ATTACHMENT C

SPECIAL STATUS SPECIES CORRESPONDENCE

FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

April 13, 2009

SBK-L-09049

U.S. Fish and Wildlife Service
New Hampshire Field Office
Endangered Species Program
70 Commercial Street, Suite 300
Concord, NH 03301

Attn: Anthony Tur

Seabrook Station
Request for Information on Threatened or Endangered Species

FPL Energy Seabrook, LLC (FPL Energy Seabrook), the owner of a controlling interest in and the operator of Seabrook Station plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Operating License for 20 years beyond the current expiration date. The current NRC Operating License for Seabrook Station expires at midnight on March 15, 2030. FPL Energy Seabrook plans to submit its application to the NRC in the second quarter of 2010.

FPL Energy Seabrook is contacting the U.S. Fish and Wildlife Service in order to obtain input regarding issues that may need to be addressed in the Seabrook Station license renewal environmental reports, and to help identify any information that would be helpful to expedite consultation with the NRC in the future, if necessary.

The NRC requires that the license renewal application for Seabrook Station include environmental reports describing potential environmental impacts from refurbishment necessary for license renewal and from continued operations of the site and its associated transmission corridors during the renewal term. Transmission corridors from Seabrook Station extend into Massachusetts. One of these potential environmental impacts would be the potential effect caused by activities specifically related to license renewal on threatened or endangered species located on the Seabrook Station site and its immediate environs, regardless of ownership or control of the land. Accordingly, the NRC requires that the environmental report for each

an FPL Group company

U.S. Fish and Wildlife Service
Page 2

license renewal application assess such a potential effect in accordance with the Endangered Species Act (10 CFR 51.53). Later, during its review of the proposed license renewals pursuant to the National Environmental Policy Act (NEPA), the NRC will use that assessment to evaluate whether a basis exists to request consultation with your office under Section 7 of the Endangered Species Act.

Seabrook Station is located in the town of Seabrook, New Hampshire on the western shore of Hampton Harbor, approximately two miles west of the Atlantic Ocean (Figure 1). The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Over 400 acres of the site property are marshland and the majority of the remaining upland has been developed as part of the station. The upland component is generally low quality for wildlife and is not an important natural resource area.

Three transmission lines operating at 345 kV were constructed to deliver Seabrook Station's electrical output to the New England 345 kV transmission grid (Figure 2). These lines run through a variety of common natural and man-influenced habitats in New Hampshire and Massachusetts. These transmission corridors are considered by the NRC to be within the scope of its environmental reviews for the Seabrook license renewal. These transmission corridors are owned and maintained by Public Service Company of New Hampshire (PSNH) and National Grid (NGRID). The first line runs north 17 miles (27.4 km) from Seabrook Station to Newington Station, located in Newington, NH. Immediately north of Seabrook Station, this line crosses the salt marsh on a previously existing rail bed, generally following the I-95 corridor thereafter. A second line runs east then south for approximately 30 miles (47.9 km) to the Scobie Pond Substation in Londonderry, NH. A third line extends approximately 39 miles (63.2 km) south and southwest from Seabrook Station to the Tewksbury Substation, in Tewksbury, MA.

Based on a review of information available on the New Hampshire Natural Heritage Program website (town records of rare species and natural communities), information provided by the Massachusetts Natural heritage and Endangered Species Program, and previous on-site surveys, FPL Energy Seabrook believes that no federal or state-listed threatened or endangered plant or animal species resides on the Seabrook Station site. However, some state-listed threatened terrestrial animal species have potential to occur within Rockingham County and the counties crossed by the transmission corridors (see Table 1), and these species may occasionally migrate through the sites. Also, Atlantic Sturgeon, Shortnose Sturgeon and five species of federally-listed sea turtles may occur offshore in the Atlantic Ocean near the Seabrook Station site. FPL Energy Seabrook is contacting the National Oceanic and Atmospheric Administration - National Marine Fisheries Service regarding these marine species.

Seabrook Station has a once-through heat dissipation system that withdraws water from the western Gulf of Maine through three offshore, submerged intake structures located approximately 1.3 miles (2.1 km) offshore in about 60 feet (18.3 m) of water (Figure 3). The three intake structures are approximately 110 feet (33.5 m) apart and each has a 9-10 foot (2.7-3.0 m) inside diameter vertical intake shaft. A submerged concrete structure is mounted on the top of each structure to minimize fish entrapment by reducing the intake velocity to 0.5 ft per second. These intakes were modified in 1999 with additional vertical bars to prevent the intake of Marine Mammals.

A single Atlantic sturgeon was captured near Seabrook prior to 1987, during site gill-net monitoring.

Although five sea turtle species could occur in this portion of the Atlantic, none have been reported near Seabrook or its intake/discharge structures nor are they likely to be entrapped at the intakes given the low intake and the presence of vertical bars on the intake structure.

FPL Energy Seabrook does not expect Seabrook Station operation during the license renewal term (an additional 20 years) to adversely affect threatened or endangered species at the station site, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license renewal. Public Service Company of New Hampshire and National Grid have established management procedures for transmission lines that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After review of the information provided in this letter, FPL Energy Seabrook would appreciate a letter detailing any concerns the U.S. Fish and Wildlife Service may have about any listed species or critical habitat in the area of the Seabrook Station site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of Seabrook over the license renewal terms would have no effect on any threatened or endangered species. FPL Energy Seabrook will include copies of this letter and your response in the environmental reports that will be submitted to the NRC as part of the Seabrook Station license renewal application. Letters detailing any concerns would be appreciated by June 30, 2009 to support the current submittal schedule.

If you have any questions regarding this information, please contact me, at (603) 773-7745. Thank you in advance for your assistance.

Sincerely yours,

Michael O'Keefe
Licensing Manager

Enclosure: Figure 1 – Location of Seabrook Station
Figure 2 – Transmission lines associated with Seabrook
Figure 3 – Diagram of Intake and Discharge Systems
Table 1 – Endangered and Threatened Species Recorded in Rockingham County and Counties Crossed by Transmission Lines

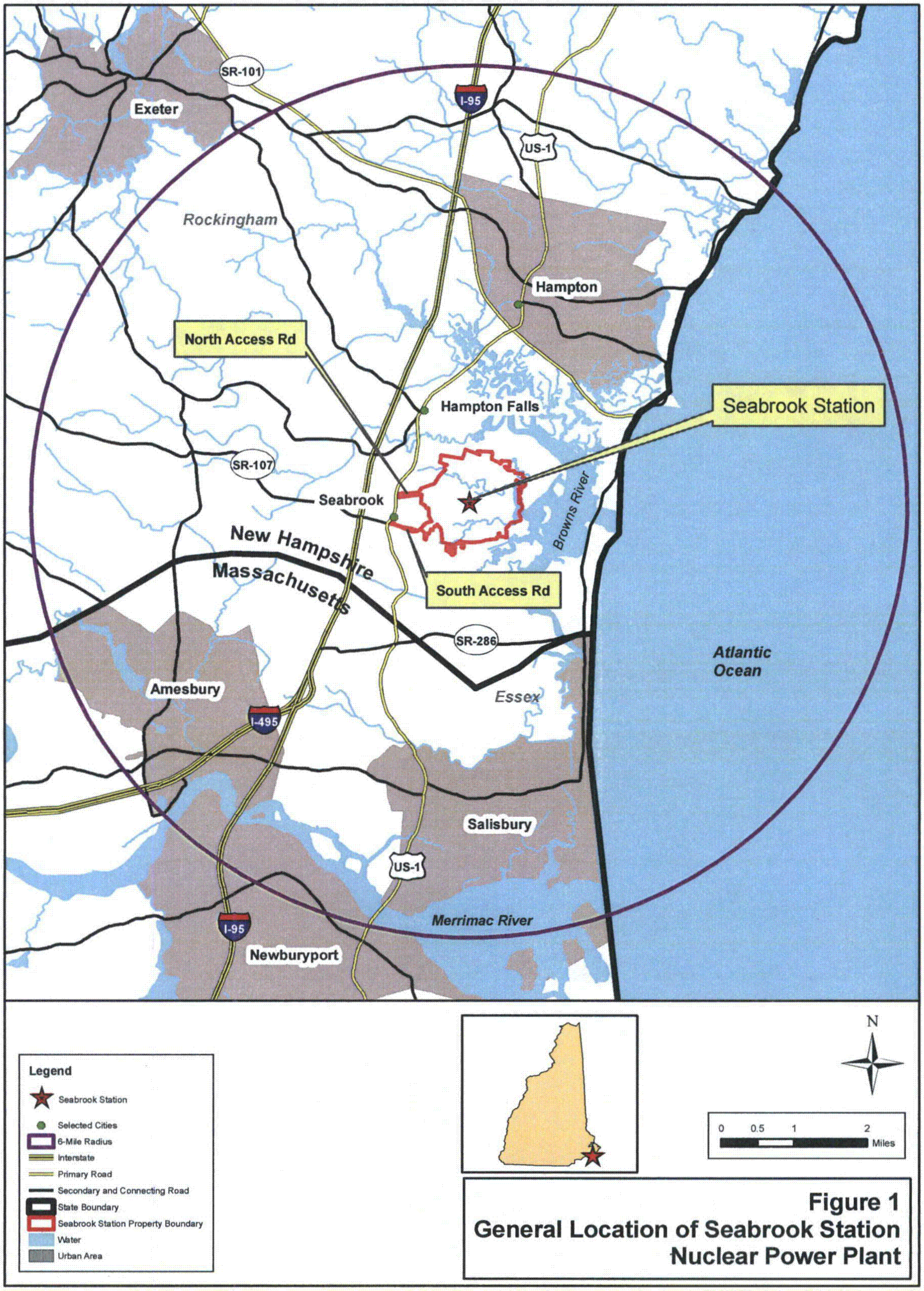


Figure 1
General Location of Seabrook Station Nuclear Power Plant

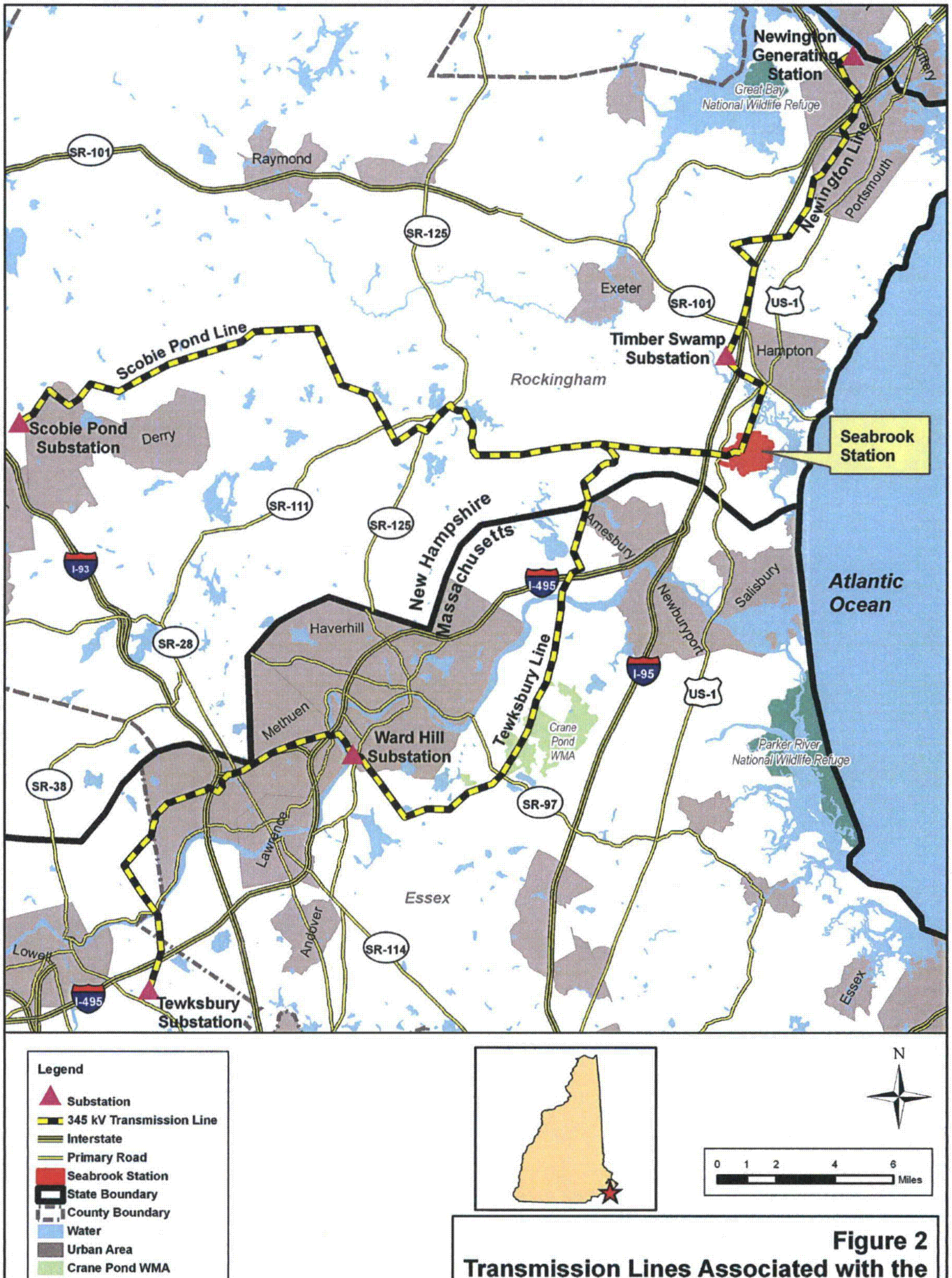
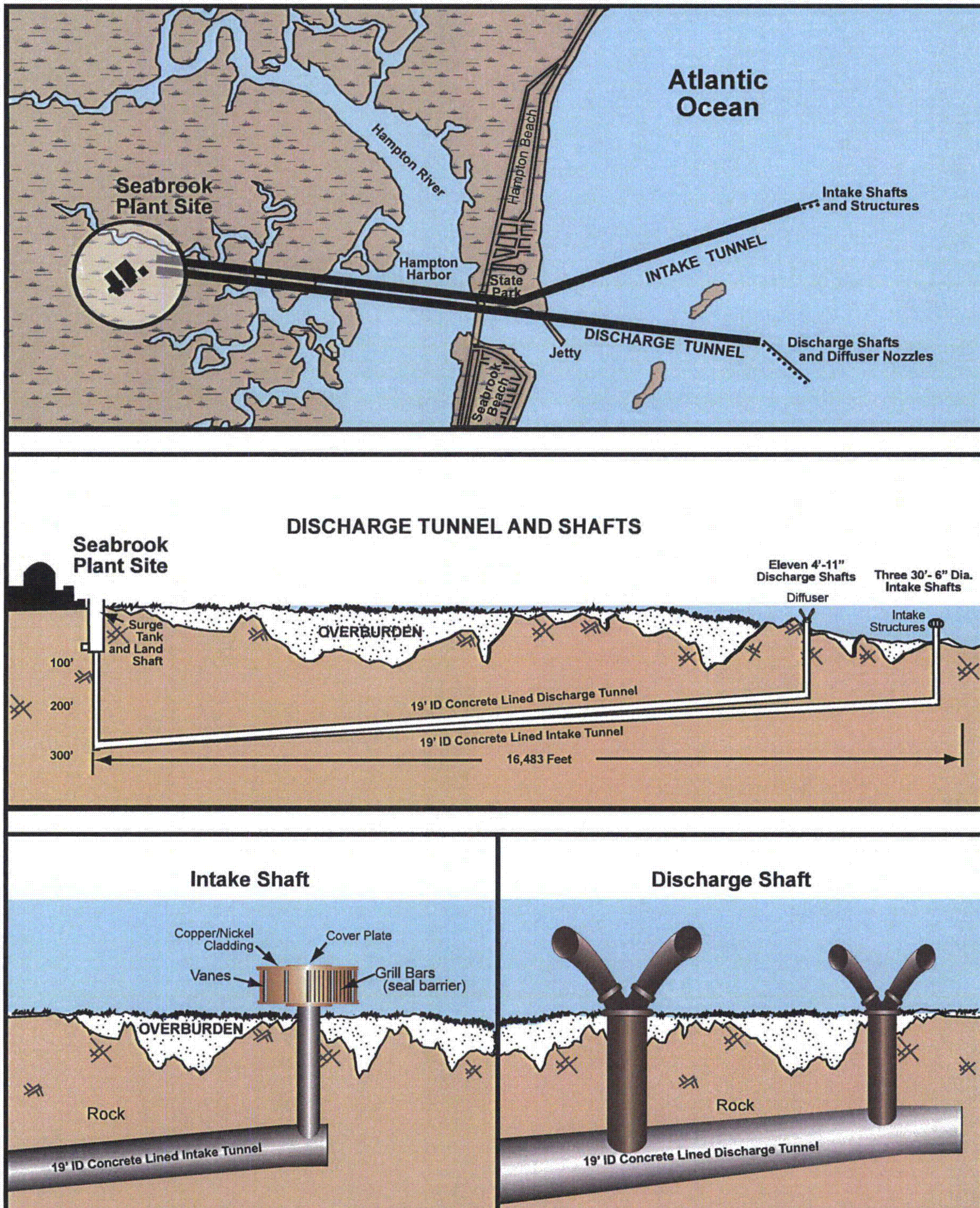


Figure 2
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant



Drawings not to scale

Figure 3
Cooling Water Intake/Discharge Structures
for Seabrook Station Nuclear Power Plant

Table 1. Endangered and Threatened Species Recorded in Rockingham County and Counties* Crossed by Transmission Lines.

Species	Common Name	Federal Status**	State Status**
Birds			
Charadrius melodus	Piping plover	T	NHE,
Falco peregrinus	Peregrine falcon	-	NHT
Haliaeetus leucocephalus	Bald eagle	-	NHT
Sterna dougallii	Roseate tern	E	NHE, MAE
Vermivora chrysoptera	Golden-winged warbler	-	MAE
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	NHE, MAE
Acipenser oxyrynchus	Atlantic sturgeon	C	MAE
Mammals			
Sylvilagus transitionalis	New England cottontail	C	NHE
Plants			
Aristida purpurascens	Purple needlegrass	-	MAT
Carex bullata	Inflated sedge	-	NHE
Carex striata var. brevis	Walter's sedge	-	NHE
Carex trichocarpa	Hairy-fruited edge	-	NHE
Celtis occidentalis	Hackberry	-	NHT
Cyperus engelmannii	Engelmann's Umbrella-sedge	-	MAT
Gaylussacia dumosa	Dwarf huckleberry	-	NHT
Gentianopsis crinita	Fringed gentian	-	NHT
Hottonia inflata	Featherfoil	-	NHE
Houstonia longifolia	Long-leaved bluets	-	NHE
Hypoxis hirsuta	Hairy stargrass	-	NHE
Iris prismatica	Slender blue flag	-	NHT
Isotria meleoloides	Small-whorled pogonia	T	
Lespedeza virginica	Slender bush-clover	-	NHE
Liatris scariosa var. novae-angliae	Northern blazing star	-	NHE
Prunus americana	American plum	-	NHE
Platanthera flava var. herbiola	Pale green orchid	-	NHT
Sparganium eurycarpum	Large bur-reed	-	NHT
Sporobolus cryptandrus	Sand dropseed	-	NHT
Triosteum aurantiacum	Orange horse-gentian	-	NHE
Viola pedata	Bird's-foot violet	-	NHT
Reptiles			
Caretta caretta	Loggerhead sea turtle	T	MAT
Chelonia mydas	Green sea turtle	T	MAT
Clemmys guttata	Spotted turtle	-	NHT
Coluber constrictor	Black racer	-	NHT
Dermochelys coriacea	Leatherback sea turtle	E	MAE
Emydoidea blandingii	Blanding's turtle	-	NHE, MAE
Eretmochelys imbricata	Hawksbill sea turtle	E	MAE
Heterodon platyhinos	Eastern hognose snake	-	NHE
Lepidochelys kempii	Kemp's ridley sea turtle	E	MAE

*Essex and Middlesex Counties in Massachusetts.
**Status: E=federal endangered, T=federal threatened, C=federal candidate, MAE=Massachusetts endangered, MAT=Massachusetts threatened, NHE= New Hampshire endangered, NHT=New Hampshire threatened, and "-"= Not listed.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087
http://www.fws.gov/northeast/newenglandfieldoffice

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M.D. O'Keefe

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May 15, 2009

Michael O'Keefe
FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874

Dear Mr. O'Keefe:

This responds to your recent correspondence requesting information on the presence of federally-listed and/or proposed endangered or threatened species in relation to the Seabrook Station (Station) in Seabrook, New Hampshire. FPL Energy Seabrook Station plans to apply to the Nuclear Regulatory Commission for renewal of the Operating License for 20 years beyond the current expiration date of March 15, 2030.

No federally-listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project areas. However, the federally-threatened piping plover (*Charadrius melodus*) is known to nest on the coastal beaches located approximately 1.8 miles east of the Station. This office is not aware of any impacts to the piping plover that could be attributed to the operation of the Station. In addition, the federally-endangered roseate tern (*Sterna dougallii*) is known to occur in the coastal waters of New Hampshire and is likely to be found in the vicinity of the cooling water intake and discharge structures. Because these structures are located approximately 1.3 miles offshore in about 60 feet of water, no effects to the roseate tern or its habitat are known or anticipated. Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required.

While there are no occurrences of federally-listed species in the project area, the New England cottontail (*Sylvilagus transitionalis*) is known to occur in the Towns of Derry and Londonderry, New Hampshire. Furthermore, our records indicate that the New England cottontail has been recorded at a site just east of the Scobie Pond substation in Derry, New Hampshire. The U.S. Fish and Wildlife Service announced the New England cottontail as a Candidate Species for listing on September 12, 2006 in the Federal Register (50 CFR part 17). While the New England cottontail remains an official candidate species, there is currently no legal federal obligation to avoid affecting the habitat of the species. However, the New England cottontail is state-listed as an endangered species by the New Hampshire Department of Fish and Game (NHDF&G), and we suggest that you contact the NHDF&G for further guidance.

Michael O'Keefe
May 15, 2009 2

New England cottontails are considered habitat specialists, insofar as they are dependent on early-successional habitats typically described as thickets. In addition to New England cottontails demonstrating a strong affinity for heavy cover, they are also reluctant to stray from it (>5 m). Habitats of this type are typically associated with beaver flowage wetlands, idle agricultural lands, power line corridors, railroad right-of-ways, and patches of regenerating forests. In contrast, eastern cottontails (which can often be found living with New England cottontails) appear to have relatively generalized habitat requirements and can often be found in residential-type habitats, such as private lawns, golf courses, and active agriculture areas.

Vegetation management along utility right-of-ways has a significant impact on the New England cottontail. In fact, there is strong evidence that take of New England cottontails has occurred as a result of powerline right-of-way management. Long-term management that converts scrub-shrub corridors into herbaceous covers serves to eliminate habitat and hinder dispersal, while short-term management of shrubs serves as a temporary impact to habitat. These short-term impacts to shrub vegetation are necessary to ensure that successional forces do not proceed to the point where habitat is no longer suitable for the New England cottontail. Given the conservation status of this species, a full federal listing in the future is probable. As such, it may be beneficial to begin a discussion about how your company could manage habitat for this species.

This concludes our review of listed species and critical habitat in the project locations and environs referenced above. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

In order to curtail the need to contact this office in the future for updated lists of federally-listed or proposed threatened or endangered species and critical habitats, please visit the Endangered Species Consultation page on the New England Field Office's website:

www.fws.gov/northeast/newenglandfieldoffice/EndangeredSpec-Consultation.htm

In addition, there is a link to procedures that may allow you to conclude if habitat for a listed species is present in the project area. If no habitat exists, then no federally-listed species are present in the project area and there is no need to contact us for further consultation. If the above conclusion cannot be reached, further consultation with this office is advised. Information describing the nature and location of the proposed activity that should be provided to us for further informal consultation can be found at the above-referenced site.

Michael O'Keefe
May 15, 2009 3

Thank you for your coordination. Please contact Anthony Tur at 603-223-2541 to discuss management of the transmission corridors and their impacts to the New England cottontail, or if we can be of further assistance.

Sincerely yours,

Eric L. Derleth
Acting Supervisor
New England Field Office

FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

April 14, 2009

SBK-L-09048

National Marine Fisheries Service
Protected Resources Division
One Blackburn Drive
Gloucester, MA 01930

Attn: Mary Colligan
Assistant Regional Administrator

Seabrook Station
Request for Information on Threatened or Endangered Species

FPL Energy Seabrook, LLC (FPL Energy Seabrook), the owner of a controlling interest in and the operator of Seabrook Station plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Operating License for 20 years beyond the current expiration date. The current NRC Operating License for Seabrook Station expires at midnight on March 15, 2030. FPL Energy Seabrook plans to submit its application to the NRC in the second quarter of 2010.

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an FPL Group company

National Marine Fisheries Service
Page 2

to the National Environmental Policy Act (NEPA), the NRC will use that assessment to evaluate whether a basis exists to request consultation with your office under Section 7 of the Endangered Species Act.

Seabrook Station is located within Rockingham County, in the town of Seabrook, New Hampshire on the western shore of Hampton Harbor, approximately two miles west of the Atlantic Ocean (Figure 1). The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Over 400 acres of the site property are marshland and the majority of the remaining upland has been developed as part of the station. The upland component is generally low quality for wildlife and is not an important natural resource area.

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A single Atlantic sturgeon was captured near Seabrook prior to 1987, during site gill-net monitoring.

National Marine Fisheries Service
Page 3

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Sincerely yours,

Michael O'Keefe
Licensing Manager

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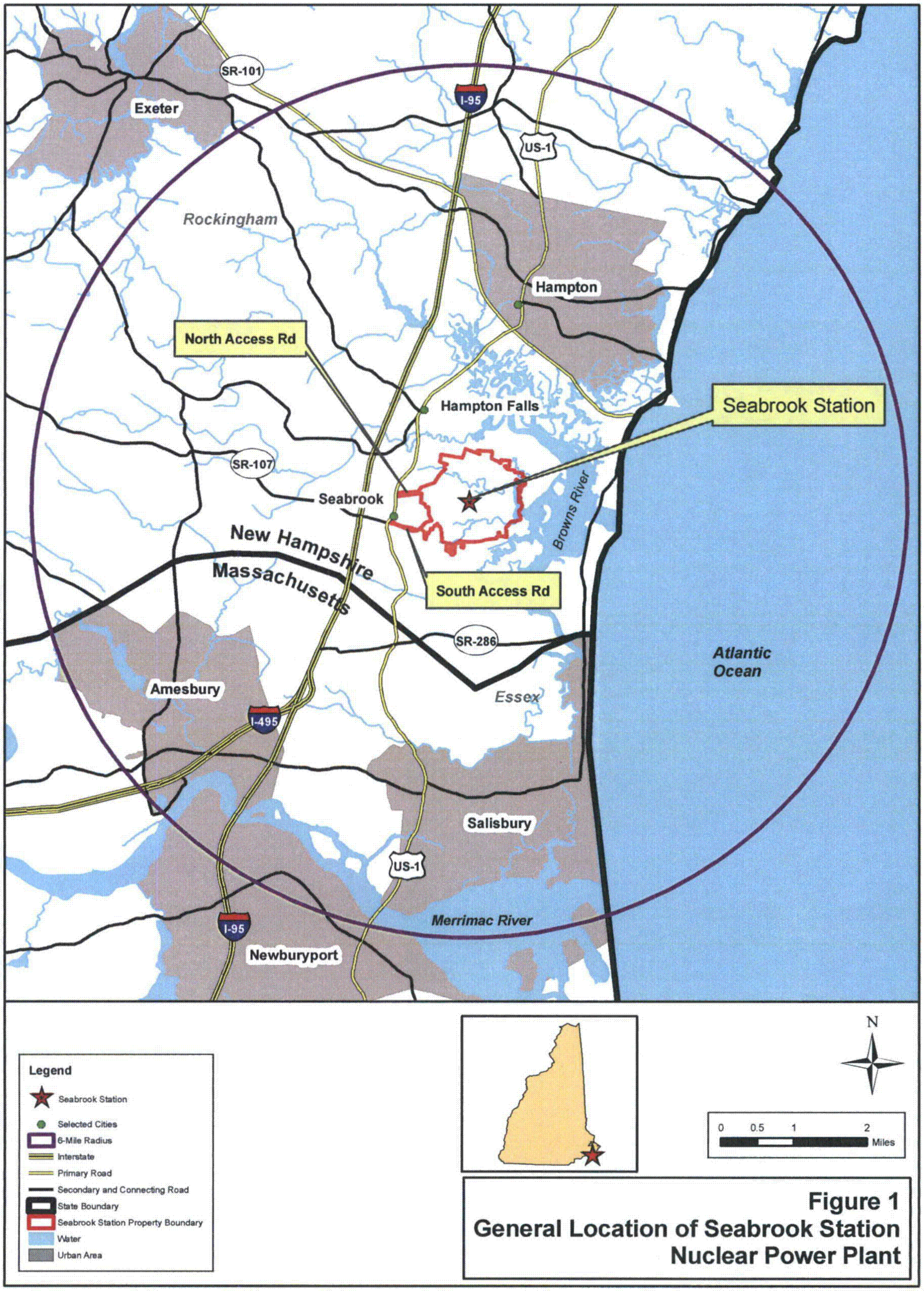

