401), 40 CFR 70, and New Hampshire RSA 125-C	Title V Operating Permit	TP-OV-017 (NHDES 2006)	Issued: 06/05/2006 Expires:06/30/2011	Air emissions from auxiliary boilers and emergency generators
New Hampshire Department of Environmental Services, Waste Management Division	New Hampshire Code of Administrative Rules, ENV-WM 300	Hazardous Waste Limited Permit	DES-HW-LP-02-09 (NHDES 2005a)	Issued: 10/09/2008 Expires: 10/09/2013	Treatment of hazardous wastewater streams
New Hampshire Department of Environmental Services, Waste Management Division	New Hampshire Code of Administrative Rules, ENV-WM-1400	Aboveground Storage Tank Registration	Facility ID# 930908A (NHDES 2008f)	Issued: 12/24/2007 Expires:none	Aboveground tanks
New Hampshire Fish and Game Department	New Hampshire RSA 214:29	Permit to Display Finfish and Invertebrates	MFD 0801 (NHDFG 2010)	Issued: 01/04/2010 Expires:12/31/2010	Display of finfish and invertebrates at the Science and Nature Center
Virginia Department of Emergency Management	Title 44, Code of Virginia, Chapter 3.3, Section 44-146.30	Registration to transport radioactive material	FP-S-103110 (Virginia 2008)	Issued: 09/17/2008 Expires:10/31/2010	Registration for transporting radioactive material in Virginia
Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to deliver radioactive material	T-NH001-L10 (TNDEC 2009)	Issued: 1/1/2010 Expires:12/31/2010	License to deliver radioactive material to processing facility in Tennessee
Utah Department of Environmental Quality	Utah Rule 313-26	Permit to deliver radioactive material	0111000045 (UTDEQ 2009)	Issued: 4/28/2009 Expires:4/28/2010	Permit to deliver radioactive material to disposal facility in Utah

NPDES – National Pollutant Discharge Elimination System
[a] Current through March 1, 2010.

Table 9.1-2 Environmental Authorizations for Seabrook Station License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the USFWS (Attachment C)
National Marine Fisheries Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the NMFS (Attachment C)
New Hampshire Department of Resources and Economic Development	Clean Water Act Section 401 (33 USC 1341)	Certification	Requires State certification that proposed action would comply with Clean Water Act standards (Attachment B)
New Hampshire Division of Historical Resources	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Attachment D)
Massachusetts Historical Commission	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Attachment D)
New Hampshire Department of Environmental Services	The Federal Coastal Zone Management Act (16 USC 1451)	Coastal Zone Consistency Certification	Requires the federal agency issuing the license (NRC) to verify that the State of New Hampshire has determined that renewal of the Seabrook Station operating license would be consistent with the federally approved State Coastal Zone Management program. The applicant (NextEra Energy Seabrook) must request the consistency determination from the New Hampshire Department of Environmental Services by submitting a certification of consistency for review. (Attachment E)

9.2 ALTERNATIVES

NRC

"...The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The new nuclear, coal- and gas-fired alternatives discussed in Chapter 7 can be constructed and operated to comply with all applicable environmental quality standards and requirements.

10.0 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in NextEra Energy Seabrook files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by NextEra Energy Seabrook have been given for these pages, even though they may not be directly accessible.

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ATTACHMENT A

NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

NextEra Energy Seabrook, LLC (NextEra Energy Seabrook) has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants. Table A-1 lists these 92 issues and identifies the section in which NextEra Energy Seabrook addressed each applicable issue in the environmental report. For organization and clarity, NextEra Energy Seabrook has assigned a number to each issue and uses the issue numbers throughout the environmental report.

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a]

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
Surface Water Quality, Hydrology, and Use (for all plants)			
1. Impacts of refurbishment on surface water quality	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
2. Impacts of refurbishment on surface water use	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
3. Altered current patterns at intake and discharge structures	1	NA	Issue applies to a plant feature, withdrawal from or discharge to a small body of water, which Seabrook does not have.
4. Altered salinity gradients	1	4.0	4.2.1.2.2/4-4
5. Altered thermal stratification of lakes	1	NA	Issue applies to a plant feature, discharge to a lake, which Seabrook does not have.
6. Temperature effects on sediment transport capacity	1	NA	Issue applies to a plant feature, discharge to a river, which Seabrook does not have.
7. Scouring caused by discharged cooling water	1	4.0	4.2.1.2.3/4-6
8. Eutrophication	1	NA	Issue applies to a plant feature, withdrawal from or discharge to a small body of water, which Seabrook does not have.
9. Discharge of chlorine or other biocides	1	4.0	4.2.1.2.4/4-10
10. Discharge of sanitary wastes and minor chemical spills	1	4.0	4.2.1.2.4/4-10
11. Discharge of other metals in waste water	1	4.0	4.2.1.2.4/4-10
12. Water use conflicts (plants with once-through cooling systems)	1	4.0	4.2.1.3/4-13

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
13. Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	Identified as NA in 4.1	Issue applies to plant features, cooling pond, cooling towers, and withdrawal from or discharge to a small body of water, which Seabrook does not have.
14. Refurbishment impacts to aquatic resources	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
Aquatic Ecology (for all plants)			
15. Accumulation of contaminants in sediments or biota	1	4.0	4.2.1.2.4/4-10
16. Entrainment of phytoplankton and zooplankton	1	4.0	4.2.2.1.1/4-15
17. Cold shock	1	4.0	4.2.2.1.5/4-18
18. Thermal plume barrier to migrating fish	1	4.0	4.2.2.1.6/4-19
19. Distribution of aquatic organisms	1	4.0	4.2.2.1.6/4-19
20. Premature emergence of aquatic insects	1	4.0	4.2.2.1.7/4-20
21. Gas supersaturation (gas bubble disease)	1	4.0	4.2.2.1.8/4-21
22. Low dissolved oxygen in the discharge	1	4.0	4.2.2.1.9/4-23
23. Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.0	4.2.2.1.10/4-24
24. Stimulation of nuisance organisms (e.g., shipworms)	1	4.0	4.2.2.1.11/4-25
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)			
25. Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2	4.2.2.1.2/4-16

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
26. Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3	4.2.2.1.3/4-16
27 Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4	4.2.2.1.4/4-17
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)			
28. Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
29. Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
30. Heat shock for plants with cooling-tower-based heat dissipation systems	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
Ground-water Use and Quality			
31. Impacts of refurbishment on groundwater use and quality	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	NA	Issue applies to a plant feature, groundwater use, which Seabrook does not have.
33. Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	Identified as NA in 4.5	Issue applies to a plant feature, groundwater use, which Seabrook does not have.
34. Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	Identified as NA in 4.6	Issue applies to a plant feature, withdrawal from a small body of water, which Seabrook does not have.
35. Groundwater use conflicts (Ranney wells)	2	Identified as NA in 4.7	Issue applies to a feature, Ranney wells, which Seabrook does not have.

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
36. Groundwater quality degradation (Ranney wells)	1	NA	Issue applies to a feature, Ranney wells, which Seabrook does not have.
37. Groundwater quality degradation (saltwater intrusion)	1	4.0	4.8.2/4-118
38. Groundwater quality degradation (cooling ponds in salt marshes)	1	NA	Issue applies to a feature, cooling ponds, which Seabrook does not have.
39. Groundwater quality degradation (cooling ponds at inland sites)	2	Identified as NA in 4.8	Issue applies to a feature, cooling ponds, which Seabrook does not have.
Terrestrial Resources			
40. Refurbishment impacts to terrestrial resources	2	Identified as NA in 4.9	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
41. Cooling tower impacts on crops and ornamental vegetation	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
42. Cooling tower impacts on native plants	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
43. Bird collisions with cooling towers	1	NA	Issue applies to a feature, cooling towers, which Seabrook does not have.
44. Cooling pond impacts on terrestrial resources	1	NA	Issue applies to a feature, cooling ponds, which Seabrook does not have.
45. Power line right-of-way management (cutting and herbicide application)	1	4.0	4.5.6.1/4-71
46. Bird collisions with power lines	1	4.0	4.5.6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0	4.5.6.3/4-77
48. Floodplains and wetlands on power line right-of-way	1	4.0	4.5.7/4-81

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
Threatened or Endangered Species (for all plants)			
49. Threatened or endangered species	2	4.10	4.1/4-1
Air Quality			
50. Air quality during refurbishment (non-attainment and maintenance areas)	2	Identified as NA in 4.11	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
51. Air quality effects of transmission lines	1	4.0	4.5.2/4-62
Land Use			
52. Onsite land use	1	4.0	3.2/3-1
53. Power line right-of-way land use impacts	1	4.0	4.5.3/4-62
Human Health			
54. Radiation exposures to the public during refurbishment	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
55. Occupational radiation exposures during refurbishment	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
56. Microbiological organisms (occupational health)	1	NA	Issue applies to a plant feature, circulating water system cooling towers, which Seabrook does not have.
57. Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	Identified as NA in 4.12	Issue applies to a plant feature, withdrawal from or discharge to a small river, which Seabrook does not have.
58. Noise	1	4.0	4.3.7/4-49
59. Electromagnetic fields, acute effects (electric shock)	2	4.13	4.5.4.1/4-66
60. Electromagnetic fields, chronic effects	NA	4.0	NA – Not applicable. The categorization and impact finding definitions do not apply to this issue.

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
61. Radiation exposures to public (license renewal term)	1	4.0	4.6.2/4-87
62. Occupational radiation exposures (license renewal term)	1	4.0	4.6.3/4-95
		Socioeconomics	
63. Housing impacts	2	4.14	3.7.2/3-10 (refurbishment) 4.7.1/4-101 (renewal term)
64. Public services: public safety, social services, and tourism and recreation	1	4.0	Refurbishment 3.7.4/3-14 (public services) 3.7.4.3/3-18 (safety) 3.7.4.4/3-19 (social) 3.7.4.6/3-20 (tour, rec) Renewal Term 4.7.3/4-104 (public services) 4.7.3.3/4-106 (safety) 4.7.3.4/4-107 (social) 4.7.3.6/4-107 (tour, rec)
65. Public services: public utilities	2	4.15	3.7.4.5/3-19 (refurbishment) 4.7.3.5/4-107 (renewal term)
66. Public services: education (refurbishment)	2	Identified as NA in 4.16	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
67. Public services: education (license renewal term)	1	4.0	4.7.3.1/4-106
68. Offsite land use (refurbishment)	2	Identified as NA in 4.17.1	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.
69. Offsite land use (license renewal term)	2	4.17.2	4.7.4/4-107
70. Public services: transportation	2	4.18	3.7.4.2/3-17 (refurbishment) 4.7.3.2/4-106 (renewal term)
71. Historic and archaeological resources	2	4.19	3.7.7/3-23 (refurbishment) 4.7.7/4-114 (renewal term)
72. Aesthetic impacts (refurbishment)	1	NA	Issue applies to an activity, refurbishment, which Seabrook does not plan to conduct.

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
73. Aesthetic impacts (license renewal term)	1	4.0	4.7.6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	1	4.0	4.5.8/4-83
Postulated Accidents			
75. Design basis accidents	1	4.0	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)
76. Severe accidents	2	4.20	5.3.3/5-12 (probabilistic analysis) 5.3.3.2/5-19 (air dose) 5.3.3.3/5-49 (water) 5.3.3.4/5-65 (groundwater) 5.3.3.5/5-96 (economic) 5.4/5-106 (mitigation) 5.5.2/5-114 (summary)
Uranium Fuel Cycle and Waste Management			
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0	6.2/6-8
78. Offsite radiological impacts (collective effects)	1	4.0	Not in GEIS.
79. Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0	Not in GEIS.
80. Nonradiological impacts of the uranium fuel cycle	1	4.0	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical)
81. Low-level waste storage and disposal	1	4.0	6.4.2/6-36 (low-level definition) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects)
82. Mixed waste storage and disposal	1	4.0	6.4.5/6-63
83. Onsite spent fuel	1	4.0	6.4.6/6-70
84. Nonradiological waste	1	4.0	6.5/6-86
85. Transportation	1	4.0	6.3/6-31, as revised by Addendum 1, August 1999.

Table A-1 Seabrook Environmental Report Discussion of License Renewal NEPA Issues[a] (Continued)

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
Decommissioning			
86. Radiation doses (decommissioning)	1	4.0	7.3.1/7-15
87. Waste management (decommissioning)	1	4.0	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88. Air quality (decommissioning)	1	4.0	7.3.3/7-21 (air) 7.4/7-25 (conclusion)
89. Water quality (decommissioning)	1	4.0	7.3.4/7-21 (water) 7.4/7-25 (conclusion)
90. Ecological resources (decommissioning)	1	4.0	7.3.5/7-21 (ecological) 7.4/7-25 (conclusion)
91. Socioeconomic impacts (decommissioning)	1	4.0	7.3.7/7-24 (socioeconomic) 7.4/7-25 (conclusion)
Environmental Justice			
92. Environmental justice	NA	4.0	NA – Not applicable. The categorization and impact finding definitions do not apply to this issue.

a. Source: 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Source: Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437).
NEPA = National Environmental Policy Act.

ATTACHMENT B

CLEAN WATER ACT DOCUMENTATION

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act, as amended, (33 U.S.C. Sections 1251 et seq.; the "CWA"),

FPL Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

is authorized to discharge from a facility located at

FPL Energy Seabrook, LLC
Seabrook Station
Lafayette Road
Seabrook, NH

to receiving water named

Atlantic Ocean

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on April 1, 2002.

This permit and the authorization to discharge expire at midnight, five years from the effective date.

This permit supersedes the permit issued on September 30, 1993

This permit consists of 30 pages in Part I including effluent limitations, monitoring requirements, etc., 19 pages in Part II including General Conditions and Definitions, [illegible] Attachment A, 1 page in Attachment B, 11 pages in Attachment C, and [illegible] pages in [illegible] D.

Signed this 12 day of February, 2002

Linda M. Murphy
Director, Office of Ecosystem Protection
U.S. Environmental Protection Agency
Region I

This permit is transferred to FPL Energy Seabrook, LLC
Signed this 24th day of 2002, DECEMBER

Linda M. Murphy, Director, Office of Ecosystem Protection

PART I

A. **Effluent Limitations and Monitoring Requirements**

1. This permit shall be modified, revoked or reissued to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b) (2), and 307(a) (2) of the CWA, if the effluent standard or limitation so issued or approved:

   a. contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

   b. controls any pollutant not limited by this permit.

   If the permit is modified or reissued, it shall be revised to reflect all currently applicable requirements of the CWA.

2. The design, construction and capacity of all components of the cooling water system seaward of the inlets to the main condensers or other heat exchangers ("Cooling Water System") of Seabrook Station shall comply with the following:

   a. The permittee shall use and maintain an anti-fouling protective coating on all appropriate components of the intake structures. The permittee shall perform manual cleaning of the intake structures twice per year.

   b. The velocity of water as it enters the intake structures shall at no time exceed 1.0 foot per second.

   c. The intake structures shall incorporate such behavioral or other deterrents or barriers as the Regional Administrator determines to be appropriate. This determination will be made under Section 316(b) of the Clean Water Act after reviewing the results of any studies or other information provided by the permittee.

   d. The Regional Administrator has determined that the Cooling Water Intake System, as presently designed, employs the best technology available for minimizing adverse environmental impact. Therefore, no change in the location, design or capacity of the present system can be made without prior approval of the Regional Administrator and the Director. The present design shall be reviewed for conformity to regulations pursuant to Section 316(b) when such are promulgated.

3. Should the intake tunnel and/or discharge tunnel require dewatering during an emergency condition, the permittee shall submit to the Regional Administrator and the Director an Emergency Dewatering Plan for their approvals as required in Paragraphs II.B.4 and II.B.5 of this permit which define "Bypass" and "Upset" operating conditions.

4. All material shall be removed from the traveling screens and disposed of in accordance with all existing Federal, State, and/or Local laws and regulations that apply to waste disposal. Such material shall not be returned to the receiving waters.

5. Chlorine and/or EVAC™ may be used as a biocide. No other biocide shall be used without explicit approval from the Regional Administrator and the Director.

6. The permittee shall submit an annual Chlorine Minimization Report to the Regional Administrator and the Director. The objective of this chlorination report is to document the amount of chlorine used to maintain suitable biofouling control of the intake cooling water system and thereby maintaining a high condenser efficiency.. The Chlorine Minimization Report should include, at a minimum:

   a. The seasonal chlorination cycle employed during the reporting period: the months the system was chlorinated, the sodium hypochlorite dosage level, the TRO reported in the Discharge Monitoring Reports, an evaluation of the chlorine demand of the marine water, and the results of any inspections of the intake structures by divers or robots.

   b. The permittee shall report on the likelihood that the thermal backflushing operation will be needed to compliment the continuous chlorination program in the ensuing year (frequency and reason for the backflushing).

   The data developed for this report shall be incorporated into the statistical hydrological and biological data base for future operational data comparison.

7. The discharge shall not jeopardize any Class B use of the nearshore Atlantic Ocean and shall not violate State Water Quality Standards of the receiving water.

8. The permittee shall not at any time, either alone or in conjunction with any person or persons, cause directly or indirectly, the discharge of any waste into the receiving waters except waste that has been treated in such a manner as will not lower the Class B quality or interfere with the uses assigned to said waters by the New Hampshire Legislature (Chapter 311, Laws of 1967).

9. There shall be no discharge of polychlorinated biphenyl compounds such as commonly used for transformer fluid.

10. The discharge of radioactive materials shall be in accordance with the Nuclear Regulatory Commission requirements (10 CFR 20 and the Seabrook Station Operating License, Appendix A, Technical Specifications).

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

11\. During the period beginning the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **001**, Circulating Water System Discharge.

a. Such discharge shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			Monitoring Requirements	
	Avg. Monthly		Max. Daily	Measurement Frequency	Sample Type
Flow, MGD	720		720	Continuous[1]	Estimate
Temperature Rise, (Delta-T), °F[2]	39		41	Continuous [2]	Recorder
Temperature Rise, (Delta-T), °F[2,3]	45		47	Continuous [2]	Recorder
Temperature (Maximum), °F	Report		Report	Continuous	Recorder
Total Residual Oxidants (TRO), mg/l	0.15		0.20	1/day[4]	Grab
pH, s.u.[5]	6.5	to	8.0	1/week	Grab
Whole Effluent Toxicity[6]	Report		Report	1/Quarter	24-Hour Composite
EVAC, mg/l	-------		3.0[7]	When in Use	Grab
EVAC, mg/l	-------		4.3[8]	When in Use	Calculation

[1]The flow rate may be estimated from pump capacity curves.