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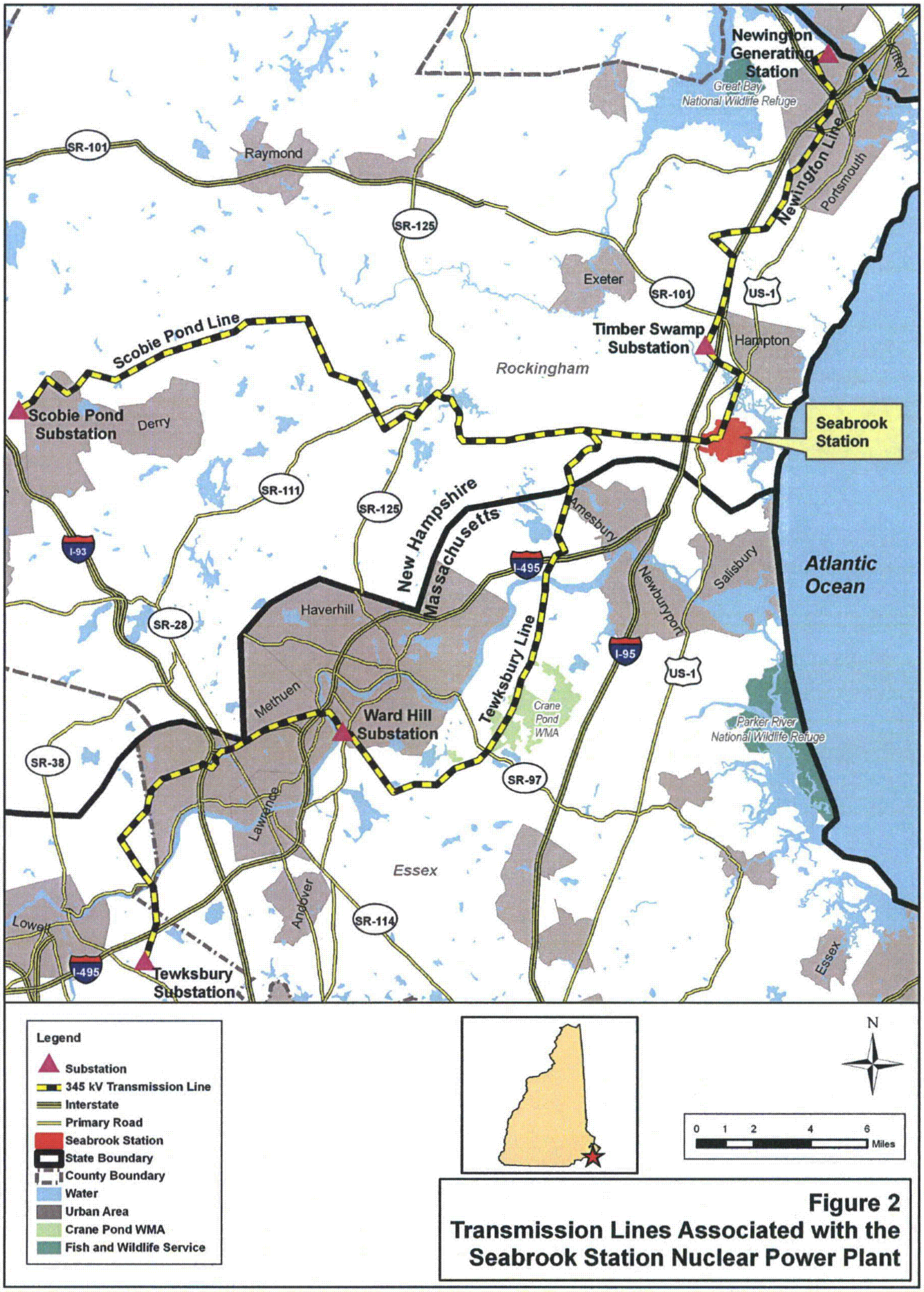

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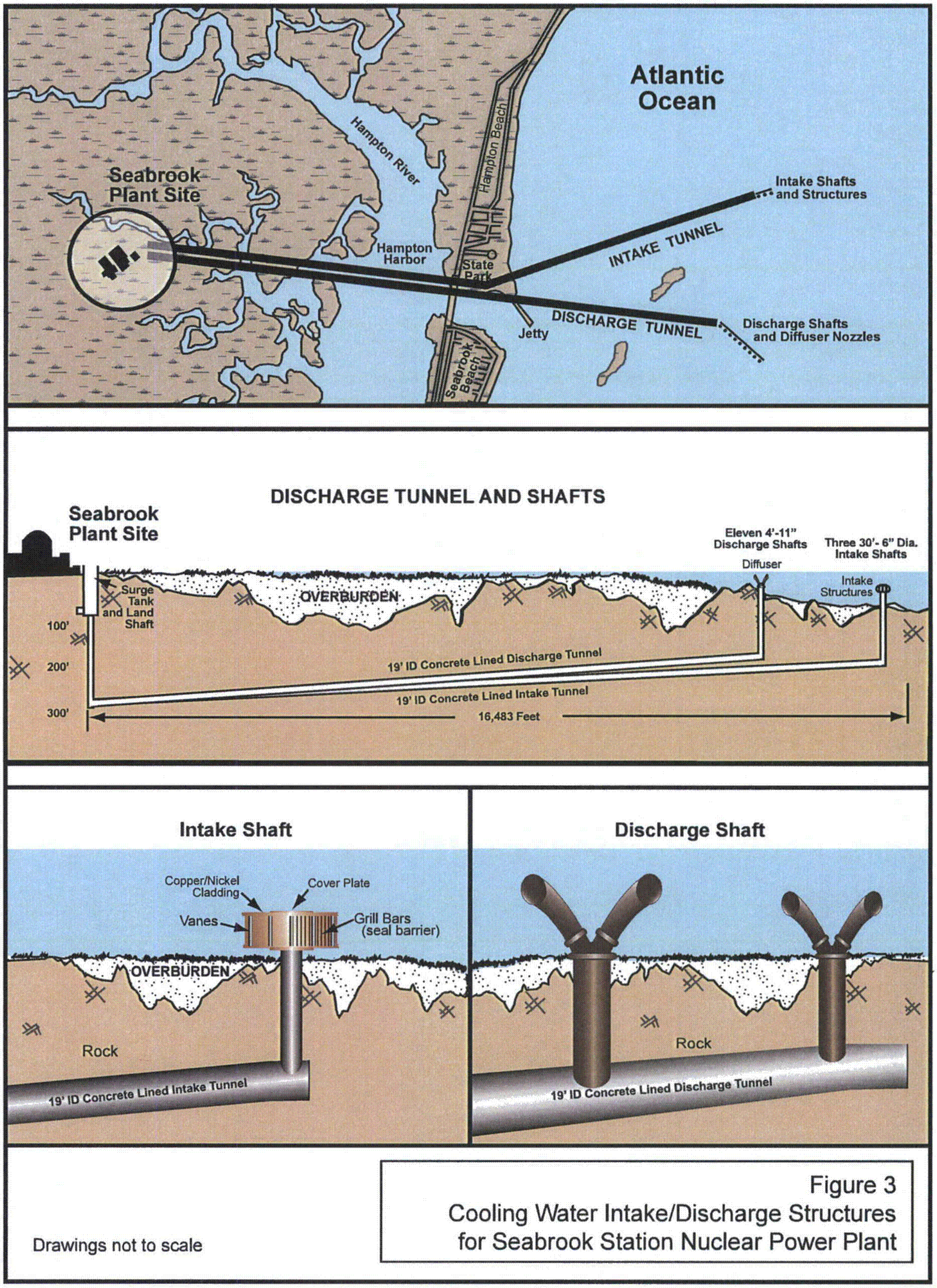

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Lepidochelys kempii	Kemp's ridley sea turtle	E	MAE

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FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

April 13, 2009

SBK-L-09047

New Hampshire Department of Resources and Economic Development
Division of Forests and Lands
New Hampshire Natural Heritage Bureau
172 Pembroke Road
P.O. Box 1856
Concord, NH 03301-1856

Attn: Melissa Coppola
Environmental Information Specialist

Seabrook Station
Request for Information on Threatened or Endangered Species

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N.H. Department of Resources and Economic Development
Page 2

of ownership or control of the land. Accordingly, the NRC requires that the environmental report for each license renewal application assess such a potential effect in accordance with the Endangered Species Act (10 CFR 51.53). Later, during its review of the proposed license renewals pursuant to the National Environmental Policy Act (NEPA), the NRC will use that assessment to evaluate whether a basis exists to request consultation with your office under Section 7 of the Endangered Species Act.

Seabrook Station is located in the town of Seabrook, New Hampshire on the western shore of Hampton Harbor, approximately two miles west of the Atlantic Ocean (Figure 1). The site is bounded on the north, east and south by estuarine marshlands, veined with man-made ditches and tidal creeks. Over 400 acres of the site property are marshland and the majority of the remaining upland has been developed as part of the station. The upland component is generally low quality for wildlife and is not an important natural resource area.

Three transmission lines operating at 345 kV were constructed to deliver Seabrook Station's electrical output to the New England 345 kV transmission grid (Figure 2). These lines run through a variety of common natural and man-influenced habitats in New Hampshire and Massachusetts. These transmission corridors are considered by the NRC to be within the scope of its environmental reviews for the Seabrook license renewal. These transmission corridors are owned and maintained by Public Service Company of New Hampshire (PSNH) and National Grid (NGRID). The first line runs north 17 miles (27.4 km) from Seabrook Station to Newington Station, located in Newington, NH. Immediately north of Seabrook Station, this line crosses the salt marsh on a previously existing rail bed, generally following the I-95 corridor thereafter. A second line runs west then south for approximately 30 miles (47.9 km) to the Scobie Pond Substation in Londonderry, NH. A third line extends approximately 39 miles (63.2 km) south and southwest from Seabrook Station to the Tewksbury Substation, in Tewksbury, MA.

Based on a review of information available on the New Hampshire Natural Heritage Program website (town records of rare species and natural communities), FPL Energy Seabrook believes there are four possible federally-protected terrestrial species within Rockingham County, which contains the Seabrook Station site and the New Hampshire component of transmission corridors: New England Cottontail, Piping Plover, Roseate Tern, and Small Whorled Pogonia. Habitat for these species is not thought to occur at the site or along the transmission corridors, although it is possible that New England Cottontails may occur along portions of the corridors. Some state-listed terrestrial animal species also have potential to occur in this county (see Table 1). Also, Atlantic Sturgeon, Shortnose Sturgeon, marine mammals and five species of federally-listed sea turtles may occur offshore in the Atlantic Ocean near the Seabrook Station site. FPL Energy Seabrook is contacting the National Oceanic and Atmospheric Administration - National Marine Fisheries Service regarding these marine species.

Seabrook Station has a once-through heat dissipation system that withdraws water from the western Gulf of Maine through three offshore, submerged intake structures located approximately 1.3 miles (2.1 km) offshore in about 60 feet (18.3 m) of water (Figure 3). The three intake structures are approximately 110 feet (33.5 m) apart and each has a 9-10 foot (2.7-3.0 m) inside diameter vertical intake shaft. A submerged concrete structure is mounted on the top of each structure to minimize fish entrapment by reducing the intake velocity to 0.5 ft per

N.H. Department of Resources and Economic Development
Page 3

second. These intakes were modified in 1999 with additional vertical bars to prevent the intake of marine mammals.

A single Atlantic Sturgeon was captured near Seabrook prior to 1987, during site gill-net monitoring.

Although five sea turtle species could occur in this portion of the Atlantic, none have been reported near Seabrook or its intake/discharge structures nor are they likely to be entrapped at the intakes given the low intake rates given the low intake rates and the presence of vertical bars on the intake structure.

FPL Energy Seabrook does not expect Seabrook Station operation during the license renewal term (an additional 20 years) to adversely affect threatened or endangered species at the station site, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license renewal. Public Service Company of New Hampshire has established management procedures for transmission lines within New Hampshire that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After review of the information provided in this letter, FPL Energy Seabrook would appreciate a letter detailing any concerns the New Hampshire Natural Heritage Bureau may have about any listed species or critical habitat in the area of the Seabrook Station site and the associated transmission corridors, or alternatively, confirming our conclusion that operation of Seabrook over the license renewal terms would have no effect on any threatened or endangered species. FPL Energy Seabrook will include copies of this letter and your response in the environmental reports that will be submitted to the NRC as part of the Seabrook license renewal application. Letters detailing any concerns would be appreciated by June 30, 2009 to support the current submittal schedule.

If you have any questions regarding this information, please contact me, at (603) 773-7745. Thank you in advance for your assistance.

Sincerely yours,

Michael O'Keefe
Licensing Manager

Enclosure: Figure 1 – Location of Seabrook Station

Figure 2 – Transmission lines associated with Seabrook

Figure 3– Diagram of Intake and Discharge Systems

Table 1 – Endangered and Threatened Species Recorded in Rockingham County and Counties Crossed by Transmission Lines

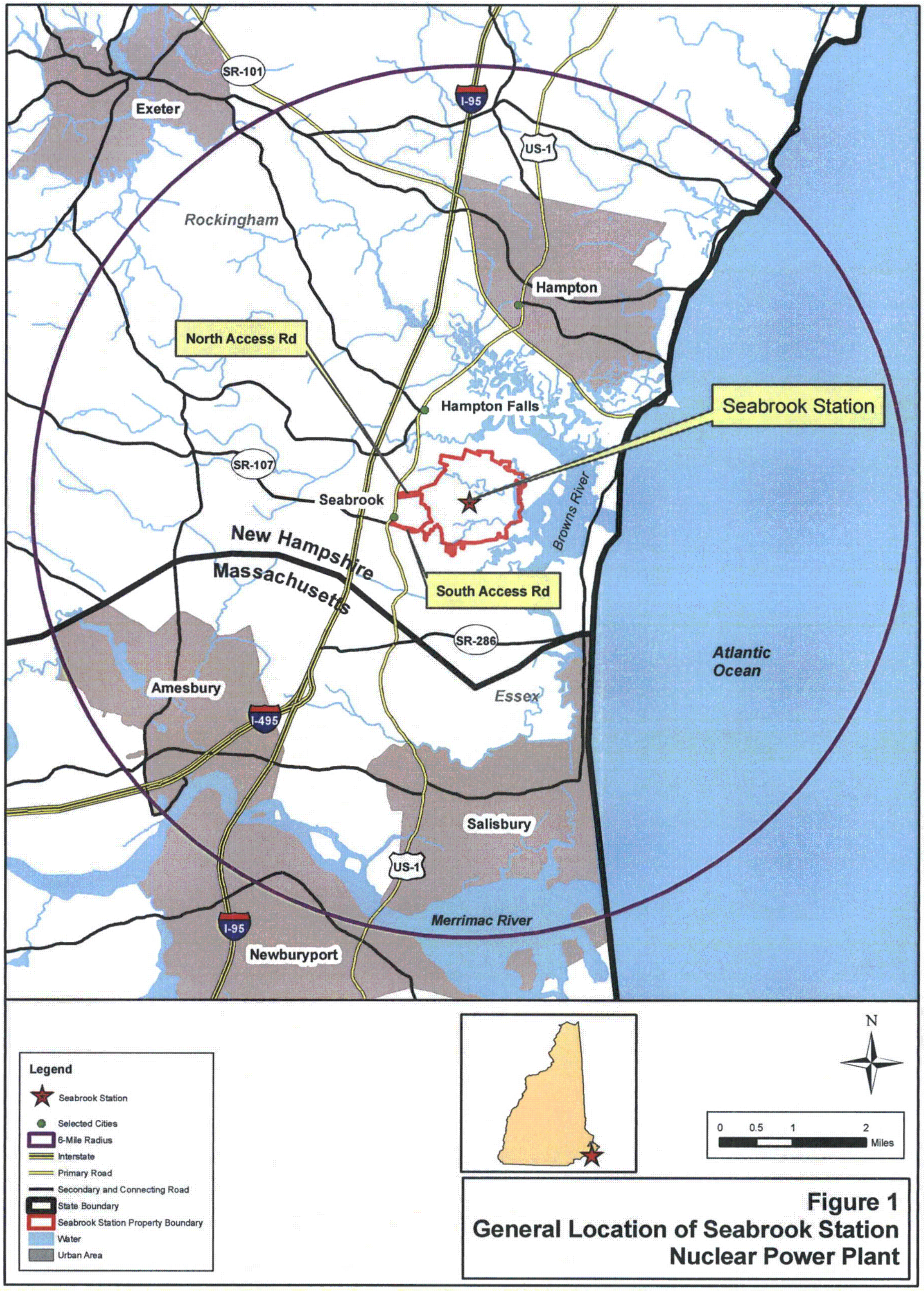

Figure 1
General Location of Seabrook Station Nuclear Power Plant

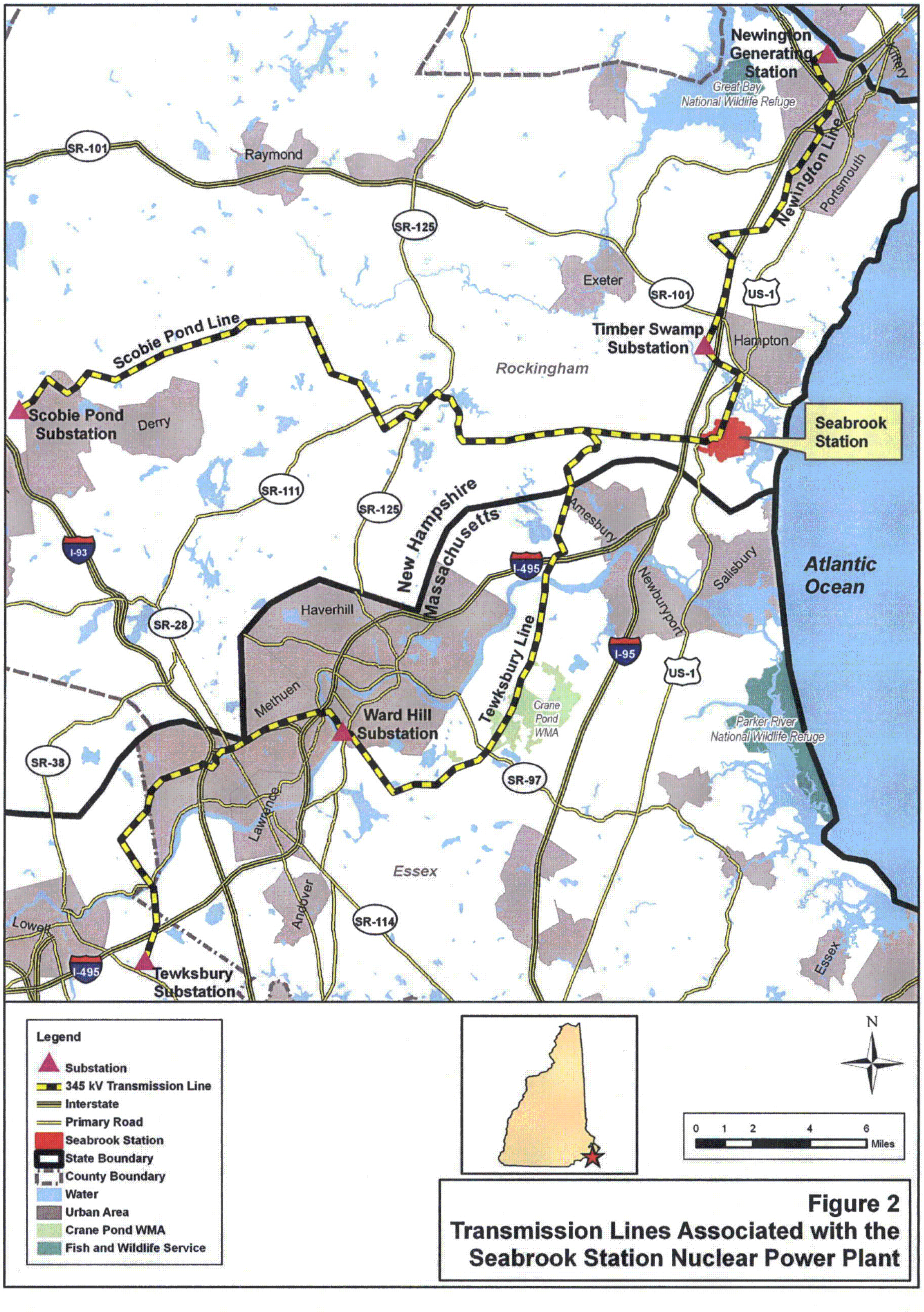

Figure 2
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant

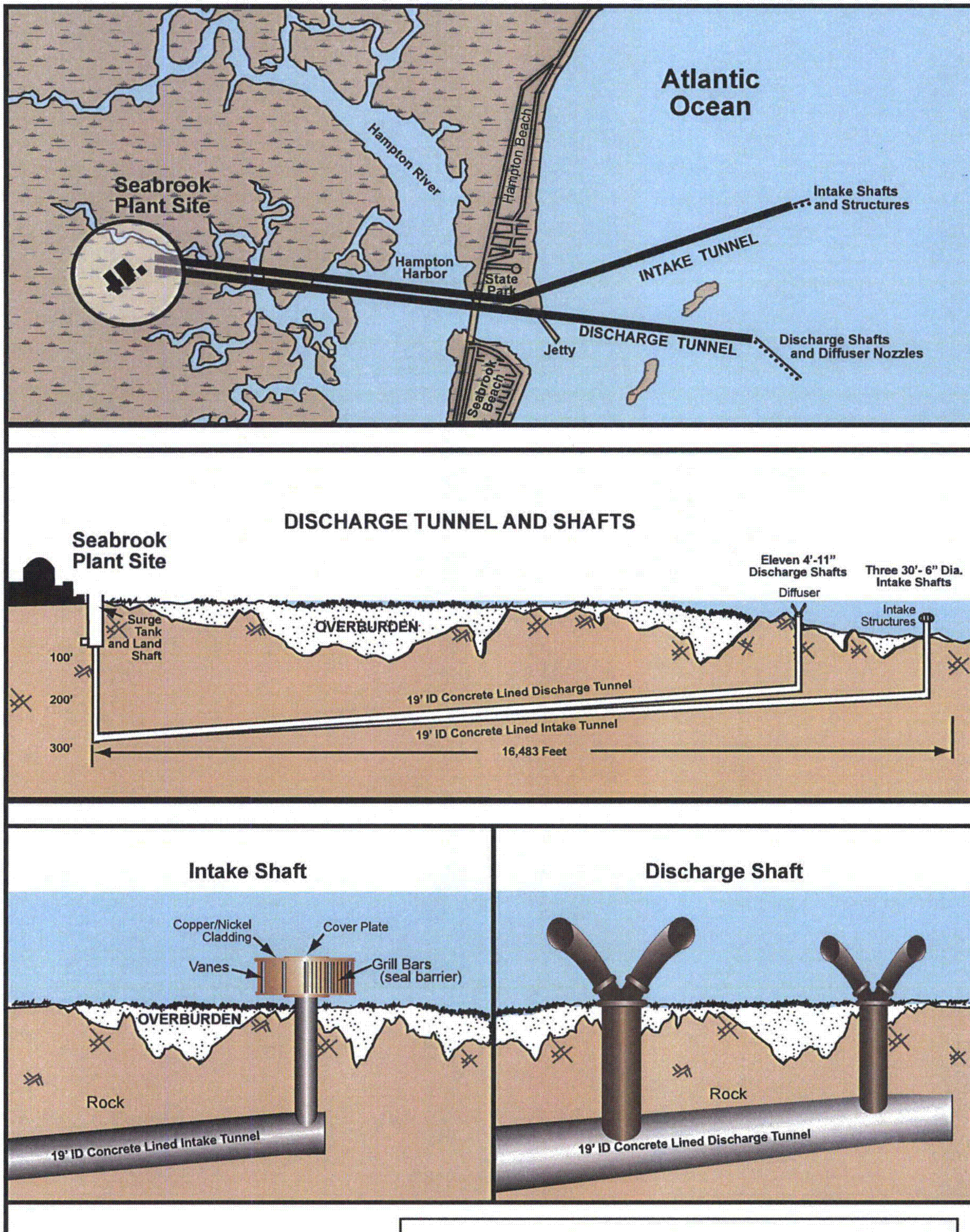

Figure 3
Cooling Water Intake/Discharge Structures
for Seabrook Station Nuclear Power Plant

Table 1. Endangered and Threatened Species Recorded in Rockingham County and Counties* Crossed by Transmission Lines.

Species	Common Name	Federal Status**	State Status**
Birds			
Charadrius melodus	Piping plover	T	NHE,
Falco peregrinus	Peregrine falcon	-	NHT
Haliaeetus leucocephalus	Bald eagle	-	NHT
Sterna dougallii	Roseate tern	E	NHE, MAE
Vermivora chrysoptera	Golden-winged warbler	-	MAE
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	NHE, MAE
Acipenser oxyrynchus	Atlantic sturgeon	C	MAE
Mammals			
Sylvilagus transitionalis	New England cottontail	C	NHE
Plants			
Aristida purpurascens	Purple needlegrass	-	MAT
Carex bullata	Inflated sedge	-	NHE
Carex striata var. brevis	Walter's sedge	-	NHE
Carex trichocarpa	Hairy-fruited edge	-	NHE
Celtis occidentalis	Hackberry	-	NHT
Cyperus engelmannii	Engelmann's Umbrella-sedge	-	MAT
Gaylussacia dumosa	Dwarf huckleberry	-	NHT
Gentianopsis crinita	Fringed gentian	-	NHT
Hottonia inflata	Featherfoil	-	NHE
Houstonia longifolia	Long-leaved bluets	-	NHE
Hypoxis hirsuta	Hairy stargrass	-	NHE
Iris prismatica	Slender blue flag	-	NHT
Isotria meleoloides	Small-whorled pogonia	T	
Lespedeza virginica	Slender bush-clover	-	NHE
Liatris scariosa var. novae-angliae	Northern blazing star	-	NHE
Prunus americana	American plum	-	NHE
Platanthera flava var. herbiola	Pale green orchid	-	NHT
Sparganium eurycarpum	Large bur-reed	-	NHT
Sporobolus cryptandrus	Sand dropseed	-	NHT
Triosteum aurantiacum	Orange horse-gentian	-	NHE
Viola pedata	Bird's-foot violet	-	NHT
Reptiles			
Caretta caretta	Loggerhead sea turtle	T	MAT
Chelonia mydas	Green sea turtle	T	MAT
Clemmys guttata	Spotted turtle	-	NHT
Coluber constrictor	Black racer	-	NHT
Dermochelys coriacea	Leatherback sea turtle	E	MAE
Emydoidea blandingii	Blanding's turtle	-	NHE, MAE
Eretmochelys imbricata	Hawksbill sea turtle	E	MAE
Heterodon platyhinos	Eastern hognose snake	-	NHE
Lepidochelys kempii	Kemp's ridley sea turtle	E	MAE

*Essex and Middlesex Counties in Massachusetts.
**Status: E=federal endangered, T=federal threatened, C=federal candidate, MAE=Massachusetts endangered, MAT=Massachusetts threatened, NHE= New Hampshire endangered, NHT=New Hampshire threatened, and "-"= Not listed.

Memo

NH NATURAL HERITAGE BUREAU

To: Michael O'Keefe
NextEra Energy Seabrook, LLC
PO Box 300
Seabrook, NH 03874

From: Melissa Coppola, NH Natural Heritage Bureau
Date: 3/18/2009 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB09-0508
Town: Seabrook, Hampton, North Hampton, Greenland
Project type: Railroads, Transmission lines, Pipelines: Transmission line
Location: powerline ROW-Seabrook Station
cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: NHB will need to be contacted when projects occur within the R-O-W. This memo is for license renewal only.

Natural Community	State[1]	Federal	Notes
Atlantic white cedar - yellow birch - pepperbush swamp	--	--	Changes to the hydrology of the wetland are the greatest threat facing the cedar swamp. Damming which causes pooling for extended periods can flood and drown existing trees, and drainage that results in lower water levels can lead to invasion by other species that can out compete -- and eventually eliminate -- Atlantic white cedar trees. Increased nutrient input from stormwater runoff could also deleteriously impact this acidic, low-nutrient plant community.
Brackish marsh	--	--	
High salt marsh	--	--	
Low salt marsh	--	--	
Poor level fen/bog system	--	--	Level fens are stagnant, and as such are characterized by low nutrient levels, relatively high acidity levels, and accumulations of peat. The primary threats to this community are changes to its hydrology (especially that which causes pooling), increased nutrient input from stormwater runoff, and sedimentation from nearby disturbance.
Red maple - sensitive fern swamp*	--	--	These swamps are influenced by groundwater seepage and springs which moderate water fluctuations and maintain conditions favorable for the accumulation of organic matter. The primary threats are changes to the hydrology of the wetland complex, particularly raising or lowering the water levels, and increased nutrient and pollutant input carried in by stormwater runoff.

Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

Memo

NH NATURAL HERITAGE BUREAU

Saline/brackish intertidal flat	--	--	Threats to these communities are primarily alterations to the hydrology of the wetland (such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat) and increased input of nutrients and pollutants in storm runoff.
Saline/brackish subtidal channel/bay bottom	--	--	
Swamp white oak floodplain forest	--	--	Threats are primarily changes to the hydrology of the river, land conversion and fragmentation, introduction of invasive species, and increased input of nutrients and pollutants.
Temperate minor river floodplain system*	--	--	
Tidal creek bottom	--	--	Threats to these communities are primarily alterations to water level or flow regimes, and increased input of nutrients and pollutants in storm runoff.

Plant species	**State[1]**	**Federal**	**Notes**
Dwarf Glasswort (*Salicornia bigelovii*)*	E	--	Threats are primarily alterations to the hydrology of the wetland, such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat, activities that eliminate plants, and increased input of nutrients and pollutants in storm runoff.
Woody Glasswort (*Sarcocornia perennis*)	E	--	
Tall Wormwood (*Artemisia campestris ssp. caudata*)	T	--	This species grows in dry dune systems and is sensitive to disturbances that eliminate its habitat or disturb the natural dynamics of the dune area.

Vertebrate species	**State[1]**	**Federal**	**Notes**
Common Tern (*Sterna hirundo*)*	T	--	Contact the NH Fish & Game Dept (see below).
Golden-winged Warbler (*Vermivora chrysoptera*)*	--	--	Contact the NH Fish & Game Dept (see below).
Osprey (*Pandion haliaetus*)	--	--	Contact the NH Fish & Game Dept (see below).
Redfin Pickerel (*Esox americanus americanus*)	--	--	Contact the NH Fish & Game Dept (see below).
Spotted Turtle (*Clemmys guttata*)	T	--	Contact the NH Fish & Game Dept (see below).
Vesper Sparrow (*Pooecetes gramineus*)	--	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. For some purposes, including legal requirements for state wetland permits, the fact that no species of concern are known to be present is sufficient. However, an on-site survey would provide better information on what species and communities are indeed present.

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Division of Forests and Lands
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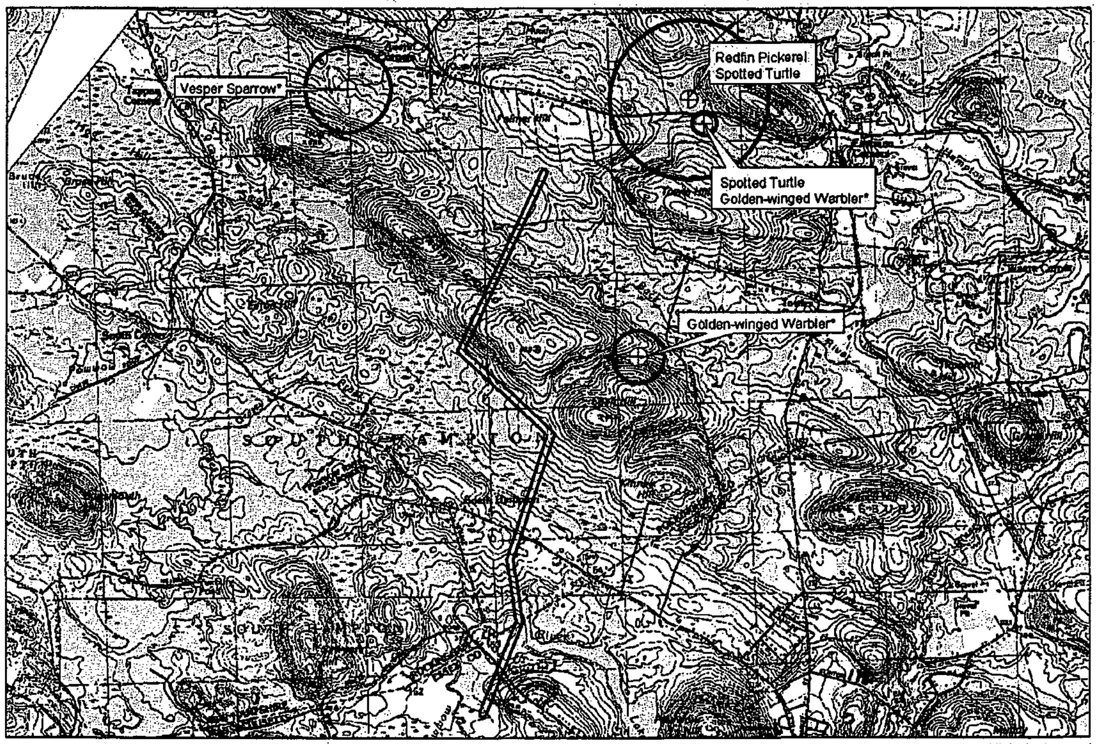
NH NATURAL HERITAGE BUREAU

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.



0.5 0 0.5 1 Miles

1:35000

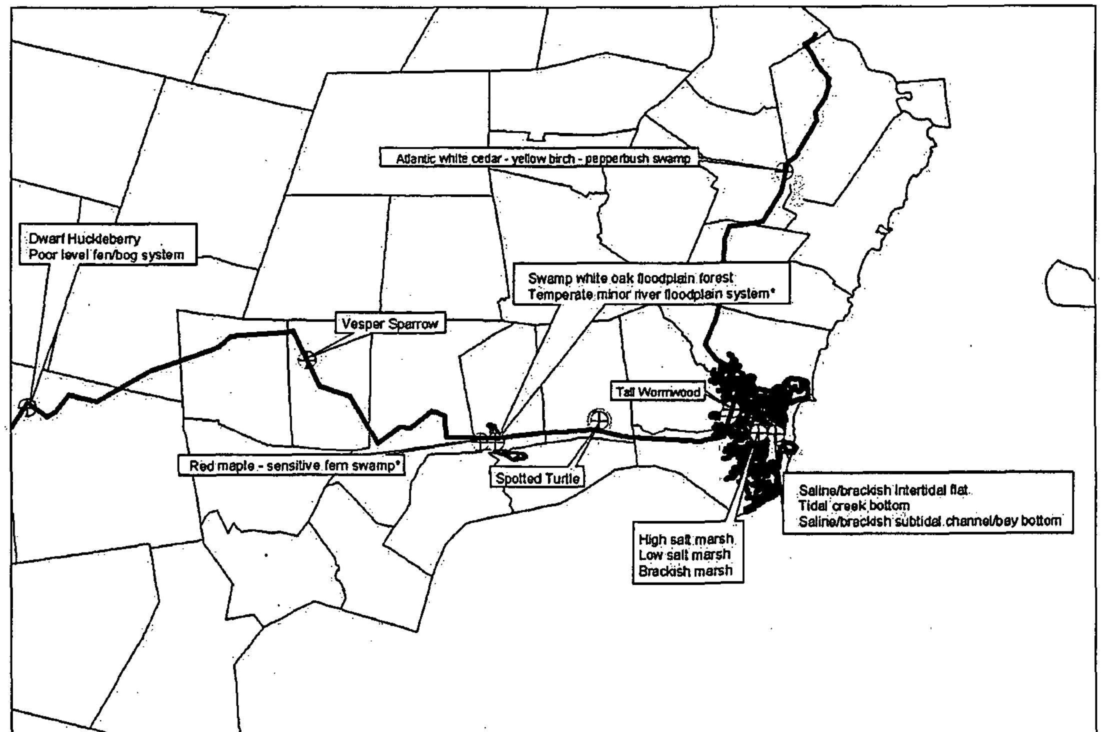
*Historical record

Valid for one year from this date: 18 Mar 2009

NH NATURAL HERITAGE BUREAU

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.



0.5 0 0.5 1 Miles

1:250000

*Historical record

Valid for one year from this date: 18 Mar 2009

NHB09-0508 EOCODE: CP00000166*001*NH

New Hampshire Natural Heritage Bureau - Community Record

Atlantic white cedar - yellow birch - pepperbush swamp

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Good quality, condition and lanscape context ('B' on a scale of A-D).
Comments on Rank:

Detailed Description: 1996: No details. 1989: Has a healthy population of *Chamaecyparis thyoides* (Atlantic white cedar) plus *Picea mariana* (black spruce), *Tsuga canadensis* (hemlock), and *Larix* (larch). Excellent variety of bog plants.
General Area: 1972: Bordered by two roads, forest land, and a railroad bed.
General Comments: Swamp logged in the past, but has since regained a natural quality. NH Natural Area #3. 335 acres total wetlands at Packer Bog.
Management Comments:

Location

Survey Site Name: Packer Bog
Managed By: Packer Bog

County:	Rockingham	USGS quad(s):	Portsmouth (4307017)
Town(s):	Greenland	Lat, Long:	430149N, 0704851W
Size:	359.6 acres	Elevation:	30 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Greenland at Packer Bog.

Dates documented

First reported: 1972 Last reported: 1996-07-16

Nichols, Bill. 1996. Field survey to Packer Bog, Greenland on July 16.

Nichols, B. & D. Sperduto. 1996. Ecological inventories of 1996 project areas on the White Mountain National Forest in New Hampshire. New Hampshire Natural Heritage Program, Concord, NH. 83 pp.

NHB09-0508 EOCODE: CE00000005*012*NH

New Hampshire Natural Heritage Bureau - Community Record

Brackish marsh

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Good quality, condition and lanscape context ('B' on a scale of A-D).

Comments on Rank: Rank is for largest area visited (Taylor River). Others were B- (three sites) or C (Seabrook Salt Marsh).

Detailed Description: 1997: A characteristic mix of graminoids includes *Agrostis stolonifera* var. *palustris* (marsh creeping bent-grass), *Spartina patens* (salt-meadow cord-grass), *Juncus gerardii* (salt marsh rush), *Solidago sempervirens* (seaside goldenrod), *Distichlis spicata* (spike-grass), *Juncus arcticus* var. *littoralis* (shore rush), *Elytrigia repens* (quack-grass), *Spartina pectinata* (fresh-water cord-grass, slough-grass), *Carex paleacea* (chaffy salt sedge), *Hierochloe odorata* (sweet grass), *Aster novi-belgii* (New York aster), *Scirpus pungens* (three-square rush), and several other less frequent species. At the Seabrook School area, ephemeral runoff channel/stream entering from west; area dominated by *Lythrum salicaria* (purple loosestrife). Small elevated knoll in middle with *Quercus bicolor* (swamp white oak), *Toxicodendron radicans* (climbing poison ivy), and *Rosa virginiana* (Virginia rose).

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Exemplary subtidal communities are ***tidal creek bottom*** and undifferentiated ***saline/brackish subtidal channel/bay bottom***. Exemplary intertidal communities are ***brackish marsh, coastal shoreline strand/swale, saline/brackish intertidal flat***, and high and ***low salt marsh***. Exemplary dry Appalachian oak-hickory forest occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments: 1997: Tidally flooded by salt water only during spring tides and storm surges. Supports a greater diversity of plants and generally flooded less frequently than the robust forb brackish marsh. Elevationally higher, received more freshwater input, and experienced less frequent tidal flooding than the high salt marsh. Occasionally occurs along the upper margins of the high salt marsh where sufficient fresh water runoff or groundwater discharge flows onto the marsh surface. This hydrologic regime supports brackish marsh species and other species most often found in fresh or salt marshes but tolerant of brackish conditions and able to successfully compete in this environment.

Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: ASNH to Properties, Inc. - Pelton

County: Rockingham USGS quad(s): Hampton (4207087)

NHB09-0508 EOCODE: CE00000005*012*NH

Town(s):	Hampton	Lat, Long:	425407N, 0704957W
Size:	3448.9 acres	Elevation:	5 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. 1997: Five areas visited. Wrights Island (park at Seabrook Sewage Treatment Plant), Farm Brook (drive to east end of Depot Road and park in lot), two areas at Seabrook School Salt Marsh (park behind the Seabrook Elementary/Middle School off of Walton Road), and Taylor River (along the northern portions of the Taylor River Estuary from Drakes Creek to Tide Mill Creek).

Dates documented

First reported: 1997-07-05 Last reported: 1997-10-06

Nichols, Bill. 1997. Field survey to Blackwater River Salt Marsh on July 5.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hamphire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: CE00000004*034*NH

New Hampshire Natural Heritage Bureau - Community Record

High salt marsh

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).
Comments on Rank: These ranks are for the entire estuary.

Detailed Description: 2006: Community observed and photographed.1997: In addition to *Spartina patens* (salt-meadow cord-grass) and *Juncus gerardii* (salt marsh rush), other common plants on the high marsh included smooth cord-grass (short form) and *Distichlis spicata* (spike-grass). *D. spicata* formed pure stands in wetter, more poorly drained areas, or mixed with *S. patens*, growing at similar elevations on the high marsh. *J. gerardii* dominated landward of salt meadow-grass in narrow vegetative zones with decreased tidal flooding and soil water salinity, beginning at about mean spring high water. This zone had the highest species richness within the high marsh and included *Solidago sempervirens* (seaside goldenrod), *Panicum virgatum* (switch-grass), *Hierochloe odorata* (sweet grass), *Carex hormathodes* (necklace sedge), *Festuca rubra* (red fescue), *Aster novi-belgii* (New York aster), *Elytrigia repens* (quack-grass), *Spartina pectinata* (fresh-water cord-grass), and *Potentilla anserina* (silverweed).

General Area: 1997: At Hampton Harbor, the mean tidal range is 8.3 feet with spring tides averaging 9.5 feet. Here, the high marsh rises from ca. 4 feet above mean sea level at its lower end to 5 feet above mean sea level at the landward limit of the salt marsh rush zone. The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Subtidal communities include the undifferentiated ***saline/brackish subtidal channel/bay bottom*** and ***tidal creek bottom***. Other intertidal communities are ***brackish marsh, coastal shoreline strand/swale, saline/brackish intertidal flat***, and ***low salt marsh***. Exemplary ***dry Appalachian oak-hickory forest*** occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments:

Management Comments: 1997: Marsh ditched heavily; greenhead boxes present.

Location

Survey Site Name: Hampton Harbor
Managed By: ASNH to Properties, Inc. - Pelton

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton	Lat, Long:	425407N, 0704957W
Size:	3448.9 acres	Elevation:	4 feet

NHB09-0508 EOCODE: CE00000004*034*NH

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs behind barrier beaches, along inland bays, and other areas protected from high-energy wave action.

Dates documented

First reported:	1997-07-05	Last reported:	2006-08-17

Kimball, Ben and Pete Bowman. 2006. Field survey to The Sands on August 17.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hampshire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: CE00000003*035*NH

New Hampshire Natural Heritage Bureau - Community Record

Low salt marsh

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).
Comments on Rank: These ranks are for the entire estuary.

Detailed Description: 1997: No details.

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Subtidal communities include the undifferentiated ***saline/brackish subtidal channel/bay bottom*** and ***tidal creek bottom.*** Other intertidal communities are ***brackish marsh, coastal shoreline strand/swale, saline/brackish intertidal flat,*** and ***high salt marsh.*** Exemplary dry Appalachian oak-hickory forest occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments:
Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: ASNH to Properties, Inc. - Pelton

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton	Lat, Long:	425407N, 0704957W
Size:	3448.9 acres	Elevation:	4 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs behind barrier beaches, along inland bays, and other areas protected from high-energy wave action.

Dates documented

First reported: 1997-07-05 Last reported: 1997-10-08

Nichols, Bill. 1997. Field survey to Blackwater River Salt Marsh on July 5.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hampshire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: EP00000002*028*NH

New Hampshire Natural Heritage Bureau - System Record

Poor level fen/bog system

Legal Status	**Conservation Status**
Federal: Not listed	Global: Not ranked (need more information)
State: Not listed	State: Rare or uncommon

Description at this Location

Conservation Rank: Fair quality, condition and/or lanscape context ('C' on a scale of A-D).
Comments on Rank:

Detailed Description: 1992: Population of *Gaylussacia dumosa* var bigeloviana was found in the fen community.
General Area: he classic fen sequence of floating mat, open peat, low heath, tall heath, dwarf spruce and larch, and shrub swamp is found in this wetland complex. The lag varies from 20 to over 200 feet wide, although the low and high heath zones are not always well developed. The dominant plant in the low heath where the dwarf huckleberry was found was leatherleaf. Dwarf black spruce and larch are scattered throughout this zone. The shrub swamp further back from the pond is dominated by mountain holly, winterberry holly, and high bush blueberry.
General Comments:
Management Comments:

Location

Survey Site Name: Lower Shields Pond
Managed By:

County: Rockingham	USGS quad(s): Derry (4207183)
Town(s): Derry	Lat, Long: 425503N, 0711927W
Size: 41.8 acres	Elevation: 380 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Take Rte 28BYP north from Derry Village traffic circle ca 2 miles to Shields Pond Road on the right. Go ca. 0.5 mile to culverted creek. There is a path beyond the powerlines that you hike to from the west side of the stream.

Dates documented

First reported: 1992-09-11 Last reported: 1992-09-11

Royte, Josh and John Lortie. 1992. Field survey to Lower Shields Pond on September 11.

NHB09-0508 EOCODE: CP00000094*014*NH

New Hampshire Natural Heritage Bureau - Community Record

Red maple - sensitive fern swamp

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1987: Large swamp with mature characteristic vegetation. *Acer rubrum* (red maple) dominates with a nearly uniform *Lindera benzoin* (northern spicebush) shrub layer. A variety of plants occur in pools (*Calla palustris* (wild calla), *Carex lacustris* (lake sedge)) and on hummocks (*Rubus pubescens* (dwarf raspberry), *Coptis trifolia* var. *groenlandica* (goldthread)).

General Area: 1987: A seepage swamp at headwaters of small drainage with well-defined and mature vegetation structure.

General Comments: 1987: Powerline crosses swamp. Some cutting has been done.

Management Comments:

Location

Survey Site Name: Powwow Pond, SE of
Managed By:

County:	Rockingham	USGS quad(s):	Kingston (4207181)
Town(s):	East Kingston	Lat, Long:	425357N, 0710114W
Size:	39.2 acres	Elevation:	120 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Seepage swamp southeast of Powwow Pond. At powerline right-of-way just south of junction of Rte. 107A and Rte. 108.

Dates documented

First reported:	1987	Last reported:	1987-07-22

Korpi, John. 1987. Field survey to Powwow Pond Swamp of 22 July.

NHB09-0508 EOCODE: CE00000011*036*NH

New Hampshire Natural Heritage Bureau - Community Record

Saline/brackish intertidal flat

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).
Comments on Rank: Ranks are for an area at Seabrook School Salt Marsh.

Detailed Description: 1997: No details.

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Subtidal communities include the undifferentiated ***saline/brackish subtidal channel/bay bottom*** and ***tidal creek bottom.*** Other intertidal communities are ***brackish marsh, coastal shoreline strand/swale,*** and high and ***low salt marsh.*** Exemplary dry Appalachian oak-hickory forest occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuaryis unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments: 1997: Extensive areas of this community type were found within the Blackwater - Hampton River Estuary. Intertidal sand and mud flats are gently sloping, sparsely vegetated, habitats. The substrate, exposed completely at extra low spring tide, ranges in composition from sands to muds and silts. Benthic diatoms and other microalgae occurring in this environment are important contributors to the primary productivity of the total estuarine system (Sickley 1989). Macroalgae is typically uncommon across the exposed substrate. Characteristic invertebrates found in New Hampshire's intertidal mudflats include polychaete worms (including Nereis virens, Nephtys caeca, Clymenella tortquata, and Scoloplos spp.) and mollusks (including soft-shelled clam [Mya arenaria], Baltic Macoma [Macoma balthica], gem shell [Gemma gemma], and swamp Hydrobia [Hydrobia minuta]) (NAI 1973). Arthropods are also well represented and include green crabs (Carcinus maenus), rock crabs (Cancer irroratus), flat-clawed hermit crabs (Pagurus pollicaris), and horseshoe crabs (Limulus polyphemis). During the diurnal (twice daily) tidal flooding several species of fish and other aquatic species feed on the benthos and epibenthic algae. This community also provides important foraging habitat for shorebirds and other animals when the intertidal flat is exposed. The diverse variety of primary foods (microalgae, phytoplankton, and detritus) available to consumers supports the high productivity found on intertidal flats. The substrate is composed of sand or silt and clay rich in organic matter. Vascular plants are sparse to more typically absent.

Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: Hampton Beach State Park

NHB09-0508 EOCODE: CE00000011*036*NH

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton	Lat, Long:	425405N, 0704917W
Size:	1183.7 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs between estuarine marshes or other coastal communities landward and subtidal communities seaward and includes tidal creek channels exposed at low tide.

Dates documented

First reported: 1997-07-05 Last reported: 1997-10-08

Nichols, Bill. 1997. Field survey to Blackwater River Salt Marsh on July 5.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hamphire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: CE00000012*038*NH

New Hampshire Natural Heritage Bureau - Community Record

Saline/brackish subtidal channel/bay bottom

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).
Comments on Rank: Ranks are for an area at Seabrook School Salt Marsh.

Detailed Description: 1997: No details.

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Another subtidal community is ***tidal creek bottom***. Intertidal communities are ***brackish marsh***, ***coastal shoreline strand/swale***, ***saline/brackish intertidal flat***, and high and ***low salt marsh***. Exemplary dry Appalachian oak-hickory forest occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments: 1997: These communities perform important ecological functions including supporting fish populations, providing refuge for fish and invertebrates that retreat from intertidal flats and estuarine marshes at low tide, and serving as a spawning and nursery area for numerous species of aquatic animals (Short 1992). Salinities in coastal areas remain close to 30 ppt year-round (Short 1992). Substrates varied at different locations and included mud, sand, gravel, cobble, or rock. Vascular plants were typically absent or sparse. Seaweeds are an important component of this habitat and the surrounding environment.

Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: Hampton Beach State Park

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton	Lat, Long:	425405N, 0704917W
Size:	1183.7 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs in permanently flooded saline tidal channels and bays.

Dates documented

First reported:	1997-07-05	Last reported:	1997-10-08

NHB09-0508 EOCODE: CE00000012*038*NH

Nichols, Bill. 1997. Field survey to Blackwater River Salt Marsh on July 5.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hamphire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: CT00000226*001*NH

New Hampshire Natural Heritage Bureau - Community Record

Swamp white oak floodplain forest

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).

Comments on Rank:

Detailed Description: 1998: The low terrace floodplain forest is dominated by *Quercus bicolor* (swamp white oak), *Acer rubrum* (red maple), and *Carya ovata* (shagbark hickory), with *Fraxinus americana* (white ash) and *Ulmus americana* (American elm) in the understory. *Onoclea sensibilis* (sensitive fern) and *Osmunda cinnamomea* (cinnamon fern) are dominant in the herb layer. The terrace sits distinctly lower than the surrounding landscape (by 2-4 meters) and buffers the meandering river course. Vines and shrub species (e.g. *Toxicodendron radicans* (climbing poison ivy), *Viburnum lentago* (nannyberry), and *Viburnum dentatum* var. *lucidum* (northern arrowwood)) fill in natural gaps and edges. Soils are not particularly enriched (pH=5.2), but they are dark, very fine sandy loams that may have some coastal influence (i.e. silt from marine sedimentation). A fair amount of dead wood was scattered throughout the floodplain, with a large recent blowdown oak adjacent to the observation plot. River is entrenched by 1-2 meters within a steep silty bank, yet flooding and depositional processes appear to be active, with some meanders cutting more deeply, and others about to be cut off. Microtopographic variation is slight on this mostly flat terrace.

General Area: 1998: Housing and other development appear to encroach from all sides, but not actually into the low terrace. The wetland complex seems to be fairly large and wide, but above the flooded zone, there appears to be considerable human disturbance and fragmentation. Just downstream of the surveyed area, the Richard Sargent Management area provides a buffer along and upslope of the floodplain.

General Comments: 1998: From aerial photographs, the low terrace floodplain forest appears to extend well beyond the surveyed property. This is an excellent example of swamp white oak floodplain, but landowner patterns and development may threaten its integrity over the long term.

Management Comments: 1998: Monitor landowner patterns and adjacent fragmentation

Location

Survey Site Name: Powwow River
Managed By: Welch Parcel

County:	Rockingham	USGS quad(s):	Kingston (4207181)
Town(s):	East Kingston	Lat, Long:	425357N, 0710038W
Size:	193.3 acres	Elevation:	80 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From Kingston, take Rte. 107A south to Rte. 108 south in East Kingston. Turn left into CWR Timber Management and Realty dirt driveway/timber yard. Park and hike east on logging roads to floodplain terrace. An alternate route is to access the natural community directly from Chase Rd. at Smith Corner.

Dates documented

First reported:	1998-09-02	Last reported:	1998-09-02

Bechtel, Doug. 1998. Field survey to Powwow River on September 2.

NHB09-0508 EOCODE: CT00000226*001*NH

Nichols, William F., Daniel D. Sperduto, Douglas A. Bechtel, and Katherine F. Crowley. 2000. Floodplain Forest Natural Communities along Minor Rivers and Large Streams in New Hampshire. Prepared by NH Natural Heritage. Concord, NH.

NHB09-0508 EOCODE: ER00000003*026*NH

New Hampshire Natural Heritage Bureau - System Record

Temperate minor river floodplain system

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: Unique coastal plain river with large exemplary wetland.

Detailed Description: 1986: Dominated by *Acer rubrum* and *Quercus bicolor* (dominant only on coastal plain in NH) w/some *Carya ovata* (shagbark hickory). Vines abound; *Toxicodendron radicans* (poison ivy), *Smilax rotundifolia* (bullbrier), Vitis spp. (grape). Dense vegetation, swamp extends to regularly inundated alluvial areas.
General Area: 1986: Narrow river that drains large area in flat coastal plain area; seems to result in frequent flooding of narrow, swampy floodplain.
General Comments: 1986: Historic station for Lygodium palmatum (climbing fern); swamp has very dense physiognomy, natural & undisturbed.
Management Comments:

Location

Survey Site Name: Pow Wow River
Managed By: Welch Parcel

County:	Rockingham	USGS quad(s):	Exeter (4207088)
Town(s):	East Kingston	Lat, Long:	425357N, 0710038W
Size:	191.7 acres	Elevation:	95 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Pow Wow River. SW corner of Exeter quad. Along river west of Chase Road.

Dates documented

First reported:	1986	Last reported:	1986-06-23

Korpi, J. and F. Brackley. 1986. Field survey to Chase Hill on August 4.

NHB09-0508 EOCODE: CE00000014*037*NH

New Hampshire Natural Heritage Bureau - Community Record

Tidal creek bottom

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Excellent quality, condition and lanscape context ('A' on a scale of A-D).
Comments on Rank: Ranks are for an area at Seabrook School Salt Marsh.

Detailed Description: 1997: The substrate was composed of mud rich in organic matter. Vascular plants were sparse but included *Ruppia maritima* (widgeon-grass).

General Area: 1997: The Blackwater - Hampton River Estuary contains the majority of the estimated 6200 acres of salt marsh in the state. The Blackwater River portion of the estuary continues south into Salisbury, MA. The estuarine system extends seaward to an imaginary line drawn across Hampton Harbor Inlet and upstream and landward to where ocean-derived salts are less than or equal to 0.5 parts per thousand during the period of average annual low freshwater flow (Cowardin et al. 1979). This estuary is surrounded by moderate levels of residential and commercial development. Several exemplary subtidal and intertidal communities occur in this estuary. Another subtidal community is the undifferentiated ***saline/brackish subtidal channel/bay bottom***. Intertidal communities are ***brackish marsh, coastal shoreline strand/swale, saline/brackish intertidal flat***, and high and ***low salt marsh***. Exemplary dry Appalachian oak-hickory forest occurs at the site as "salt marsh islands", forested uplands surrounded by salt marsh. Most of the estuary is unaffected by restricted tidal flow. Other areas are described as having an adequate tidal inlet by the USDA Soil Conservation Service (1994). The largest portions of the estuary determined to have inadequate tidal inlets include the Meadow Pond area, the Taylor River - Drakes River area west of the rail road track, and the Browns River west of the rail road track (USDA Soil Conservation Service 1994). In the last four years, several salt marsh restoration projects have begun in this estuary (Ammann, A.P. pers. comm., 1997).

General Comments: 1997: Tidal creeks provide habitat for stickleback (Pungitius pungitius, Gasterosteus aculeatus, and Apeltes quadracus), mummichog (Fundulus heteroclitus), and several other species of fish (Short 1992) and foraging ground for migratory and year round bird species and other animals. As the salt marsh replaces accreting intertidal flats seaward, tidal creeks develop along former intertidal flat drainage channels. Landward, as the high salt marsh develops above mean high water, tidal flooding frequency decreases, reducing drainage flow in the creeks. This tends to cause the upstream end of the tidal creek to fill in as sediment deposition occurs at a greater rate than erosion (Redfield 1972). The banks of tidal creeks were nearly vertical and often slump, supporting a narrow band of Spartina alterniflora (smooth cord-grass) (see low salt marsh description).

Management Comments:

Location

Survey Site Name: Hampton Harbor
Managed By: Hampton Beach State Park

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton	Lat, Long:	425405N, 0704917W
Size:	1183.7 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Large area more or less framed by Rte. 1 to the west, Rte. 101 to the north, Rte. 1A to the east, and the Massachusetts state line to the south. Occurs in permanently flooded creek-bottoms draining

NHB09-0508 EOCODE: CE00000014*037*NH

water from the high and low salt marsh into the main channel or bay.

Dates documented

First reported:	1997-07-05	Last reported:	1997-10-08

Nichols, Bill. 1997. Field survey to Blackwater River Salt Marsh on July 5.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hampshire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: PDCHE0J040*002*NH

New Hampshire Natural Heritage Bureau - Plant Record

Dwarf Glasswort (*Salicornia bigelovii*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: Sub-population of a large "A-" population.

Detailed Description: 1982: 25 or more plants in 5x2 area directly east of *Salicornia virginica*. Plants just starting to flower.
General Area: Flat, full sun, damp but above main area of inundated marsh with *Salicornia virginica*.
General Comments:
Management Comments:

Location

Survey Site Name: RR Tracks
Managed By: Landing + Vicinity Marsh

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton Falls	Lat, Long:	425437N, 0705110W
Size:	2.8 acres	Elevation:	10 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hampton Falls. RR tracks site.drive to east end of Depot Rd. Go south along RR tracks to Hampton Falls River. Site on west side of RR tracks just north of Hampton Falls River.

Dates documented

First reported: 1982 Last reported: 1982-08-17

Dunlop, Deb. New England College, Botany Department, Box 30, Henniker, NH 03242. 603/428-2233.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hamphire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: PDAST0S0D7*007*NH

New Hampshire Natural Heritage Bureau - Plant Record

Tall Wormwood (*Artemisia campestris ssp. caudata*)

Legal Status
Federal: Not listed
State: Listed Threatened

Conservation Status
Global: Demonstrably widespread, abundant, and secure
State: Imperiled due to rarity or vulnerability

Description at this Location
Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 1997: Common (11-50 plants) on railroad tracks leading down to salt marsh to east. 1982: Numerous plants scattered along railroad bed on both sides. Specimens at NHA, NEBC (1916, 1982).
General Area: 1997: Open habitat on railroad banks.
General Comments:
Management Comments:

Location
Survey Site Name: Hampton Falls River
Managed By: ASNH Hampton Falls Saltmarsh - Swain

County: Rockingham
Town(s): Hampton Falls
Size: 2.8 acres
USGS quad(s): Hampton (4207087)
Lat, Long: 425449N, 0705102W
Elevation: 10 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Railroad tracks, north of Hampton Falls River in Hampton Harbor salt marsh.

Dates documented
First reported: 1916
Last reported: 1997-09-19

Nichols, Bill. 1997. Field survey to Hampton Falls River Salt Marsh on September 19.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hampshire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: PDCHE0M030*004*NH

New Hampshire Natural Heritage Bureau - Plant Record

Woody Glasswort (*Sarcocornia perennis*)

Legal Status	**Conservation Status**
Federal: Not listed	Global: Demonstrably widespread, abundant, and secure
State: Listed Endangered	State: Not ranked (need more information)

Description at this Location

Conservation Rank: Fair quality, condition and/or lanscape context ('C' on a scale of A-D).
Comments on Rank:

Detailed Description: 1997: At least two large mats in a 5-10 square-meter area. 1982: 50 or more stalks in 15x10 foot area, plants just starting to flower. Plants appear vigorous.
General Area: 1997: Gulf of Maine Salt Marsh. 1982: Flat, wet, full sun, with *Spartina patens* (salt-meadow cord-grass). Salt Marsh.
General Comments:
Management Comments:

Location

Survey Site Name: Hampton Falls River
Managed By: Landing + Vicinity Marsh

County: Rockingham	USGS quad(s): Hampton (4207087)
Town(s): Hampton Falls	Lat, Long: 425437N, 0705110W
Size: 2.8 acres	Elevation: 10 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hampton Falls. "Birmins" [Brimers?] Salt Marsh. Take Depot Ave to railroad tracks, go south on tracks 1/8 mile. Plants on west side of tracks at base of banking in salt marsh.

Dates documented

First reported: 1982-08-17 Last reported: 1997-09-19

Nichols, Bill. 1997. Field survey to Hampton Falls River Salt Marsh on September 19.

Nichols, William F. 2000. Ecological Assessment of Selected Towns in New Hampshire's Coastal Zone. Prepared by NH Natural Heritage Inventory. Concord, NH.

NHB09-0508 EOCODE: ABNNM08070*005*NH

New Hampshire Natural Heritage Bureau - Animal Record

Common Tern (*Sterna hirundo*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Threatened	State:	Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: 2007: No records from this site since 1978.

Detailed Description: 1978: At least 2 nests.1969: 10 adults, 1 chick observed.1966: Ca. 10 birds present, 1 nest with 2 eggs.1964: 10 birds nesting.
General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Hampton Falls RR Station
Managed By: Former Dodge Marsh

County:	Rockingham	USGS quad(s):	Hampton (4207087)
Town(s):	Hampton Falls	Lat, Long:	425444N, 0705105W
Size:	2.8 acres	Elevation:	5 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hampton Falls Railroad station, Route 1, then East on Depot Ave.