[2]Temperature Rise is the difference between the discharge temperature (Discharge Transition Structure) and intake temperature (Intake Transition Structure). The intake and discharge temperatures will recorded by instruments or computers. The Temperature Rise and Maximum Temperature shall be calculated as a hourly average based upon at least twelve readings per hour (12 times per hour). These hourly average values will then be reported in the monthly DMRs.

[3]These average monthly and maximum daily temperature values are allowed up to a maximum of 15 days per year and only when one circulating water pump has been taken out-of-service for corrective or preventative maintenance. The Delta-T limits of 39 °F and 41 °F (average monthly and maximum daily, respectively) shall remain in effect at all other times of the year.

[4]Samples to be taken once per day at approximately the same time period. See Subparagraph "b" below for additional TRO requirements.

[5]See Part I.D.1 of this permit for State pH requirements.

[6]See Part I.A.22 of this permit for WET testing requirements.

[7]See Part I.A.11.f of this permit for EVAC use requirements.

[8]This limit may apply after the permittee has demonstrated that 4.3 ppm at the DTS is equivalent to 3.0 ppm or lower EVAC concentration at the Diffuser Nozzles. See Part I.A.11.f of this permit.

b. Total Residual Oxidants shall be tested using the Amperometric Titration Method, Method 4500-CL D in Standard Methods for the Examination of Water and Wastewater, 18th or subsequent edition(s), as approved in 40 CFR Part 136, or Method 330.1 in the EPA Manual of Methods of Analysis of Water and Wastes.

c. Samples taken for compliance with the monitoring requirements as specified in I.A.11.a above shall be taken at the Discharge Transition Structure, except for the intake water temperature, prior to the cooling water entering the discharge tunnel. See Part I.A.11.f of this permit for EVAC sampling requirements.

d. The discharge plume from the Seabrook Station shall:

(1) not block zones of fish passage,

(2) not interfere with spawning of indigenous populations,

(3) not change the balanced indigenous population of the receiving water,

(4) not contact surrounding shorelines, and,

(5) not violate Section 1707 of the State of New Hampshire Surface Water Quality Regulations.

e. The thermal component of the discharge shall in all aspects be in accordance with the discharge described in the permittee's NPDES Permit Application No. NH0020338, dated August 1, 1974, as modified in the reapplication dated April 1998, except as specifically modified below.

(1) The thermal component of the discharge from the Seabrook Station shall not cause a monthly mean temperature rise of more than 5 °F in the "near-field jet mixing region." The 5 °F monthly limit shall apply only at the surface of the receiving waters. For the purposes of this paragraph the "near-field jet mixing region" means that portion of the receiving waters within 300 feet of the submerged diffuser in the direction of discharge.

Permit compliance with this requirement shall be demonstrated by comparing the temperature difference between sampling point DS, (inside the mixing region) and sampling point T7 (reference sampling station). The locations of sampling points DS and T7 are shown in Attachment B. No change in the location of the sampling point is allowed without prior approval from the Regional Administrator and the Director. Temperature measurements shall be taken and recorded every fifteen minutes. The daily temperature shall be the arithmetic average of these measurements. The monthly mean temperature shall be determined by the arithmetic average of the daily temperature. Delta T shall be determined by taking the difference of the monthly mean temperature between DS and T7.

This paragraph shall apply only to temperature rises caused by the addition of heat to the receiving waters by the permittee. This temperature requirement does not apply during the cooling water flow reversal (thermal backflushing) used for biological control.

This monthly temperature limit constitutes the need for a CWA 316(a) thermal variance. See Attachment A.

(2) During operation of Seabrook Station, the permittee shall conduct additional thermal plume prediction studies as determined by the Regional Administrator and/or the Director. Such studies will be for the purpose of evaluating the accuracy of the thermal plume predictions the permittee has submitted to EPA in support of the

NPDES Permit Application No. NH0020338. Any such studies may apply to both the normal operation and thermal back-flushing operation at Seabrook Station.

(3) During operation of Seabrook Station, the permittee shall conduct biological/environmental studies as determined by the Regional Administrator and/or the Director. The purpose of any such studies shall be to evaluate the effects of Seabrook Station's discharge on the balanced, indigenous population of shellfish, fish and wildlife in and on the Atlantic Ocean.

(4) This NPDES permit may be modified to contain additional or different thermal limitations if the above studies and/or other available information indicates such modifications are necessary to assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the receiving waters.

(5) The effluent limitations of this permit shall apply to all thermal components of the discharge from the Seabrook Station including, but not limited to, discharge during normal station operation and discharge during cooling water flow reversal for bio-fouling control.

(6) The permittee is allowed to discontinue temperature monitoring, for a period of up to 48 hours, during non-power operations and when the nuclear reactor is shutdown. The permittee may perform maintenance on the temperature monitoring equipment and/or other equipment sharing common power supplies during these non-monitoring periods.

f. The molluscicide EVAC may be applied twice per year, in late spring and late summer. Each application shall occur over a period not to exceed 48 hours. The discharge concentration shall not exceed 3.0 mg/l, at the Diffuser Nozzles. The discharge concentration shall be determined by grab sample at the Diffuser Nozzles after the concentration has reached a steady state condition throughout the plant. This steady state application concentration is expected to be approximately 4.3 ppm. Seabrook shall also sample and analyze for EVAC at the Discharge Transition Structure concurrently with the grab sample at the Diffuser Nozzles.

At least 3 months prior to the first application, the permittee shall submit the result of hydrological modeling which demonstrates the dissipation of EVAC. This model shall show the expected dissipation of EVAC concentration, until its concentration is undetectable (include EVAC half-life). Results of the modeling shall be submitted to the Regional Administrator and the Director..

At least 30 days prior to each planned use of EVAC, the permittee shall notify the EPA and the NH DES. Such notification shall include the dates over which the application is expected to occur, the amount (in pounds) of the molluscicide to be used, and the calculated discharge concentration. After the initial dosing with EVAC, the permittee shall also include, in the notification, an estimate of the effectiveness of EVAC.

The permittee may request that compliance be determined at the DTS, by calculation, after demonstration that a calculated 4.3 ppm DTS EVAC concentration results in a 3.0 ppm or lower discharge EVAC concentration at the Diffuser Nozzles. At least 4 consecutive EVAC applications and sampling events must occur prior to the permittee requesting such a change in compliance sampling point.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

12. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial numbers: **022, 023,** and **024**. These outfalls are Secondary Plant Leakage and Drainage, Vault #1; Secondary Plant Leakage and Drainage, Vault #2; and Plant System Leakage and Drainage, Vault #3; respectively.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max Daily	Measurement Frequency	Sample Type
Flow, gpd	Report	122,400	Monthly	Estimate
Oil and Grease, mg/l	15	20	Weekly	Grab.
Total Suspended Solids(TSS), mg/l	30	100	Weekly	Grab

b. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

13. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025A**, Steam Generator Blowdown.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow, gpd	Report	425,000	Continuous[1]	Estimate
Oil and Grease, mg/l	15	20	1/Quarter[1]	Grab
Total Suspended Solids, mg/l	30	100	1/Week[1]	Grab

[1]This discharge is considered continuous, although the frequency and duration may vary depending on plant operation. Therefore the frequency of measurement for flow is continuous when in use. The measurement frequency for TSS is once per discharge, and weekly if the discharge continues for more than seven days. The discharge may be interrupted and restarted but will still be considered continuous, as long as the discharge is reinitiated within four hours of interruption.

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

14. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025B**, Steam Generator Blowdown Demineralizer Rinse.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow, gpd	Report	210,000	Continuous[1]	Estimate
Oil and Grease, mg/l	15	20	1/Quarter[1]	Grab
Total Suspended Solids, mg/l	30	100	1/Week[1]	Grab

[1]This discharge is considered continuous, although the frequency and duration may vary depending on plant operation. Therefore the frequency of measurement for flow is continuous when in use. The measurement frequency for TSS is once per discharge, and weekly if the discharge continues for more than seven days. The discharge may be interrupted and restarted but will still be considered continuous, as long as the discharge is reinitiated within four hours of interruption.

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

15. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **025C**, Waste Holdup Sump.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow, gpd	Report	60,000	1/Batch	Estimate
Oil and Grease, mg/l	15	20	1/Batch	Grab
Total Suspended Solids, mg/l	30	100	1/Batch	Grab

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other stream.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

16. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall number serial **025D**, Waste Test or Recovery Test Tanks.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow, gpd	Report	100,000	1/Batch	Estimate
Oil and Grease, mg/1	15	20	1/Batch	Grab
Total Suspended Solids, mg/1	30	100	1/Batch	Grab

b. Samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other waste stream.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

17. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **026,** Metal Cleaning Wastes from stationary or portable treatment equipment.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency[1]	Sample Type
Flow, gpd	Report	450,000	1/Batch	Estimate
Oil and Grease, mg/l	15	20	1/Batch	Grab
Copper, mg/l	1.0	1.0	1/Batch	Grab
Iron, mg/l	1.0	1.0	1/Batch	Grab
Total Suspended Solids, mg/l	30	100	1/Batch	Grab
pH, s.u.	6.0 to 9.0		1/Batch	Grab

[1]Sample frequency is once per batch prior to release when treated chemical cleaning waste is being discharged from either stationary or portable holding tanks.

b. A minimum of one Circulating Water System pump shall be in operation when the Treated Chemical Cleaning Wastes are discharged.

c. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point from stationary or portable holding tanks and prior to mixing with any other stream. The ultimate discharge shall be through the Circulating Water System, Outfall 001.

d. The permittee shall notify the Regional Administrator and the Director in writing, at least 72 hours prior to the discharge from any chemical cleaning operations and provide an estimate of the duration of the operation, the chemicals to be used, and the point or location of wastewater release into the discharge tunnel..

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

18. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number 027, Cooling Tower Blowdown.

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			Monitoring Requirements	
	Daily Max.	Avg. Concentration	Max. Concentration	Measurement Frequency	Sample Type
Flow, gpd	-----	Report	Report	Daily[1]	Estimate
Total Residual Oxidants	-----	-----	0.5[2] mg/l	Daily[1]	Grab
Total Residual Oxidants	2.6[3] pounds	Report	-----	Daily[1]	Calculation[3]
pH, s.u.	6.0 to 9.0			Daily[1]	Grab

[1]Sample frequency is once daily when the Cooling Tower has a discharge.
[2] This limit is an instantaneous maximum concentration, mg/l.
[3] This is calculated over a single period of chlorine release, not to exceed two hours per day. The following equation shall be used: Mass TRO (pounds/event) = [Flow of outfall 027 (gallons per minute)] x [average TRO concentration (mg/l)] x [3.78 liters/gallon] x [120 minutes/event] ÷ [454,000 mg/pound].

b. None of the 126 priority pollutants shall be used for cooling tower maintenance chemicals.

c. The samples taken in compliance with the monitoring requirements specified above shall be taken at a representative point prior to mixing with any other stream.

d. See Section I.A.11.b for Total Residual Oxidants analytical requirements.

PART I

A. Effluent Limitations, Conditions, and Monitoring Requirements (Continued)

19. During the period beginning on the Effective Date and lasting through the Expiration Date, the permittee is authorized to discharge from outfall serial number **003**, Thermal Back-flushing Operation.[1]

a. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Avg. Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow, gpm	Report	500,000	When in use	Estimate[2]
Temperature, Maximum (T_{MAX})°F	Report	120	Continuous when in use	Recording Max. Temp.

[1]During the back-flushing operation, the diffuser serves as the intake and the intake structure is the discharge point.
[2]Flow rate may be estimated from pump curves.

b. The permittee shall perform back-flushing (cooling water flow reversal for bio-fouling control) only during times when hydrological and meteorological conditions are such that the plume flows off-shore and/or temperature increases are minimized at the Outer Sunk Rocks.

c. The multiport diffuser shall be maintained free of marine fouling organisms. The permittee has coated the external surfaces of the diffuser with a material approved by the Regional Administrator and the Director. The permittee may propose alternate chemicals or methods for minimizing biological growth on the diffuser nozzles to the Regional Administrator and the Director for approval.

d. The pH shall not be less than 6.5 standard units nor greater than 8.0 standard units or as naturally occurs in the receiving water, Par. I.D.1.a (Sampling not required.)

e. There shall be no visible discharge of oil sheen, foam, or floating solids in the vicinity of the discharge (the intake structures). Naturally occurring sea foam in the intake transition structure is allowed.

f. The continuous back-flushing flow shall not exceed 120 °F maximum and the duration at the maximum temperature shall not exceed 2 hours. The total back-flushing cycle shall not exceed 6 hours.

g. The permittee shall not conduct more than 4 back-flushing cycles per calendar year unless prior approval is obtained from the Regional Administrator and the Director.

h. There shall be no chlorination operations during the thermal backflushing process except for safety related functions, i.e.: Service Water System Chlorination.

i. The permittee shall notify the Regional Administrator and the Director, in writing, 15 days before each back-flushing operation is initiated.

j. The permittee shall include the date, maximum temperature, and duration in the monthly submittal of the Discharge Monitoring Report each time Discharge 003 is used.

k. Should the permittee propose to use thermal backflushing, then the December 16, 1994, thermal backflushing report entitled "Alternatives to Thermal Backflushing", shall be expanded to include the environmental impact and technical feasibility of each alternative, including EVAC. The report shall describe seasonal impacts on fish migration and spawning, endangered species, initial dilution, and plume dispersion. This report shall define the hydrological and meteorological conditions that would minimize the thermal impact on the biologically rich Sunk Rocks. Data shall be collected for a period of at least one year prior to submittal to EPA.

The updated study shall be submitted to the EPA and the NH DES at least 6 months before thermal backflushing is used.

20. The chemicals listed in Attachment C are approved, with limits, for water discharge. The permittee may propose to conduct feasibility studies involving new chemicals not currently approved for water discharge. The permittee shall gain approval from the Regional Administrator and the Director before any such studies take place. A report summarizing the results of any such studies shall be submittted to the Regional Administrator and the Director regarding discharge frequency, concentration, and the impact, if any, on the indigenous populations of the receiving water. The Regional Administrator or the Director may require Whole Effluent Toxicity testing as part of feasibility studies.

    The permittee may substitute or add laboratory chemicals that are discharged in de minimis amounts without conducting feasibility studies. The permittee shall submit, to the Regional Administrator and the Director, relevant information on the proposed addition/substitution regarding toxicity, frequency of discharge, concentration, and anticipated impacts. This submittal shall include a certification that the proposed chemical(s) is not carcinogenic, mutagenic, teratogenic or will bioaccumulate..

    Prior approval from the Regional Administrator and the Director is not necessary before any such addition/substitution of laboratory chemicals takes place. The permittee will continue to employ its Best Management Practice procedures entitled "Disposal of Laboratory Chemicals and Reagents" for laboratory chemicals. The permittee may not use any laboratory chemicals that are carcinogenic, mutagenic, teratogenic or that will bioaccumulate.

    No increase in chemical discharge concentrations, chemical substitution, or the use of additional chemicals is allowed without written approval by the Regional Administrator and the Director or their designees. Laboratory chemical use is excluded from this requirement.

    No use of chemicals that bioaccumulate is allowed.

21. There shall be no visible discharge of oil sheen, foam, or floating solids in the vicinity of the diffuser ports. Naturally occurring sea foam in the discharge transition structure is allowed. Except in cases of condenser leak seeking and sealing, use of a reasonable amount of biodegradable and non-toxic material may be used to the extent necessary to locate and/or seal any condenser leak. The permittee shall report in the appropriate monthly DMR the occasions wherein this material was used giving the date(s) of the incident, the type of materials used and the amount of materials discharged.

22. The permittee is required to report the results of chronic (and modified acute) WET tests using Inland Silverside (Menidia beryllina), acute WET tests using Mysid Shrimp (Mysidopsis bahia) and chronic Sea Urchin (Arbacia punctulata) WET tests on a quarterly basis. A 24-Hour composite sample is the required "sample type" for WET testing. If after eight consecutive sampling periods (two

years), no toxicity is found, the permittee may request a reduction in toxicity testing to twice per year. The permittee shall use the procedures and protocols contained in Attachement D to this permit when conducting the WET testing.

The toxicity tests shall be performed at times when various chemicals and waste tanks are discharged at the facility. The permittee shall document and submit to EPA the various scenarios under which the toxicity test has been performed. The permittee shall conduct quarterly toxicity testing as outlined below:

Administrative controls shall be in-place to control these discharges according to the following restrictions:

(a) NPDES Permit Outfalls 025 (A, B, C & D) will not be discharged during EVAC, mollusicide applications (expected frequency to be twice per year with a duration of up to about two days).

(b) When Outfall 025B (Steam Generator Blowdown rinses) is being discharged, none of the other Outfall 025 can be discharged.

<u>**Quarter #1 WET Testing (January - March)**</u>

Day 1	Day 3	Day 5
(Acute and sample #1 for chronic)	**(sample #2 for chronic)**	**(sample #3 for chronic)**
Outfalls 025A and 025C and 025D or EVAC	Outfalls 025A and 025B or Outfalls 025C and 025D	Outfalls 025A and 025B or Outfalls 025C and 025D

Note: If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025A and 025B being discharged, then Day 5 samples should be obtained with 025C and 025D being discharged.

<u>**Quarter #2 WET Testing (April - June)**</u>

Day 1	Day 3	Day 5
(Acute and sample #1 for chronic)	**(sample #2 for chronic)**	**(sample #3 for chronic)**
Outfalls 025A and 025B (These discharges shall not be concurrent) or EVAC	Outfalls 025C or 025D	Outfalls 025C or 025D

Note: If EVAC is not applied during the quarter, then 025A and 025B shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025C being discharged, then Day 5 samples shall be obtained with 025D being discharged.

Quarter #3 WET Testing (July - September)

Day 1	Day 3	Day 5
(Acute and sample #1 for chronic)	**(sample #2 for chronic)**	**(sample #3 for chronic)**
Outfalls 025A and 025C and 025D	Outfalls 025A and 025B	Outfalls 025A and 025B
or	or	or
EVAC	Outfalls 025C and 025D	Outfalls 025C and 025D

Note: If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled. Day 3 and Day 5 cover both "or" conditions. For example: if Day 3 samples were obtained with 025A and 025B being discharged, then Day 5 samples should be obtained with 025C and 025D being discharged.

Quarter #4 WET Testing (October - December)

Day 1	Day 3	Day 5
(Acute and sample #1 for chronic)	**(sample #2 for chronic)**	**(sample #3 for chronic)**
Outfalls 025A and 025C and 025D	Outfalls 025B and 025C	Outfalls 025C and 025D
or	or	
EVAC	Outfalls 025B and 025D (These discharges shall not be concurrent)	

Note: * If EVAC is not applied during the quarter, then 025A, 025C, and 025D shall be discharged and sampled.

23. Chlorine Transit Study. The permittee shall conduct a "chlorine transit study" a minimum of twice per year for the first three years of the permit. This study shall be based on the 1993 Chlorine Transit Study performed at Seabrook Station. The study(s) shall measure the TRO concentration at the Discharge Transition Structure and the corresponding (taking into account the transit time) TRO at the Discharge Diffuser Nozzles (DDN). The study shall be conducted during periods of low chlorine demand of the cooling water. At least one of these studies shall be conducted when the plant is shut down and the effluent is not heated.

The permittee shall submit a study proposal to the Regional Administrator and the Director 30 days after the effective date of this permit and yearly thereafter. The study shall, to the maximum extent possible, represent "worst case" situations. That is, the facility shall be discharging TRO, as measured at the Discharge Transition Structure (DTS), as close to the permitted daily maximum as possible and the cooling water shall be exerting its lowest chlorine demand. Upon approval from the Regional Administrator and the Director, the permittee shall implement the study and submit the results to the Regional Administrator and the Director.

Should any of the Chlorine Transit Study results indicate that the permitted TRO concentration, as measured at the DTS, is not sufficiently stringent to ensure that the chronic and acute water-quality standards for chlorine are met at the DDN, this permit may be reopened to incorporate stricter limits.

24. Biological and Water Quality Monitoring Program

a. The Biological and Water Quality Monitoring Program (BP) shall be submitted to EPA for approval within 30 days of the effective date of this permit. Upon approval from EPA, the BP is an enforceable element of this permit. This BP shall be based on the 1996 Biological and Water Quality Monitoring Program, except for the following alternative regimes which will replace those previously employed:

(1) Intertidal Monitoring only will be implemented if Seabrook Station decides to employ back flushing of the Cooling Water System to control macrofouling. Any such Intertidal Monitoring Program will begin at least one year prior to back flushing.

(2) The Impingement Monitoring Program will be enhanced to include: collecting two 24-hour impingement samples each week, the evaluation of screen wash efficiencies using dead fish, and a sampling protocol for high impingement events.

(3) Ichthyoplankton Entrainment Sampling Program will allow greater understanding of diel variability in ichthyoplankton densities and will include more definitive day-night sampling (4 x 2-hour samplings/week: morning, day, evening, night), increased sample volume, and decreased net mesh size.

(4) The previous reviews by EPA and NH DES and Fish & Game of the long-term studies of coastal New Hampshire have concluded that the kelp communities in the study area should not be adversely influenced by plant operation. Therefore, monitoring of kelp communities is no longer required.

b. The Contingency Plan

This Contingency Plan identifies actions that Seabrook Station may undertake when improvements to the BP are necessary. The Contingency Plan authorizes the evaluation, annually at a minimum, of the BP and associated data, and, if necessary, requires recommendations for improvements in the BP and the development of a Management Plan (See Management Plan, below).

1. BP Evaluation

At a minimum, the BP is evaluated through the following:

i. An annual review of the environmental/biological sampling and analysis plan and data,

ii. The identification of change in the aquatic or biological system,

iii. The determination of statistically significant change,

iv. The determination of biological importance,

v. The determination of the likelihood that Seabrook Station contributed to the change,

vi. A review and analysis of BP data variability and power analysis update,

vii. The identification of improved sampling and/or analysis technologies, including, but not limited to: statistical methods, sampling equipment, and modeling technologies.

2. BP Evaluation Schedule

The BP will undergo an annual review according to the following schedule:

i. Sept. 1: Permittee submits the results from the previous year's BP to the Permitting Authority.

ii. Nov. 1: Permitting Authority submits comments and questions to the Permittee.

iii. Dec. 1: Permittee schedules meeting to present data and review proposed BP for the following year.

iv. Feb. 1: Improvements reviewed and approved by the Permitting Authority.

v. Mar. 1: Permittee continues BP and implements improvements, if applicable.

3. Management Plan

The BP requires the Permittee to determine whether any adverse environmental impacts are occurring due to facility operations. If they are, then the Permittee must, in a timely manner, develop and implement a Management Plan, approved by the Permitting Authority, to prevent such impacts. A report on these efforts must be submitted to EPA and NH DES every thirty days until the issue has been resolved.

c. BP Improvements

This permit authorizes improvements, as approved by the Permitting Authority, to the BP when indicated by results and analysis of BP data (acceptable data from other sources may also be considered). Analysis of data from measured parameters such as temperature, delta T, and rates of impingement, and entrainment indicate the need for monitoring program enhancements or improvements.

The Permitting Authority will require a review, at least annually, of sampling data and protocols and an evaluation of the need for more frequent sampling. Additional sampling locations and any other justified analytical or biological program improvements may be authorized. Prior to authorization, the permittee must seek input from biologists from NHDES, NHF&G, U.S. Fish and Wildlife, and EPA. This review will be chaired by the EPA with input from NHDES, NHF&G, U.S. Fish and Wildlife, and other agencies or experts as appropriate.

Within 30 days of authorization of biological program improvements, the permittee shall update and resubmit the Biological and Water Quality Monitoring Program to include any such improvements.

Examples of BP improvements include, but are not limited to:

1. Additional sampling stations,

2. Increased sampling frequency,

3. Changes demonstrated to reduce data variability or increased analysis sensitivity,

4. Changes demonstrated to increase the power to detect statistical significance,

5. Collection of additional data demonstrated to more definitively determine Seabrook Station impacts,

6. Additional predictive models such as species-specific population, community, and/or trophic level risk.

d. Biological, hydrological, and chlorination study reports shall be submitted on a semi-annual basis with the annual report summarizing the previous year's information and conclusions. The report is due in February.

The semi-annual mid-year report shall be a letter report providing the status of the on-going programs, the expected effort in the ensuing six months, and a synopsis of the data and information obtained since the last annual report. This report shall be submitted in July.

e. Fish Mortality Monitoring and Reporting.

Any incidence of fish mortality associated with the discharge plume or of unusual number of fish impinged on the Intake Traveling Screens shall be reported to the Regional Administrator and the Director within 24-Hours by telephone report as required in Paragraph II.D.1.e of this permit. A written confirmation report is to be provided within five (5) days. This report should include the following:

1. The species, sizes, and approximate number of fish involved in the incident.

2. The time, date, and duration of the occurrence.

3. The operating mode of the station at the time of the occurrence.

4. The opinion of the permittee as to the cause of the incident.

5. The remedial action that the permittee will undertake to prevent a recurrence of the incident.

25. Requirements for Seabrook Station Discharge Diffuser Nozzles

a. The 22 submerged offshore diffuser nozzles shall be maintained when necessary to ensure proper operation. Proper operation means that the plumes from each nozzle will be balanced relative to each other and that they all have unobstructed flow. maintenance may include dredging in the vicinity of the diffuser nozzles, removal of marine growth or other solids on the interior surfaces of the diffuser nozzles or repair/replacement of the nozzle structure.

b. Any necessary maintenance dredging must be performed only during the marine construction season authorized by the New Hampshire Fish and Game Department and only after receiving all necessary permits from the DES Wetlands Bureau, U.S. Coast Guard, U.S. Army Corps of Engineers, etc.

c. To determine if maintenance will be required the diffuser nozzles will be inspected by a licensed diver or licensed marine contractor at least every 36 months. The as-found or pre-maintenance condition of the nozzles will be documented on videotape. The maintenance performed on any nozzle and the as-left or post maintenance conditions will be documented in a written report prepared by the diver or marine contractor.

d. Copies of the videotape and written report of the maintenance provided on any nozzle will be submitted to EPA and NHDES WD within 60 days of each inspection. Where it is determined that additional maintenance will be necessary, the permittee shall provide the proposed scope and schedule for the maintenance.

B. MONITORING AND REPORTING

Monitoring results obtained during the previous month shall be summarized and reported on Discharge Monitoring Report Form(s) postmarked no later than the 15th day of the month following the completed reporting period.

Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and one signed copy to the State at the following addresses:

Environmental Protection Agency
NPDES Program Operation Section
P. O. Box 8127
Boston, MA 02114

The State Agency is:

New Hampshire DES
Water Division
Permits and Compliance Section
6 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

C. NOTIFICATION

1. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe (40 CFR §122.42):

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"

      (1) One hundred micrograms per liter (100 $\mu g/l$);

      (2) Two hundred micrograms per liter (200 $\mu g/l$) for acrolein and acrylonitrile; five hundred micrograms per liter (500 $\mu g/l$) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (mg/l) for antimony;

      (3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

      (4) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and New Hampshire regulations.

b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"

(1) Five hundred micrograms per liter (500 μg/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR §122.21(g)(7); or

(4) Any other notification level established by the Director in accordance with 40 CFR §122.44(f) and New Hampshire regulations.

c. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

D. State Permit Conditions

1. The permittee shall comply with the following conditions which are included as State Certification requirements:

a. "The pH for Class B waters is 6.5 to 8.0 s.u. or as naturally occurs in the receiving water. The 6.5 to 8.0 s.u. range must be achieved in the final effluent, outfall 001, unless the permittee can demonstrate to the Division: (1) that the range should be widened due to naturally occurring conditions in the receiving water or (2) that the naturally occurring source water pH is unaltered by the permittee's operations. The scope of any demonstration project must receive prior approval from the Division. In no case shall the above procedure result in pH limits less restrictive than any applicable federal effluent limitation guidelines."

b. "The permittee shall submit the Executive Summary and Section D (Surface Water) of the Seabrook Station Annual Radiological Environmental Operating Report to NH DES at the address in Par. I.B as well as to EPA, NH Fish and Game, and NMFS within 30 days of preparation."

2. This NPDES Discharge Permit is issued by the U.S. Environmental Protection Agency (EPA) under Federal and State law. Upon final issuance by the federal EPA, the New Hampshire Department of Environmental Services, Water Division, may adopt this permit, including all terms and conditions, as a State discharge permit pursuant to RSA 485-A:13.

   Each agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this Permit shall be effective only with respect to the Agency taking such action, and shall not effect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared invalid, illegal or otherwise issued in violation of State law, such permit shall remain in full force and effect under Federal law as an NPDES permit issued by the U.S. Environmental Protection Agency. In the event this permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit, if adopted as a state permit, shall remain in full force and effect under State law as a Permit issued by the State of New Hampshire.

E. Special Conditions

1. Whole Effluent Toxicity Test Frequency Adjustment

   The permittee may submit a written request to the EPA requesting a reduction in the frequency (to not less than twice per year) of required toxicity testing, after completion of a minimum of eight (8) successive toxicity tests of effluent all of which must be valid tests and must demonstrate acceptable toxicity. Until written notice is received by certified mail from the EPA indicating that the Whole Effluent Testing requirement has been changed, the permittee is required to continue testing at the frequency specified in the respective permit.

2. pH Range Adjustment

   The permittee may submit a written request to the EPA requesting a change in the permitted pH limit range to no more than 6.0 to 9.0 Standard Units. The permittee's written request must include the State's approval letter containing an original signature (no copies). The State's letter shall state that the permittee has demonstrated to the State's satisfaction that as long as discharges to the receiving water from a specific outfall are within a specific numeric pH range the naturally occurring receiving water pH will be unaltered. That letter must specify for each outfall the associated numeric pH limit range.

Until written notice is received by certified mail from the EPA indicating the pH limit range has been changed, the permittee is required to meet the permitted pH limit range in the respective permit.

F. Re-opener Clause

1. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable standard or limitation promulgated or approved under sections 301(b)(2)(C) and (d), 304 (b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

   (a) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or

   (b) Controls any pollutants not limited in the permit.

2. This permit may be modified to incorporate necessary Total Residual Oxidant (TRO) adjustments should the results of any of the "Chlorine Transit Study(s)", as required in Part I.A.23 of this permit, indicate potential violation(s) of the water-quality standards for chlorine at the diffuser nozzles. Results of the "Chlorine Transit Study(s)" are considered "New Information" and the permit can be modified as provided in 40 CFR Section 122.62(a)(2).

ATTACHMENT A - NH0020338
316(a) variance document, Seabrook Station

I. <u>Introduction</u>

Section 316(a) of the Clean Water Act (CWA) addresses the thermal component of any effluent. EPA has not promulgated Best Practicable Control Technology currently available (BPT) for the thermal component of a facility's discharge. However, EPA assumes that if thermal limits satisfying BPT were developed in accordance with Section 301(b)(1)(A) of the CWA, they would be more stringent than what would be proposed by the NPDES permit applicant. This is based upon the premise that water quality criteria developed by EPA or by individual water quality standards, developed by the states, would be the limiting factor in the development of the NPDES permit. It should be noted that thermal discharges (heat content) are not subject to the technology standards required by best conventional pollutant control technology economically achievable (BCT) since heat is not identified as a toxic pollutant or a conventional pollutant as defined by the CWA and outlined at 40 CFR Section 401.15 or Section 401.16. Rather, thermal discharges (heat) are treated as a separate type of pollutant under Section 316 of the CWA.

Section 316(a) gives the Administrator of EPA the authority to impose alternative effluent limitations (i.e., a "thermal variance") for the control of the thermal component of any discharge. However, the owner or operator of the point source must demonstrate to the satisfaction of the Administrator that existing effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced indigenous community of shellfish, fish and wildlife in and on the receiving water. This authority has been delegated to the Regional Administrators or their designees.

New Hampshire Water Pollution Control Law addresses thermal waste discharged in RSA485-A:8 Section VIII which states, in pertinent part, that the "division shall adhere to the water quality requirements and recommendations of the New Hampshire Fish and Game Department, the New England Interstate Water Pollution Control Commission, or the United States Environmental Protection Agency, whichever requirements and recommendations provide the most effective level of thermal pollution control."

EPA, in the "Quality Criteria for Water, 1986," (i.e., the Gold Book), has set a maximum acceptable increase in the weekly average temperature at 1.8 °F during all seasons of the year. Seabrook Station's 1993 NPDES permit allows a maximum 5 °F temperature rise at the surface in the near field jet mixing region (on a daily basis). At the time of the 1993 permit issuance, the Regional Administrator tentatively determined that this temperature limit would ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on the nearshore Atlantic Ocean waters. Therefore, the limits proposed in the 1993 permit constituted a Section 316(a) thermal discharge variance. The facility has sought to continue this variance in the next permit.

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II. Criteria for Determining Alternative Effluent Limitations Under Section 316(a)

40 CFR Part 125, Subpart H specifies the criteria and information necessary for EPA to make a Section 316(a) thermal variance. For existing discharges, Section 125.73(c)(1) allows the demonstration to be based on the absence of prior appreciable harm in lieu of predictive studies.

Seabrook Station began commercial operation in 1990, and, therefore, is considered an existing discharger. Pursuant to 40 CFR Section 125.73(c), the determination shall be based upon the absence of prior appreciable harm in lieu of predictive studies and shall show: (i) that no appreciable harm has resulted from the normal component of the discharge (taking into account the interaction of such thermal component with other pollutants and the additive effect of other thermal sources to a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge has been made; or (ii) that despite the occurrence of such previous harm, the desired alternative effluent limitations (or appropriate modifications thereof) will nevertheless assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge is made. In determining whether or not prior appreciable harm has occurred, the director shall consider the length of time in which the applicant has been discharging and the nature of the discharge.

III. Environmental Monitoring Program

Seabrook Station environmental monitoring programs began as early as 1969. These early programs focused on plant design and siting. Later, monitoring programs were designed to assess the temporal and spatial variability during the preoperational period as a baseline. The preoperational data focused on fisheries from 1976 - 1989 and plankton and benthic from 1978 - 1989. During these years, consistent sampling regimes were developed that included data from nearfield and farfield stations to provide background information in order to address the question of operational effects. Commercial operation of Seabrook Station began in 1990 and August 1990 is considered the beginning of the operation period for the purposes of environmental assessment.

In 1975, EPA and the State jointly formed a committee of biologists from regulatory agencies which were responsible for the aquatic community in the Hampton Harbor and Seabrook area. The agencies included the EPA, the National Marine Fisheries Service (NMFS), the NH DES-Water Division, and NH Fish and Game. The committee has been responsible for assisting the permittee in developing study programs, evaluating the resulting data, reviewing program conclusions, and approving/rejecting proposed program modifications and/or remediation by the permittee. In the past, the committee has also provided EPA with recommendations for the NPDES permit that would ensure the protection of the ecological community in and on the receiving water.

In the 1993 permit renewal, the biological committee was formalized into the Technical Advisory Committee (TAC) to ensure that its effort was an official part of the permit. The TAC

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was empowered to accept, reject, or modify the facility's biological monitoring program and/or schedules.

As previously noted, Seabrook Station began commercial operation in 1990 and has operated to-date with only routine outages due to refueling and maintenance needs. A review of the entire biological monitoring program was undertaken in 1996. A number of program elements were revised, with the approval of the Technical Advisory Committee (TAC). The entrainment and impingement programs were enhanced to improve the quality of the data. Programs that monitored nutrients, phytoplankton, microzooplankton, pelagic fish (gill net sampling program), surface fouling panels, and macrobenthos at the deep stations were eliminated because the TAC felt sufficient data existed to eliminate concerns for potential impacts. Data collection at Station P5 was also ended because it was determined that is was too far from the discharge to reflect potential effects and was essentially the same as data collected from the Intake Station, P2.