Dates documented

First reported: 1964 Last reported: 1978

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: ABPBX01030*001*NH

New Hampshire Natural Heritage Bureau - Animal Record

Golden-winged Warbler (*Vermivora chrysoptera*)

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	Not listed	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1986: 1 adult female seen (Obs_id 1634).
General Area: 1986: Terrestrial - Scrub / shrubland (Obs_id 1634).
General Comments: 1986: Female observed carrying food to undisclosed nest location in old clear cut (Obs_id 1634).
Management Comments:

Location

Survey Site Name: Chair Hill
Managed By: Brookside Wildlife Sanctuary

County:	Rockingham	USGS quad(s):	Exeter (4207088)
Town(s):	South Hampton	Lat, Long:	425329N, 0705641W
Size:	30.8 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1986: South of Peak Road at south side of Brookside Wildlife Sanctuary (ASNH). [Off of Woodman Rd., north of Chair Hill.] (Obs_id 1634).

Dates documented

First reported: 1986-06-04 Last reported: 1986-06-04

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: ABPBX01030*003*NH

New Hampshire Natural Heritage Bureau - Animal Record

Golden-winged Warbler (*Vermivora chrysoptera*)

Legal Status	**Conservation Status**
Federal: Not listed	Global: Apparently secure but with cause for concern
State: Not listed	State: Not ranked (need more information)

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1994: 1 adult male (Obs_id 1944). 1984: 1 male, 1 female (Obs_id 1944). 1982: 1 male (Obs_id 1944). 1981: 1 male (Obs_id 1944). 1980: 1 male (Obs_id 1944).
General Area: 1994: Terrestrial - Scrub / shrubland (Obs_id 1944).
General Comments:
Management Comments:

Location

Survey Site Name: Horse Hill, SW of
Managed By:

County: Rockingham	USGS quad(s): Exeter (4207088)
Town(s): Kensington	Lat, Long: 425427N, 0705618W
Size: 6.4 acres	Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1994: South Road (Rt. 107) residence (Obs_id 1944).

Dates documented

First reported: 1984-07-01 Last reported: 1984-07-01

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: ABNKC01010*154*NH

New Hampshire Natural Heritage Bureau - Animal Record

Osprey (*Pandion haliaetus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Not listed	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2006: Brookside Sanctuary: 1 fledged.
General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Brookside Sanctuary
Managed By: Crosby

County:	Rockingham	USGS quad(s):	Exeter (4207088)
Town(s):	South Hampton	Lat, Long:	425348N, 0705648W
Size:	.4 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From Towles Corner, go W on Highland Rd. ca. 0.6 miles and turn left onto Woodman Rd. Follow ca. 0.3 miles to the crossing of the Back River. Nest is ca. 0.3 miles NE along the Back River.

Dates documented

First reported: 2006 Last reported: 2006

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: AFCHD01011*001*NH

New Hampshire Natural Heritage Bureau - Animal Record

Redfin Pickerel (*Esox americanus americanus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Not listed	State:	Apparently secure but with cause for concern

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2006: Area 11491: 2 adults, sex unknown caught in bag seine.2004: Area 4563: 7+ adult, sex unknown, 3+ immature, sex unknown.

General Area: 2006: Area 11491: Freshwater stream. Very shallow water upstream of long unpaved driveway. Small wetland/stream flows under driveway through small culvert. 2004: Area 4563: Freshwater stream.

General Comments: 2006: Area 11491: NHFGD fish survey. 2004: Area 4563: They are a common species here--in wetlands in & adjacent to the TNC designated Horse Hill Seepage Swamp--Registered Natural Area. (Obs_id 1906).

Management Comments:

Location

Survey Site Name: Horse Hill Swamp
Managed By: KLC

County:	Rockingham	USGS quad(s):	Exeter (4207088)
Town(s):	Kensington	Lat, Long:	425433N, 0705623W
Size:	4.3 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2006: Area 11491: Intermittent steam crossing long driveway (mailbox #217), north of Rte. 107 and directly across from Highland Road. 2004: Area 4563: Winkley Brook & associated ponds, marshes, swamps. Gavutis (residence) property. Rte. 107 (231 South Rd.) ca. 0.7mi. west of the junction with Rte.150. South of Cottage Hill and west of Horse Hill.

Dates documented

First reported:	2004-03-05	Last reported:	2006-06-26

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: ABPBX95010*007*NH

New Hampshire Natural Heritage Bureau - Animal Record

Vesper Sparrow (*Pooecetes gramineus*)

Legal Status	**Conservation Status**
Federal: Not listed	Global: Demonstrably widespread, abundant, and secure
State: Not listed	State: Not ranked (need more information)

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2001: 10 seen, age and sex unknowns (Obs_id 1190).
General Area: 2001: Habitat not clear - birds in powerline corridor so probably a mix of open areas and shrubs (Obs_id 1190).
General Comments: 2001: Total of 10 birds includes some presumed to be juveniles, but exact breakdown of adults and young was not made by the observer (Obs_id 1190).
Management Comments:

Location

Survey Site Name: Coburn Hill, Powerlines West of
Managed By: Danville Town Forest

County: Rockingham	USGS quad(s): Sandown (4207182)
Town(s): Danville	Lat, Long: 425624N, 0710810W
Size: 84.1 acres	Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2001: Powerlines near Ticker Town Road (class 6). [From intersection of Sandown Rd. travel the powerlines southwest to junction of 2 more powerlines. Go southwest, past wetland area about 1.1 miles.] (Obs_id 1190).

Dates documented

First reported: 2001-07-24 Last reported: 2001-07-24

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

NHB09-0508 EOCODE: ABPBX95010*011*NH

New Hampshire Natural Heritage Bureau - Animal Record

Vesper Sparrow (*Pooecetes gramineus*)

Legal Status	**Conservation Status**
Federal: Not listed	Global: Demonstrably widespread, abundant, and secure
State: Not listed	State: Not ranked (need more information)

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1983: 2 adult males, 1 adult, sex unknown, seen and heard (Obs_id 1235).
General Area: 1983: Terrestrial - grassland / field (Obs_id 1235).
General Comments: 1983: One bird carrying food, indicating dependant young in vicinity. Species also present in this location in 1981 and 1982 (Obs_id 1235).
Management Comments:

Location

Survey Site Name: Hog Hill, north of
Managed By:

County: Rockingham	USGS quad(s): Exeter (4207088)
Town(s): Kensington	Lat, Long: 425436N, 0705819W
Size: 84.1 acres	Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Hog Hill, west end of Bartlett Road. [Off of Rte. 107 near the Kensington/East Kingston town line.] (Obs_id 1235).

Dates documented

First reported: 1983-06-14 Last reported: 1983-06-14

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

EOCODE:

Legal Status	**Conservation Status**
Federal:	Global:
State:	State:

Description at this Location

Conservation Rank:
Comments on Rank:

Detailed Description:
General Area:
General Comments:
Management Comments:

Location

Survey Site Name:
Managed By:

County:	USGS quad(s):
Town(s):	Lat, Long:
Size:	Elevation:

Precision:

Directions:

Dates documented

First reported:	Last reported:

EOCODE:

Legal Status	**Conservation Status**
Federal:	Global:
State:	State:

Description at this Location

Conservation Rank:
Comments on Rank:

Detailed Description:
General Area:
General Comments:
Management
Comments:

Location

Survey Site Name:
Managed By:

County:	USGS quad(s):
Town(s):	Lat, Long:
Size:	Elevation:

Precision:

Directions:

Dates documented

First reported:	Last reported:

FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

April 13, 2009

SBK-L-09046

Natural Heritage and Endangered Species Program
Attn: Regulatory Review
Massachusetts Division of Fisheries & Wildlife
North Drive
Westborough, MA 01581

Attn: Emily Holt
Endangered Species Review Assistant

Seabrook Station
Transmission Corridors
Request for Information on Threatened or Endangered Species

FPL Energy Seabrook, LLC (FPL Energy Seabrook), the owner of a controlling interest in and the operator of Seabrook Station plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Operating License for 20 years beyond the current expiration date. The current NRC Operating License for Seabrook Station expires at midnight on March 15, 2030. FPLE Seabrook plans to submit its application to the NRC in the second quarter of 2010.

FPL Energy Seabrook is contacting the Massachusetts Division of Fisheries and Wildlife in order to obtain input regarding issues that may need to be addressed in the Seabrook Station license renewal environmental reports, and to help identify any information that would be helpful to expedite consultation with the NRC in the future, if necessary.

The NRC requires that the license renewal application for Seabrook Station include environmental reports describing potential environmental impacts from refurbishment necessary for license renewal and from continued operations of the site and its associated transmission corridors during the renewal term. Transmission corridors from Seabrook extend into Massachusetts. One of these potential environmental impacts would be the potential effect caused by activities specifically related to license renewal on threatened or endangered species located on the Seabrook Station site and its immediate environs, regardless of ownership or

an FPL Group company

Natural Heritage and Endangered Species Program
Page 2

control of the land. Accordingly, the NRC requires that the environmental report for each license renewal application assess such a potential effect in accordance with the Endangered Species Act (10 CFR 51.53). Later, during its review of the proposed license renewals pursuant to the National Environmental Policy Act (NEPA), the NRC will use that assessment to evaluate whether a basis exists to request consultation with your office under Section 7 of the Endangered Species Act.

Seabrook Station is located within an 889-acre parcel of property in the town of Seabrook, New Hampshire owned by FPLE Seabrook. The existing operating license for Seabrook Station Unit 1 was initially issued for a 40-year term that expires in 2030. License renewal would extend the operating period for the reactor by 20 years beyond the expiration of its existing license.

Seabrook Station is on the western shore of Hampton Harbor, approximately two miles west of the Atlantic Ocean (Figure 1). Three transmission lines operating at 345 kV were constructed to deliver Seabrook Station's electrical output to the New England 345 kV transmission grid (Figure 2). These lines run through a variety of common natural and man-influenced habitats in New Hampshire and Massachusetts. These transmission corridors are considered by the NRC to be within the scope of its environmental reviews for the Seabrook license renewal. These transmission corridors are owned and maintained by Public Service Company of New Hampshire (PSNH) and National Grid (NGRID). The first line runs north 17 miles (27.4 km) from Seabrook Station to Newington Station, located in Newington, NH. Immediately north of Seabrook Station, this line crosses the salt marsh on a previously existing rail bed, generally following the I-95 corridor thereafter. A second line runs west then south for approximately 30 miles (47.9 km) to the Scobie Pond Substation in Londonderry, NH. A third line extends approximately 39 miles (63.2 km) south and southwest from Seabrook Station to the Tewksbury Substation, in Tewksbury, MA.

Based on a review of information available on the Massachusetts Natural Heritage Program website, FPL Energy Seabrook believes there are four possible federally-protected terrestrial species within Essex and Middlesex Counties, which contain the Massachusetts component of transmission corridors: New England Cottontail, Piping Plover, Roseate Tern, and Small Whorled Pogonia. Habitat for these species is not thought to occur along the transmission corridors, although it is possible that NE cottontails may occur along portions of the corridors. Some state-listed terrestrial animal species also have potential to occur within these counties (see Table 1). Also, Atlantic Sturgeon, Shortnose Sturgeon, marine mammals and five species of federally-listed sea turtles may occur offshore in the Atlantic Ocean near the Seabrook site. FPL Energy Seabrook is contacting the National Oceanic and Atmospheric Administration - National Marine Fisheries Service regarding these marine species.

FPL Energy Seabrook does not expect Seabrook Station operation during the license renewal term (an additional 20 years) to adversely affect threatened or endangered species at the station site, the immediate environs, or the transmission line corridors because license renewal will not alter existing operations. No expansion of existing facilities is planned, and no structural modifications or other refurbishments have been identified that are necessary to support license

Natural Heritage and Endangered Species Program
Page 3

renewal. Public Service Company of New Hampshire and National Grid have established management procedures for transmission lines that involve minimal disturbance of land, wetlands, and streams and are unlikely to adversely affect any threatened or endangered species.

After review of the information provided in this letter, FPL Energy Seabrook would appreciate a letter detailing any concerns the Division of Fisheries and Wildlife may have about any listed species or critical habitat in the area of the transmission corridors, or alternatively, confirming our conclusion that operation of Seabrook Station over the license renewal term would have no effect on any threatened or endangered species. FPL Energy Seabrook will include copies of this letter and your response in the environmental reports that will be submitted to the NRC as part of the Seabrook Station license renewal application. Letters detailing any concerns would be appreciated by June 30, 2009 to support the current submittal schedule.

If you have any questions regarding this information, please contact me, at (603) 773-7745. Thank you in advance for your assistance.

Sincerely yours,

Michael O'Keefe
Licensing Manager

Enclosure: Figure 1 – Location of Seabrook Station

Figure 2 – Transmission lines associated with Seabrook

Table 1 – Endangered and Threatened Species Recorded in Rockingham County and Counties Crossed by Transmission Lines

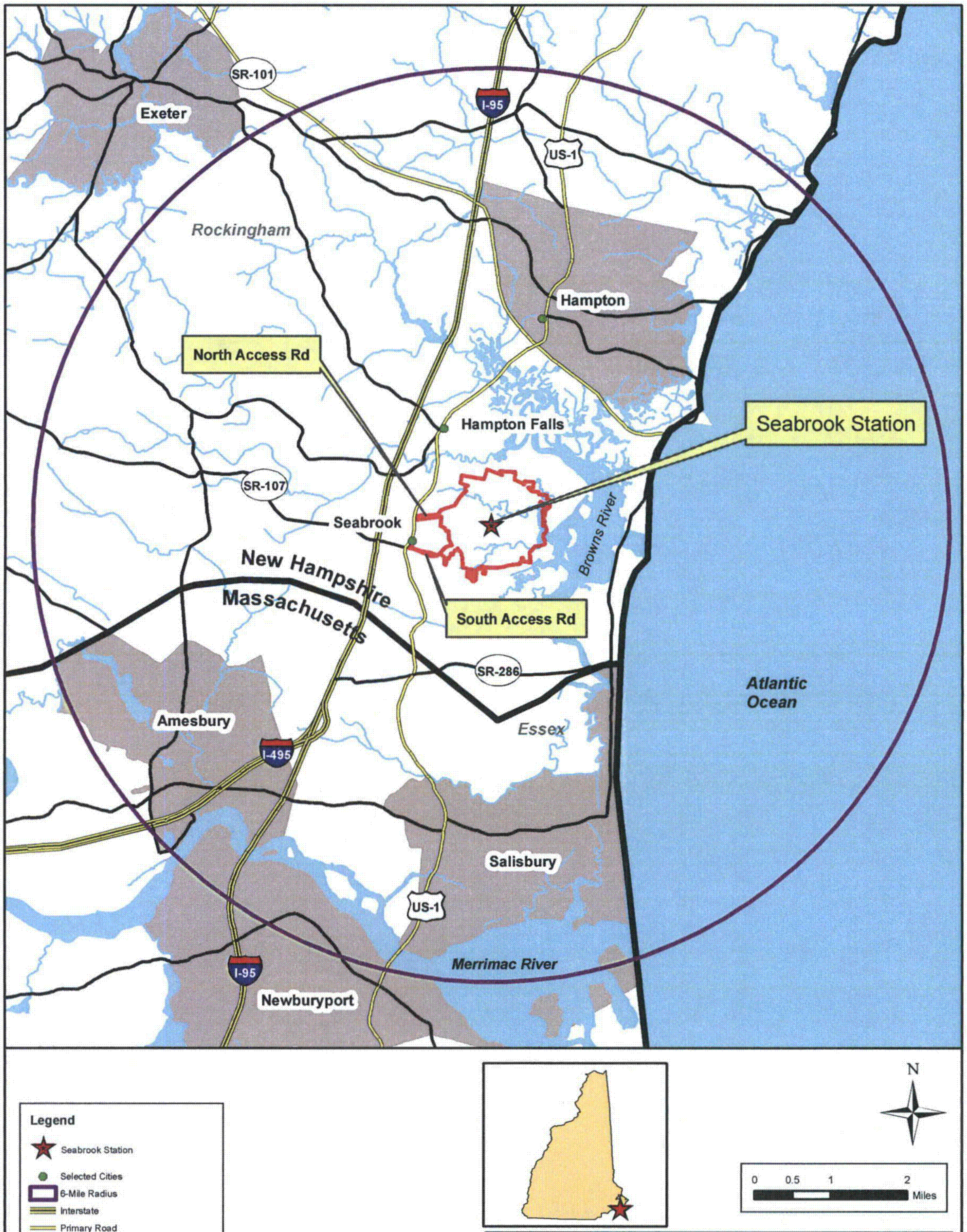


Figure 1
General Location of Seabrook Station Nuclear Power Plant

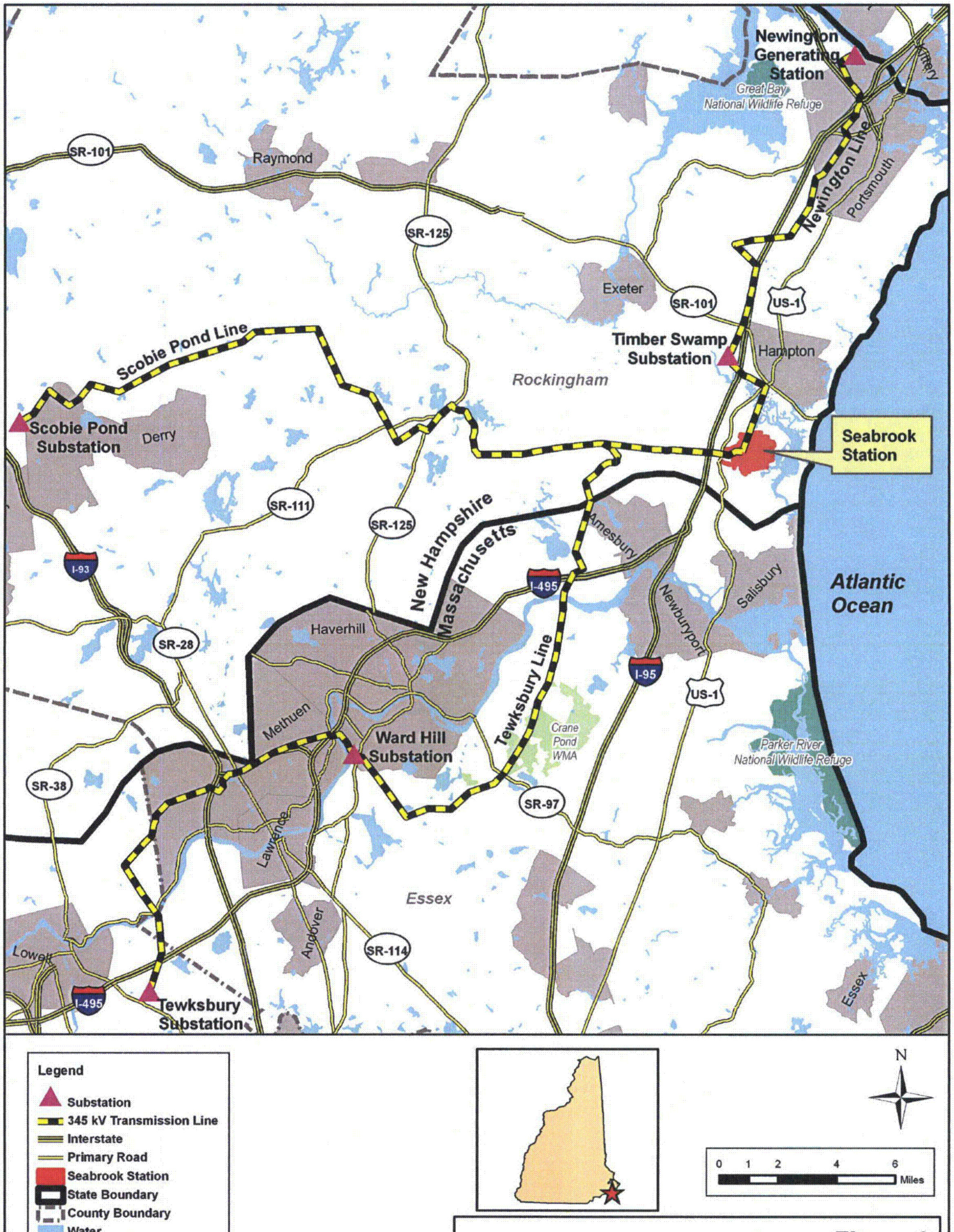


Figure 2
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant

Table 1. Endangered and Threatened Species Recorded in Rockingham County and Counties* Crossed by Transmission Lines.

Species	Common Name	Federal Status**	State Status**
Birds			
Charadrius melodus	Piping plover	T	NHE,
Falco peregrinus	Peregrine falcon	-	NHT
Haliaeetus leucocephalus	Bald eagle	-	NHT
Sterna dougallii	Roseate tern	E	NHE, MAE
Vermivora chrysoptera	Golden-winged warbler	-	MAE
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	NHE, MAE
Acipenser oxyrynchus	Atlantic sturgeon	C	MAE
Mammals			
Sylvilagus transitionalis	New England cottontail	C	NHE
Plants			
Aristida purpurascens	Purple needlegrass	-	MAT
Carex bullata	Inflated sedge	-	NHE
Carex striata var. brevis	Walter's sedge	-	NHE
Carex trichocarpa	Hairy-fruited edge	-	NHE
Celtis occidentalis	Hackberry	-	NHT
Cyperus engelmannii	Engelmann's Umbrella-sedge	-	MAT
Gaylussacia dumosa	Dwarf huckleberry	-	NHT
Gentianopsis crinita	Fringed gentian	-	NHT
Hottonia inflata	Featherfoil	-	NHE
Houstonia longifolia	Long-leaved bluets	-	NHE
Hypoxis hirsuta	Hairy stargrass	-	NHE
Iris prismatica	Slender blue flag	-	NHT
Isotria meleoloides	Small-whorled pogonia	T	
Lespedeza virginica	Slender bush-clover	-	NHE
Liatris scariosa var. novae-angliae	Northern blazing star	-	NHE
Prunus americana	American plum	-	NHE
Platanthera flava var. herbiola	Pale green orchid	-	NHT
Sparganium eurycarpum	Large bur-reed	-	NHT
Sporobolus cryptandrus	Sand dropseed	-	NHT
Triosteum aurantiacum	Orange horse-gentian	-	NHE
Viola pedata	Bird's-foot violet	-	NHT
Reptiles			
Caretta caretta	Loggerhead sea turtle	T	MAT
Chelonia mydas	Green sea turtle	T	MAT
Clemmys guttata	Spotted turtle	-	NHT
Coluber constrictor	Black racer	-	NHT
Dermochelys coriacea	Leatherback sea turtle	E	MAE
Emydoidea blandingii	Blanding's turtle	-	NHE, MAE
Eretmochelys imbricata	Hawksbill sea turtle	E	MAE
Heterodon platyhinos	Eastern hognose snake	-	NHE
Lepidochelys kempii	Kemp's ridley sea turtle	E	MAE

*Essex and Middlesex Counties in Massachusetts.
**Status: E=federal endangered, T=federal threatened, C=federal candidate, MAE=Massachusetts endangered, MAT=Massachusetts threatened, NHE= New Hampshire endangered, NHT=New Hampshire threatened, and "-"= Not listed.

Ed Corley
File
RMW

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

RECEIVED

JUN 15 2009

M.D. O'Keefe

Wayne F. MacCallum, *Director*

6/11/2009

Michael O'Keefe
FPL Energy Seabrook Station
PO Box 300
Seabrook NH 03874

RE: Project Location: Transmission Lines associated with the Seabrook Station Nuclear Power Plant
Town: TEWKSBURY, AMESBURY, MERRIMAC, WEST NEWBURY, GROVELAND, GEORGETOWN, BOXFORD, HAVERHILL, METHUEN, DRACUT, ANDOVER
NHESP Tracking No.: 09-26515

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program ("NHESP") of the MA Division of Fisheries & Wildlife for information regarding state-listed rare species in the vicinity of the above referenced site. Please note that I have returned the check submitted by Normandeau Associates because we received two requests and two fees for this site.

Based on the information provided, portions of the transmission lines are located within *Priority Habitat* and *Estimated Habitat* as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Our database indicates that the following state-listed rare species have been found in the vicinity of the site:

Amesbury
Priority Habitat 967 (PH 967) and *Estimated Habitat 798* (EH 798)

Scientific name	Common Name	Taxonomic Group	State Status
Ligumia nasuta	Eastern Pondmussel	Mussel	Special Concern

Merrimac
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Acipenser brevirostrum	Shortnose Sturgeon	Fish	Endangered

West Newbury
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Acipenser brevirostrum	Shortnose Sturgeon	Fish	Endangered

West Newbury
Priority Habitat 875 (PH 875) and *Estimated Habitat 698* (EH 698)

Scientific name	Common Name	Taxonomic Group	State Status
Somatochlora georgiana	Coppery Emerald	Dragonfly	Endangered

www.masswildlife.org

Division of Fisheries and Wildlife
Field Headquarters, North Drive, Westborough, MA 01581 (508) 389-6300 Fax (508) 389-7891
An Agency of the Department of Fish and Game

West Newbury
Priority Habitat 1440 (PH 1440) and *Estimated Habitat 46* (EH 46)

Scientific name	Common Name	Taxonomic Group	State Status
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened

Groveland
Priority Habitat 1440 (PH 1440) and *Estimated Habitat 46* (EH 46)

Scientific name	Common Name	Taxonomic Group	State Status
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened
Ambystoma laterale	Blue-Spotted Salamander	Amphibian	Special Concern

Georgetown
Priority Habitat 1440 (PH 1440) and *Estimated Habitat 46* (EH 46)

Scientific name	Common Name	Taxonomic Group	State Status
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Ambystoma laterale	Blue-Spotted Salamander	Amphibian	Special Concern
Enallagma laterale	New England Bluet	Damselfly	Special Concern

Boxford
Priority Habitat 1440 (PH 46) and *Estimated Habitat 1440* (EH 46)

Scientific name	Common Name	Taxonomic Group	State Status
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Ambystoma laterale	Blue-Spotted Salamander	Amphibian	Special Concern

Haverhill
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Neurocordulia obsoleta	Umber Shadowdragon	Dragonfly	Special Concern
Stylurus spiniceps	A Clubtail Dragonfly	Dragonfly	Threatened
Gomphus vastus	Cobra Clubtail	Dragonfly	Special Concern

Methuen
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Neurocordulia obsoleta	Umber Shadowdragon	Dragonfly	Special Concern
Stylurus spiniceps	A Clubtail Dragonfly	Dragonfly	Threatened
Gomphus vastus	Cobra Clubtail	Dragonfly	Special Concern
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Ambystoma laterale	Blue-Spotted Salamander	Amphibian	Special Concern

Methuen
Priority Habitat 249 (PH 249) and *Estimated Habitat 135* (EH 135)

Scientific name	Common Name	Taxonomic Group	State Status
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened

Methuen
Priority Habitat 374 (PH 374) and *Estimated Habitat 263* (EH 263)

Scientific name	Common Name	Taxonomic Group	State Status
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened

Dracut
Priority Habitat 374 (PH 374) and *Estimated Habitat 263* (EH 263)

Scientific name	Common Name	Taxonomic Group	State Status
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Emydoidea blandingii	Blanding's Turtle	Reptile	Threatened

Dracut
Priority Habitat 678 (PH 678) and *Estimated Habitat 636* (EH 636)

Scientific name	Common Name	Taxonomic Group	State Status
Glyptemys insculpta	Wood Turtle	Reptile	Special Concern
Ambystoma laterale	Blue-Spotted Salamander	Amphibian	Special Concern

Dracut
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Neurocordulia obsoleta	Umber Shadowdragon	Dragonfly	Special Concern

Andover
Priority Habitat 1321 (PH 1321) and *Estimated Habitat 65* (EH 65)

Scientific name	Common Name	Taxonomic Group	State Status
Haliaeetus leucocephalus	Bald Eagle	Bird	Endangered
Neurocordulia obsoleta	Umber Shadowdragon	Dragonfly	Special Concern

The species listed above are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed rare species can be found on our website (www.nhesp.org).

This evaluation is based on the most recent information available in the NHESP database, which is constantly being expanded and updated through ongoing research and inventory. If you have any questions regarding this letter please contact Emily Holt, Endangered Species Review Assistant, at (508) 389-6361.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

cc: Sarah Barnum, Normandeau Associates, Inc.

ATTACHMENT D

STATE HISTORIC PRESERVATION OFFICE CORRESPONDENCE

FPL Energy
Seabrook Station

FPL Energy Seabrook Station
P.O. Box 300
Seabrook, NH 03874
(603) 773-7000

April 13, 2009

SBK-L-09050

New Hampshire Division of Historical Resources
State Historic Preservation Office
19 Pillsbury Street
Concord, NH 03301-3570

Attention: Review & Compliance

Seabrook Station
Request for Project Review by the
New Hampshire Division of Historical Resources

FPL Energy Seabrook, LLC (FPL Energy Seabrook) is enclosing a Request for Project Review by the New Hampshire Division of Historical Resources. FPL Energy Seabrook, the owner of a controlling interest in and the operator of Seabrook Station plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the Operating License for 20 years beyond the current expiration date. The NRC Operating License for Seabrook Station expires at midnight on March 15, 2030. FPL Energy Seabrook plans to submit its application to the NRC in the second quarter of 2010.

If you have any questions regarding this information, please contact me, at (603) 773-7745. Thank you in advance for your assistance.

Sincerely yours,

Michael O'Keefe
Licensing Manager

Enclosure

an FPL Group company

DHR Use Only	
R&C #	________
Log In Date	___/___/___
Response Date	___/___/___
Sent Date	___/___/___

Please mail the completed form and required material to:

New Hampshire Division of Historical Resources
State Historic Preservation Office
Attention: Review & Compliance
19 Pillsbury Street, Concord, NH 03301-3570

Request for Project Review by the New Hampshire Division of Historical Resources

☒This is a new submittal

☐*This is additional information relating to DHR Review #:*

GENERAL PROJECT INFORMATION

Project Title License Renewal for the Seabrook Station Nuclear Power Plant

Project Location Seabrook, New Hampshire
NH State Plane Geographic Coordinates: Easting 1202708 Northing 146127

Lead Federal Agency Nuclear Regulatory Commission
(Agency providing funds, licenses, or permits)

Permit or Job Reference # n/a

State Agency and Contact (if applicable)

Permit or Job Reference #

APPLICANT INFORMATION

Applicant Name FPL Energy Seabrook, LLC

Street Address Seabrook Station, P.O. Box 300, Lafayette Road Phone Number 6037737000

City Seabrook State NH Zip 03874 Email

CONTACT PERSON TO RECEIVE RESPONSE

Name/Company Mr. Richard Cliché / FPL Energy Seabrook, LLC

Street Address Seabrook Station, P.O. Box 300, Lafayette Road Phone Number 6037737003

City Seabrook State NH Zip 03874 Email richard_cliche@fpl.com

Please refer to the Request for Project Review manual for direction on completing this form. Submit one copy of this project review form for each project for which review is requested. Include a self-addressed stamped envelope to expedite review response. Project submissions will not be accepted via facsimile or e-mail. This form is required. Review request form must be complete for review to begin. Incomplete forms will be sent back to the applicant without comment. Please be aware that this form may only initiate consultation. For some projects, the Division of Historical Resources (DHR) may require additional information to complete our review. All items and supporting documentation submitted with a review request, including photographs and publications, must be retained by the DHR as part of its review records. Items to be kept confidential should be clearly identified. For questions regarding the DHR review process, please visit our website at: http://www.nh.gov/nhdhr/review or contact the R&C Specialist at 603.271.3558.