IV. Previous 316(a) determinations

A series of decisions and legal actions on the design and impact of the cooling system on aquatic resources led to a Decision on Remand on August 4, 1978, by the EPA Administrator. Considered in the Decision on Remand were the potential for impact from: thermal discharge, thermal backflushing, cold shock, discharge plume scouring of the ocean bottom, entrainment of plankton through the cooling system, attraction of fish to the intake structures, entrapment of fish and subsequent impingement on the traveling screens, thermal plume barriers to migrating fish, increase in nuisance species populations, and gas bubble disease of fish. The Decision on Remand concluded that: 1) the requirements of Section 316(a) and (b) of the CWA had been met, and 2) the once-through cooling system would ensure the protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife in and on the receiving waters with respect to the thermal discharge.

In the July 1993 Fact Sheet for the renewal of the permit, the Regional Administrator tentatively determined that a favorable 316(a) determination could be made. The proposed permit was consistent with the Administrator's previous 316(a) determinations.

This tentative determination was made after consultation with the biological committee and was based on a review of the biological and hydrological monitoring data which showed that a once-through cooling system satisfied the State of New Hampshire thermal requirements and, as required by section 316(a) of the CWA, ensured the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the nearshore Atlantic Ocean.

The permit specified that the operational phase biological monitoring program would continue in order to assure EPA and the State that the continued operation of Seabrook Station did not significantly impact the local biological community.

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The July 1993 Fact Sheet also noted that the 316 tentative determinations were made on the data as presented by the permittee and consultants during the plant construction (17 years) and upon post-operational data since 1990.

V. Current 316(a) determination

Seabrook Station has certified that the thermal component of the discharge has not changed since last permit issuance (see April 1998 renewal application). A thermal plume comparative evaluation was submitted to the EPA in June 1991 which concluded that there was agreement between plume model predictions and field data in terms of surface temperature rise isotherms, thermocline depths and plume pattern.

As previously noted in this document, the impact of the thermal component of the discharge is assessed on an ongoing basis through the biological monitoring program. Seabrook Station's 1998 Environmental Monitoring Report (received by EPA November 1999) demonstrates that the operation of the facility has not caused "appreciable harm" to the balanced, indigenous community of shellfish, fish and wildlife in the Hampton-Seabrook area. Seabrook Station has submitted information to support the continuation of the variance based on actual operating experience.

Therefore, in accordance with 40 CFR Part 125, Section 125.73, and after consultation with members of the Technical Advisory Committee, the Regional Administrator has determined that the current biological and hydrological monitoring data shows that a once-through cooling system for Seabrook Station satisfies the thermal requirements and will ensure the protection and propagation of a balanced indigenous community of fish, shellfish, and wildlife in and on Hampton Harbor and the nearshore Atlantic Ocean. In making this determination, the Regional Administrator has taken into account the length of time and the nature of the discharge (approximately ten years and about 560 Million Gallons per Day of heated effluent).

The thermal limits proposed in the draft permit constitute a Section 316(a) thermal discharge variance. The post-operational phase of the biological monitoring program will continue in order to assure EPA and the State that the continued operations of Seabrook Station does not significantly impact the local biological community.

BIBLIOGRAPHY TO 316(a) VARIANCE DOCUMENT

1. New Hampshire Water Pollution Control Law, Chapter 485-A

2. Quality Criteria for Water, 1986, EPA 440/5-86-001, "Gold Book Criteria"

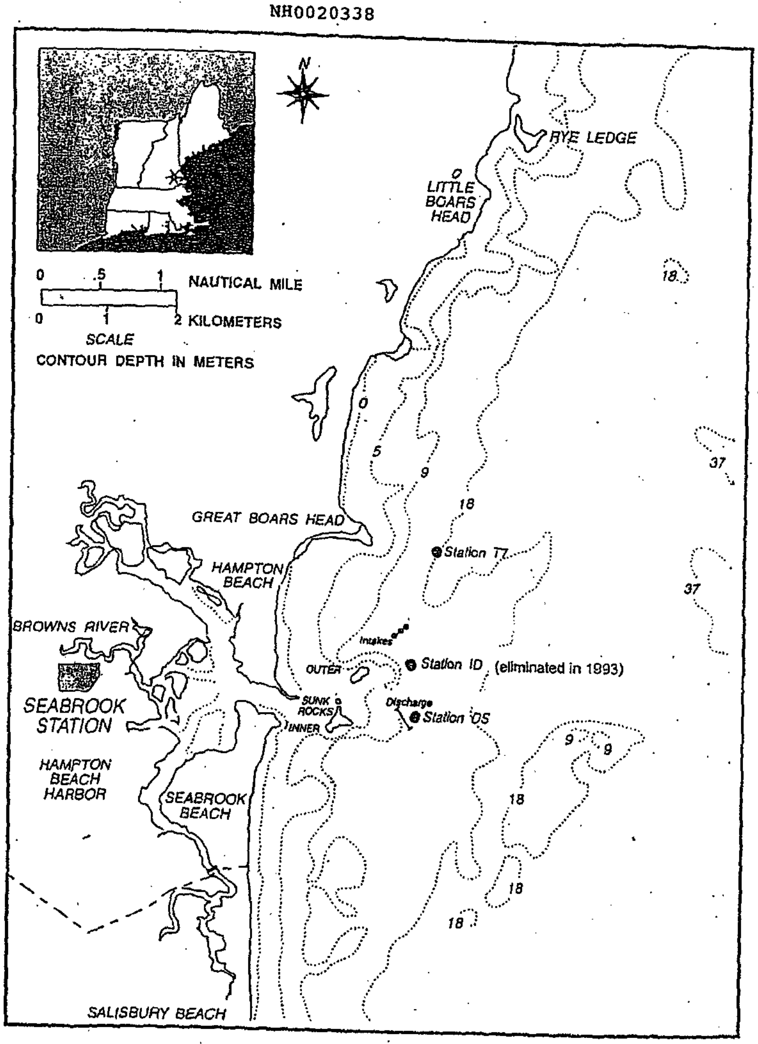
3. 40 CFR Part 125, Subpart H

4. North Atlantic Energy Service Corporation's National Pollutant Discharge Elimination System (NPDES) Permit and Fact Sheet, 1993

5. Seabrook Station 1999 Environmental Monitoring Report, December 2000

6. Seabrook Station NPDES Permit NH0020338 Renewal Application, April 1998

ATTACHMENT: B
NH0020338



Seabrook Station Temperature Monitoring Station Locations

ATTACHMENT C
NH0020388
CHEMICAL USE

BULK CHEMICALS

CHEMICAL NAME	CHEMICAL FORMULA	LIMIT at 001 in mg/L	INTERNAL OUTFALL	INTERNAL CONCENTRATION	DISCHARGE FREQUENCY	TOTAL YEARLY DISCHARGE (Lbs)
Total Residual Chlorine	OCl-	See section I.A.11.a				41300
			2	< 0.18	Batch(Q)	negligible
			22	<0.18	Batch(M)	negligible
			23	< 0.18	Batch(M)	negligible
			24	<0.18	Batch(M)	negligible
			25C	< 0.18	Batch(M)	negligible
			27		Batch(Y)	10
Ammonia	NH4OH	0.5				
			2	<1 mg/l	Cont.	~2
			22	<2 mg/l	Cont.	5368
			23	<1 mg/l	Cont.	~200
			25A	~1 mg/l	Batch(M)	55.1
			25B	<.1 mg/l	Batch(M)	~2
			25C	1146 mg/l	Batch(2/M)	398.8
			25D	<.1 mg/l	Batch(3/W)	~1
CIL	Na2SiO3	5				
			27	5-7 mg/l	Batch(M)	10
Boric Acid	H3BO3	5.0 (as boron)				
			25D	<1500 mg/l	Batch(3/W)	5201
			25A	<10 ppm	Infrequent	
Hypersperse	Proprietary	0.02				
			WT Reject	0.02 mg/l	Batch(W)	363
Ethanolamine (ETA)	C2H7NO	0.5				
			2	< 0.01 mg/l	Cont.	negligible
			22	~0.1 mg/l	Cont.	negligible
			23	~0.01 mg/l	Cont.	negligible
			25A	2 mg/l	Batch(2/M)	110
			25B	<0.01 mg/l	Batch(M)	negligible
			25C	~400 mg/l	Batch(2/M)	1868
			25D	<0.01 mg/l	Batch(3/W)	negligible
Ethylene Glycol	C2H6O2	50				
			2	N/A	Accidental	negligible
			22	N/A	Accidental	negligible
			23	N/A	Accidental	negligible

			25D	N/A	Accidental	negligible
Hydrazine	N2H4	0.5				
			2	5 mg/l	Batch	negligible
			2	<0.05 mg/l	Cont.	negligible
			22	~0.1 mg/l	Cont.	negligible
			23	~0.1mg/l	Cont.	negligible
			25A	<0.05 mg/l	Batch(2/M)	1.87
			25B	<0.05 mg/l	Batch(M)	negligible
			25C	5-100 mg/l	Batch(2/M)	48.1
			25D	<0.05 mg/l	Batch(3/W)	negligible
Methoxypropylamine (MPA)	C4H11NO	0.5, 5				
			2	<0.05 mg/l	Cont.	negligible
			22	<1 mg/l	Cont.	negligible
			23	<0.01 mg/l	Cont.	negligible
			25A	~ 5 mg/l	Batch(2/M)	163
			25B	<0.01 mg/l	Batch(M)	negligible
			25C	~1500 mg/l	Batch(2/M)	2774
			25D	<0.05 mg/l	Batch(3/W)	negligible
Sodium Hydroxide	NaOH	pH, See I.A.11.a	25C	see comment sheet	Batch(2/M)	6255
Sulfuric Acid	H2SO4	pH, See I.A.11.a	25C	see comment Sheet	Batch(2/M)	14572
Nalcolyte	Proprietary	0.1 mg/l	25D	~0.11 mg/l	Batch(3/W)	15.2
Muriatic Acid	HCl	pH, See I.A.11.a	WT Reject	12 mg/l	Batch(W)	202
DC-13 (Floor Cleaner)	NonylPhenyl -Ethoxylate(15%)	0.1	022	2.1 mg/l	cont.	95.4
EVAC (as proposed)	C26H49NO4	3 mg/l	001	4-5 mg/l	Semi-Annual/24 hrs	2.50E+004
BetzDearborn DA6801	poly acrylic acid and ethanolamine	0.007ppb	001	1-10 ppb	Continuous	
Dynacool 1385 (Thruguard 300)	proprietary phosphonate	0.05	001	~20 mg/l (chlorination)	Continuous	18,000

Bulk Chemicals Used in the past but Currently not in Use

Morpholine	C4H9NO	0.1	025D	<0.1	<1
Bulab 6002		0.1	001	<0.1	~20
Bulab 9328		0.1	001	<0.1	~21
Cat Floc L		0.1	25D	<0.1	~20
Cat Floc TL		0.1	25D	<0.1	~20

Bulk Chemicals Proposed for Future Use

CHEMICAL NAME	CHEMICAL FORMULA	LIMIT at 001 in mg/L	OUTFALL	INTERNAL CONCENTRATION	FREQUENCY OF DISCHARGE	TOTAL YEARLY DISCHARGE
1,2-Diamino ethane(or ethylene diamine)	C2H8N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
1,2-diaminoethane 3-Hydroxyquinuclide	C11H24N3	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		4100
2-Amino, 2-methylpropanol	C4H11NO	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000
2-METHYL-2-AMINO-1-PROPANE	C4H11N	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
2,2'-Dipyridyl	C10H8N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
2,9-Dimethyl-1,10-Phenanthroline	C14H12N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
4,4'-Dipyridyl	C10H8N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
4,7-Dimethyl-1,10-phenanthroline	C14H12N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
5-AMINOPENTANOL	C5H13NO	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3361
Terpyridine	C10H8N2	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000
Pyrolidine	C4H9N	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		2350
Pyrolidone	C4H7NO	5 5	025A 025D	1-10 mg/l 1000-5000 mg/l		3000-5000

Carbohydrazide	CH8N4O	5	025A	50-500 mg/l	200
Sulfuric Acid (note already in use at outfall 025C)	H2SO4	pH	001		~16000
Sodium Hydroxide (note already in use at outfall 25C)	NaOH	pH	001		~32000

PROCESS CHEMICALS

CHEMICAL NAME	CHEMICAL FORMULA	PROPOSED LIMIT at 001	OUTFALL	INTERNAL CONCENTRATION	FREQUENCY OF DISCHARGE	TOTAL USE LBS/YR
Diisopropylamine	C6H15N	0.5	025D	0.2mg/l	Batch(3/W)	32
			025C	1.5 mg/l	^Batch(2/M)	6.3
			022	1.1 mg/l	CONT	43.7
			023	0.89 mg/l	CONT	
Molybdate-3 Reagent	Mo12Na3O40P	0.5	WT Reject	0.26 mg/l	CONT	4.3
			025C	1 mg/l	CONT	4.3
Citric Acid	C6H8O7		WT Reject	0.25 mg/l	CONT	4.2
			025C	0.98 mg/l	CONT	4.2
			002	N/A	N/A	
Silica Standard		0.5	023	<<1 mg/l		
			025C	<<1 mg/l		
Amino Acid F Reagent(sum of two part reagent)		0.5	023	0.93 mg/l		
			025C	1.63 mg/l		
Lithium Hydroxide	LiOH-(H2O)	0.5 (as Li)	025D	0.18 (as Li)	Batch(3/W)	44.8 (as LiOH-H2O)
Hydrogen Peroxide	H2O2	0.5	025D	0.08 mg/l	1/18months	10.6
Lysol	isopropyl alcohol o-benzyl,p-chlorophenol(10%) o-phenyl phenol(10%)	0.1	022	0.15 mg/l	Cont	6.7
Lestoil	Stoddard solvent Pine Oil sodium Hydroxide	0.1	022	1.9 mg/l	Cont	85.9

	Tall oil Fatty Acid, sodium salt					
[redacted]						
Aqueous Fire Fighting Foam(AFFF)			002	N/A		
[redacted]						
Caustic Soda	Na2CO3		002 025C	N/A		
[redacted]						
Syntech Touch-it-up Spray	(2-butoxy ethanol(1%), octylphenyl polyethoxylate(1%) trisodium phosphate(1%), sodium meta silicate(1%))	0.1	025C 025D	1.25 mg/l 0.33 mg/l	batch batch	50

CHEMICAL NAME	CHEMICAL FORMULA	CONCENTRATI in 025D (MG/L)	CONCENTRATION in 001 (MG/L)	LIMIT 001	OUTFALL	DISCHARGE FREQUENCY	TOTAL LBS/YR
1-AMINO-2-NAPTHOL-4-SULFONIC ACID	C10NSO4H9	0.131393065802	8.92616E-006	0.1	025D	Batch (3/W)	2.907E-002
Acetate Standards (1000ppm)	C2H3O2	0.119448241638	8.11469E-006	0.1	025D		2.643E-002
Acetate Standards (100ppb)	C2H3O2	0.000007166894	4.86881E-010	0.1	025D		1.586E-006
Acetate Standards (100ppm)	C2H3O2	0.011944824164	8.11469E-007	0.1	025D		2.643E-003
Acetate Standards (10ppb)	C2H3O2	0.000000716689	4.86881E-011	0.1	025D		1.586E-007
Acetate Standards (10ppm)	C2H3O2	0.001194482416	8.11469E-008	0.1	025D		2.643E-004
Acetate Standards (25ppb)	C2H3O2	0.000001791724	1.21720E-010	0.1	025D		3.965E-007
Acetate Standards (25ppm)	C2H3O2	0.002986206041	2.02867E-007	0.1	025D		6.608E-004
Acetate Standards (50ppb)	C2H3O2	3.58345E-006	2.43441E-010	0.1	025D		7.930E-007
Aluminum Standards (100ppb)	AL	0.000007166894	4.86881E-010	0.1	025D		1.586E-006
Aluminum Standards (10ppb)	AL	0.000000716689	4.86881E-011	0.1	025D		1.586E-007
Aluminum Standards (10ppm)	AL	0.001194482416	8.11469E-008	0.1	025D		2.643E-004
Aluminum Standards (1ppm)	AL	0.000119448242	8.11469E-009	0.1	025D		2.643E-005
Aluminum Standards (50ppb)	AL	0.000003583447	2.43441E-010	0.1	025D		7.930E-007
Ammonia Standards (1.02ppm)	NH3	0.000121837206	8.27698E-009	0.1	025D		2.696E-005
Ammonia Standards (1.7ppm)	NH3	0.000203062011	1.37950E-008	0.1	025D		4.493E-005
Ammonia Standards (1020ppm)	NH3	0.121837206471	8.27698E-006	0.1	025D		2.696E-002
Ammonia Standards (1700ppm)	NH3	0.203062010785	1.37950E-005	0.1	025D		4.493E-002
Ammonia Standards (2.38ppm)	NH3	0.000284286815	1.93130E-008	0.1	025D		6.291E-005
Ammonia Standards (340ppb)	NH3	0.000040612402	2.75899E-009	0.1	025D		8.987E-006
Boron Standard (1ppm)	H3BO3	0.000238896483	1.62294E-008	0.1	025D		5.286E-005
Boron Standard (2ppm)	H3BO3	0.000477792967	3.24588E-008	0.1	025D		1.057E-004
Boron Standard (4ppm)	H3BO3	0.000014333789	9.73763E-010	0.1	025D		3.172E-006
Calcium Standards (100ppb)	Ca	0.000007166894	4.86881E-010	0.1	025D		1.586E-006
Calcium Standards (10ppb)	Ca	0.000000716689	4.86881E-011	0.1	025D		1.586E-007
Calcium Standards (10ppm)	Ca	0.001194482416	8.11469E-008	0.1	025D		2.643E-004
Calcium Standards (1ppm)	Ca	0.000119448242	8.11469E-009	0.1	025D		2.643E-005
Calcium Standards (50ppb)	Ca	0.000003583447	2.43441E-010	0.1	025D		7.930E-007
Chloride Standards (1000ppm)	Cl	0.119448241638	8.11469E-006	0.1	025D		2.643E-002
Chloride Standards (100ppb)	Cl	0.00000477793	3.24588E-010	0.1	025D		1.057E-006
Chloride Standards (100ppm)	Cl	0.011944824164	8.11469E-007	0.1	025D		2.643E-003
Chloride Standards (10ppb)	Cl	0.000000716689	4.86881E-011	0.1	025D		1.586E-007
Chloride Standards (1ppb)	Cl	0.000000597241	4.05735E-011	0.1	025D		1.322E-007
Chloride Standards (1ppm)	Cl	0.000119448242	8.11469E-009	0.1	025D		2.643E-005