PROJECT BOUNDARIES AND DESCRIPTION

PROJECTS CANNOT BE PROCESSED WITHOUT THIS INFORMATION

REQUIRED

☒ Attach the relevant portion of a 7.5' USGS Map (photocopied or computer-generated) ***indicating the defined project boundary.***

☒ Attach a detailed written description of the proposed project. Include: (1) a narrative description of the proposed project; (2) site plan; (3) photos and description of the proposed work if the project involves rehabilitation, demolition, additions, or alterations to existing buildings or structures; and (4) a photocopy of the relevant portion of a soils map (if accessible) for ground-disturbing projects.

Architecture

Are there any buildings or structures within the project area? ☐ Yes ☒ No

If yes, submit all of the following information:

Approximate age(s):

☐ Photographs of ***each*** building located within the project area along with a photo key. Include streetscape images if applicable. (Digital photographs are accepted. All photographs must be clear, crisp and focused)

Please note that as part of the review process, the DHR may request an architectural survey or other additional information.

Archaeology

Does the proposed undertaking involve ground-disturbing activity? ☐ Yes ☒ No

If yes, submit all of the following information:

☐ Project specific map and/or preliminary site plan that fully describes the project boundaries and areas of proposed excavation.

☐ Description of current and previous land use and disturbances.

☐ Any available information concerning known or suspected archaeological resources within the project area.

Please note that as part of the review process, the DHR may request an archaeological survey or other additional information.

DHR COMMENT *This Space for Division of Historical Resources Use Only*

☐ No Potential to cause Effects ☐ Additional information is needed in order to complete our review

☐ No Adverse Effect ☐ No Historic Properties Affected ☐ Adverse Effect

Comments:____

If plans change or resources are discovered in the course of this project, you must contact the Division of Historical Resources as required by federal law and regulation.

Authorized Signature: ____________________________ Date: ______________

FPLE Seabrook, LLC
Request for Project Review
Seabrook Station Nuclear Power Plant

Additional Information

Description of the Proposed Undertaking

The proposed undertaking to be considered by the Nuclear Regulatory Commission (NRC) is whether to renew the license for continued operation and maintenance of the existing Seabrook Station Nuclear Power Plant (Seabrook Station). The license term would be an additional 20 years. Continued operation and maintenance of Seabrook Station and its associated infrastructure would not involve any license-related construction, demolition, or refurbishment activities. Routine operation and maintenance activities would continue to occur as they have since the plant started operations in 1986. All such activities would occur in areas previously disturbed through construction activities.

Description of the Seabrook Station and Associated Infrastructure

Seabrook Station is situated on approximately 889 acres east of Seabrook, New Hampshire (Figures 1 and 2). It is located along Route 1, two miles north of the Massachusetts border. The station received a construction license from the Atomic Energy Commission in 1976 and an operating license in 1986. The station layout can be seen in Figure 3.

Existing infrastructure associated with the operation of Seabrook Station includes transmission lines and intake/discharge systems. There are three transmission lines serving the Seabrook Station (Figure 4):

- Scobie Pond 345 kV Line – this is a single circuit line that runs west from Seabrook Station in a 245 to 255-foot wide corridor shared with the Tewksbury Line for approximately five miles. After the Tewksbury Line splits off, the corridor becomes 170 feet wide and continues west approximately 25 miles to termination at the Scobie Pond Substation in Derry, New Hampshire.
- Tewksbury 345 kV Line – this is a single circuit line that runs west from Seabrook Station in a 245 to 255-foot wide corridor shared with the Scobie Pond Line for approximately five miles. After the Scobie Pond Line splits off, the corridor becomes 170 feet wide and continues south and west approximately 20 miles to termination at the Ward Hill Substation in Ward Hill, Massachusetts.
- Newington 345 kV Line – this is a single circuit line that runs north from Seabrook Station in a 170-foot wide corridor for approximately 4.5 miles to termination at the Timber Swamp Substation in Hampton Falls, New Hampshire. It then continues approximately 13.5 miles north to the Newington Generating Station.

The cooling system for Seabrook Station uses water from the Atlantic Ocean (Figure 5). Water is brought to the plant through a 17,000-foot long intake tunnel imbedded in the underlying bedrock. Water is returned to the ocean through a 16,500-foot long discharge tunnel also imbedded in the underlying bedrock. The tunnels begin below Seabrook Station at 240 feet below mean sea level and gradually ascend to approximately 160 feet below the ocean surface, where they connect to the intake and discharge shafts offshore.

Previous Cultural Resource Studies and Compliance

In October and November 1973, an archaeological survey was conducted for the planned Seabrook Station site by Charles Bolian of the University of New Hampshire, a consultant to the applicant (Bolian, 1974). This survey was conducted in support of development of the Environmental Report for the construction license application. The consultant conducted a surface reconnaissance and performed selected test excavations in areas that appeared to have archaeological deposits. The survey identified five archaeological sites on the Seabrook Station plant site. All five had prehistoric components, and one also had a European Contact Period component. Two of the sites were determined to be outside of the area proposed for construction activities and no further work was conducted on them. Three of the sites (NH47-20, -21, and -22) were determined to be within the area of proposed construction and were excavated in 1974 and 1975 by Charles Bolian of the University of New Hampshire, with the assistance of avocational archaeologists and volunteers (Robinson and Bolian, 1987). These three sites together comprise the Rocks Road Site. The Rocks Road Site was a prehistoric habitation area 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. Four prehistoric burials were identified and excavated from the site. Two separate studies were conducted of the burials. The first was conducted in 1981 by Howard M. Hecker of the University of New Hampshire (Hecker, 1981). The second study was conducted in 1994 by Marcella H. Sorg of Sorg Associates for the New Hampshire Division of Historical Resources, and was likely conducted to meet the inventory requirements promulgated by the Native American Graves Protection and Repatriation Act (NAGPRA) (Sorg, 1994).

The remains of all four individuals were transferred to the NH Division of Historical Resources for curation in 1999. In compliance with NAGPRA, the Notice of Inventory Completion for the human remains from the Rocks Road Site was published in the Federal Register in 2002 (Federal Register, 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 NH Division of Historical Resources that there is a relationship of shared group identity between the human remains and the Abenaki Nation of Missisquoi.

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FPL Energy Seabrook knows of two archaeological resources on the plant site. Both sites are prehistoric and, at the time of the 1973 survey, one was reported as being impacted by vehicular traffic resulting in compaction, erosion, and mixing. FPL Energy Seabrook is not aware of any historic or archaeological resources that have been affected to date by Seabrook Station operations, including operation and maintenance of transmission lines. Because FPL Energy Seabrook is aware of the potential for discovery of cultural resources during land-disturbing activities at Seabrook Station, it has developed procedures that protect archaeological resources on the Seabrook Station site.

Designated Resources Near the Seabrook Station

As of January 2009, the National Register of Historic Places listed 111 properties in Rockingham County, New Hampshire (National Park Service 2009a). Of these, 10 properties in Rockingham County are located within 6 miles of the Seabrook Station. Table 1 lists the 10 properties within 6 miles of the station. There are no National Historic Landmarks in Rockingham County within 6 miles of the Seabrook Station (National Park Service 2009b).

Table 1. New Hampshire properties listed in the National Register of Historic Places that fall within a 6-mile radius of Seabrook Station

Property	Location
Benjamin James house	186 Towle Farm Road, Hampton
Reuben Lamprey homestead	416 Winnacunnet Road, Hampton
Unitarian Church	Exeter Road, Hampton Falls
Gov. 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

MRA = multiple resource area

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 the Seabrook Station, Marelli's Market at Lafayette Road in Hampton, NH. (NH DHR 2009).

None of the designated national or state properties discussed above are located within or adjacent to the Seabrook Station property.

Assessment of Effect

The undertaking involves renewal of the operating license for Seabrook Station for 20 years and continued operation and maintenance activities during the term of the license. No license-related construction, demolition, or refurbishment activities would be conducted. Routine operation and maintenance activities would continue in areas previously disturbed by construction activities. Seabrook Station has procedures in place to ensure protection of historic and archaeological resources during operation and maintenance activities therefore, FPL Energy Seabrook concludes that there would be no effect to historic properties from license renewal and associated operation and maintenance activities.

References Cited

Bolian, Charles E. 1974. Report: An Archaeological Survey of the Seabrook Site. University of New Hampshire, Durham.

Federal Register. 2002. Notice of Inventory Completion for Native American Human Remains and Associated Funerary Objects in the Control of Franklin Pierce College, Rindge, NH; Manchester Historical Association, Manchester, NH; NH Division of Historical Resources, Concord, NH; and University of New Hampshire, Durham, NH; and in the Possession of the New Hampshire Division of Historical Resources, Concord, NH. U.S. Department of the Interior, National Park Service. Federal Register 67(131):45536 – 45539. July 9, 2002.

Federal Register. 2008. Notice of Intent to Repatriate Cultural Items: University of New Hampshire, Durham, NH. U.S. Department of the Interior, National Park Service. Federal Register 73(104):30967 – 30968. May 29, 2008.

Hecker, Howard M. 1981. Preliminary Physical Anthropological Report on the 650 Year Old Skeleton from Seabrook, New Hampshire. *Man in the Northeast* 21: 37 – 60.

National Park Service. 2009a. Properties in Rockingham County, NH, Listed on the National Register of Historic Places. -National Register Information System, accessed on January 2, 2009. http://www.nr.nps.gov/iwisapi/explorer.dll/x2_3anr4_3aNRIS1/script/report.iws.

National Park Service. 2009b. National Historic Landmarks within the 6-mile Radius of Seabrook Station. National Historic Landmarks Program database, accessed on January 2, 2009. http://tps.cr.nps.gov/nhl.

NH DHR (New Hampshire Division of Historical Resources). 2009. NH State Register of Historic Places, Listed Properties by Town. Accessed on January 2, 2009. http://www.nh.gov/nhdhr/programs/StateRegisterListingsByTown.htm.

NRC (Nuclear Regulatory Commission). 1982. Final Environmental Statement related to the operation of Seabrook Station, Units 1 and 2. Office of Nuclear Reactor Regulation, Docket Nos. 50-443 and 50-444, NUREG-0895. December 1982.

Robinson, Brian S., and Charles E. Bolian. 1987. A Preliminary Report on the Rocks Road Site (Seabrook Station): Late Archaic to Contact Period Occupation in Seabrook, New Hampshire. *The New Hampshire Archeologist* 28(1): 19 – 48.

Sorg, Marcella. 1994. Osteology and Odontology of Human Remains from Seabrook, New Hampshire (NH47-21). Prepared for the NH Division of Historical Resources. Sorg Associates, Orono, Maine.

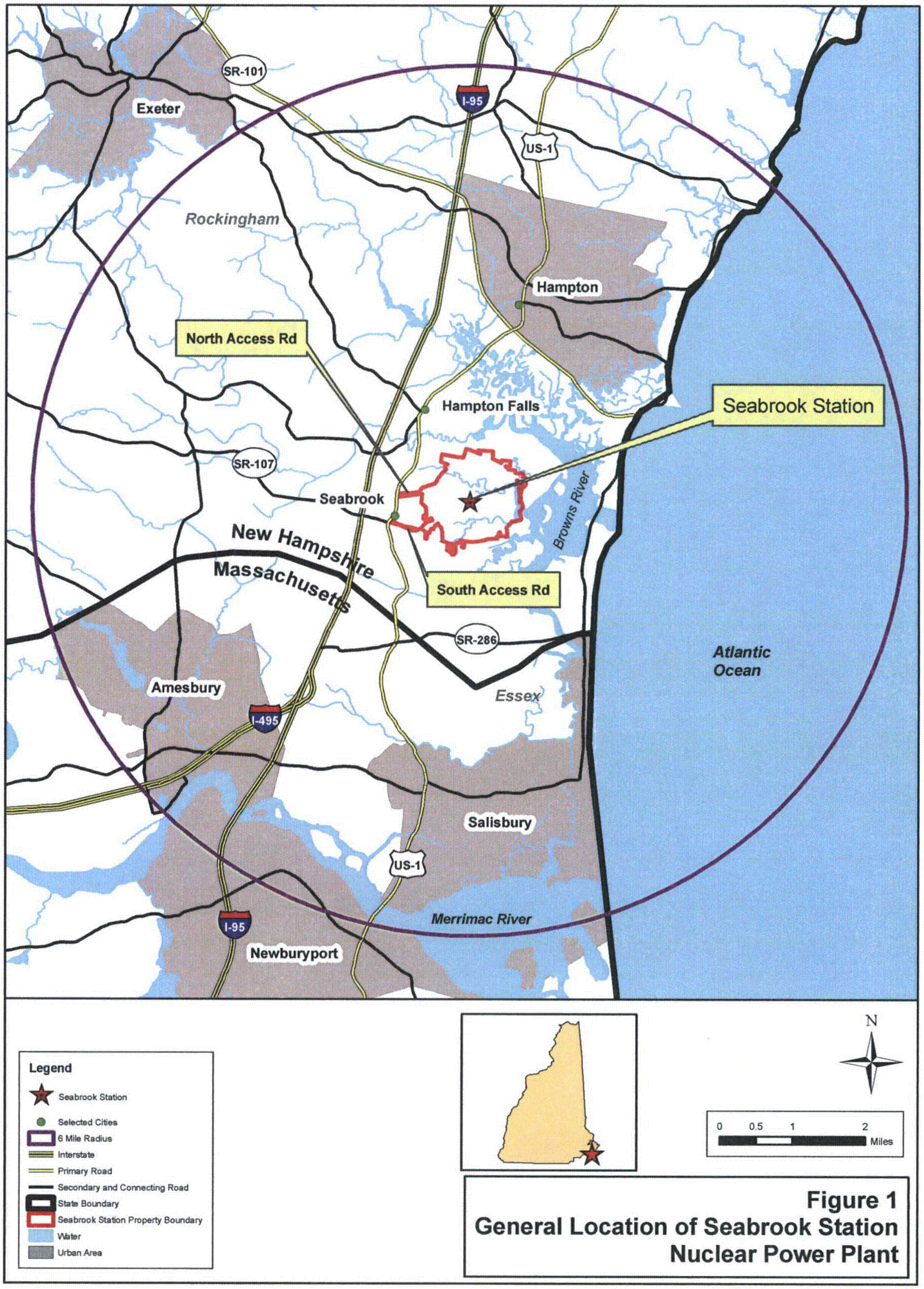


Figure 1
General Location of Seabrook Station Nuclear Power Plant

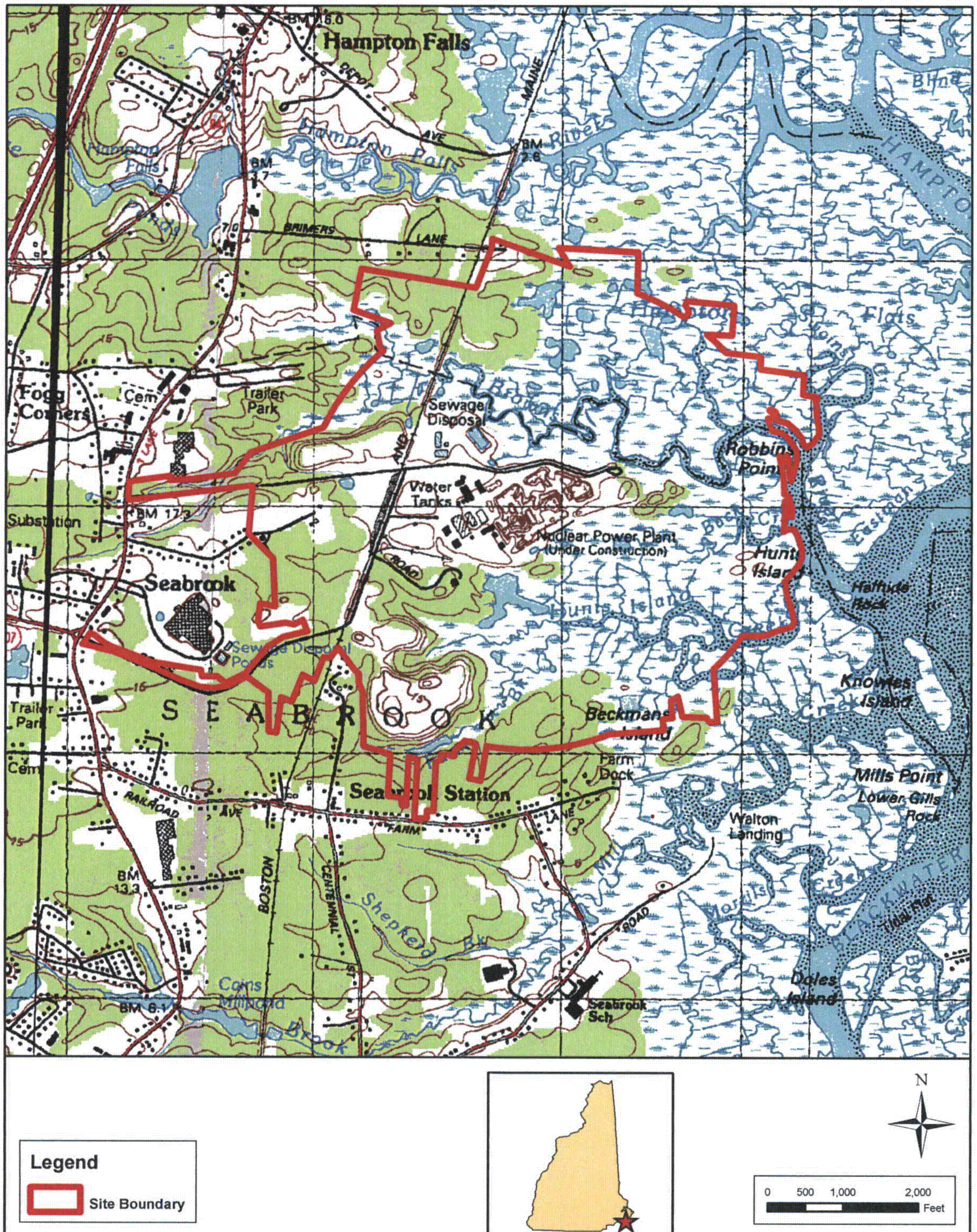


Figure 2
Location of the Seabrook Station Nuclear Power Plant
USGS Hampton 7.5 Minute Topographic Quadrangle New Hampshire, 1985

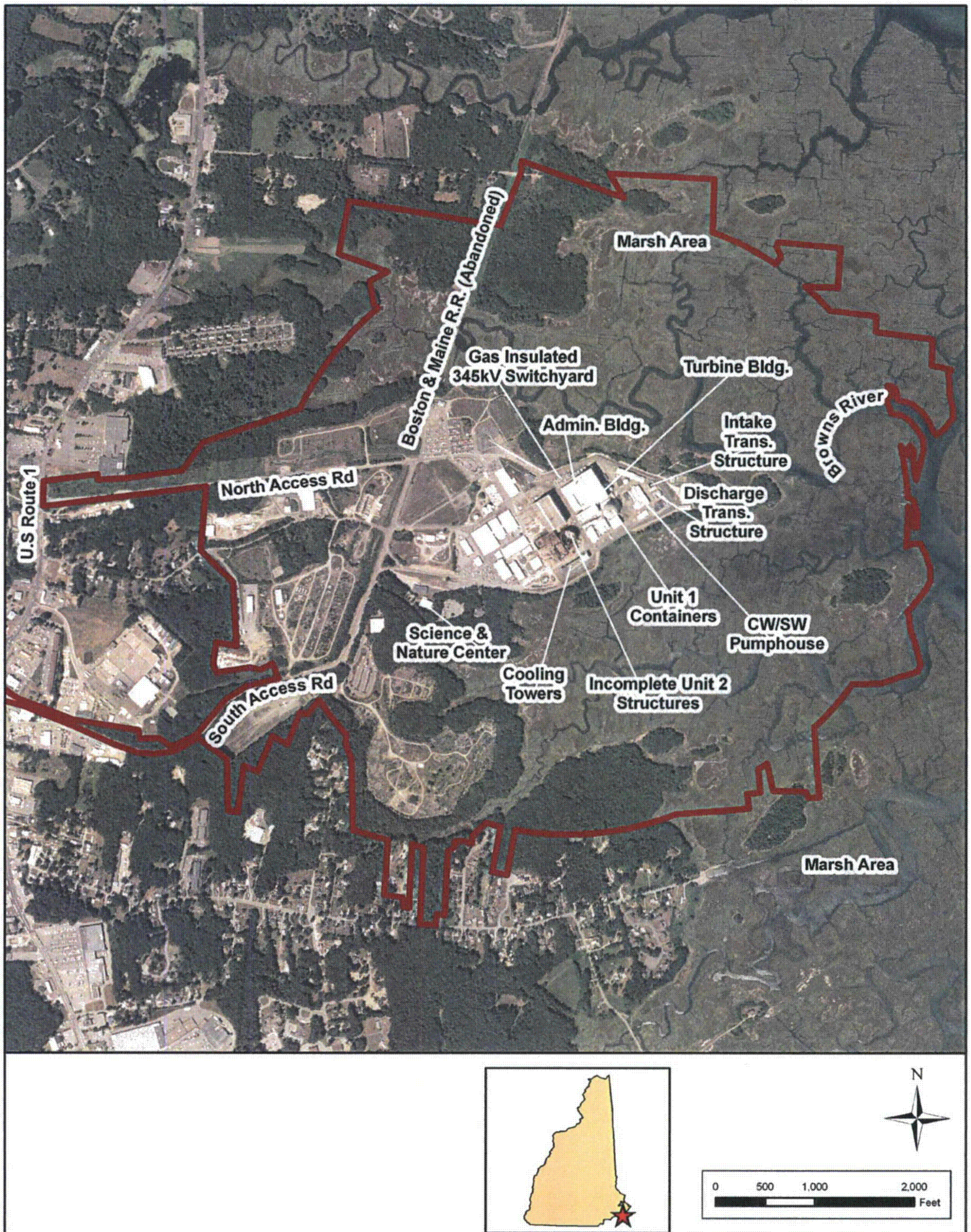


Figure 3
Site Plan of the Seabrook Station Nuclear Power Plant

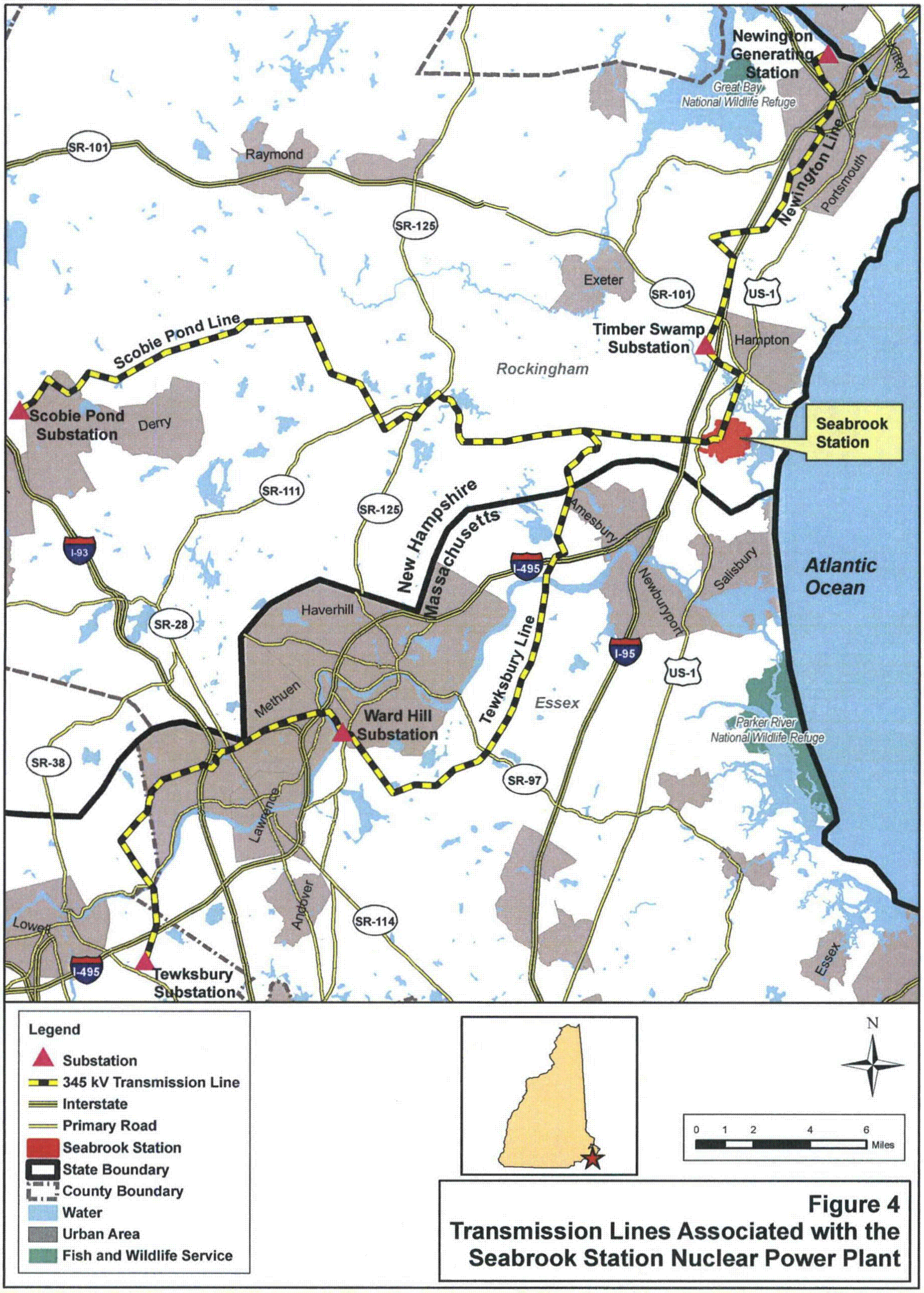
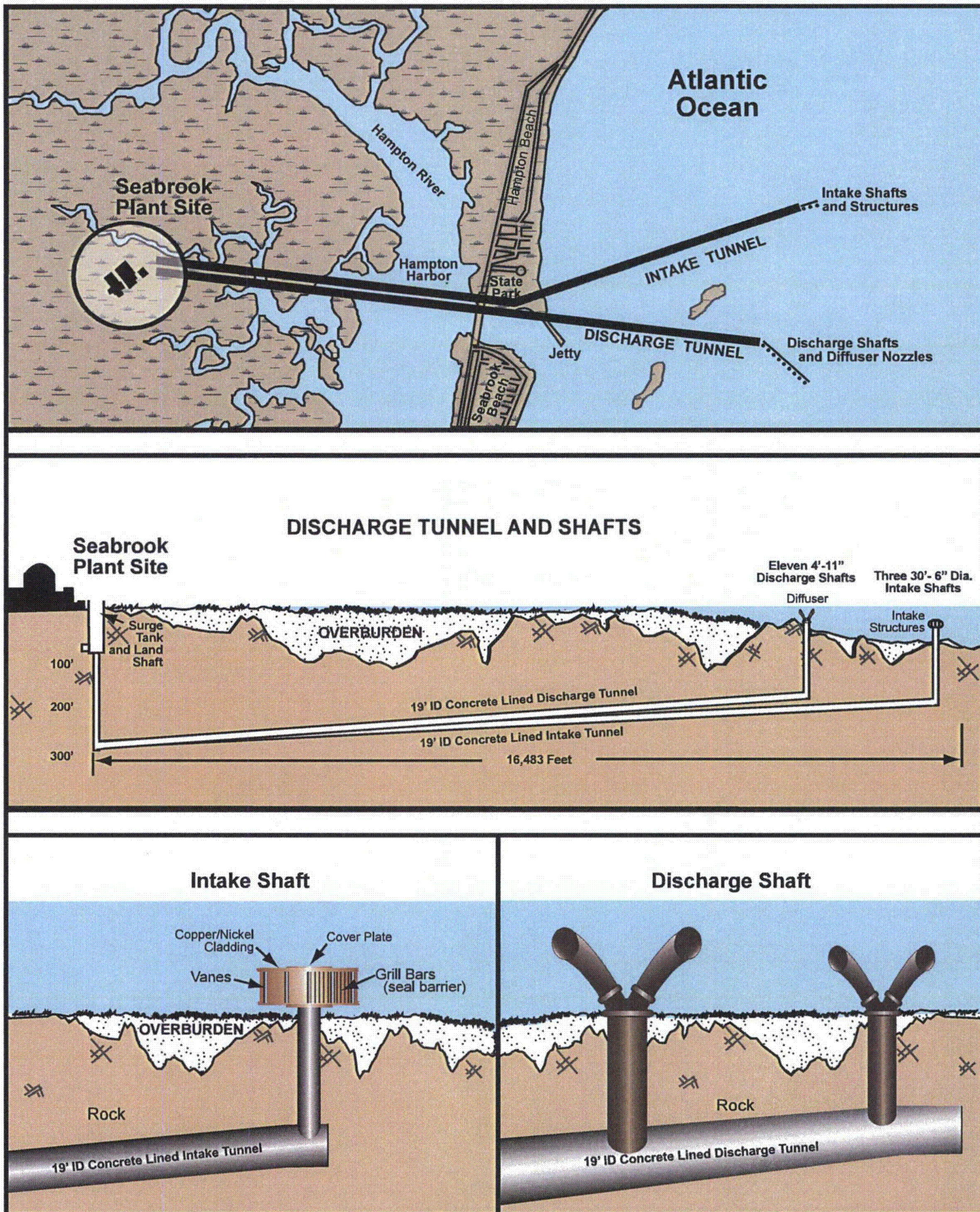


Figure 4
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant



Drawings not to scale

Figure 5
Cooling Water Intake/Discharge Structures for Seabrook Station Nuclear Power Plant

DHR Use Only	
R&C#	863
Log In Date	4/16/09
Response Date	4/24/09
Sent Date	4/28/09

RECEIVED APR 16 2009

Please mail the completed form and required material to:

New Hampshire Division of Historical Resources
State Historic Preservation Office
Attention: Review & Compliance
19 Pillsbury Street, Concord, NH 03301-3570

Request for Project Review by the New Hampshire Division of Historical Resources

☒ This is a new submittal

☐ This is additional information relating to DHR Review #:

GENERAL PROJECT INFORMATION

Project Title License Renewal for the Seabrook Station Nuclear Power Plant

Project Location Seabrook, New Hampshire
NH State Plane Geographic Coordinates: Easting 1202708 Northing 146127

Lead Federal Agency Nuclear Regulatory Commission
(Agency providing funds, licenses, or permits)

Permit or Job Reference # n/a

State Agency and Contact (if applicable)

Permit or Job Reference #

APPLICANT INFORMATION

Applicant Name FPL Energy Seabrook, LLC

Street Address Seabrook Station, P.O. Box 300, Lafayette Road Phone Number 6037737000

City Seabrook State NH Zip 03874 Email

CONTACT PERSON TO RECEIVE RESPONSE

Name/Company Mr. Richard Cliché / FPL Energy Seabrook, LLC

Street Address Seabrook Station, P.O. Box 300, Lafayette Road Phone Number 6037737003

City Seabrook State NH Zip 03874 Email richard_cliche@fpl.com

Please refer to the Request for Project Review manual for direction on completing this form. Submit one copy of this project review form for each project for which review is requested. Include a self-addressed stamped envelope to expedite review response. Project submissions will not be accepted via facsimile or e-mail. This form is required. Review request form must be complete for review to begin. Incomplete forms will be sent back to the applicant without comment. Please be aware that this form may only initiate consultation. For some projects, the Division of Historical Resources (DHR) may require additional information to complete our review. All items and supporting documentation submitted with a review request, including photographs and publications, must be retained by the DHR as part of its review records. Items to be kept confidential should be clearly identified. For questions regarding the DHR review process, please visit our website at: http://www.nh.gov/nhdhr/review or contact the R&C Specialist at 603.271.3558.