Chloride Standards (2.5ppb)	Cl	0.000000179172	1.21720E-011	0.1	025D	3.965E-008
Chloride Standards (20ppb)	Cl	0.000000955586	6.49175E-011	0.1	025D	2.115E-007
Chloride Standards (25ppb)	Cl	0.000001194482	8.11469E-011	0.1	025D	2.643E-007
Chloride Standards (3ppb)	Cl	0.000000215007	1.46064E-011	0.1	025D	4.758E-008
Chloride Standards (3ppm)	Cl	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Chloride Standards (50ppb)	Cl	0.000002388965	1.62294E-010	0.1	025D	5.286E-007
Chloride Standards (5ppb)	Cl	0.000000358345	2.43441E-011	0.1	025D	7.930E-008
Chloride Standards (6ppb)	Cl	0.000000430014	2.92129E-011	0.1	025D	9.515E-008
Chloride Standards (0.5ppb)	Cl	0.000000035834	2.43441E-012	0.1	025D	7.930E-009
Coagulant solution (1%)		0.053751708737	3.65161E-006	0.1	025D	1.189E-002
Copper Standards (10ppm)	Cu	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Copper Standards (1ppm)	Cu	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Copper Standards (2ppm)	Cu	0.000238896483	1.62294E-008	0.1	025D	5.286E-005
Copper Standards (3ppm)	Cu	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Copper Standards (5ppm)	Cu	0.000597241208	4.05735E-008	0.1	025D	1.322E-004
Disodium EDTA (pH 10 Buf.)(<10,000ppm)	Na2C10N2O8	2.388964832769	1.62294E-004	0.1	025D	5.286E-001
Disodium EDTA (pH 10 Buf.)(<10,000ppm)	Na2C10N2O8	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
Disodium EDTA (pH 10 Buf.)(<10,000ppm)	Na2C10N2O8	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Ethanolamine Standards (1.0ppm)	C2NOH7	0.000597241208	4.05735E-008	0.1	025D	1.322E-004
Ethanolamine Standards (1.2ppm)	C2NOH8	0.000086002734	5.84258E-009	0.1	025D	1.903E-005
Ethanolamine Standards (1000ppm)	C2NOH9	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Ethanolamine Standards (200ppb)	C2NOH10	0.000014333789	9.73763E-010	0.1	025D	3.172E-006
Ethanolamine Standards (3ppm)	C2NOH11	0.000215006835	1.46064E-008	0.1	025D	4.758E-005
Ethanolamine Standards (500ppb)	C2NOH12	0.000035834472	2.43441E-009	0.1	025D	7.930E-006
Fluoride Standards (1000ppm)	F	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Fluoride Standards (100ppb)	F	0.00000477793	3.24588E-010	0.1	025D	1.057E-006
Fluoride Standards (100ppm)	F	0.011944824164	8.11469E-007	0.1	025D	2.643E-003
Fluoride Standards (10ppb)	F	0.000001194482	8.11469E-011	0.1	025D	2.643E-007
Fluoride Standards (1ppm)	F	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Fluoride Standards (2.5ppb)	F	0.000001791724	1.21720E-010	0.1	025D	3.965E-007
Fluoride Standards (20ppb)	F	0.000014333789	9.73763E-010	0.1	025D	3.172E-006
Fluoride Standards (25ppb)	F	0.000017917236	1.21720E-009	0.1	025D	3.965E-006
Fluoride Standards (2ppb)	F	0.000000095559	6.49175E-012	0.1	025D	2.115E-008
Fluoride Standards (30ppb)	F	0.000021500683	1.46064E-009	0.1	025D	4.758E-006
Fluoride Standards (3ppb)	F	0.000001791724	1.21720E-010	0.1	025D	3.965E-007
Fluoride Standards (3ppm)	F	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Fluoride Standards (50ppb)	F	0.000002388965	1.62294E-010	0.1	025D	5.286E-007
Fluoride Standards (5ppb)	F	0.000000238896	1.62294E-011	0.1	025D	5.286E-008

Fluoride Standards (6ppb)	F	0.000000286676	1.94753E-011	0.1	025D	6.344E-008
ormaldehyde (Formazin Turb.)(<10,000pp	CH2O	1.194482416385	8.11469E-005	0.1	025D	2.643E-001
Formaldehyde (pH 4 Buffer) (<10,000ppm)	CH2O	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
Formaldehyde (pH 4 Buffer) (<10,000ppm)	CH2O	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Formate Standards (1000ppm)	CH2O2	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Formate Standards (100ppb)	CH2O2	0.000007166894	4.86881E-010	0.1	025D	1.586E-006
Formate Standards (100ppm)	CH2O2	0.011944824164	8.11469E-007	0.1	025D	2.643E-003
Formate Standards (10ppb)	CH2O2	0.000000716689	4.86881E-011	0.1	025D	1.586E-007
Formate Standards (10ppm)	CH2O2	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Formate Standards (25ppb)	CH2O2	0.000001791724	1.21720E-010	0.1	025D	3.965E-007
Formate Standards (25ppm)	CH2O2	0.002986206041	2.02867E-007	0.1	025D	6.608E-004
Formate Standards (50ppb)	CH2O2	0.000003583447	2.43441E-010	0.1	025D	7.930E-007
Glycolate Standards (1000ppm)	C2H4O3	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Glycolate Standards (100ppb)	C2H4O3	0.000007166894	4.86881E-010	0.1	025D	1.586E-006
Glycolate Standards (100ppm)	C2H4O3	0.011944824164	8.11469E-007	0.1	025D	2.643E-003
Glycolate Standards (10ppb)	C2H4O3	0.000000716689	4.86881E-011	0.1	025D	1.586E-007
Glycolate Standards (10ppm)	C2H4O3	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Glycolate Standards (25ppb)	C2H4O3	0.000001791724	1.21720E-010	0.1	025D	3.965E-007
Glycolate Standards (25ppm)	C2H4O3	0.002986206041	2.02867E-007	0.1	025D	6.608E-004
Glycolate Standards (50ppb)	C2H4O3	0.000003583447	2.43441E-010	0.1	025D	7.930E-007
amethylenetetramine(Form Turb)(<10,000p	C6H20N4	1.194482416385	8.11469E-005	0.1	025D	2.643E-001
Hydrazine Dihydrochloride (1000ppm)	N2H6Cl	0.005972412082	4.05735E-007	0.1	025D	1.322E-003
Hydrazine Dihydrochloride (1ppm)	N2H6Cl	0.000005972412	4.05735E-010	0.1	025D	1.322E-006
Hydrazine Dihydrochloride (20ppb)	N2H6Cl	0.000002388965	1.62294E-010	0.1	025D	5.286E-007
Hydrazine Dihydrochloride (80ppb)	N2H6Cl	0.000000477793	3.24588E-011	0.1	025D	1.057E-007
Hydrazine Dihydrochloride (80ppm)	N2H6Cl	0.000477792967	3.24588E-008	0.1	025D	1.057E-004
Hydrochloric Acid (.032M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (.048M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (6.05M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (1.121M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (12.1M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (12.1M)	HCl	0	0.00000E+000		025D	0.000E+000
Hydrochloric Acid (12.1M)	HCl	0	0.00000E+000		025D	0.000E+000
Iron Standards (.5ppm)	Fe	0.000059724121	4.05735E-009	0.1	025D	1.322E-005
Iron Standards (10ppm)	Fe	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Iron Standards (1ppm)	Fe	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Iron Standards (2ppm)	Fe	0.000238896483	1.62294E-008	0.1	025D	5.286E-005

Iron Standards (3ppm)	Fe	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Iron Standards (5ppm)	Fe	0.000597241208	4.05735E-008	0.1	025D	1.322E-004
Isopropyl Alcohol	C3H8O	1.791723624577	1.21720E-004	0.1	025D	3.965E-001
Isopropyl Alcohol	C3H8O	0.023889648328	1.62294E-006	0.1	025D	5.286E-003
Isopropyl Alcohol	C3H8O	0.143337889966	9.73763E-006	0.1	025D	3.172E-002
Lithium Standards (1ppm)	Li	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Lithium Standards (2.5ppm)	Li	0.000298620604	2.02867E-008	0.1	025D	6.608E-005
Lithium Standards (3.5ppm)	Li	0.000418068846	2.84014E-008	0.1	025D	9.251E-005
Lithium Standards (3ppm)	Li	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Lithium Standards (4ppm)	Li	0.000477792967	3.24588E-008	0.1	025D	1.057E-004
Liquinox Soap(99% water)	Anionic Soap	0.000000281152	1.91000E-011		025D	2.500E+001
Magnesium Standards (100ppb)	Mg	0.000007166894	4.86881E-010	0.1	025D	1.586E-006
Magnesium Standards (10ppb)	Mg	0.000000716689	4.86881E-011	0.1	025D	1.586E-007
Magnesium Standards (10ppm)	Mg	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Magnesium Standards (1ppm)	Mg	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Magnesium Standards (50ppb)	Mg	0.000003583447	2.43441E-010	0.1	025D	7.930E-007
Mannitol (18%)	C6H14O6	47.30150368883	3.21342E-003	0.1	025D	1.047E+001
Mannitol (9%)	C6H14O6	21.50068349492	1.46064E-003	0.1	025D	4.758E+000
Methyl Orange	C14H14N3Na	0.023889648328	1.62294E-006	0.1	025D	5.286E-003
Methanesulfonic Acid (6.5ml/l)	CH6O3S	0.045031987098	3.05924E-006	0.1	025D	9.965E-003
Methoxypropylamine Standards (1000ppm)	C4H11NO	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Methoxypropylamine Standards (1ppm)	C4H11NO	0.000071668945	4.86881E-009	0.1	025D	1.586E-005
Methoxypropylamine Standards (3ppm)	C4H11NO	0.000215006835	1.46064E-008	0.1	025D	4.758E-005
Methoxypropylamine Standards (4000ppm)	C4H11NO	0.477792966554	3.24588E-005	0.1	025D	1.057E-001
Methoxypropylamine Standards (4ppm)	C4H11NO	0.002388964833	1.62294E-007	0.1	025D	5.286E-004
Methoxypropylamine Standards (500ppb)	C4H11NO	0.000035834472	2.43441E-009	0.1	025D	7.930E-006
Methoxypropylamine Standards (6ppm)	C4H11NO	0.00043001367	2.92129E-008	0.1	025D	9.515E-005
Methyl Alcohol	CH4O	130.4374798692	8.86124E-003	0.1	025D	2.886E+001
Methyl Alcohol (pH 4 buffer)(<10,000ppm)	CH4O	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
Methyl Alcohol (pH 4 buffer)(<10,000ppm)	CH4O	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Nickel standards (.5ppm)	Ni	0.000059724121	4.05735E-009	0.1	025D	1.322E-005
Nickel standards (1.5ppm)	Ni	0.000179172362	1.21720E-008	0.1	025D	3.965E-005
Nickel standards (10ppm)	Ni	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Nickel standards (1ppm)	Ni	0.000119448242	8.11469E-009	0.1	025D	2.643E-005

Nickel standards (2ppm)	Ni	0.000238896483	1.62294E-008	0.1	025D	5.286E-005
Nickel standards (3ppm)	Ni	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Nickel standards (5ppm)	Ni	0.000597241208	4.05735E-008	0.1	025D	1.322E-004
Nitric Acid (1.59M)	HO3N	0	0.00000E+000		025D	0.000E+000
Nitric Acid (15.9M)	HO3N	0	0.00000E+000		025D	0.000E+000
Nitric Acid (15.9M)	HO3N	0	0.00000E+000		025D	0.000E+000
Nitric Acid (15.9M)	HO3N	0	0.00000E+000		025D	0.000E+000
Nitric Acid (15.9M)	HO3N	0	0.00000E+000		025D	0.000E+000
Nitric Acid (15.9M)	HO3N	0	0.00000E+000		025D	0.000E+000
Oxalic Acid (0.11M)	C2H2O4	0	0.00000E+000		025D	0.000E+000
Para-dimethylaminobenzaldehyde	C9H11NO	2.580082019391	1.75277E-004	0.1	025D	5.709E-001
Phenolphthalein (1%)	C20H14O4	0.017917236246	1.21720E-006	0.1	025D	3.965E-003
Phenolphthalein (1%)	C20H14O4	0.000238896483	1.62294E-008	0.1	025D	5.286E-005
Phenolphthalein (1%)	C20H14O4	0.0014333789	9.73763E-008	0.1	025D	3.172E-004
Phosphoric Acid (2.96M)	H3PO4	0	0.00000E+000		025D	0.000E+000
Potassium Acid Phthalate (100ppb)	C8H5O4K	0.000011944824	8.11469E-010	0.1	025D	2.643E-006
Potassium Acid Phthalate (200ppb)	C8H5O4K	0.000023889648	1.62294E-009	0.1	025D	5.286E-006
Potassium Acid Phthalate (200ppm)	C8H5O4K	0.023889648328	1.62294E-006	0.1	025D	5.286E-003
ot. Acid Phthalate (pH 4 Buf.)(<10,000ppm	C8H5O4K	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
ot. Acid Phthalate (pH 4 Buf.)(<10,000ppm	C8H5O4K	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Potassium Acid Phthalate (3%)	C8H5O4K	0.071668944983	4.86881E-006	0.1	025D	1.586E-002
Potassium Acid Phthalate (3%)	C8H5O4K	0.071668944983	4.86881E-006	0.1	025D	1.586E-002
orate in formaldehyde(0.1%) (pH 10)(<1000	KH2O3B	2.388964832769	1.62294E-004	0.1	025D	5.286E-001
orate in formaldehyd(0.1%) (pH 10)(<1000	KH2O3B	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
orate in formaldehyde(0.1%) (pH 10)(<1000	KH2O3B	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Pot. Carbonate (pH buf. 10) (<10,000ppm)	K2CO3	2.388964832769	1.62294E-004	0.1	025D	5.286E-001
Pot. Carbonate (pH buf. 10) (<10,000ppm)	K2CO3	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
Pot. Carbonate (pH buf. 10) (<10,000ppm)	K2CO3	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Potassium Chloride (744ppm)	KCl	0.355477967116	2.41493E-005	0.1	025D	7.866E-002
Potassium Persulfate (2%)	K2S2O8	2.388964832769	1.62294E-004	0.1	025D	5.286E-001
Pot. Phosphate (pH buffer 7)(<10,000ppm)	KH2PO4	2.388964832769	1.62294E-004	0.1	025D	5.286E-001
Pot. Phosphate (pH buffer 7)(<10,000ppm)	KH2PO4	3.583447249154	2.43441E-004	0.1	025D	7.930E-001
Pot. Phosphate (pH buffer 7)(<10,000ppm)	KH2PO4	0.597241208192	4.05735E-005	0.1	025D	1.322E-001

Scintillation Cocktail(99% water)	High MW Eth	0.000000234048	1.59000E-011		025D	2.050E+001
Silica standard (1000ppm)	SiO3H2	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Silica standard (100ppb)	SiO3H2	0.000001194482	8.11469E-011	0.1	025D	2.643E-007
Silica standard (10ppm)	SiO3H2	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Silica standard (200ppb)	SiO3H2	0.000002388965	1.62294E-010	0.1	025D	5.286E-007
Silica standard (50ppb)	SiO3H2	0.000017917236	1.21720E-009	0.1	025D	3.965E-006
Silver Nitrate (48.5g/L)	AgNO3	0.00289661986	1.96781E-007	0.1	025D	6.410E-004
Sodium Bicarbonate (142.8ppmg/L)	NaHCO3	1.296347876854	8.80671E-005	0.1	025D	2.869E-001
Sodium Bisulfite	NaHSO3	7.883583948139	5.35570E-004	0.1	025D	1.744E+000
Sodium Carbonate	Na2CO3	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Sodium Carbonate (190.8ppm)	Na2CO3	1.732095062351	1.17670E-004	0.1	025D	3.833E-001
Sodium Hydroxide (0.02M)	NaOH	0	0.00000E+000		025D	0.000E+000
Sodium Hydroxide (0.05M)	NaOH	0	0.00000E+000		025D	0.000E+000
Sodium Hydroxide (19.4M)	NaOH	0	0.00000E+000		025D	0.000E+000
Sodium Hydroxide (19.4M)	NaOH	0	0.00000E+000		025D	0.000E+000
Sodium Hydroxide (19.4M)	NaOH	0	0.00000E+000		025D	0.000E+000
Sodium Standards (0.5ppb)	Na	0.000000035834	2.43441E-012	0.1	025D	7.930E-009
Sodium Standards (1000ppm)	Na	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Sodium Standards (100ppb)	Na	0.000011944824	8.11469E-010	0.1	025D	2.643E-006
Sodium Standards (10ppb)	Na	0.000000716689	4.86881E-011	0.1	025D	1.586E-007
Sodium Standards (10ppm)	Na	0.001194482416	8.11469E-008	0.1	025D	2.643E-004
Sodium Standards (1ppm)	Na	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Sodium Standards (30ppb)	Na	0.000002150068	1.46064E-010	0.1	025D	4.758E-007
Sodium Standards (3ppb)	Na	0.000001791724	1.21720E-010	0.1	025D	3.965E-007
Sodium Standards (3ppm)	Na	0.000358344725	2.43441E-008	0.1	025D	7.930E-005
Sodium Standards (5ppb)	Na	0.000000358345	2.43441E-011	0.1	025D	7.930E-008
Sodium Standards (80ppb)	Na	0.000009555859	6.49175E-010	0.1	025D	2.115E-006
Sodium Sulfate	Na2SO4	0.597241208192	4.05735E-005	0.1	025D	1.322E-001
Sodium Sulfite	Na2SO3	0.262786131605	1.78523E-005	0.1	025D	5.815E-002
Sodium Tetraborate (10.06g/l)	Na4B4O7	80.51050382916	5.46946E-003	0.1	025D	1.782E+001
Stannous Chloride	SnCl2	5.972412081924	4.05735E-004	0.1	025D	1.322E+000
Sulfate Standards (0.5ppb)	SO4	0.000000035834	2.43441E-012	0.1	025D	7.930E-009
Sulfate Standards (1000ppm)	SO4	0.119448241638	8.11469E-006	0.1	025D	2.643E-002
Sulfate Standards (100ppm)	SO4	0.011944824164	8.11469E-007	0.1	025D	2.643E-003