PROJECT BOUNDARIES AND DESCRIPTION

PROJECTS CANNOT BE PROCESSED WITHOUT THIS INFORMATION

REQUIRED

☒ Attach the relevant portion of a 7.5' USGS Map (photocopied or computer-generated) ***indicating the defined project boundary.***

☒ Attach a detailed written description of the proposed project. Include: (1) a narrative description of the proposed project; (2) site plan; (3) photos and description of the proposed work if the project involves rehabilitation, demolition, additions, or alterations to existing buildings or structures; and (4) a photocopy of the relevant portion of a soils map (if accessible) for ground-disturbing projects.

Architecture

Are there any buildings or structures within the project area? ☒ Yes ☐ No

If yes, submit all of the following information:

Approximate age(s):

☐ Photographs of ***each*** building located within the project area along with a photo key. Include streetscape images if applicable. (Digital photographs are accepted. All photographs must be clear, crisp and focused)

Please note that as part of the review process, the DHR may request an architectural survey or other additional information.

Archaeology

Does the proposed undertaking involve ground-disturbing activity? ☐ Yes ☒ No

If yes, submit all of the following information:

☐ Project specific map and/or preliminary site plan that fully describes the project boundaries and areas of proposed excavation.

☐ Description of current and previous land use and disturbances.

☐ Any available information concerning known or suspected archaeological resources within the project area.

Please note that as part of the review process, the DHR may request an archaeological survey or other additional information.

DHR COMMENT *This Space for Division of Historical Resources Use Only*

☒ No Potential to cause Effects ☐ Additional information is needed in order to complete our review

☐ No Adverse Effect ☐ No Historic Properties Affected ☐ Adverse Effect

Comments: 20 year license renewal

If plans change or resources are discovered in the course of this project, you must contact the Division of Historical Resources as required by federal law and regulation.

Authorized Signature: Ece Murphy Date: 4/24/09

NEXTera ENERGY SEABROOK

February 19, 2010

SBK-L-10031

Mr. W. F. Galvin
Secretary of the Commonwealth
Massachusetts Historical Commission
220 Morrissey Blvd.
Boston, Ma. 02125 - 3314

Seabrook Station
Tewksbury Transmission Line Project Notification

NextEra Energy Seabrook, LLC (NextEra Energy Seabrook) is enclosing a Project Notification Form to the Massachusetts Historical Commission. NextEra Energy Seabrook, the owner of a controlling interest and the operator of Seabrook Station, plans to apply to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the NextEra Energy Seabrook Facility Operating License for 20 years beyond the current expiration date. The Facility Operating License for Seabrook Station expires at midnight on March 15, 2030. NextEra Energy Seabrook plans to submit its application to the NRC in the second quarter of 2010.

NRC requires that a license renewal application include an environmental report, and that impacts of the proposed action (license renewal) on transmission lines be considered. One transmission line from Seabrook Station, the Tewksbury line, extends approximately 20 miles into Massachusetts, to the Ward Hill Substation. It is that component of the project that we are seeking Massachusetts Historical Commission review.

Included with the Project Notification Form is an attachment that describes the project and historic resources in the Commonwealth of Massachusetts within 6 miles of the project. Table 1 of the attachment lists sites on the National Historic Register within 6 miles of the project. Table 2 lists properties within 2 miles of the transmission line. Figure 3 of the attachment is a USGS quadrangle map with the transmission corridor marked.

Should you have any questions regarding this letter please contact Mr. Richard Cliche, Seabrook Station License Renewal Project Manager, (603) 773-7003. Thank you in advance for your assistance.

Sincerely,
NextEra Energy Seabrook, LLC

Michael O'Keefe
Licensing Manager

NextEra Energy Seabrook, LLC, P.O. Box 300, Lafayette Road, Seabrook, NH 03874

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A
MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: License Renewal for Seabrook Station Nuclear Power Plant

Location / Address: State Plane Geographic Coordinates: Easting 1202708 Northing 146127

City / Town: Seabrook, NH

Project Proponent

Name: NextEra Energy Seabrook, LLC

Address: Seabrook Station, P.O. Box 300, Lafayette Road

City/Town/Zip/Telephone: Seabrook NH, 03874 /(603) 773 7000

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name	Type of License or funding (specify)
U.S. Nuclear Regulatory Commission	Facility Operating License Renewal

Project Description (narrative): see attached narrative -- specifically see information regarding Tewksbury 345 kV transmission line which runs for approximately 20 miles from the MA line to the Ward Hill substation

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

No

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

No

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

No

5/31/96 (Effective 7/1/93) - corrected 950 CMR - 275

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify. NextEra Energy Seabrook is not aware of any sites within the transmission line right-of-way. Twenty historic properties occur within a 2-mile radius of the ROW.

What is the total acreage of the project area? approximately 618 acres (20 miles of 245' - 255'-wide ROW)

Woodland ____	acres	Productive Resources:	
Wetland ____	acres	Agriculture ____	acres
Floodplain ____	acres	Forestry ____	acres
Open space ____	acres	Mining/Extraction ____	acres
Developed ____	acres	Total Project Acreage ____	acres

What is the acreage of the proposed new construction? 0 acres

What is the present land use of the project area? transmission line right of way

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

See Figure 3 of the attachment

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form: Richard R Cliche Date: 2/17/2010

Name: Richard Cliche , License Renewal Project Manager

Address: Seabrook Station, P.O. Box 300

City/Town/Zip: Seabrook, NH 03874

Telephone: 603 773 7003

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

7/1/93 950 CMR - 276

NextEra Energy Seabrook, LLC
Request for Project Review
Seabrook Station Nuclear Power Plant

Additional Information

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1

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Designated Resources Near the Seabrook Station

As of January 2009, the National Register of Historic Places listed 444 properties in Essex County, Massachusetts (National Park Service 2009a). Of these, 9 properties are within 6 miles of the Seabrook Station and 20 are within 2 miles of the transmission line. Table 1 lists the nine properties within 6 miles of the station. Table 2 lists the 20 properties within 2 miles of the transmission line.

Table 1. Massachusetts properties listed in the National Register of Historic Places within a 6-mile radius of Seabrook Station

Property	Location
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	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	86 Friends 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

National Park Service 2009a

3

Table 2. Massachusetts properties listed in the National Register of Historic Places within a 2-mile radius of the Tewksbury transmission line

Property	Location
Adams-Clarke House	93 W. Main Street, Georgetown
Amesbury and Salisbury Mills Village Historic District	Market Square, roughly bounded by Boardman, Water, Main and Pond Streets, Amesbury
Amesbury Friends Meeting House	120 Friend Street, Amesbury
Samuel Chase House	154 Main Street, West Newbury
Ephraim Davis House	Merrimack Road, Haverhill
Georgetown Central School	1 Library, Street, Georgetown
Joseph Hardy House	93 King Street, Grovetown
George Hopkinson House	362 Main Street, Groveland
House at 922 Dale Street	922 Dale Street, Andover
Intervale Factory	402 River Street, Haverhill
Capt. Timothy Johnson House	18 -20 Stevens Street, Essex
George Kunhardt Estate	1518 Great Pond Road, North Andover
Samuel Marsh House	444 Main Street, West Newbury
Timothy Morse House	628 Main Street, West Newbury
Newell Farm	243 Main Street, West Newbury
Osgood Hill	709 and 723 Osgood Street, Andover
Col. John Osgood House	547 Osgood Street, Andover
Rocks Village Historic District	NE of Haverhill at Merrimack River, Haverhill
Rev. John Tufts House	750 Main Street, West Newbury
John Greenleaf Whittier House	86 Friend Street, Amesbury

National Park Service 2009a

Assessment of Effect

The undertaking involves renewal of the operating license for Seabrook Station for 20 years and continued operation and maintenance activities during the term of the license. No license-related construction, demolition, or refurbishment activities would be conducted. Routine operation and maintenance activities would continue in areas previously disturbed by construction activities. Therefore, NextEra Energy concludes that there would be no effect to historic properties from license renewal and associated operation and maintenance activities.

4

REFERENCES CITED

Bolian, Charles E. 1974. Report: An Archaeological Survey of the Seabrook Site. University of New Hampshire, Durham.

Federal Register. 2002. Notice of Inventory Completion for Native American Human Remains and Associated Funerary Objects in the Control of Franklin Pierce College, Rindge, NH; Manchester Historical Association, Manchester, NH; NH Division of Historical Resources, Concord, NH; and University of New Hampshire, Durham, NH; and in the Possession of the New Hampshire Division of Historical Resources, Concord, NH. U.S. Department of the Interior, National Park Service. Federal Register 67(131):45536 – 45539. July 9, 2002.

Federal Register. 2008. Notice of Intent to Repatriate Cultural Items: University of New Hampshire, Durham, NH. U.S. Department of the Interior, National Park Service. Federal Register 73(104):30967 – 30968. May 29, 2008.

Hecker, Howard M. 1981. Preliminary Physical Anthropological Report on the 650 Year Old Skeleton from Seabrook, New Hampshire. *Man in the Northeast* 21: 37 – 60.

MHC (Massachusetts Historical Commission). 2009. State and Local Archaeological and Historical Landmarks in Amesbury, Salisbury, and Newburyport, Massachusetts. Massachusetts Cultural Resource Information System Database. Accessed January 2, 2009 at http://mhc-macris.net

National Park Service. 2009a. Properties in Essex County, MA, Listed on the National Register of Historic Places. -National Register Information System, accessed on January 2, 2009. http://www.nr.nps.gov/iwisapi/explorer.dll/x2_3anr4_3aNRIS1/script/report.iws.

NRC (Nuclear Regulatory Commission). 1982. Final Environmental Statement related to the operation of Seabrook Station, Units 1 and 2. Office of Nuclear Reactor Regulation, Docket Nos. 50-443 and 50-444, NUREG-0895. December 1982.

Robinson, Brian S., and Charles E. Bolian. 1987. A Preliminary Report on the Rocks Road Site (Seabrook Station): Late Archaic to Contact Period Occupation in Seabrook, New Hampshire. *The New Hampshire Archeologist* 28(1): 19 – 48.

Sorg, Marcella. 1994. Osteology and Odontology of Human Remains from Seabrook, New Hampshire (NH47-21). Prepared for the NH Division of Historical Resources. Sorg Associates, Orono, Maine.

5

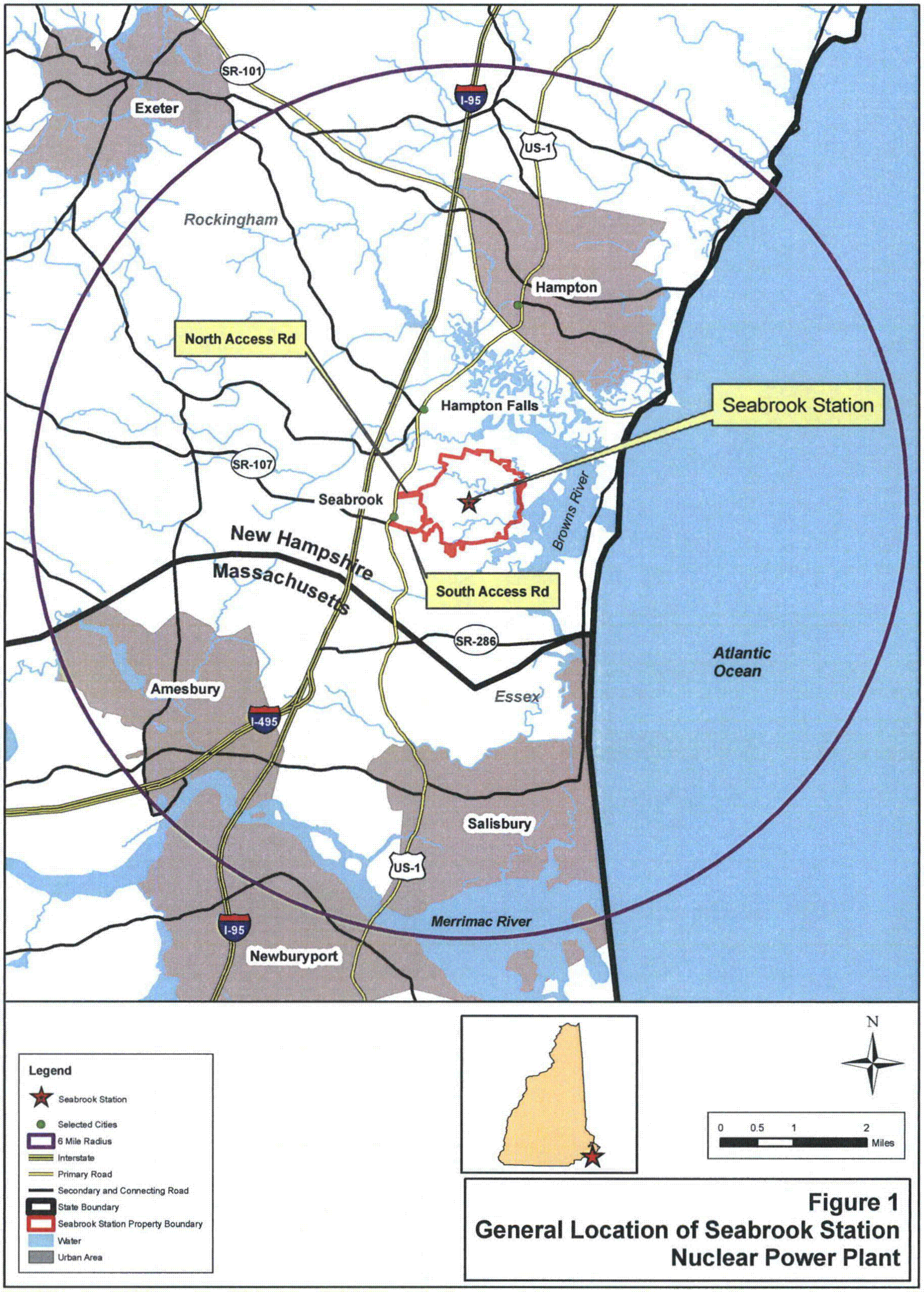

Figure 1
General Location of Seabrook Station Nuclear Power Plant

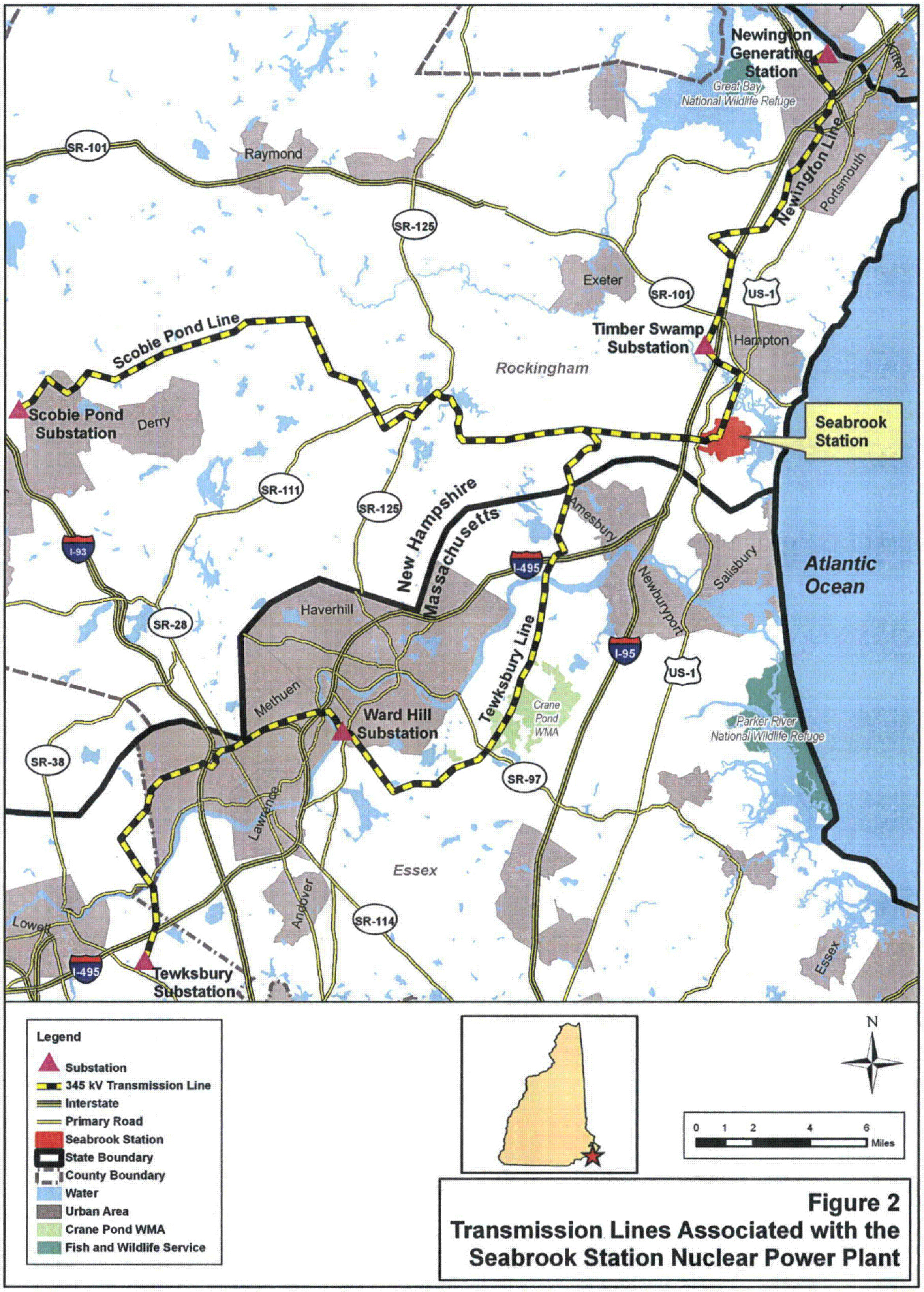

Figure 2
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant

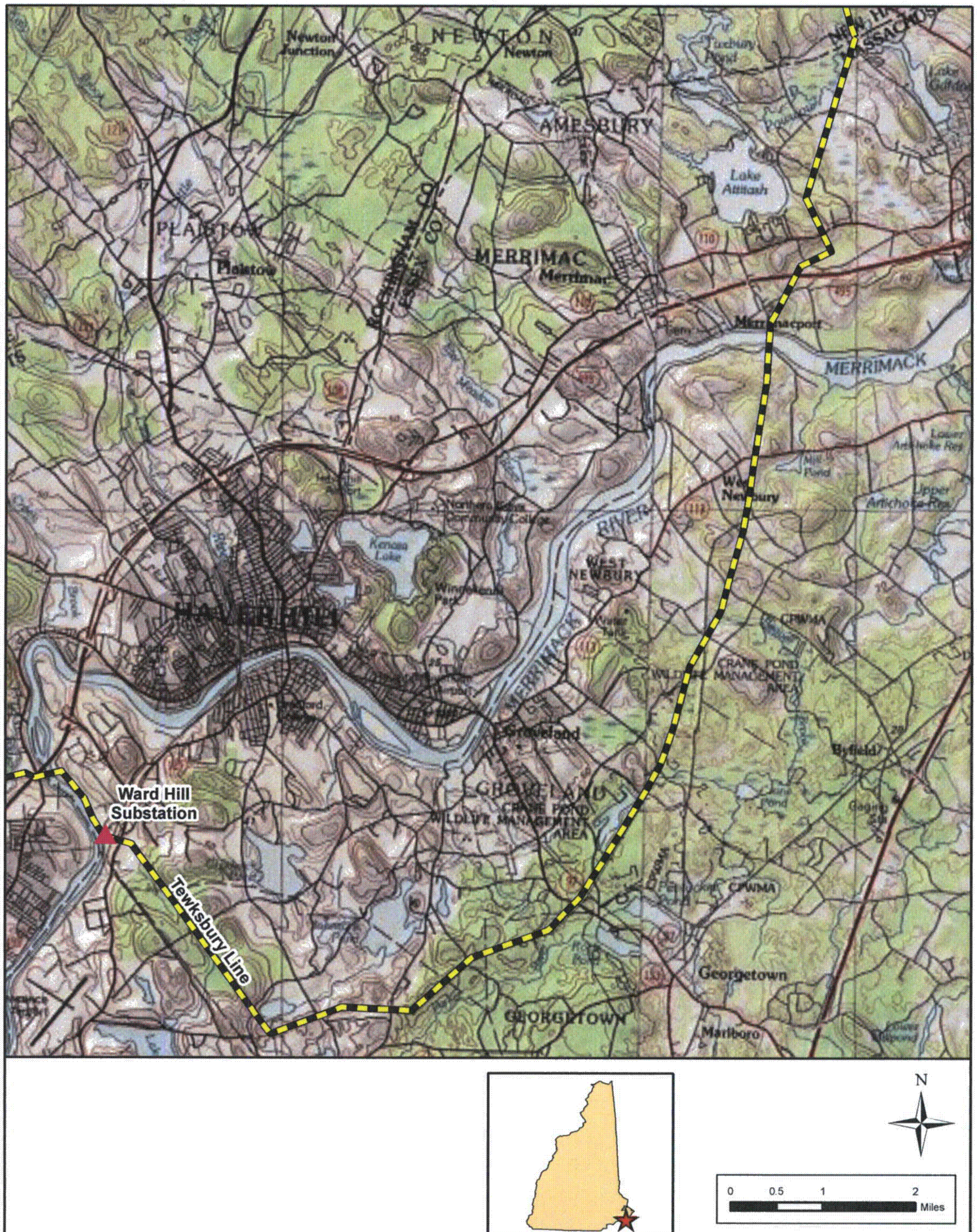

Figure 3
Transmission Lines Associated with the Seabrook Station Nuclear Power Plant, 7.5 Minute Topographic Quandrangle

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

March 3, 2010

Brian Holian
Director
Division of License Renewal
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Seabrook Nuclear Power Station License Renewal Application, Tewksbury 345 kV Transmission Line to Ward Hill Substation, Amesbury, Merrimac, West Newbury, Groveland, Georgetown, Boxford, Haverhill, MA. MHC #RC.48153.

Dear Mr. Holian:

Staff of the Massachusetts Historical Commission (MHC), office of the Massachusetts State Historic Preservation Officer (SHPO), have reviewed a Project Notification Form (PNF) and additional information for the proposed project referenced above and have the following comments.

MHC understands that the proposed license renewal for the Seabrook, New Hampshire Nuclear Power Plant, including existing 345 kV transmission lines in Massachusetts, proposes no new construction, demolition or refurbishment activities. Because no new construction is proposed, the MHC has no concerns.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800). If you have any questions please contact Jonathan K. Patton at this office.

Sincerely,

Brona Simon
Brona Simon
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission

xc: Richard Cliche, NextEra Energy Seabrook, LLC
Dennis L. Egan, NRC Region I
New Hampshire Division of Historical Resources

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ATTACHMENT E

COASTAL ZONE CONSISTENCY CERTIFICATION

COASTAL ZONE CONSISTENCY CERTIFICATION

Federal Consistency Certification for Federal Permit and License Applications

NextEra Energy Seabrook, LLC (NextEra Energy Seabrook) certifies to the U.S. Nuclear Regulatory Commission (NRC) that renewal of the Seabrook Station operating license is consistent with enforceable policies of the federally-approved coastal zone management program for the State of New Hampshire. The Consistency Certification is set forth below, and is followed by the information and data necessary to satisfy Coastal Zone Management Act (CMZA) requirements.

CONSISTENCY CERTIFICATION

The proposed activity, NRC's renewal of the Seabrook Station operating license, complies with the enforceable policies of New Hampshire's approved coastal management program and will be conducted in a manner consistent with such program.

NECESSARY DATA AND INFORMATION

Statutory and Regulatory Background

The CZMA (16 USC 1451 *et seq.*) imposes certification 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 in the application to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal management program. The Act also requires the applicant to provide to the state a copy of the certification, with all necessary information and data, and requires the state to notify the federal agency and the applicant at the earliest practicable time whether the state concurs with, or objects to, the consistency certification. If the state objects, the federal agency cannot issue the license unless the Secretary of Commerce determines that the activity is consistent with the objectives of the CZMA or is otherwise necessary in the interest of national security. See 16 USC 1456(c)(3)(A).

The Secretary of Commerce has delegated federal CZMA responsibilities to the National Oceanic and Atmospheric Administration (NOAA). NOAA has promulgated regulations implementing the CZMA (15 CFR 930 et seq.) that indicate that consistency requirements apply to license renewals under certain circumstances, including renewals of federal licenses not previously reviewed by the state agency. NOAA approved the New Hampshire coastal management program in 1982 (Ref. E-5).

The New Hampshire Department of Environmental Services, Water Division, Watershed Management Bureau administers the New Hampshire Coastal Program and maintains a website on the program in general (Ref. E-1). The website provides a link to a state coastal zone map that shows that the towns of Seabrook, Hampton and Hampton Falls are included in the coastal zone (Ref. E-2). The website also provides a link to information on federal consistency (Ref. E-3). The state has published a guide to federal consistency that lists NRC licensing and U. S. Environmental Protection Agency (EPA) permitting under the National Pollutant Discharge Elimination System (NPDES) as federal licensing activities that the state presumes have reasonably foreseeable coastal effects and thus require CZMA certification (Ref. E-4, Section IV and Appendix C.II).

EPA administers the NPDES program in New Hampshire. In 1985, the State of New Hampshire concurred with Seabrook Station's certification that EPA's issuance of the Station's NPDES permit and subsequent renewals were consistent with the New Hampshire coastal zone management program (e.g., Ref. E-9). However, the State of New Hampshire has not previously performed a CZMA review of the NRC operating license.

Proposed Action

The NRC license for Seabrook Station will expire in 2030. The NRC regulations provide for license renewal, and NextEra Energy Seabrook is applying for renewal of the Seabrook Station operating license. Renewal would extend the Seabrook Station operating license term to 2050.

Seabrook Station is an electric generating plant located within the New Hampshire coastal zone, in the Town of Seabrook, Rockingham County, on the western shore of Hampton Harbor, two miles west of the Atlantic Ocean (Figures E-1 and E-2). The location is approximately two miles north of the Massachusetts state line. The site consists of 889 acres and is bounded on the north, east, and south by estuarine marshlands (Figure E-3). Approximately two thirds of the site area is 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 developed portion of the site encompasses slightly more than 100 acres. Three transmission lines connect Seabrook Station to the New England electric grid, as shown on Figure E-4.

Seabrook Station has been in commercial operation since 1990. The station is a single-unit pressurized water reactor with a net electric output of 1,245 megawatts. The station has a once-through heat dissipation system that withdraws cooling water from, and discharges heated effluent to, the Atlantic Ocean via offshore intake and discharge structures. During normal operations, the cooling system withdraws and discharges approximately 600 million gallons per day (gpd). The station uses approximately 115,000 gpd of fresh water from the Seabrook, New Hampshire municipal water system and normally discharges a maximum of approximately 20,000 gpd to the municipal wastewater system (discharge increases by approximately 29,000 gpd during refueling outages). There are no major aquifers in the site vicinity and the station's use of groundwater is limited to approximately 35,000 gpd from dewatering that discharges to the site storm water drainage system. Stormwater from the site is discharged through the cooling water system.

Seabrook Station employs approximately 1,100 full-time workers and an additional 800 temporary (30-day) workers every 18 months for refueling outages.

NextEra Energy Seabrook has identified no need for environmentally significant new aging management programs or major modifications to existing programs and has no plans to add outage or non-outage employees to support Seabrook Station operations during the license renewal term. As such, renewal would result in a continuation of environmental impacts currently regulated by the state. Table E-1 lists state and federal environmental licenses, permits, and other authorizations for current Seabrook Station operations and Table E-2 identifies compliance activities associated specifically with NRC license renewal.

Environmental Impacts

Discussion of Seabrook Station environmental impacts can be found in the following three documents:

NRC generic environmental impact statement (GEIS) for license renewal

NextEra Energy Seabrook environmental report for Seabrook Station license renewal

Exhibit E-1 to this coastal consistency certification

The following paragraphs discuss each of these documents in more detail. Prior to renewing the Seabrook Station license, the NRC will issue a site-specific supplement to the GEIS. This document will also discuss the environmental impacts to the proposed action.

Generic Environmental Impact Statement for License Renewal

The NRC has prepared a GEIS (Ref. E-6) to assess the environmental impacts that could be associated with nuclear power plant license renewal and an additional 20 years of operation of individual plants and has codified its findings (10 CFR 51, Subpart A, Appendix B, Table B-1). The codification identified 92 potential environmental issues, 69 of which the NRC identified as having small impacts and termed "Category 1 issues." The NRC defines "small" as:

Small – For the issue, 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 purpose 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 as the term is used in this table (10 CFR 51, Subpart A, Appendix B, Table B-1)

The NRC codification and the GEIS discuss the following types of Category 1 environmental issues:

Surface water quality, hydrology, and use

Aquatic ecology

Groundwater use and quality

Terrestrial resources

Air quality

Land use

Human health

Postulated accidents

Socioeconomics

Uranium fuel cycle and waste management

Decommissioning

In its decision-making for plant-specific license renewal applications, absent new and significant information to the contrary, the NRC relies on its codified findings, as amplified by supporting information in the GEIS, for assessment of environmental impacts from Category 1 issues [10 CFR 51.95(c)(40)]. For plants, such as Seabrook Station, that are located in the coastal zone, many of these issues involve impacts to the coastal zone. NextEra Energy Seabrook has adopted by reference the NRC findings and GEIS analyses for 47[1] applicable Category 1 issues.