Sulfate Standards (1ppb)	SO4	0.000000645021	4.38193E-011	0.1	025D	1.427E-007
Sulfate Standards (1ppm)	SO4	0.000119448242	8.11469E-009	0.1	025D	2.643E-005
Sulfate Standards (20ppb)	SO4	0.000000955586	6.49175E-011	0.1	025D	2.115E-007
Sulfate Standards (25ppb)	SO4	0.000001194482	8.11469E-011	0.1	025D	2.643E-007
Sulfate Standards (3ppb)	SO4	0.000000215007	1.46064E-011	0.1	025D	4.758E-008
Sulfate Standards (50ppb)	SO4	0.000002388965	1.62294E-010	0.1	025D	5.286E-007
Sulfate Standards (5ppb)	SO4	0.000000358345	2.43441E-011	0.1	025D	7.930E-008
Sulfuric Acid (2.7M)	H2SO4	0	0.00000E+000		025D	0.000E+000
Sulfuric Acid (25mM)	H2SO4	0	0.00000E+000		025D	0.000E+000
Sulfuric Acid (6M)	H2SO4	0	0.00000E+000		025D	0.000E+000
Sulfuric Acid (18M)	H2SO4	0	0.00000E+000		025D	0.000E+000
Thioglycolic acid (14M)	C2H4SO2	0.000000001119	7.60000E-014		025D	1.000E-001
Toluene	C7H8	0.000035834472	2.43441E-009	0.1	025D	7.930E-006

ATTACHMENT D **NH0020338**

**MARINE ACUTE
TOXICITY TEST PROCEDURE AND PROTOCOL**

I. GENERAL REQUIREMENTS

The permittee shall conduct acceptable acute toxicity tests in accordance with the appropriate test protocols described below:

- **Mysid Shrimp (Mysidopsis bahia) definitive 48-hour test.**
- **Inland Silverside (Menidia beryllina) definitive 48-hour test.**

Acute toxicity data shall be reported as outlined in Section VIII.

II. METHODS

Methods to follow are those recommended by EPA in:

Weber, C.I. et al. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, Fourth Edition. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH, August 1993, EPA/600/4-90/027F.

Any exceptions are stated herein.

III. SAMPLE COLLECTION

A discharge sample shall be collected. Aliquots shall be split from the sample, containerized and preserved (as per 40 CFR Part 136) for the chemical and physical analyses. The remaining sample shall be dechlorinated (if detected) in the laboratory using sodium thiosulfate for subsequent toxicity testing. (Note that EPA approved test methods require that samples collected for metals analyses be preserved immediately after collection.) Grab samples must be used for pH, temperature, and total residual oxidants (as per 40 CFR Part 122.21).

Standard Methods for the Examination of Water and Wastewater describes dechlorination of samples (APHA, 1992). Dechlorination can be achieved using a ratio of 6.7 mg/L anhydrous sodium thiosulfate to reduce 1.0 mg/L chlorine. A thiosulfate control (maximum amount of thiosulfate in lab control or receiving water) should also be run.

All samples held overnight shall be refrigerated at 4°C.

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IV. DILUTION WATER

A grab sample of dilution water used for acute toxicity testing shall be collected at a point away from the discharge which is free from toxicity or other sources of contamination. Avoid collecting near areas of obvious road or agricultural runoff, storm sewers or other point source discharges. An additional control (0% effluent) of a standard laboratory water of known quality shall also be tested.

If the receiving water diluent is found to be, or suspected to be toxic or unreliable, an alternate standard dilution water of known quality with a conductivity, salinity, total suspended solids, and pH similar to that of the receiving water may be substituted **AFTER RECEIVING WRITTEN APPROVAL FROM THE PERMIT ISSUING AGENCY(S).** Written requests for use of an alternative dilution water should be mailed with supporting documentation to the following address:

Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency - New England
One Congress Street
Suite 1100 (Mail Code: CAA)
Boston, Massachusetts 02114-2023

It may prove beneficial to have the proposed dilution water source screened for suitability prior to toxicity testing. EPA strongly urges that screening be done prior to set up of a full definitive toxicity test any time there is question about the dilution water's ability to support acceptable performance as outlined in the 'test acceptability' section of the protocol.

V. TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA

EPA New England requires tests be performed using four replicates of each control and effluent concentration because the non-parametric statistical tests cannot be used with data from fewer replicates. The following tables summarize the accepted Mysid and Menidia toxicity test conditions and test acceptability criteria:

EPA NEW ENGLAND RECOMMENDED EFFLUENT TOXICITY TEST CONDITIONS FOR THE MYSID, MYSIDOPSIS BAHIA 48 HOUR TEST[1]

1. Test type	Static, non-renewal
2. Salinity	25ppt ± 10 percent for all dilutions by adding dry ocean salts
3. Temperature (°C)	20°C ± 1°C or 25°C ± 1°C
4. Light quality	Ambient laboratory illumination
5. Photoperiod	16 hour light, 8 hour dark
6. Test chamber size	250 ml
7. Test solution volume	200 ml
8. Age of test organisms	1-5 days
9. No. Mysids per test chamber	10
10. No. of replicate test chambers per treatment	4
11. Total no. Mysids per test concentration	40
12. Feeding regime	Light feeding using concentrated Artemia nauplii while holding prior to initiating the test·
13. Aeration[2]	None
14. Dilution water	Natural seawater, or deionized water mixed with artificial sea salts
15. Dilution factor	≥ 0.5
16. Number of dilutions[3]	5 plus a control. An additional dilution at the permitted effluent concentration (%

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	effluent) is required if it is not included in the dilution series.
17. Effect measured	Mortality - no movement of body appendages on gentle prodding
18. Test acceptability	90% or greater survival of test organisms in control solution
19. Sampling requirements	For on-site tests, samples are used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection.
20. Sample volume required	Minimum 1 liter for effluents and 2 liters for receiving waters

Footnotes:

1. Adapted from EPA/600/4-90/027F.
2. If dissolved oxygen falls below 4.0 mg/L, aerate at rate of less than 100 bubbles/min. Routine D.O. checks are recommended.
3. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

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EPA NEW ENGLAND RECOMMENDED TOXICITY TEST CONDITIONS FOR THE INLAND SILVERSIDE, MENIDIA BERYLLINA 48 HOUR TEST[1]

1. Test type	Static, non-renewal
2. Salinity	25 ppt ± 2 ppt by adding dry ocean salts
3. Temperature	20°C ± 1°C or 25°C ± 1°C
4. Light quality	Ambient laboratory illumination
5. Photoperiod	16 hr light, 8 hr dark
6. Size of test vessel	250 mL (minimum)
7. Volume of test solution	200 mL/replicate (minimum)
8. Age of fish	9-14 days; 24 hr age range
9. No. fish per chamber	10 (not to exceed loading limits)
10. No. of replicate test vessels per treatment	4
11. Total no. organisms per concentration	40
12. Feeding regime	Light feeding using concentrated Artemia nauplii while holding prior to initiating the test
13. Aeration[2]	None
14. Dilution water	Natural seawater, or deionized water mixed with artificial sea salts.
15. Dilution factor	≥ 0.5
16. Number of dilutions[3]	5 plus a control. An additional dilution at the permitted concentration (% effluent) is

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	required if it is not included in the dilution series.
17. Effect measured	Mortality-no movement on gentle prodding.
18. Test acceptability	90% or greater survival of test organisms in control solution.
19. Sampling requirements	For on-site tests, samples must be used within 24 hours of the time they are removed from the sampling device. Off-site test samples must be used within 36 hours of collection.
20. Sample volume required	Minimum 1 liter for effluents and 2 liters for receiving waters.

Footnotes:

1. Adapted from EPA/600/4-90/027F.
2. If dissolved oxygen falls below 4.0 mg/L, aerate at rate of less than 100 bubbles/min. Routine D.O. checks recommended.
3. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

VI. CHEMICAL ANALYSIS

At the beginning of the static acute test, pH, salinity, and temperature must be measured at the beginning and end of each 24-hour period in each dilution and in the controls. The following chemical analyses shall be performed for each sampling event.

Parameter	Effluent	Diluent	Minimum Quantification Level (mg/L)
pH	x	x	---
Salinity	x	x	PPT(o/oo)
Total Residual Oxidants*1	x	x	0.05
Total Solids and Suspended Solids	x	x	---
Ammonia	x	x	0.1
Total Organic Carbon	x	x	0.5
Total Metals			
Cd	x		0.001
Cr	x		0.005
Pb	x		0.005
Cu	x		0.0025
Zn	x		0.0025
Ni	x		0.004
Al	x		0.02

Superscript:

*1 Total Residual Oxidants

Either of the following methods from APHA (1992), Standard Methods for the Examination of Water and Wastewater, 18th or subsequent Edition(s) as approved in 40 CFR Part 136 must be used for these analyses:

-Method 4500-Cl E. Low-Level Amperometric Titration (the preferred method);

-Method 4500-Cl G. DPD Colorimetric Method, or use U.S. EPA Manual of Methods Analysis of Water or Wastes, Method 330.5.

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VII. TOXICITY TEST DATA ANALYSIS

LC50 Median Lethal Concentration

An estimate of the concentration of effluent or toxicant that is lethal to 50% of the test organisms during the time prescribed by the test method.

Methods of Estimation:

- Probit Method
- Spearman-Karber
- Trimmed Spearman-Karber
- Graphical

See flow chart in Figure 6 on page 77 of EPA 600/4-90/027F for appropriate method to use on a given data set.

No Observed Acute Effect Level (NOAEL)

See flow chart in Figure 13 on page 94 of EPA 600/4-90/027F.

VIII. TOXICITY TEST REPORTING

The following must be reported:

- Description of sample collection procedures, site description;
- Names of individuals collecting and transporting samples, times and dates of sample collection and analysis on chain-of-custody; and
- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests; light and temperature regime; other information on test conditions if different than procedures recommended. Reference toxicity test data must be included.
- Raw data and bench sheets.
- All chemical/physical data generated. (Include minimum detection levels and minimum quantification levels.)
- Provide a description of dechlorination procedures (as applicable).
- Any other observations or test conditions affecting test outcome.
- Statistical tests used to calculate endpoints.

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ATTACHMENT D **NH0020338**

MARINE CHRONIC
TOXICITY TEST PROCEDURE AND PROTOCOL

I. GENERAL REQUIREMENTS

The permittee shall conduct acceptable silverside chronic (and modified acute) and sea urchin chronic toxicity tests in accordance with the appropriate test protocols described below:

- **Inland Silverside (Menidia beryllina) Larval Growth and Survival Test.**
- **Sea Urchin (Arbacia punctulata) 1 Hour Fertilization Test.**

Chronic and acute toxicity data shall be reported as outlined in Section VIII. The chronic Menidia test can be used to calculate an LC50 at the end of 48 hours of exposure when both an acute (LC50) and a chronic (C-NOEC) test is specified in the permit.

II. METHODS

Methods to follow are those recommended by EPA in:

Klemm, D.J. et al. Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters To Marine and Estuarine Organisms, Second Edition. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, July 1994, EPA/600/4-91/003.

Any exceptions are stated herein.

III. SAMPLE COLLECTION

For each sampling event involving the Menidia beryllina, three discharge samples shall be collected. Fresh samples are necessary for Days 1, 3, and 5 (see Section V. for holding times). A single sample is necessary for the Arbacia punctulata test. The sample shall be analyzed chemically (see Section VI). The initial sample (Day 1) is used to start the tests, and for test solution renewal on Day 2. The second sample is collected for use at the start of Day 3, and for renewal on Day 4. The third sample is used on Days 5, 6, and 7. The initial (Day 1) sample will be analyzed chemically (see Section VI). Day 3 and 5 renewal samples will be held until test completion. If either the Day 3 or 5 renewal sample is of sufficient potency to cause lethality to 50 percent or more test organisms in any of the dilutions for either species, then a chemical analysis shall be performed on the appropriate sample(s) as well.

Aliquots shall be split from the sample, containerized and preserved (as per 40 CFR Part 136) for the chemical and physical analyses. The remaining sample shall be dechlorinated (if detected) in the laboratory using sodium thiosulfate for subsequent toxicity testing. (Note that EPA approved test methods require that samples collected for metals analyses be preserved immediately after collection.) Grab samples must be used for pH, temperature, and total residual oxidants (as per 40 CFR Part 122.21).

Standard Methods for the Examination of Water and Wastewater describes dechlorination of samples (APHA, 1992). Dechlorination can be achieved using a ratio of 6.7 mg/L anhydrous sodium thiosulfate to reduce 1 mg/L chlorine. A thiosulfate control (maximum amount of thiosulfate in lab control or receiving water) should also be run.

All samples held overnight shall be refrigerated at 4°C.

IV. DILUTION WATER

Grab samples of receiving water used for chronic toxicity testing shall be collected from one or several distances away from the discharge. It may be necessary to test receiving water at several distances in a separate chronic test to determine the extent of the zone of toxicity. Avoid collecting near areas of obvious road or agricultural runoff, storm sewers or other point source discharges. An additional control (0% effluent) of a standard laboratory water of known quality shall also be tested.

If the receiving water diluent is found to be, or suspected to be toxic or unreliable, an alternate standard dilution water of known quality with a conductivity, salinity, total suspended solids, organic carbon, and pH similar to that of the receiving water may be substituted **AFTER RECEIVING WRITTEN APPROVAL FROM THE PERMIT ISSUING AGENCY(S).** Written requests for use of an alternative dilution water should be mailed with supporting documentation to the following address:

Director
Office of Ecosystem Protection
U. S. Environmental Protection Agency-New England
JFK Federal Building (CAA)
Boston, MA 02203

It may prove beneficial to the permittee to have the proposed dilution water source screened for suitability prior to toxicity testing. EPA strongly urges that screening be done prior to set up of a full definitive toxicity test any time there is question about the dilution water's ability to support acceptable

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performance as outlined in the 'test acceptability' section of the protocol.

V. TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA

EPA New England requires that tests be performed using four replicates of each control and effluent concentration because the on-parametric statistical tests cannot be used with data from fewer replicates. Also, if a reference toxicant test was being performed concurrently with an effluent or receiving water test and fails, both tests must be repeated.

The following tables summarize the accepted Menidia and Arbacia toxicity test conditions and test acceptability criteria:

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EPA NEW ENGLAND RECOMMENDED TEST CONDITIONS FOR THE SEA URCHIN, ARBACIA PUNCTULATA, FERTILIZATION TEST[1]

1. Test type	Static, non-renewal
2. Salinity	30 o/oo ± 2 o/oo by adding dry ocean salts
3. Temperature	20 ± 1°C
4. Light quality	Ambient laboratory light during test preparation
5. Light intensity	10-20 uE/m²/s, or 50-100 ft-c (Ambient Laboratory Levels)
6. Test vessel size	Disposal (glass) liquid scintillation vials (20 ml capacity), presoaked in control water
7. Test solution volume	5 ml
8. Number of sea urchins	Pooled sperm from four males and pooled eggs from four females are used per test
9. Number of egg and sperm cells per chamber	About 2000 eggs and 5,000,000 sperm cells per vial
10. Number of replicate chambers per treatment	4
11. Dilution water	Uncontaminated source of natural seawater or deionized water mixed with artificial sea salts
12. Dilution factor	Approximately 0.5
13. Test duration	1 hour and 20 minutes
14. Effects measured	Fertilization of sea urchin eggs
15. Number of treatments per test[2]	5 and a control. An additional dilution at the permitted effluent concentration (% effluent) is required.

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16.	Acceptability of test	Minimum of 70% fertilization in controls. Effluent concentrations exhibiting greater than 70% fertilization, flagged as statistically significantly different from the controls, will not be considered statistically different from the controls for NOEC reporting.
17.	Sampling requirements	For on-site tests, samples are to be used within 24 hours of the time that they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection.
18.	Sample volume required	Minimum 1 liter

Footnotes:

1. Adapted from EPA/600/4-91/003, July 1994.
2. When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

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EPA NEW ENGLAND RECOMMENDED TEST CONDITIONS FOR THE INLAND SILVERSIDE, MENIDIA BERYLLINA, GROWTH AND SURVIVAL TEST[1]

1.	Test type	Static, renewal
2.	Salinity	5 o/oo to 32 o/oo ± 2 o/oo by adding artificial sea salts
3.	Temperature	25 ± 1°C
4.	Light quality	Ambient laboratory light
5.	Light intensity	10-20 uE/m²/s, or 50-100 ft-C (Ambient Laboratory Levels)
6.	Photoperiod	16 hr light, 8 hr darkness
7.	Test vessel size	600 - 1000 mL beakers or equivalent (glass test chambers should be used)
8.	Test solution volume	500-750 mL/replicate loading and DO restrictions must be met)
9.	Renewal of test solutions	Daily using most recently collected sample.
10.	Age of test organisms	Seven to eleven days post hatch; 24 hr range in age.
11.	Larvae/test chamber	15 (minimum of 10)
12.	Number of replicate chambers	4 per treatment
13.	Source of food	Newly hatched and rinsed Artemia nauplii less than 24 hr old
14.	Feeding regime	Feed once a day 0.10 g wet wt Artemia nauplii per replicate on days 0-2; feed 0.15 g wet wt Artemia nauplii per replicate on days 3-6
15.	Cleaning	Siphon daily, immediately before test solution renewaland feeding
16.	Aeration[2]	None

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17.	Dilution water	Uncontaminated source of natural seawater; or deionized water mixed with artificial sea salts.
18.	Effluent concentrations[3]	5 and a control. An additional dilution at the permitted effluent concentration (% effluent) is required.
19.	Dilution factor	≥ 0.5
20.	Test duration	7 days
21.	Effects measured	Survival and growth (weight)
22.	Acceptability of test	The average survival of control larvae is a minimum of 80%, and the average dry wt of unpreserved control larvae is a minimum of 0.5 mg, or the average dry wt of preserved control larvae is a minimum of 0.43 mg if preserved not more than 7 days in 4% formalin or 70% ethanol.
23.	Sampling requirements	For on-site tests, samples are collected daily and used within 24 hours of the time they are removed from the sampling device. For off-site tests, samples must be first used within 36 hours of collection.
24.	Sample Volume Required	Minimum of 6 liters/day.

Footnotes:

[1] Adapted from EPA/600/4-91/003, July 1994.

[2] If dissolved oxygen (D.O.) falls below 4.0 mg/L, aerate all chambers at a rate of less than 100 bubbles/min. Routine D.O. checks are recommended.

[3] When receiving water is used for dilution, an additional control made up of standard laboratory dilution water (0% effluent) is required.

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VI. CHEMICAL ANALYSIS

As part of each daily renewal of the Menidia test, pH, dissolved oxygen, salinity, and temperature must be measured at the beginning and end of each 24 hour period in each dilution and in the controls. It must also be done at the start of the Arbacia test. The following chemical analyses shall be performed for each sampling event.

Parameter	Effluent	Diluent	Minimum Quantification Level(mg/L)
pH	x	x	---
Salinity	x	x	PPT(o/oo)
Total Residual Oxidants*1	x	x	0.05
Total Solids and Suspended Solids	x	x	---
Ammonia	x	x	0.1
Total Organic Carbon	x	x	0.5
Total Metals			
Cd	x		0.001
Cr	x		0.005
Pb	x		0.005
Cu	x		0.0025
Zn	x		0.0025
Ni	x		0.004
Al	x		0.02

Superscripts:

*1 Total Residual Oxidants
Either of the following methods from the 18th Edition of the APHA (1992) Standard Methods for the Examination of Water and Wastewater must be used for these analyses:

-Method 4500-CL E the Amperometric Titration Method (the preferred method);
-Method 4500-CL G the DPD Photometric Method.

or use USEPA Manual of Methods Analysis of Water or Wastes, Method 330.5.

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VII. TOXICITY TEST DATA ANALYSIS

LC50 Median Lethal Concentration (Determined at 48 Hours)

Methods of Estimation:
- Probit Method
- Spearman-Karber
- Trimmed Spearman-Karber
- Graphical

See flow chart on page 56 of EPA/600/4-91/003 for appropriate point estimation method to use on a given data set.

Chronic No Observed Effect Concentration (C-NOEC)

Methods of Estimation:
- Dunnett's Procedure
- Bonferroni's T-Test
- Steel's Many-One Rank Test
- Wilcoxin Rank Sum Test

Reference flow charts on pages 191, 192, and 321 of EPA/600/4-91/003 for the appropriate method to use on a given data set.

In the case of two tested concentrations causing adverse effects but an intermediate concentration not causing a statistically significant effect, report the C-NOEC as the lowest concentration where there is no observable effect. The definition of NOEC in the EPA Technical Support Document only applies to linear dose-response data.

VIII. TOXICITY TEST REPORTING

A report of results will include the following:

- Description of sample collection procedures, site description;
- Names of individuals collecting and transporting samples, times and dates of sample collection and analysis on chain-of-custody; and
- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests; light and temperature regime; other information on test conditions if different than procedures recommended. Reference toxicant test data should be included.
- All chemical/physical data generated. (Include minimum detection levels and minimum quantification levels.)

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- Raw data and bench sheets.
- Provide a description of dechlorination procedures (as applicable).
- Any other observations or test conditions affecting test outcome.

CONTENTS - PART II
(September 1, 1993)

SECTION A. GENERAL REQUIREMENTS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

a. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405 (d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

b. The CWA provides that any person who violates Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any of such sections in a permit issued under Section 402, or any requirement imposed in a pretreatment program approved under Sections 402 (a)(3) or 402 (b)(8) of the CWA is subject to a civil penalty not to exceed $25,000 per day for each violation. Any person who negligently violates such requirements is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both. Any person who knowingly violates such requirements is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or both. Note: See 40 CFR §122.41(a)(2) for additional enforcement criteria.

c. Any person may be assessed an administrative penalty by the Administrator for violating Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA, or any permit condition or limitation implementing any of such sections in a permit issued under Section 402 of the CWA. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

2. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

3. Duty to Provide Information

The permittee shall furnish to the Regional Administrator, within a reasonable time, any information which the Regional Administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Regional Administrator, upon request, copies of records required to be kept by this permit.

4. Reopener Clause

The Regional Administrator reserves the right to make appropriate revisions to this permit in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the CWA in order to bring all discharges into compliance with the CWA.

For any permit issued to a treatment works treating domestic sewage (including "sludge-only facilities"), the Regional Administrator or Director shall include a reopener clause to incorporate any applicable standard for sewage sludge use or disposal promulgated under Section 405 (d) of the CWA. The Regional Administrator or Director may promptly modify or revoke and reissue any permit containing the reopener clause required by this paragraph if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or contains a pollutant or practice not limited in the permit.

Permit modification or revocation will be conducted according to 40 CFR §§122.62, 122.63, 122.64 and 124.5.

5. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee

from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the CWA, or Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

6. Property Rights

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges.

7. Confidentiality of Information

a. In accordance with 40 CFR Part 2, any information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission in the manner prescribed on the application form or instructions or, in the case of other submissions, by stamping the words ''confidential business information'' on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information).

b. Claims of confidentiality for the following information will be denied:

(1) The name and address of any permit applicant or permittee;

(2) Permit applications, permits, and effluent data as defined in 40 CFR §2.302(a)(2).

c. Information required by NPDES application forms provided by the Regional Administrator under §122.21 may not be claimed confidential. This includes information submitted on the forms themselves and any attachments used to supply information required by the forms.

8. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Regional Administrator. (The Regional Administrator shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)

9. Right of Appeal

Within thirty (30) days of receipt of notice of a final permit decision, any interested person, including the permittee, may submit a request to the Regional Administrator for an Evidentiary Hearing under Subpart E, or a Non-Adversary Panel Hearing under Subpart F, of 40 CFR Part 124, to reconsider or contest that decision. The request for a hearing must conform to the requirements of 40 CFR §124.74.

10. State Authorities

Nothing in Part 122, 123, or 124 precludes more stringent State regulation of any activity covered by these regulations, whether or not under an approved State program.

11. Other Laws

The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, and local laws and regulations.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of storm water pollution prevention plans. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of the permit.

Need to Halt or Reduce Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

4. Bypass

a. Definitions.

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations.

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Paragraphs B.4.c and 4.d of this section.

c. Notice.

(1) Anticipated bypass.

If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass.

The permittee shall submit notice of an unanticipated bypass as required in Paragraph D.1.e (24-hour notice).

d. Prohibition of bypass.

(1) Bypass is prohibited, and the Regional Administrator may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) (i) The permittee submitted notices as required under Paragraph 4.c of this section.

(ii) The Regional Administrator may approve an anticipated bypass, after considering its adverse effects, if the Regional Administrator determines that it will meet the three conditions listed above in Paragraph 4.d of this section.

Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary non-compliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of Paragraph B.5.c of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset.

A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly

signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;

(2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in Paragraphs D.1.a and 1.e (24-hour notice); and

(4) The permittee complied with any remedial measures required under B.3. above.

d. Burden of proof.

In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

SECTION C. MONITORING AND RECORDS

1. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

b. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application except for the information concerning storm water discharges which must be retained for a total of 6 years. This retention period may be extended by request of the Regional Administrator at any time.

c. Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;

(2) The individual(s) who performed the sampling or measurements;

(3) The date(s) analyses were performed;

(4) The individual(s) who performed the analyses;

(5) The analytical techniques or methods used; and

(6) The results of such analyses.

d. Monitoring results must be conducted according to test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, unless other test procedures have been specified in the permit.

e. The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

7. Inspection and Entry

The permittee shall allow the Regional Administrator, or an authorized representative (including an authorized contractor acting as a representative of the Administrator), upon presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Reporting Requirements

a. Planned changes. The permittee shall give notice to the Regional Administrator as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR §122.29(b); or

(2) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies neither to pollutants which are subject to the effluent limitations in the permit, nor to the notification requirements at 40 CFR §122.42(a)(1).

The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition or change may justify the application of permit conditions different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

b. Anticipated noncompliance. The permittee shall give advance notice to the Regional Administrator of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

c. Transfers. This permit is not transferable to any person except after notice to the Regional Administrator. The Regional Administrator may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act. (See §122.61; in some cases, modification or revocation and reissuance is mandatory.)

d. Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by the Regional Administrator for reporting results of monitoring of sludge use or disposal practices.

(2) If the permittee monitors any pollutant more frequently than required by the permit using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Regional Administrator.

(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Regional Administrator in the permit.

e. Twenty-four hour reporting.

(1) The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances.

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(2) The following shall be included as information which must be reported within 24 hours under this paragraph.

(a) Any unanticipated bypass which exceeds any effluent limitation in the permit. (See §122.41(g).

(b) Any upset which exceeds any effluent limitation in the permit.

(c) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Regional Administrator in the permit to be reported within 24 hours. (See §122.44(g).)

(3) The Regional Administrator may waive the written report on a case-by-case basis for reports under Paragraph D.1.e if the oral report has been received within 24 hours.

f. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

g. Other noncompliance.

The permittee shall report all instances of noncompliance not reported under Paragraphs D.1.d, D.1.e and D.1.f of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D.1.e of this section.

h. Other information.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Administrator, it shall promptly submit such facts or information.

2. Signatory Requirement

a. All applications, reports, or information submitted to the Regional Administrator shall be signed and certified. (See §122.22)

b. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

J. Availability of Reports

Except for data determined to be confidential under Paragraph A.8 above, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the CWA, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the CWA.

SECTION E. OTHER CONDITIONS.

1. DEFINITIONS FOR INDIVIDUAL NPDES PERMITS INCLUDING STORM WATER REQUIREMENTS

For purposes of this permit, the following definitions shall apply.

Administrator means the Administrator of the United States Environmental Protection Agency, or an authorized representative.

Applicable standards and limitations means all State, interstate, and Federal standards and limitations to which a "discharge", a "sewage sludge use or disposal practice", or a related activity is subject to, including "effluent limitations", water quality standards, standards of performance, toxic effluent standards or prohibitions, "best management practices", pretreatment standards, and "standards for sewage sludge use and disposal" under Sections 301, 302, 303, 304, 306, 307, 308, 403, and 405 of CWA.

Application means the EPA standard national forms for applying for a permit, including any additions, revisions or modifications to the forms; or forms approved by EPA for use in "approved States," including any approved modifications or revisions.

Average - The arithmetic mean of values taken at the frequency required for each parameter over the specified period. For total and/or fecal coliforms and Escherichia coli, the average shall be the geometric mean.

Average monthly discharge limitation means the highest allowable average of "daily discharges" over a calendar month calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

Average weekly discharge limitation means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of "waters of the United States." BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Best Professional Judgement (BPJ) means a case-by-case determination of Best Practicable Treatment (BPT), Best Available Treatment (BAT) or other appropriate technology-based standard based on an evaluation of the available technology to achieve a particular pollutant reduction and other factors set forth in 40 CFR §125.3 (d).

Class I Sludge Management Facility means any POTW identified under 40 CFR §403.8(a) as being required to have an approved pretreatment program [including such POTWs located in a state that has elected to assume local program responsibilities pursuant to 40 CFR §403.10(e)] and any other treatment works treating domestic sewage classified as a "Class I Sludge Management Facility" by the Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for its sludge use or disposal practices to adversely affect public health and the environment.

Coal pile runoff means the rainfall runoff from or through any coal storage pile.

Composite Sample - A sample consisting of a minimum of eight grab samples collected at equal intervals during a 24-hour period (or lesser period as specified in the section on Monitoring and Reporting) and combined proportional to flow, or a sample continuously collected proportionally to flow over that same time period.

Construction Activities. The following definitions apply to construction activities:

(a) Commencement of Construction is the initial disturbance of soils associated with clearing, grading, or excavating activities or other construction activities.

(b) Dedicated portable asphalt plant is a portable asphalt plant located on or contiguous to a construction site and that provides asphalt only to the construction site that the plant is located on or adjacent to. The term dedicated portable asphalt plant does not include facilities that are subject to the asphalt emulsion effluent limitation guideline at 40 CFR Part 443.

(c) Dedicated portable concrete plant is a portable concrete plant located on or contiguous to a construction site and that provides concrete only to the construction site that the plant is located on or adjacent to.

(d) Final Stabilization means that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

(e) Runoff coefficient means the fraction of total rainfall that will appear at the conveyance as runoff.

Contiguous zone means the entire zone established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

Continuous discharge means a "discharge" which occurs without interruption throughout the operating hours of the facility except for infrequent shutdowns for maintenance, process changes, or similar activities.

CWA means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483 and Pub. L. 97-117; 33 U.S.C. §§1251 et seq.

Daily Discharge means the "discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Director normally means the person authorized to sign NPDES permits by EPA or the State or an authorized representative. Conversely, it also could mean the Regional Administrator or the State Director as the context requires.

Discharge Monitoring Report Form (DMR) means the EPA standard national form, including any subsequent additions, revisions, or modifications, for the reporting of self-monitoring results by permittees. DMRs must be used by "approved States" as well as by EPA. EPA will supply DMRs to any approved State upon request. The EPA national forms may be modified to substitute the State Agency name, address, logo, and other similar information, as appropriate, in place of EPA's.

Discharge of a pollutant means:

(a) Any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source," or
(b) Any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation (See "Point Source" definition).

This definition includes additions of pollutants into waters of the United States from: surface runoff which is collected or channelled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances leading into privately owned treatment works.

This term does not include an addition of pollutants by any "indirect discharger."

Discharge Monitoring Report ("DMR") means the EPA uniform national form, including any subsequent additions, revisions, or modifications for the reporting of self-monitoring results by permittees. DMRs must be used by "approved states" as well as by EPA. EPA will supply DMRs to any approve State upon request. The EPA national forms may be modified to substitute the State Agency name, address, logo, and other similar information, as appropriate, in place of EPA's.

Effluent limitation means any restriction imposed by the Regional Administrator on quantities, discharge rates, and concentrations of "pollutants" which are "discharged" from "point sources" into "waters of the United States," the waters of the "contiguous zone," or the ocean.

Effluent limitations guidelines means a regulation published by the Administrator under Section 304(b) of CWA to adopt or revise "effluent limitations."

EPA means the United States "Environmental Protection Agency."

Flow-weighted composite sample means a composite sample consisting of a mixture of aliquots collected at a constant time interval, where the volume of each aliquot is proportional to the flow rate of the discharge.

Grab Sample - An individual sample collected in a period of less than 15 minutes.

Hazardous Substance means any substance designated under 40 CFR Part 116 pursuant to Section 311 of CWA.

Indirect Discharger means a non-domestic discharger introducing pollutants to a publicly owned treatment works.

Interference means a Discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

(a) Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal: and

(b) Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act (CWA), the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resources Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection Research and Sanctuaries Act.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile.

Land application unit means an area where wastes are applied onto or incorporated into the soil surface (excluding manure spreading operations) for treatment or disposal.

Large and Medium municipal separate storm sewer system means all municipal separate storm sewers that are either: (i) located in an incorporated place (city) with a population of 100,000 or more as determined by the latest Decennial Census by the Bureau of Census (these cities are listed in Appendices F and 40 CFR Part 122); or (ii) located in the counties with unincorporated urbanized populations of 100,000 or more, except municipal separate storm sewers that are located in the incorporated places, townships or towns within such counties (these counties are listed in Appendices H and I of 40 CFR 122); or (iii) owned or operated by a municipality other than those described in Paragraph (i) or (ii) and that are designated by the Regional Administrator as part of the large or medium municipal separate storm sewer system.

Maximum daily discharge limitation means the highest allowable "daily discharge" concentration that occurs only during a normal day (24-hour duration).

Maximum daily discharge limitation (as defined for the Steam Electric Power Plants only) when applied to Total Residual Chlorine (TRC) or Total Residual Oxidant (TRO) is defined as "Maximum Concentration or "Instantaneous Maximum Concentration" during the two hours of a chlorination cycle (or fractions thereof) prescribed in the Steam Electric Guidelines, 40 CFR Part 423. These three synonymous terms all mean "a value that shall not be exceeded" during the two-hour chlorination cycle. This interpretation differs from the specified NPDES Permit requirement, 40 CFR §122.2, where the two terms of "Maximum Daily Discharge" and "Average Daily Discharge" concentrations are specifically limited to the daily (24-hour duration) values.

Municipality means a city, town, borough, county, parish, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribe organization, or a designated and approved management agency under Section 208 of CWA.

National Pollutant Discharge Elimination System means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of CWA. The term includes an "approved program."

New discharger means any building, structure, facility, or installation:

(a) From which there is or may be a "discharge of pollutants";

(b) That did not commence the "discharge of pollutants" at a particular "site" prior to August 13, 1979;

(c) Which is not a "new source"; and

(d) Which has never received a finally effective NPDES permit for discharges at that "site".