Environmental Report for Seabrook Station License Renewal[2]

The NRC regulation identified 21 issues as "Category 2," for which license renewal applicants must submit additional site-specific information.[3] Of these,

[1] The remaining Category 1 issues do not apply to Seabrook Station either because they are associated with design or operational features the Seabrook Station does not have (e.g., circulating water cooling towers) or to an activity, refurbishment, that Seabrook Station will not undertake.

[2] This consistency certification is provided as Attachment E to the environmental report.

[3] 10 CFR 51, Subpart A, Appendix B, Table B-1 also identifies 2 issues as "NA" for which NRC could not come to a conclusion regarding categorization. NextEra Energy Seabrook believes that these issues, chronic effects of electromagnetic fields and environmental justice, do not affect the "coastal zone" as that phrase is defined by the Coastal Zone Management Act [16 USC 1453(1)].

11 apply to Seabrook Station[4] and, like the Category 1 issues, could involve impacts to the coastal zone. The following paragraphs list the applicable Category 2 issues, summarize NextEra Energy Seabrook's conclusions on impacts, and identify the location of more detailed discussion in the NextEra Energy Seabrook environmental report for Seabrook Station license renewal.

Entrainment of fish and shellfish in early life stages – This issue addresses mortality of organisms small enough to pass through the plant's cooling water system. Seabrook Station conducts an entrainment monitoring program approved by EPA and New Hampshire Department of Environmental Services (NHDES). The estimated number, by species, of entrained organisms and their adult equivalency are reported annually. Future proposed changes to the entrainment monitoring program would be subject to approval by EPA and NHDES. EPA determined that the plant's intake structure was Best Available Technology to minimize impact. Section 4.2 contains additional information about this issue. NextEra Energy Seabrook concludes that these impacts are small during current operations and has no plans that would change this conclusion for the license renewal term.

Impingement of fish and shellfish – This issue addresses mortality of organisms large enough to be impinged on the intake screens, precluding passage into the plant equipment. The studies and permit discussed above also address impingement and Section 4.3 contains additional information about this issue. NextEra Energy Seabrook concludes that these impacts are small during current operations and has no plans that would change this conclusion for the license renewal term.

Heat shock – This issue addresses mortality of aquatic organisms by exposure to heated plant effluent. The Station's NPDES permit provides a Section 316(a) variance based on past and ongoing studies showing no significant impact on the local biological community. Section 4.4 contains additional information about this issue. NextEra Energy Seabrook concludes that impacts to fish and shellfish from heat shock are small during current operations and has no plans that would change this conclusion for the license renewal term.

Threatened or endangered species – This issue addresses effects that Seabrook Station operations could have on species that are listed under federal law as threatened or endangered. NextEra Energy Seabrook has also addressed state-protected species. Six federally-listed aquatic species, the shortnose sturgeon, the loggerhead turtle, the green turtle, the hawksbill turtle, the Kemp's ridley turtle, and the leatherback turtle, potentially could be

[4] The remaining Category 2 issues do not apply to Seabrook Station either because they are associated with design or operational features the Seabrook Station does not have (e.g., circulating water cooling towers) or to an activity, refurbishment, that Seabrook Station will not undertake.

present in the vicinity of the Station. Station impingement monitoring has never encountered these species and the ecology of these species is unlikely to bring them into contact with the intakes. The habitat on the site and along its transmission corridors is unlikely to be suitable for any of the three federally-listed species known to be present in the four counties included in the project area. Based on the habitat types, a total of 8 vertebrate, 23 plant, and 2 invertebrate species with state threatened or endangered status were identified as potentially present. NextEra Energy Seabrook is unaware of any Station impacts to listed terrestrial species. Agency correspondence indicates that license renewal is unlikely to affect any listed species on the transmission corridors as long as current vegetation management practices and policies are followed. For these reasons, NextEra Energy Seabrook concludes that impacts to threatened or endangered species are small. NextEra Energy Seabrook has no plans that would change this conclusion for the license renewal term. See Section 4.10 for additional information.

Electromagnetic fields, acute effects (electric shock) – This issue addresses the potential for shock from induced currents, similar to static electricity effects, in the vicinity of transmission lines (see Section 13). Because this strictly human-health issue does not directly or indirectly affect natural resources of concern within the Coastal Zone Management Act definition of "coastal zone" (16 USC 1453[1]), NextEra Energy Seabrook concludes that the issue is not subject to the certification requirement.

Housing – This issue addresses impacts that additional NextEra Energy Seabrook employees required to support license renewal and the additional concomitant indirect jobs could have on local housing availability (Section 4.14). NextEra Energy Seabrook estimates that no additional workers would be needed to support Seabrook Station operations during the license renewal term. NextEra Energy Seabrook concludes that because there is no increase in staffing, no additional housing would be required and, therefore, the appropriate characterization of Seabrook Station license renewal housing impacts is "small."

Public services; public utilities – This issue addresses impacts that adding license renewal workers could have on public water supply systems (Section 4.15). NextEra Energy Seabrook estimates that no additional workers would be needed to support Seabrook Station operations during the license renewal term. NextEra Energy Seabrook concludes that because there is no increase in staffing, no additional demands on the public water supply system would be experienced and, therefore, the appropriate characterization of Seabrook Station license renewal impacts is "small."

Offsite land use – This issue addresses impacts to land use that could result from a larger worker population and from local government spending of Station property tax dollars in ways that can alter land use patterns. NextEra Energy Seabrook estimates that no additional workers would be needed to support Seabrook Station operations during the license renewal term, so there would be no offsite land use impacts due to an increased worker population. Generally, Seabrook Station property taxes comprise too small a percentage of revenues of local governments to cause offsite land use impacts to be other than small, with the possible exception of the Town of Seabrook. Seabrook Station's property taxes have represented between approximately 30 to 40 percent of the Town of Seabrook's net tax commitment. However, the annual rate of change of Town of Seabrook land use has been small and is half that of the county, as a whole. NextEra Energy Seabrook concludes that impacts during the Seabrook Station license renewal term would be small. Section 4.17 contains additional information about this issue.

Public services; transportation – This issue addresses impacts that additional license renewal workers could have on local traffic pattern (Section 4.18). NextEra Energy Seabrook estimates that no additional workers would be needed to support Seabrook Station operations during the license renewal term. NextEra Energy Seabrook concludes that because there is no increase in staffing, no transportation impacts would be experienced and, therefore, the appropriate characterization of Seabrook Station license renewal impacts is "small."

Historic and archaeological resources – This issue addresses impacts that license renewal activities could have on resources of historic or archaeological significance. NextEra Energy Seabrook is not aware of any historic or archaeological resources that have been affected, to date, 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. NextEra Energy Seabrook has no plans for land-disturbing activities due to license renewal and no other plans due to license renewal that would disturb such resources.

Therefore, NextEra Energy Seabrook concludes that license renewal would not affect historic and archaeological resources. NextEra Energy Seabrook also has consulted with the New Hampshire State Historic Preservation Officer (SHPO) and the Massachusetts Historical Commission (MHC) SHPO regarding this conclusion for the station and the transmission corridors and the SHPOs in both states have concurred that license renewal and associated operation and maintenance activities would have no effect on historic or archaeological resources.

Severe accidents – The NRC determined that the license renewal impacts from severe accidents would be small but that applicants who have not previously done so should perform site-specific analyses of ways to further mitigate impacts. NextEra Energy Seabrook used a NRC-approved methodology to conduct a severe accident mitigation alternatives (SAMAs) analysis and found two SAMAs that are potentially cost beneficial for Seabrook Station. Section 4.20 contains additional information about this issue. Because these SAMAs are not age-related, they need not be implemented as part of license renewal. They will be addressed in the Station's Long Range Plan.

Coastal Consistency Certification for Seabrook Station License Renewal

Previous sections of this certification discussed the environmental impacts of Seabrook Station license renewal. This section addresses how these impacts, and other Seabrook Station activities, comply with New Hampshire Coastal Program requirements.

The New Hampshire Coastal Program website lists 16 coastal zone enforceable policies (Ref. E-7). For each policy, NextEra Energy Seabrook has included in Exhibit E-1 the text of the policy and a discussion of how Seabrook Station license renewal is consistent with the policy. NOAA has published an environmental impact statement (EIS) in conjunction with its approval of the New Hampshire coastal program (Ref. E-8).

Findings

In summary, the information provided with this certification supports the following findings:

New Hampshire has concurred for the original NPDES permit for station operations and for subsequent renewals that Seabrook Station operation is consistent with the federally approved New Hampshire coastal zone management program.

The NRC has found that the impacts of certain license renewal environmental issues (i.e., Category 1 issues) are small. NextEra Energy Seabrook has adopted by reference the NRC findings for these issues as they are applicable to Seabrook Station.

For other license renewal issues (i.e., Category 2) that are applicable to Seabrook Station, NextEra Energy Seabrook has determined that the environmental impacts are small. Impacts to coastal zone resources, therefore, would also be small.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station and its associated transmission lines and corridors are in compliance with New Hampshire's licensing and permitting requirements and are in compliance with its state-issued licenses and permits.

NextEra Energy Seabrook's license renewal and continued operation of Seabrook Station would be consistent with the enforceable policies of the New Hampshire coastal zone management program.

STATE NOTIFICATION

Upon receipt of a complete consistency certification that Seabrook Station license renewal is consistent with New Hampshire's coastal zone management program, federal regulation gives the State six months in which to concur with or object to the certification [15 CFR 930.62(a)]. If the State has not issued a decision within three months following the commencement of state agency review, it shall notify the contacts listed below of the status of the matter and the basis for further delay [15 CFR 930.62(b)]. Correspondence concerning the State of New Hampshire's review of this coastal consistency certification should be sent to:

Mr. Richard R. Cliché
NextEra Energy Seabrook LLC
License Renewal Project Manager
PO Box 300
Seabrook, NH 03874

Mr. Michael D. O'Keefe
NextEra Energy Seabrook LLC
Licensing Manager
PO Box 300
Seabrook, NH 03874

REFERENCES

E-1 New Hampshire Department of Environmental Services, Water Division, Coastal Program. Website available at http://des.nh.gov/organization/divisions/water/wmb/coastal/index.htm. Accessed September 25, 2008.

E-2 New Hampshire Coastal Zone. Available at http://des.nh.gov/organization/divisions/water/wmb/coastal/documents/nh_coastal_zone_map.pdf. Accessed September 25, 2008.

E-3 New Hampshire Department of Environmental Services, Water Division, Coastal Program, Federal Consistency. Website available at http://des.nh.gov/organization/divisions/water/wmb/coastal/federal_consistency.htm. Accessed September 25, 2008.

E-4 New Hampshire Coastal Program Guide to Federal Consistency; Coastal Zone Management Act §307. Available online at http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-05-21.pdf. Accessed September 25, 2008.

E-5 Ocean and Coastal Management in New Hampshire. Website of National Oceanographic and Atmospheric Administration. Available online at http://coastalmanagement.noaa.gov/mystate/nh.html. Accessed September 18, 2008.

E-6 Generic Environmental Impact Statement for License Renewal of Nuclear Plants, U. S. Nuclear Regulatory Commission. NUREG-1437, May 1996. Available online at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/. Accessed September 23, 2008.

E-7 Coastal Program Policies. New Hampshire Department of Environmental Services, Water Division. Available on http://des.nh.gov/organization/divisions/water/wmb/coastal/documents/enforceable_policies.pdf. Accessed September 25, 2008.

E-8 New Hampshire Coastal Program and Final Environmental Impact Statement, U. S. Department of Commerce, National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management, July 1982. Available online at http://des.nh.gov/organization/divisions/water/wmb/coastal/feis.htm. Accessed October 3, 2008.

E-9 Letter, Piattoni (State of New Hampshire Coastal Program Manager), to DeVincentis (Public Service Company of New Hampshire), July 23, 1985.

Table E-1 Environmental Authorizations for Current Seabrook Station Operation

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: 03/15/2030	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)

Table E-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 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)
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

Table E-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 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 E-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 FWS (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 NHDES by submitting a certification of consistency for review. (Attachment E)

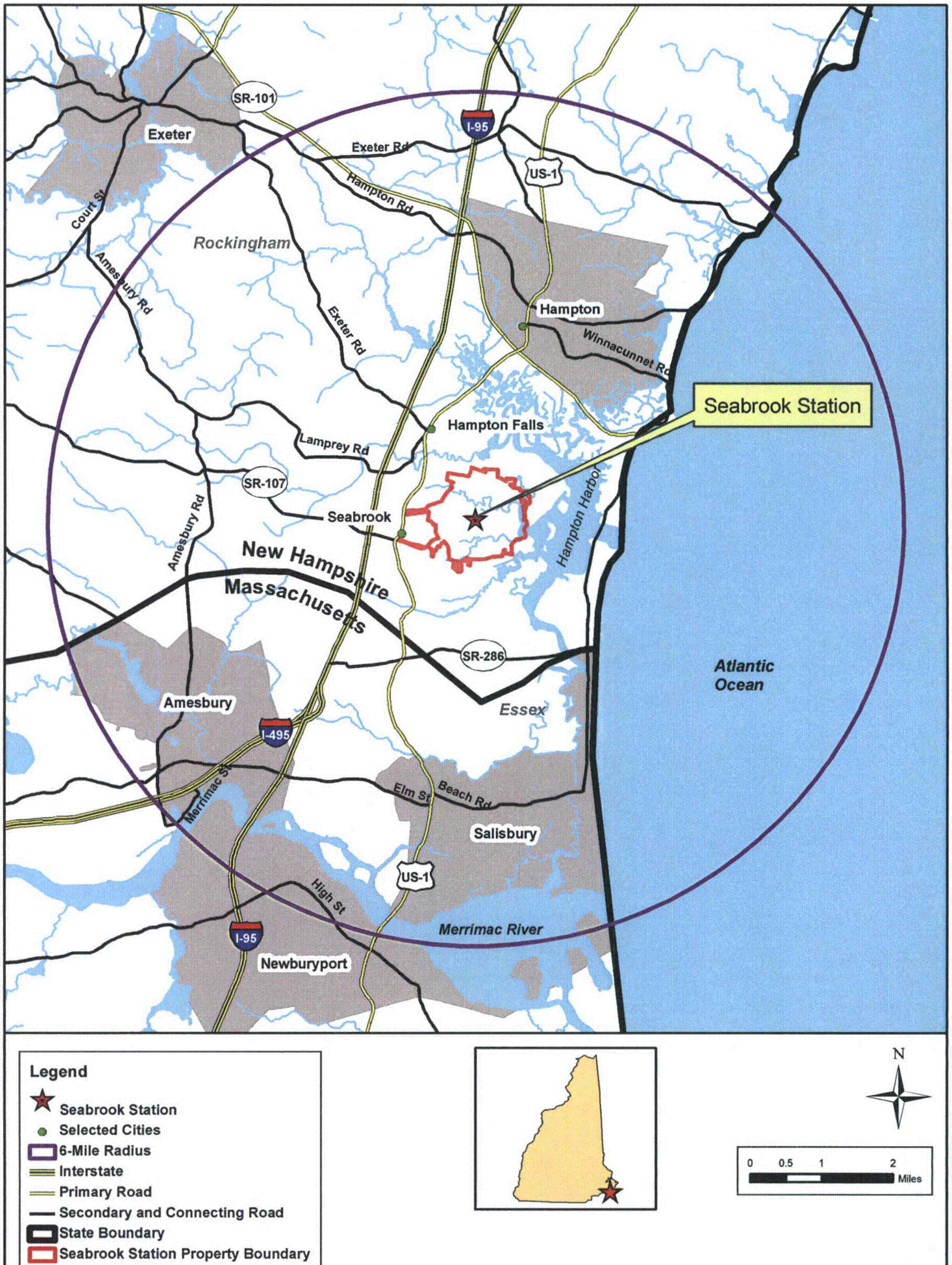

Figure E-1 6-Mile Vicinity Map

Figure E-2 50-Mile Vicinity Map

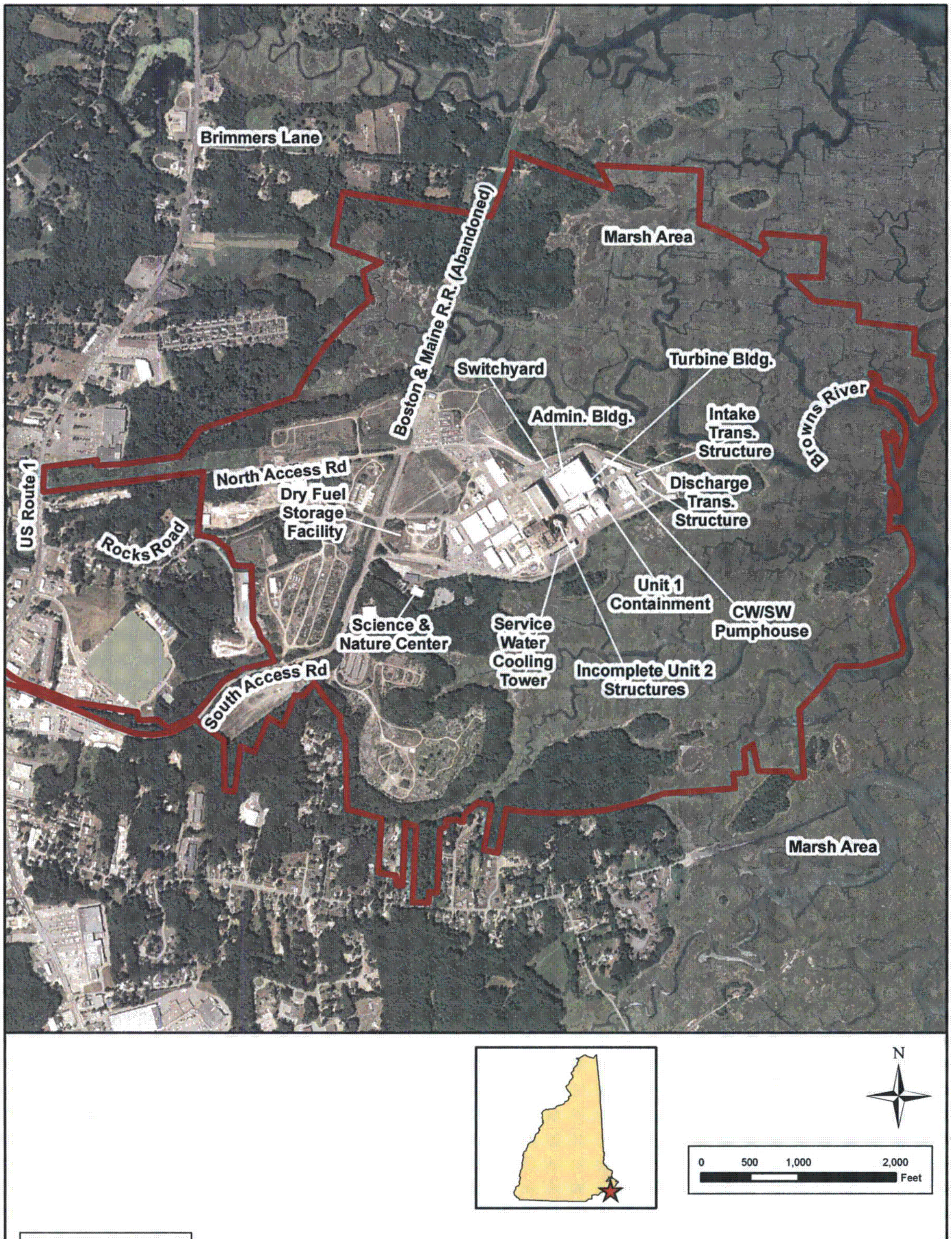

Figure E-3 Seabrook Station Site Boundary

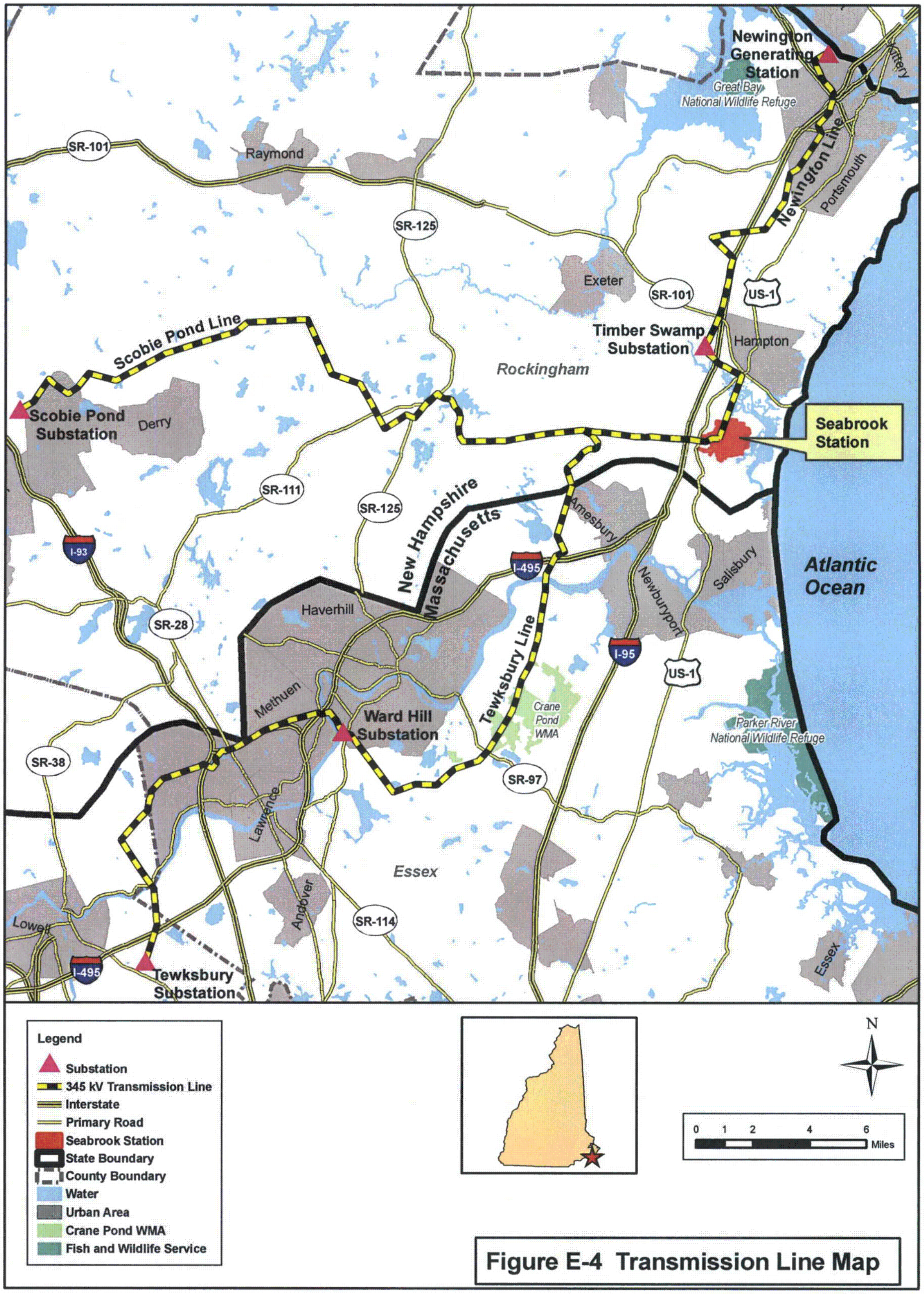

Figure E-4 Transmission Line Map

EXHIBIT E-1
NEW HAMPSHIRE COASTAL PROGRAM ENFORCEABLE POLICIES

PROTECTION OF COASTAL RESOURCES

Policy 1. Protect and preserve and, where appropriate, restore the water and related land resources of the coastal and estuarine environments. The resources of primary concern are coastal and estuarine waters, tidal and freshwater wetlands, beaches, sand dunes, and rocky shores.

NextEra Energy Seabrook Response – Applicable. The Seabrook Station site is composed of a developed area of uplands surrounded by tidal wetlands. There are no beaches, sand dunes, or rocky shores on the Seabrook Station site. NextEra Energy is not aware of any freshwater wetlands on the site.

Seabrook Station withdraws water from and discharges wastewater to the western Gulf of Maine (Atlantic Ocean) and discharges wastewater to the Town of Seabrook municipal wastewater system. The U. S. Environmental Protection Agency (EPA) regulates Station non-radiological discharges to the ocean by means of National Pollutant Discharge Elimination System (NPDES) discharge permits. Stormwater is discharged under an NPDES Multi-Sector General Stormwater Permit. Operation of the Station in accordance with its permits ensures compliance with state water quality standards. The Town of Seabrook regulates the Station's non-radiological discharges to town's publically-owned treatment works, which also discharges to the Atlantic Ocean, by way of an NPDES permit. The NRC regulates the Station's radiological discharges. The Station reports discharge water quality to EPA and the State monthly and annually and to the Town biannually, reports water use to the state quarterly, and reports radiological releases annually to the NRC.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with its permits and with Policy 1. NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

Transmission lines connecting Seabrook Station to the grid are owned by FPL New England Division, Public Service of New Hampshire and National Grid. To the best of NextEra Energy Seabrook's knowledge these corridors are maintained in accordance with all state (New Hampshire and Massachusetts) requirements.

Policy 2. Manage, conserve and, where appropriate, undertake measures to maintain, restore, and enhance the fish and wildlife resources of the state.

NextEra Energy Seabrook Response – Applicable. EPA regulates Station impacts to fish resources by means of the Station's NPDES permit. EPA, in issuing the permit, concluded that the Station's cooling water intake structure employs the best technology available for minimizing adverse environmental impact and that biological monitoring will continue to assure the EPA and the State that the continued operations of Seabrook Station do not significantly impact the local biological community.

The fish and shellfish communities in the vicinity of Seabrook Station have been studied extensively since 1969. Monitoring for most communities or species began in the late 1970s or early 1980s and provides approximately 10 years of preoperational data and, as of 2008, 18 years of operational data including impingement and entrainment data. The station provides annual reports on these studies to EPA, NOAA, and the State.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with its permit and with Policy 2. NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

Policy 3. Regulate the mining of sand and gravel resources in offshore and onshore locations so as to ensure protection of submerged lands, and marine and estuarine life. Ensure adherence to minimum standards for restoring natural resources impacted from onshore sand and gravel removal operations.

NextEra Energy Seabrook Response – Not applicable. Seabrook Station has no plans to engage in mining of sand or gravel due to license renewal. Other than excavations associated with plant construction, there are no onsite locations of previous sand or gravel mining operations. Seabrook Station has plans to remove, from an onsite upland area, spoils material deposited during the excavation of the intake and discharge tunnels. Seabrook Station is requiring the contractor to conduct the removal in accordance with state wetlands protection regulations, obtain appropriate permits, and control runoff so as to protect state waters and wetlands.

Policy 4. Undertake oil spill prevention measures, safe oil handling procedures and, when necessary, expedite the cleanup of oil spillage that will contaminate public waters. Institute legal action to collect damages from liable parties in accordance with state law.

NextEra Energy Seabrook Response – Applicable, in part. Seabrook Station maintains a Spill Prevention, Control, and Countermeasures Plan that documents Station response to spillage as required by EPA regulation 40 CFR 112. NextEra Energy Seabrook concludes that the Policy 4 provision regarding instituting legal action is applicable to the State and not to NextEra Energy Seabrook.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 4 and NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

Policy 5. Encourage investigations of the distribution, habitat needs, and limiting factors of rare and endangered animal species and undertake conservation programs to ensure their continued perpetuation.

NextEra Energy Seabrook Response – Not applicable. NextEra Energy Seabrook concludes that this policy is applicable to state agencies. See below regarding onsite species.

Policy 6. Identify, designate, and preserve unique and rare plant and animal species and geologic formations which constitute the natural heritage of the state. Encourage measures, including acquisition strategies, to ensure their protection.

NextEra Energy Seabrook Response – Applicable. NextEra Energy Seabrook reports annually on Station monitoring of aquatic marine animals in the vicinity. One listed aquatic species, the shortnose sturgeon, has the potential to exist in the vicinity of the Seabrook Station but 18 years of operational monitoring have found no occurrence of this species. Seabrook Station has made design modifications to eliminate takes of seals.

NextEra Energy Seabrook has no records of Federal- or state-listed plant or animal species resident on the Seabrook Station site. Review of site habitats and the habitat requirements of species known to exist in the county has shown that such residency is unlikely. The site could be used for foraging by non-resident bird species but station operations are unlikely to affect adversely this behavior and NextEra Energy Seabrook has no record of this occurring.

NextEra Energy Seabrook is not aware of unique or rare geologic formation on the Seabrook Station site.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 6. NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

As indicated in response to Policy 1, NextEra Energy Seabrook does not own the transmission lines that connect the station to the grid. To the best of NextEra Energy Seabrook's knowledge these corridors are maintained in accordance with all state requirements.

RECREATION AND PUBLIC ACCESS

Policy 7. Provide a wide range of outdoor recreational opportunities including public access in the seacoast through the maintenance and improvement of the existing public facilities and the acquisition and development of new recreational areas and public access.

NextEra Energy Seabrook Response – Applicable, in part. There are no public facilities onsite except for the Seabrook Station Science and Nature Center, which is open to the public (security considerations may preclude public access). 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.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 7. NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

MANAGING COASTAL DEVELOPMENT

Policy 8. Preserve the rural character and scenic beauty of the Great Bay estuary by limiting public investment in infrastructure within the coastal zone in order to limit development to a mixture of low and moderate density.

NextEra Energy Seabrook Response – Not applicable. NextEra Energy Seabrook concludes that this policy is applicable to state agencies' management of development in the Great Bay Estuary. Seabrook Station operates with current established infrastructure. License renewal would not alter this status.

Policy 9. Reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to preserve the natural and beneficial value of floodplains, through the implementation of the National Flood Insurance Program and applicable state laws and regulations, and local building codes and zoning ordinances.

NextEra Energy Seabrook Response – Applicable. Approximately 600 acres of the 889-acre site are undeveloped salt marsh which provide buffer for flood events. The developed portion of the site is located above the 0.2 percent annual chance floodplain (500-year flood). The station was constructed in the late '70s and early '80's in accordance with applicable state laws and regulations and remains in compliance with local building codes and zoning ordinances.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 9 and NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

Policy 10. Maintain the air resources in the coastal area by ensuring that the ambient air pollution level, established by the New Hampshire State Implementation Plan pursuant to the Clean Air Act, as amended, is not exceeded.

NextEra Energy Seabrook Response – Applicable. As shown in Table E-1, Seabrook Station has several small air emission sources subject to a Clean Air Act Title V Permit issued by NHDES. The station maintains records and provides annual reports to the State in accordance with the permit.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations will be in conformance with its permits and Policy 10 and any instance of non-compliance will be corrected in a timely manner. NextEra Energy Seabrook has no plans that would alter this status due to license renewal and has no plans for additional site development due to license renewal.