This definition includes an "indirect discharger" which commences discharging into "waters of the United States" after August 13, 1979. It also includes any existing mobile point source (other than an offshore or coastal oil and gas exploratory drilling rig or a coastal oil and gas developmental drilling rig) such as a seafood processing rig, seafood processing vessel, or aggregate plant, that begins discharging at a "site" for which it does not have a permit; and any offshore or coastal mobile oil and gas exploratory drilling rig or coastal mobile oil and gas developmental drilling rig that commences the discharge of pollutants after August 13, 1979, at a "site" under EPA's permitting jurisdiction for which it is not covered by an individual or general permit and which is located in an area determined by the Regional Administrator in the issuance of a final permit to be an area of biological concern. In determining whether an area is an area of biological concern, the regional Administrator shall consider the factors specified in 40 CFR §§ 125.122.(a)(1) through (10).

An offshore or coastal mobile exploratory drilling rig or coastal mobile developmental drilling rig will be considered a "new discharger" only for the duration of its discharge in an area of biological concern.

<u>New source</u> means any building, structure, facility, or installation from which there is or may be a "discharge of pollutants," the construction of which commenced:

(a) After promulgation of standards of performance under Section 306 of CWA which are applicable to such source, or

(b) After proposal of standards of performance in accordance with Section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal.

NPDES means "National Pollutant Discharge Elimination System."

<u>Owner or operator</u> means the owner or operator of any "facility or activity" subject to regulation under the NPDES programs.

<u>Pass through</u> means a Discharge which exits the POTW into Waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

<u>Permit</u> means an authorization, license, or equivalent control document issued by EPA or an "approved State."

<u>Person</u> means an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

<u>Point source</u> means any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff. (See §122.2)

<u>Pollutant</u> means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. §§2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. It does not mean:

(a) Sewage from vessels; or

(b) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

<u>Primary industry category</u> means any industry category listed in the NRDC settlement agreement (<u>Natural Resources Defense Council et al. v. Train</u>, 8 E.R.C. 2120 (D.D.C. 1976),

modified 12 E.R.C. 1833 (D.D.C. 1979)); also listed in Appendix A of 40 CFR Part 122.

Privately owned treatments works means any device or system which is (a) use to treat wastes from any facility whose operation is not the operator of the treatment works or (b) not a "POTW".

Process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Publicly Owned Treatment Works (POTW) means any facility or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature which is owned by a "State" or "municipality."

This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Regional Administrator means the Regional Administrator, EPA, Region I, Boston, Massachusetts.

Secondary Industry Category means any industry category which is not a "primary industry category."

Section 313 water priority chemical means a chemical or chemical categories which are:

(1) listed at 40 CFR §372.65 pursuant to Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) (also known as Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986);

(2) present at or above threshold levels at a facility subject to EPCRA Section 313 reporting requirements; and

(3) satisfies at least one of the following criteria:

(i) are listed in Appendix D of 40 CFR Part 122 on either Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols) or Table V (certain toxic pollutants and hazardous substances);

(ii) are listed as a hazardous substance pursuant to section 311(b)(2)(A) of the CWA at 40 CFR §116.4; or

(iii) are pollutants for which EPA has published acute or chronic water quality criteria.

Septage means the liquid and solid material pumped from a septic tank, cesspool, or similar domestic sewage treatment system, or a holding tank when the system is cleaned or maintained.

Sewage Sludge means any solid, semisolid, or liquid residue removed during the treatment of municipal wastewater or domestic sewage. Sewage sludge includes, but is not limited to solids removed during primary, secondary, or advanced wastewater treatment, scum, septage, portable toilet pumpings, Type III Marine Sanitation Device pumpings (33 CFR Part 159), and sewage sludge products. Sewage sludge does not include grit or screenings, or ash generated during the incineration of sewage sludge.

Sewage sludge use or disposal practice means the collection, storage, treatment, transportation, processing, monitoring, use, or disposal of sewage sludge.

Significant materials includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to EPCRA Section 313; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges.

Significant spills includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under section 311 of the Clean Water Act (see 40 CFR §110.10 and CFR §117.21) or Section 102 of CERCLA (see 40 CFR §302.4).

Sludge-only facility means any "treatment works treating domestic sewage" whose methods of sewage sludge use or disposal are subject to regulations promulgated pursuant to Section 405(d) of the CWA, and is required to obtain a permit under 40 CFR §122.1(b)(3).

State means any of the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands.

Storm Water means storm water runoff, snow melt runoff, and surface runoff and drainage.

Storm Water discharge associated with industrial activity means the discharge from any conveyance with is used for collecting and conveying storm water and which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. (See 40 CFR §122.26 (b)(14) for specifics of this definition).

Time-weighted composite means a composite sample consisting of a mixture of equal volume aliquots collected at a constant time interval.

Toxic pollutants means any pollutant listed as toxic under Section 307(a)(1) or, in the case of "sludge use or disposal practices", any pollutant identified in regulations implementing Section 405(d) of the CWA.

Treatment works treating domestic sewage means a POTW or any other sewage sludge or wastewater treatment devices or systems, regardless of ownership (including federal facilities), used in the storage, treatment recycling, and reclamation of municipal or domestic sewage, including land dedicated for the disposal of sewage sludge. This definition does not include septic tanks or similar devices.

For purposes of this definition, "domestic sewage" includes waste and wastewater from humans or household operations that are discharged to or otherwise enter a treatment works. In States where there is no approved State sludge management program under Section 405(f) of the CWA, the Regional Administrator may designate any person subject to the standards for sewage sludge use and disposal in 40 CFR Part 503 as a "treatment works treating domestic sewage", where he or she finds that there is a potential for adverse effects on public health and the environment from poor sludge quality or poor sludge handling, use or disposal practices, or where he or she finds that such designation is necessary to ensure that such person is in compliance with 40 CFR Part 503.

Waste pile means any noncontainerized accumulation of solid, nonflowing waste that is used for treatment or storage.

Waters of the United States means:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands",

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats,

sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purposes;

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in Paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in Paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR §423.11(m) which also meet the criteria of this definition) are not waters of the United States.

Whole Effluent Toxicity (WET) means the aggregate toxic effect of an effluent measured directly by a toxicity test. (See Abbreviations Section, following, for additional information.)

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

2. DEFINITIONS FOR NPDES PERMIT SLUDGE USE AND DISPOSAL REQUIREMENTS.

Active sewage sludge unit is a sewage sludge unit that has not closed.

Aerobic digestion is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

Agricultural land is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

Agronomic rate is the whole sludge application rate dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

Air pollution control device is one or more processes used to treat the exit gas from a sewage sludge incinerator stack.

Anaerobic digestion is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

Annual pollutant loading rate is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

Annual whole sludge application rate is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

Apply sewage sludge or sewage sludge applied to the land means land application of sewage sludge.

Aquifer is a geologic formation, group of geologic formations, or a portion of a geologic formation capable of yielding ground water to wells or springs.

Auxiliary fuel is fuel use to augment the fuel value of sewage sludge. This includes, but is not limited to, natural gas, fuel oil, coal, gas generated during anaerobic digestion of sewage sludge, and municipal solid waste (not to exceed 30 percent of the dry weight of sewage sludge and auxiliary fuel together). Hazardous wastes are not auxiliary fuel.

Base flood is a flood that has a one percent chance of occurring in any given year (i.e., a flood with a magnitude equalled once in 100 years).

PART II

Bulk sewage sludge is sewage sludge that is not sold or given way in a bag or other container for application to the land.

Contaminate an aquifer means to introduce a substance that causes the maximum contaminant level for nitrate in 40 CFR §141.11 to be exceeded in ground water or that causes the existing concentration of nitrate in ground water to increase when the existing concentration of nitrate in the ground water exceeds the maximum contaminant level for nitrate in 40 CFR §141.11.

Class I sludge management facility is any publically owned treatments works (POTW), as defined in 40 CFR §501.2, required to have an approved pretreatment program under 40 CFR §403.8 (a) (including any POTW located in a State that has elected to assume local program responsibilities pursuant to 40 CFR §403.10 (e) and any treatment works treating domestic sewage, as defined in 40 CFR §122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for sewage sludge use or disposal practice to affect public health and the environmental adversely.

Control efficiency is the mass of a pollutant in the sewage sludge fed to an incinerator minus the mass of that pollutant in the exit gas from the incinerator stack divided by the mass of the pollutant in the sewage sludge fed to the incinerator.

Cover is soil or other material used to cover sewage sludge placed on an active sewage sludge unit.

Cover crop is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

Cumulative pollutant loading rate is the maximum amount of an inorganic pollutant that can be applied to an area of land.

Density of microorganisms is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

Dispersion factor is the ratio of the increase in the ground level ambient air concentration for a pollutant at or beyond the property line of the site where the sewage sludge incinerator is located to the mass emission rate for the pollutant from the incinerator stack.

Displacement is the relative movement of any two sides of a fault measured in any direction.

Domestic septage is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

Domestic sewage is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

Dry weight Basis means calculated on the basis of having been dried at 105 degrees Celsius (°C) until reaching a constant mass (i.e., essentially 100 percent solids content).

Fault is a fracture or zone of fractures in any materials along which strata on one side are displaced with respect to strata on the other side.

Feed crops are crops produced primarily for consumption by animals.

Fiber crops are crops such as flax and cotton.

Final cover is the last layer of soil or other material placed on a sewage sludge unit at closure.

Fluidized bed incinerator is an enclosed device in which organic matter and inorganic matter in sewage sludge are combusted in a bed of particles suspended in the combustion chamber gas.

Food crops are crops consumed by humans. These include, but are not limited to fruits, vegetables, and tobacco.

Forest is a tract of land thick with trees and underbrush.

Ground water is water below the land surface in the saturated zone.

Holocene time is the most recent epoch of the Quaternary period, extending from the end of the Pleistocene epoch to the present.

Hourly average is the arithmetic mean of all measurements, taken during an hour. At least two measurements must be taken during the hour.

Incineration is the combustion of organic matter and inorganic matter in sewage sludge by high temperatures in an enclosed device.

Industrial wastewater is wastewater generated in a commercial or industrial process.

Land application is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

Land with a high potential for public exposure is land that the public uses frequently. This includes, but is not limited to, a public contact site and a reclamation site located in a populated area (e.g., a construction site located in a city).

Land with a low potential for public exposure is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

Leachate collection system is a system or device installed immediately above a liner that is designed, constructed, maintained, and operated to collect and remove leachate from a sewage sludge unit.

Liner is soil or synthetic material that has a hydraulic conductivity of 1×10^{-7} centimeters per second or less.

Lower explosive limit for methane gas is the lowest percentage of methane gas in air, by volume, that propagates a flame at 25 degrees Celsius and atmospheric pressure.

Monthly average (Incineration) is the arithmetic mean of the hourly averages for the hours a sewage sludge incinerator operates during the month.

Monthly average (Land Application) is the arithmetic mean of all measurements taken during the month.

Municipality means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal Agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management Agency under section 208 of the CWA, as amended. The definition includes a special district created under State law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201(e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use, or disposal of sewage sludge.

Other container is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

Pasture is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

Pathogenic organisms are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

Permitting authority is either EPA or a State with an EPA-approved sludge management program.

Person is an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

Person who prepares sewage sludge is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

pH means the logarithm of the reciprocal of the hydrogen ion concentration. A measure of the acidity or alkalinity of a liquid or solid material.

Place sewage sludge or sewage sludge placed means disposal of sewage sludge on a surface disposal site.

Pollutant (as defined in sludge disposal requirements) is an organic substance, an inorganic substance, a combination or organic and inorganic substances, or pathogenic organism a that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction) or

physical deformations in either organisms or offspring of the organisms.

Pollutant limit (for sludge disposal requirements) is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of pollutant that can be applied to a unit area of land (e.g., kilogram per hectare); or the volume of a material that can be applied to a unit area of land (e.g., gallons per acre).

Public contact site is a land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

Qualified ground-water scientist is an individual with a baccalaureate or post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground-water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground-water monitoring, pollutant fate and transport, and corrective action.

Range land is open land with indigenous vegetation.

Reclamation site is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

Risk specific concentration is the allowable increase in the average daily ground level ambient air concentration for a pollutant from the incineration of sewage sludge at or beyond the property line of the site where the sewage sludge incinerator is located.

Runoff is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off the land surface.

Seismic impact zone is an area that has a 10 percent or greater probability that the horizontal ground level acceleration to the rock in the area exceeds 0.10 gravity once in 250 years.

Sewage sludge is a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in treatment works.

Sewage sludge feed rate is either the average daily amount of sewage sludge fired in all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located for the number of days in a 365 day period that each sewage sludge incinerator operates, or the average daily design capacity for all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located.

Sewage sludge incinerator is an enclosed device in which only sewage sludge and auxiliary fuel are fired.

Sewage sludge unit is land on which only sewage sludge is place for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR §122.2.

Sewage sludge unit boundary is the outermost perimeter of an active sewage sludge unit.

Specific oxygen uptake rate (SOUR) is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in sewage sludge.

Stack height is the difference between the elevation of the top of a sewage sludge incinerator stack and the elevation of the ground at the base of the stack when the difference is equal to or less than 65 meters. When the difference is greater than 65 meters, stack height is the creditable stack height determined in accordance with 40 CFR §51.100(ii).

State is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian Tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

Store or storage of sewage sludge is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

Surface disposal site is an area of land that contains one or more active sewage sludge units.

Total hydrocarbons means the organic compounds in the exit gas from a sewage sludge incinerator stack measured using a flame ionization detection instrument referenced to propane.

Total solids are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

Treat or treatment of sewage sludge is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

Treatment works is either a federally owned, publicly owned, or privately owned device or system use to treat (including recycle and reclaim) either domestic sewage or a comb[illegible]tion of domestic sewage and industrial waste of a liquid nature.

Unstable area is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

Unstabilized solids are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Vector attraction is the characteristic of sewage sludge that attracts rodents, flies, mosquitos, or other organisms capable of transporting infectious agents.

Volatile solids is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

Wet electrostatic precipitator is an air pollution control device that uses both electrical forces and water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

Wet scrubber is an air pollution control device that uses water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

3. THE COMMONLY USED ABBREVIATIONS ARE LISTED BELOW.

BOD	Five-day biochemical oxygen demand unless otherwise specified
CBOD	Carbonaceous BOD

COD	Chemical oxygen demand
CFS	Cubic feet per second
Chlorine	
Cl_2	Total residual chlorine
TRC	Total residual chlorine which is a combination of free available chlorine (FAC, see below) and combined chlorine (chloramines, etc.)
TRO	Total residual chlorine in marine waters where halogen compounds are present FAC free available chlorine (aqueous molecular chlorine, hypochlorous acid, and hypochlorite ion)
Coliform	
Coliform, Fecal	Total fecal coliform bacteria
Coliform, Total	Total coliform bacteria
Cont. (Continuous)	Continuous recording of the parameter being monitored, i.e.: flow, temperature, pH, etc.
cu. M/day or M^3/day	Cubic Meters per Day
DO	Dissolved Oxygen
kg/day	Kilograms per Day
lbs/day	Pounds per Day
mg/l	Milligram(s) per Liter
ml/l	Milliliter(s) per Liter
MGD	Million Gallons per Day

Nitrogen	
Total N	Total nitrogen
NH_3-N	Ammonia nitrogen as nitrogen
NO_3-N	Nitrate nitrogen as nitrogen
NO_2-N	Nitrite nitrogen as nitrogen
NO_3-NO_2	Combined nitrate and nitrite nitrogen as nitrogen
TKN	Total Kjeldahl nitrogen as nitrogen
Oil & Grease	Freon extractable material
PCB	Polychlorinated biphenyl
pH	A measure of the hydrogen ion concentration. A measure of alkalinity of a liquid or solid material.
Surfactant	Surface-active agent
Temp. °C	Temperature in degrees Centigrade
Temp. °F	Temperature in degrees Fahrenheit
TOC	Total organic carbon
Total P	Total phosphorus
TSS or NFR	Total suspended solids or total nonfilterable residue
Turb. or Turbidity	Turbidity measured by the Nephelometric Method (NTU)
ug/l	Micrograms per liter

PART II

WET	"Whole Effluent Toxicity" is the total effect of an effluent measured directly with a toxicity test.
C-NOEC	"Chronic (Long-term Exposure Test)-No Observed Effect Concentration". The highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specific time of observation.
A-NOEC	"Acute (Short-term Exposure Test)-No Observed Effect Concentration". See C-NOEC definition.
LC-50	LC-50 is the concentration of a sample that causes mortality of 50% of the test population at a specific time of observation. The LC-50 = 100% is defined as a sample of undiluted effluent.
ZID	Zone of Initial Dilution means the region of initial mixing surrounding or adjacent to the end of the outfall pipe or diffuser ports.

5-17-12

The State of New Hampshire

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Water Supply and Pollution Control Commission
Hazen Drive – P.O. Box 95
Concord, N.H. 03301

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MAY 17 1985
SEABROOK STATION

May 13, 1985

Mr. Edward K. McSweeney, Chief
Water Quality Branch
U.S. Environmental Protection Agency
John F. Kennedy Federal Building
Boston, Massachusetts 02203

ATTENTION: Stephen J. Silva

SUBJECT: Certification of NPDES Permit to Public Service Company of New Hampshire, New Hampshire Yankee Division, Seabrook Station (NH 0020338)

Dear Mr. McSweeney:

By letter dated February 28, 1985 state certification was requested for the NPDES permit which EPA proposes to issue to Public Service Company of New Hampshire, New Hampshire Yankee Division, Seabrook Station.

At its regular meeting on May 8, 1985, the Commission unanimously voted to certify the proposed NPDES permit as provided for by Section 401(a)(1) of P.L. 95-217 under the condition that the following items be included as part of said certification:

1. that there be no chlorination of the circulating water flow during the thermal backflushing procedure; and,

2. that the total residual chlorine or oxidant (TRO) be measured at the discharge transition structure.

Mr. Edward K. McSweeney, Chief
May 13, 1985
Page 2.

The Commission also adopted the proposed NPDES permit, together with the conditions of certification, as a State permit issued pursuant to RSA 149:8, III (Supp.).

Sincerely,

William A. Healy, P.E.
Executive Director

WAH/RAN/vr
cc: Mr. John DeVincentis, Director
Engineering & Licensing
Public Service Company of New Hampshire
New Hampshire Yankee Division