Policy 11. Protect and preserve the chemical, physical, and biological integrity of coastal water resources, both surface and groundwater.

NextEra Energy Seabrook Response – Applicable. See response to Policies 1 and 2 regarding Seabrook Station impacts to surface water and aquatic resources. Other than limited dewatering of groundwater leakage into buildings, Seabrook Station does not withdraw from or discharge to groundwater.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with its permits and Policy 11. NextEra Energy Seabrook has no plans that would alter this status due to license renewal and has no plans for additional site development due to license renewal.

Policy 12. Ensure that the siting of any proposed energy facility in the coast will consider the national interest and will not unduly interfere with the orderly development of the region and will not have an unreasonable adverse impact on aesthetics, historic sites, coastal and estuarine waters, air and water quality, the natural environment and the public health and safety.

NextEra Energy Seabrook Response – Not applicable. Seabrook Station is an existing, not a proposed, energy facility. The New Hampshire programmatic coastal documentation acknowledges Seabrook Station existence and the processes that were available to the State to evaluate the siting of the Station. Seabrook Station has operated consistent with this policy for 20 years. The license renewal and continued operation will not alter this status.

COASTAL DEPENDENT USES

Policy 13. Allow only water dependent uses and structures on state properties in Portsmouth-Little Harbor, Rye Harbor, and Hampton-Seabrook Harbor, at state port and fish pier facilities and state beaches (except those uses or structures which directly support the public recreation purpose). For new development, allow only water dependent uses and structures over waters and wetlands of the state. Allow repair of existing over-water structures within guidelines. Encourage the siting of water dependent uses adjacent to public waters.

NextEra Energy Seabrook Response – Applicability assumed. While Seabrook Station is not located on state property, its intake and discharge pipelines pass beneath Hampton Harbor and its submerged intake and discharge structures are present in offshore waters of the state. Documentation for the New Hampshire Coastal Program indicates that water pipelines for electric generating plants located back from the shoreline are water dependent uses. Other than a publicly accessible interpretive nature trail, Seabrook Station has no over-water structures.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 13. NextEra Energy Seabrook has no plans that would alter this status due to license renewal and has no plans for additional site development due to license renewal.

Policy 14. Preserve and protect coastal and tidal waters and fish and wildlife resources from adverse effects of dredging and dredge disposal, while ensuring the availability of navigable waters to coastal-dependent uses. Encourage beach renourishment and wildlife habitat restoration as a means of dredge disposal whenever compatible.

NextEra Energy Seabrook Response – Not applicable. Seabrook Station does not foresee a need to perform dredging or dredge disposal and NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

PRESERVATION OF HISTORIC AND CULTURAL RESOURCES

Policy 15. Support the preservation, management, and interpretation of historic and culturally significant structures, sites and districts along the Atlantic coast and in the Great Bay area.

NextEra Energy Seabrook Response – Applicable. 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 knows of two archaeological resources on the site but is not aware of any historic or archaeological resources that have been affected by Seabrook Station operations, including operation and maintenance of transmission lines. Because NextEra Energy Seabrook is aware of the potential for discovery of cultural resources during land-disturbing activities at its facilities, it is developing procedures that would protect archaeological resources and that address discovery of cultural resources on the Seabrook Station site. The New Hampshire and Massachusetts SHPOs have concurred that license renewal and associated operation and maintenance activities would have no effect on historic or archaeological resources.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 15. NextEra Energy Seabrook has no plans that would alter this status due to license renewal and has no plans for additional site development due to license renewal.

As indicated in response to Policy 1, NextEra Energy Seabrook does not own the transmission lines that connect the station to the grid. To the best of NextEra Energy Seabrook's knowledge these corridors are maintained in accordance with all state requirements. The transmission lines are critical to the ISO-NE system and would remain, regardless of license renewal.

MARINE AND ESTUARINE RESEARCH AND EDUCATION

Policy 16. Promote and support marine and estuarine research and education that will directly benefit coastal resource management.

NextEra Energy Seabrook Response – Applicable. The fish and shellfish communities in the vicinity of Seabrook Station have been monitored extensively since 1969. Monitoring for most communities or species began in the late 1970s or early 1980s and provides approximately 10 years of preoperational data and, as of 2008, 18 years of operational data including impingement and entrainment data. The station provides annual reports on these studies to EPA and the State. The Seabrook Station Science and Nature Center is open to the public. 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.

To the best of NextEra Energy Seabrook's knowledge, Seabrook Station operations are in conformance with Policy 16. NextEra Energy Seabrook has no plans that would alter this status due to license renewal.

ATTACHMENT F

SEVERE ACCIDENT MITIGATION ALTERNATIVES

SEABROOK STATION SAMA ANALYSIS

EXECUTIVE SUMMARY

This attachment provides an analysis of the Severe Accident Mitigation Alternatives (SAMAs) that were identified for consideration by Seabrook Station. The analysis was conducted on a cost-benefit basis. The benefit results are in Section F.4 of this report. Candidate SAMAs that do not have benefit evaluations have been eliminated from further consideration for any of the following reasons:

- The cost is considered excessive compared with benefits.
- The improvement is not applicable to Seabrook Station.
- The improvement has already been implemented at Seabrook Station or the intent of the improvement has been met at Seabrook Station.

After eliminating the SAMAs that met one of the preceding reasons, the remaining SAMAs are evaluated from a cost-benefit perspective. In general, the SAMA analyses use a bounding approach to determine whether the expected cost would exceed a conservative approximation of the expected benefit. In most cases, therefore, a detailed risk evaluation of a specific modification or procedure change would indicate a smaller benefit than calculated in this bounding analysis.

Major insights from this benefit evaluation process include the following:

- If all core-damage risk is eliminated, then the benefit in dollars over 20 years is $818,721.
- The largest contributors to the total benefit estimate are offsite dose savings and offsite property costs.
- Many of the SAMAs had already been addressed by existing plant features, modifications to improve the plant or existing procedures, or procedure changes to enhance human performance.
- Two SAMAs were identified as potentially cost-beneficial and are described in the following table.

Seabrook SAMA Number	Potential Improvement	Discussion
157	Provide independent AC power source for battery chargers - example: provide portable generator to charge station battery.	Reduce core-damage frequency of long-term station blackout sequences; extend battery life to allow additional time for recovery of offsite power.
165	Reactor water storage tank fill from firewater during containment injection - modify 6" Reactor water storage tank flush flange to have a 2½-inch female fire hose adapter with isolation valve	Could enhance long term containment injection sequences that would benefit from reactor water storage tank makeup. Installing permanent valve connection would improve alignment efficiency.

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ACRONYMS

AFW	Auxiliary Feedwater
ALT	Alternate Cooling Modification
AMSAC	ATWS Mitigation System Actuation Circuitry
AOT	Allowed Outage Time
AOV	Air Operated Valve
ATWS	Anticipated Transient Without Scram
CCF	Common Cause Failure
CCW	Component Cooling Water
CDF	Core Damage Frequency
CET	Containment Event Tree
CI	Containment Isolation
CR	Control Rod
CST	Condensate Storage Tank
CT	Cooling Tower
DCH	Direct Containment Heating
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EPRI	Electric Power Research Institute
EFW	Emergency Feedwater System
EOP	Emergency Operating Procedure
EPZ	Emergency Planning Zone
FB	Feed and Bleed
F-V	Fussel-Vesely Importance
FSAR	Final Safety Analysis Report
GDC	General Design Criterion
HEP	Human Error Probability
HPI	High Pressure Injection
HPCI	High Pressure Coolant Injection
HRA	Human Reliability Analysis
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination External Events
ISGTR	Induced Steam Generator tube Rupture
ISLOCA	Interfacing System Loss of Coolant Accident
IST	In-Service Test
LERF	Large Early Release Frequency
LOCA	Loss of Coolant Accident
LOSP	Loss of Offsite Power
LPCI	Low Pressure Coolant Injection

ACRONYMS (CONTINUED)

MAAP	Modular Accident Analysis Progression
MG	Motor Generator
MLOCA	Medium Loss of Coolant Accident
MOV	Motor Operated Valve
MSIV	Main Steam Isolation Valve
NOP	Normal Operating Pressure
NOT	Normal Operating Temperature
NRC	Nuclear Regulatory Commission
PCC	Primary Closed Cooling
PCCW	Primary Component Cooling Water
PDP	Positive Displacement Pump
PDS	Plant Damage State
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Analysis
PSNH	Public Service of New Hampshire
PSF	Performance Shaping Factor
PWR	Pressurized Water Reactor
RAT	Reserve Auxiliary Transformer
RAW	Risk Achievement Worth
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RNO	Response Not Obtained
RRW	Risk Reduction Worth
RWST	Reactor Water Storage Tank
SAMA	Severe Accident Mitigation Alternatives
SBO	Station Blackout
SCC	Secondary Component Cooling
SEPS	Supplemental Electric Power System
SER	Safety Evaluation Report
SG	Steam Generator
SGTR	Steam Generator Tube Rupture
SI	Safety Injection
SLOCA	Small Loss of Coolant Accident
SRP	Standard Review Plan
SSPSS	Seabrook Station Probabilistic Safety Study
STCP	Source Term Code Package
SUFP	Startup Feed Pump

ACRONYMS (CONTINUED)

Sv	Seivert
SW	Service Water
SWGR	Switchgear
SWS	Service Water System
TCA	Time Critical Activity
TDAFW	Turbine-driven Auxiliary Feedwater
UAT	Unit Auxiliary Transformer
UB	Upper bound
UFSAR	Updated Final Safety Analysis Report

F.1 INTRODUCTION

F.1.1 PURPOSE

The purpose of the analysis is to identify Severe Accident Mitigation Alternative (SAMA) candidates at Seabrook Station that have the potential to reduce severe accident risks and to determine whether implementation of the individual SAMA candidate would be cost-beneficial. NRC license renewal environmental regulations require a SAMA evaluation.

F.1.2 REQUIREMENTS

10 CFR 51.53(c)(3)(ii)(L)

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, Subpart A, Appendix B, Table B-1, Issue 76

"...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...."

F.2 METHOD

The SAMA analysis approach applied in the Seabrook Station assessment consists of the following steps:

Determine Severe Accident Risk

Level 1 and 2 Probabilistic Risk Assessment (PRA) Model

The Seabrook Station PRA model (Section 3.1 – 3.2) was used as input to the Seabrook Station Level 3 PRA analysis (Section F.3.4).

The PRA results include the risk from internal and external events. The external hazards evaluated are internal fires, external floods, and seismic events only. High winds and tornadoes, and transportation and nearby facility accidents are not included in the results because they were screened from the IPEEE submittal because their individual CDF fell below the cutoff criterion of 1.0E-06 per year.

Level 3 PRA Analysis

The Level 1 and 2 PRA output and site-specific meteorological, demographic, land use, and emergency response data were used as input for the Seabrook Station Level 3 PRA (Section F.3). This combined model was used to estimate the severe accident risk (i.e., off-site dose and economic impacts of a severe accident). The NRC regulatory analysis techniques to estimate the cost of severe accident risks were used throughout this analysis.

Determine Cost of Severe Accident Risk / Maximum Benefit

In this step the NRC regulatory analysis techniques were used to estimate the maximum benefit that a SAMA could achieve if it eliminated all risk (i.e., the maximum benefit) (Section F.4).

SAMA Identification

In this step potential SAMA candidates (plant enhancements that reduce the likelihood of core damage and/or reduce releases from containment) were identified by Seabrook Station plant staff, from the PRA model, Individual Plant Examination (IPE) and IPE – External Events (IPEEE) recommendations, and industry documentation (Section F.5). The process included consideration of the PRA importance analysis because it has been demonstrated by past SAMA analyses that SAMA candidates are not likely to prove cost-beneficial if they only mitigate the consequences of events that present a low risk to the plant.

Preliminary Screening (Phase I SAMA Analysis)

Because many of the SAMA candidates identified in the previous step are from the industry, it was necessary to screen out SAMA candidates that were not applicable to the Seabrook design, that had already been implemented or whose benefits had been achieved at the plant using other means, and whose roughly estimated cost exceeded the maximum benefit. Additionally, PRA importance measures were used directly to screen SAMA candidates that did not address significant contributors to risk in this phase (Section F.6).

Final Screening (Phase II SAMA Analysis)

In this step of the analysis, the benefit of severe accident risk reduction was estimated for each of the remaining SAMA candidates and compared to an implementation cost estimate to determine net cost-benefit (Section F.7). The benefit associated with each SAMA was determined as the reduction in severe accident risk from the baseline and was derived by modifying the plant model to represent the plant after implementing the candidate. In general, the approach was to first determine a bounding value of the benefit. If the bounding value of the benefit was determined to be smaller than the expected cost, no further modeling was necessary. If the bounding value of the benefit was greater than the estimated cost, the conservatism in the model was removed and a less conservative benefit was determined for comparison with the estimated cost.

The initial cost estimate used in this analysis was determined with input from an expert panel (plant staff familiar with design, construction, operation, training and maintenance). All costs associated with a SAMA were considered, including design, engineering, safety analysis, installation and long-term maintenance, calibration, training, etc. If the estimated cost was close to the estimated benefit, the benefit evaluation was refined to remove conservatism, and if the estimated cost and benefit were still close, then the cost estimate was refined to assure that both the benefit calculation and the cost estimate were sufficiently accurate to justify further decision-making using the estimates.

Sensitivity Analysis

The sensitivity analysis evaluated the impact on the cost-benefit analysis of changes in SAMA analysis assumptions and uncertainties (Section F.8).

Identify Conclusions

The final step involved summarizing the results and conclusions (Section F.9).

F.3 SEVERE ACCIDENT RISK

The Seabrook Station PRA models describe the results of the first two levels of the Seabrook probabilistic risk assessment. Level 1 determines core damage frequency (CDF) based on system analyses and human reliability assessments. Level 2 evaluates the impact of severe accident phenomena on radiological releases and quantifies the condition of the containment and the characteristics of the release of fission products to the environment. The Seabrook Station models use PRA techniques to:

- Understand severe accident behavior;
- Understand the most likely severe accident consequences;
- Understand quantitatively the overall probabilities of core damage and fission product releases; and
- Evaluate hardware and procedure changes to assess the overall probabilities of core damage and fission product releases.

The PRA was initiated in response to Generic Letter 88-20, which resulted in an IPE and IPEEE analysis. The current model includes both internal and external initiating events (i.e., it consolidates IPE and IPEEE studies into a single PRA model) for power operation. This means that severe accident sequences have been developed from internally- and externally-initiated events, including internal floods, internal fires, external floods, and seismic events.

The PRA models are described in the following section. The Level 1 PRA model (internal and external), the Level 2 PRA model, PRA model review history, and the Level 3 PRA model, are described in Sections F.3.1, F.3.2 and F.3.4.

F.3.1 LEVEL 1 PRA MODEL

F.3.1.1 INTERNAL EVENTS

F.3.1.1.1 Description of Level 1 Internal Events PRA Model

The NRC issued Generic Letter No. 88-20, in December 1988, which requested each plant to perform an IPE of internal events to identify any vulnerabilities. In response, New Hampshire Yankee submitted an IPE report (Reference 1) using a probabilistic risk assessment (PRA) approach for Seabrook Station in March 1991 that examined risk from internal events, including internal flooding.

The 2006 updated PRA model is the base model used to support the SAMA analysis. The Level 1 PRA models internal and external initiating events. The software used to quantify the PRA model is RISKMAN. The Level 1 PRA presents the risk associated with core damage. Core damage is defined as the uncovering and heatup of the reactor core to the point where prolonged cladding oxidation and severe fuel damage is anticipated. This condition is defined as the maximum fuel clad temperature exceeding 1100°F for an extended period of time, e.g. > 10 minutes.

The Seabrook Station internal and external events baseline, at power CDF, is calculated to be 1.44E-05 per year. The fault tree method of quantification is binary decision diagram quantification, which provides an exact solution for split fraction values. The event tree quantification was calculated using a truncation cut-off frequency of 1.0E-14, or more than 8 orders of magnitude below the baseline CDF. The results of the CDF quantification of risk from internal and external events is summarized in Table F.3.1.1.1- 1 (Dominant Initiating Event Contribution to Core Damage) and Table F.3.1.1.1-2 (Top Basic Events by Risk Reduction Worth). The approximate CDF contributions from Anticipated Transients Without Scram (ATWS) and Station Blackout (SBO) events are presented below for information purposes.

	Contribution to Internal CDF (per year)
ATWS	~4.6E-07
SBO	~5.3E-06

The Seabrook Station PRA was initially developed in 1983 to provide a Level 3 baseline risk assessment to help support establishment of the station's EPZ. Since 1983 the PRA model has undergone periodic update and was used to support the IPE and IPEEE. The PRA model underwent certification peer review in 1999. A focused peer review of the PRA was performed in

2005. PRA model SSPSS-2006 is the model-of record used to support the SAMA evaluation. A summary of the entire PRA update history is provided in Section F.3.1.1.2, Level 1 and 2 PRA Model Changes. The peer review summary is provided in Section F.3.3, Model Review Summary.

Table F.3.1.1.1-1 Dominant Initiating Event Contribution to Core Damage

Initiator	Description	Initiating Event Frequency	Contribution to CDF	Percent of CDF	Cumulative Percent of CDF
LOSPW	Loss of Off-Site Power due to Weather – Modes 1, 2, 3	6.70E-03	1.45E-06	10.00%	10.00%
RXT1	Reactor Trip – Condenser Available	1.17E+00	9.27E-07	6.40%	16.40%
E7T	Seismic 0.7g Transient Event	9.30E-06	9.22E-07	6.30%	22.70%
LOSPG	Loss of Off-Site Power due to Grid-Related Events – Modes 1, 2, 3	1.00E-02	8.95E-07	6.20%	28.90%
E10T	Seismic 1.0g Transient Event	1.77E-06	8.65E-07	5.90%	34.80%
LOSPP	Loss of Off-Site Power due to Hardware or Maintenance – Modes 1, 2, 3	1.07E-02	8.11E-07	5.60%	40.40%
FLLP	Flood in Turbine Building – LOSP	8.71E-04	6.17E-07	4.20%	44.60%
LACPB	Loss of Train B Essential AC Power (4kV Bus E6)	4.97E-03	6.02E-07	4.10%	48.70%
SGTR	Steam Generator Tube Rupture	3.69E-03	5.88E-07	4.00%	52.70%
FSGBE6	Fire SWGR Room B – Loss of Bus E6	1.00E-03	3.72E-07	2.60%	55.30%
FSGAE5	Fire in SWGR Room A – Loss of E5	1.10E-03	3.66E-07	2.50%	57.80%
E14T	Seismic 1.4g Transient Event	6.00E-07	3.61E-07	2.50%	60.30%
LACPA	Loss of Train A Essential AC Power (4kV Bus E5)	4.96E-03	3.51E-07	2.40%	62.70%
LOC1VS	Interfacing Systems LOCA, RHR Suction Valves Failure – Modes 1, 2, 3	3.28E-06	3.40E-07	2.30%	65.00%
LOC1LG	Large LOCA – at NOT/NOP	7.20E-06	3.38E-07	2.30%	67.30%
LOC1MD	Medium LOCA – at NOT/NOP	6.13E-05	3.32E-07	2.30%	69.60%
LPCCA	Loss of Train A Primary Component Cooling System – Modes 1, 2, 3	1.31E-02	2.67E-07	1.80%	71.40%
LPCCB	Loss of Train B Primary Component Cooling System – Modes 1, 2, 3	1.31E-02	2.66E-07	1.80%	73.20%
LOC1EX	Excessive LOCA – at NOT/NOP	2.66E-07	2.50E-07	1.70%	74.90%
ISI	Inadvertent Safety Injection	2.81E-02	2.47E-07	1.70%	76.60%
LDCPB	Loss of Train B Essential DC Power (125Vdc Bus 11B)	4.41E-03	2.47E-07	1.70%	78.30%
RXT2SD	Reactor Trip - During Shutdown from 20% to 0% (Manual Secondary Control)	7.83E+01	2.13E-07	1.50%	79.80%
FCRAC	Fire in Control Room – AC Power Loss	9.11E-07	2.12E-07	1.50%	81.30%
LOC1SM	Small LOCA – above 300 psig	1.62E-03	1.86E-07	1.30%	82.60%
RXT1NC	Reactor Trip with No Condenser Cooling	1.48E-01	1.72E-07	1.20%	83.80%
LDCPA	Loss of Train A Essential DC Power (125Vdc Bus 11A)	4.41E-03	1.41E-07	1.00%	84.80%
FCRPL	Fire in Control Room – PORV LOCA	4.51E-05	1.41E-07	1.00%	85.80%

Table F.3.1.1.1-1 Dominant Initiating Event Contribution to Core Damage (Continued)

Initiator	Description	Initiating Event Frequency	Contribution to CDF	Percent of CDF	Cumulative Percent of CDF
RXT1SD	Reactor Trip - During Shutdown from 70% to 20% (Auto Secondary Control)	8.03E+01	1.40E-07	1.00%	86.80%
E10A	Seismic 1.0g ATWS	1.77E-06	1.14E-07	0.80%	87.60%
FL2SG	Flood in Turbine Building - LOSP and Loss of Both Vital Switchgear Rooms	1.20E-07	1.13E-07	0.80%	88.40%
E14L	Seismic 1.4g Large LOCA	6.00E-07	1.11E-07	0.80%	89.20%
E7A	Seismic 0.7g ATWS	9.30E-06	1.04E-07	0.70%	89.90%
E10L	Seismic 1.0g Large LOCA	1.77E-06	8.91E-08	0.60%	90.50%

Table F.3.1.1.1-2 Top Basic Events by Risk Reduction Worth

Basic Event	Basic Event Description	RRW	Associated SAMA
FWP37A.FR	Turbine Driven PUMP FW-P-37A fails to run	1.1713	Feedwater & Condensate SAMAs
DGDG1A.FR3	DG-1A fails to run for 24 hours	1.0774	AC Power SAMAs
DGDG1B.FR3	DG-1B fails to run for 24 hours	1.0694	AC Power SAMAs
EDESWG6.FX	4KV BUS E6 fault	1.0442	AC Power SAMAs
ZZ.SY1.FX	Loss of Offsite Power subsequent to plant trip	1.0391	AC Power SAMAs
ZZ.SY2.FX	Loss of Offsite Power subsequent to LOCA initiator	1.0387	AC Power SAMAs
FWP37A.FS1	Turbine Driven Pump TURBINE FW-P-37A fails to start on demand	1.0376	Feedwater & Condensate SAMAs
SEPSDG2A.FR3	1-SEPS-DG-2-B fails to run within 24 hours	1.0324	AC Power SAMAs
SEPSDG2B.FR3	1-SEPS-DG-2-B fails to run within 24 hours	1.0324	AC Power SAMAs
HH.OSEP1.FA	OPERATOR fails to close SEPS breaker from MCB	1.0323	See text Section F.5.1
HH.OHPR3.FA	OPERATOR fails to close SEPS breaker from MCB, given SI signal	1.0307	See text Section F.5.1
RCPCV456B.RS	PORV RC-PCV-456B fails to reseat	1.0300	ECCS SAMAs
EDESWG5.FX	4KV BUS E5 fault	1.0279	AC Power SAMAs
RCPCV456A.RS	PORV RC-PCV-456A fails to reseat	1.0265	ECCS SAMAs
HH.ORWMZ1.FA	OPERATOR minimizes ECCS flow w/ recirc failure	1.0223	See text Section F.5.1
EDESWG11B.FX	DC Power Panel 111B fails to operate	1.0217	DC Power SAMAs
CCTE2271.FZ	PCC Train B Temperature ELEMENT CC-TE-2271 transmits false low	1.0194	Cooling Water SAMAs
CCTE2171.FZ	PCC Train A Temperature ELEMENT CC-TE-2171 transmits false low	1.0192	Cooling Water SAMAs
HH.OLPR2.FA	OPERATOR fails switchover to sump recirc, given MLOCA	1.0180	See text Section F.5.1
HH.OSEP2Q.FA	OPERATOR fails to close SEPS breaker from MCB, given SI signal	1.0178	See text Section F.5.1
HH.OLPR1.FA	OPERATOR fails switchover to sump recirc, given LLOCA	1.0178	See text Section F.5.1

Table F.3.1.1.1-2 Top Basic Events by Risk Reduction Worth (Continued)

Basic Event	Basic Event Description	RRW	Associated SAMA
HH.OTSI3.FA	OPERATOR fails to terminate SI from E-3, given SGTR	1.0166	See text Section F.5.1
HH.ORHPI2.FA	OPERATOR restores HPI, given recovery w/ SI	1.0152	See text Section F.5.1
HH.OSUFP1.FA	OPERATOR fails to start SUFP	1.0151	See text Section F.5.1
FWV156.FC	SUFP to EFW Header MOV FW-V-156 fails to open on demand	1.0144	Feedwater & Condensate SAMAs
FWV163.FC	SUFP to EFW Header MOV FW-V-163 fails to open on demand	1.0144	Feedwater & Condensate SAMAs
HH.OFB1C.FA	OPERATOR fails to establish feed & bleed cooling	1.0143	See text Section F.5.1
SWV5.FO	SW Secondary Isolation MOV SW-V-5 fails to close on demand	1.0142	Cooling Water SAMAs
EDESWG11A.FX	DC Power Panel 111A fails to operate	1.0142	DC Power SAMAs
HH.OFCR5.FL	OPERATOR fails to restore AC Power from RSS, before RCP Seal LOCA	1.0141	See text Section F.5.1
DGP115A.FS	DG-1A Engine Driven LUBE OIL PUMP fails to run	1.0136	AC Power SAMAs
DGDG1A.FS	DG-1A fails to start on demand	1.0132	AC Power SAMAs
CCE17B.GL	Train B HX E-17B Excessive Leakage During Operation	1.0119	Cooling Water SAMAs
EDEB1B.FP	Battery EDE-B-1B failure on demand	1.0119	DC Power SAMAs
DGDG1A.FR2	DG-1A fails to run for 6 hours	1.0116	AC Power SAMAs
CCE17A.GL	Train A HX E-17A Excessive Leakage During Operation	1.0115	Cooling Water SAMAs
DGDG1A.FR1	DG-1A fails to run for first hour	1.0113	AC Power SAMAs
DGP115B.FS	DG-1B Engine Driven Lube Oil Pump fails to start on demand	1.0111	AC Power SAMAs
FWP161.FS	Startup Prelube Oil Pump FW-P-161 fails to start on demand	1.0110	Feedwater & Condensate SAMAs
HH.ORHPI1.FA	OPERATOR restores normal charging, given recovery w/o SI	1.0107	See text Section F.5.1
DGDG1B.FS	DG-1B fails to start on demand	1.0107	AC Power SAMAs

Table F.3.1.1.1-2 Top Basic Events by Risk Reduction Worth (Continued)

Basic Event	Basic Event Description	RRW	Associated SAMA
HH.OSEP1Q.FA	OPERATOR fails to close SEPS breaker from MCB	1.0095	See text Section F.5.1
DGDG1B.FR1	DG-1B fails to run for first hour	1.0091	AC Power SAMAs
SEPSDG2A.FS	SEPS DG1 fails to start on demand	1.0089	AC Power SAMAs
SEPSDG2B.FS	SEPS DG2 fails to start on demand	1.0089	AC Power SAMAs
HH.OSGLT1.FA	OPERATOR maintains long term control of SG cooling, given TRANS	1.0088	See text Section F.5.1
FWP37B.FS	Motor Driven PUMP FW-P-37B fails to start on demand	1.0088	Feedwater & Condensate SAMAs
DGDG1B.FR2	DG-1B fails to run for 6 hours	1.0080	AC Power SAMAs
DGP38A.FS	DG Fuel Oil Transfer Pump DG-P-38A fails to start on demand	1.0079	AC Power SAMAs
HH.OCSTM2.FL	OPERATOR establishes makeup to CST using CT Port. Pump	1.0076	See text Section F.5.1
SWV4.FO	SW Secondary Isolation MOV SW-V-4 fails to close on demand	1.0073	Cooling Water SAMAs
HH.OCSTM1.FA	OPERATOR establishes makeup to CST for Long Term SG Cooling	1.0069	See text Section F.5.1
CBSV8.FC	RHR Train A Suction from CRS MOV CBS-V-8 fails to open on demand	1.0068	ECCS SAMAs
ZZ.RCCA.FP	Control Rod Assembly fail to insert due to mechanical binding	1.0068	ATWS SAMAs
RCPCV456A.FC	PORV RC-PCV-456A fails to open on demand	1.0066	ECCS SAMAs
FWP113.FS	Startup Feed PUMP FW-P113 fails to start on demand	1.0066	Feedwater & Condensate SAMAs
HH.ODC121.FL	OPERATOR fails to shed DC loads to extend battery lifetime	1.0065	See text Section F.5.1
HH.ORHCD7.FA	OPERATOR cools/dep. RCS for RHR S/D cooling, for SGTR w/ OSGRD	1.0065	See text Section F.5.1
HH.OSGLT7.FL	OPERATOR fails long term control of RCS inventory & SG cooling	1.0064	See text Section F.5.1
DGP38B.FS	DG Fuel Oil Transfer Pump DG-P-38B fails to start on demand	1.0064	AC Power SAMAs
ZZ.EDEACBA54.FO	DG-1A Output Breaker to Bus E5 fails to close on demand	1.0062	AC Power SAMAs
HH.RDGL2Q.FL	OPERATOR fails to locally reset breakers & start pumps	1.0057	See text Section F.5.1

Table F.3.1.1.1-2 Top Basic Events by Risk Reduction Worth (Continued)

Basic Event	Basic Event Description	RRW	Associated SAMA
ZZ.EDELOADBBK.FC	4KV Load Supply BREAKER fails to open on demand	1.0057	AC Power SAMAs
ZZ.EDE4KLOADB.FX	4KV Load faults (3 normally operating pumps)	1.0057	AC Power SAMAs
RCPCV456B.FC	PORV RC-PCV-456B fails to open on demand	1.0054	ECCS SAMAs
ZZ.2PORV.NOCRI	PROB(UET), given 2 PORVs & 3 SVs available, w/o Control rod insertion	1.0051	ATWS SAMAs
EPSE6PR1.FX	EPS Train B Relay PR1 (auto DG start) fails to close	1.0051	AC Power SAMAs
EPSE6PR1X.FX	EPS Train B Relay PR1 (auto DG start) fails to close	1.0051	AC Power SAMAs
ZZ.EDEACBA74.FO	DG-1B Output Breaker to Bus E6 fails to close on demand	1.0050	AC Power SAMAs
FWPCV4326.FC	1-FW-PCV-4326 SUFP Recirc fails to open on demand	1.0050	Feedwater & Condensate SAMAs

F.3.1.1.2 Level 1 and 2 PRA Model Changes

The major Level 1 and 2 changes incorporated into each revision of the Seabrook PRA model are discussed below. Seabrook Station maintains and updates a combined Level 1 and Level 2 model. A Level 3 model was developed to support the SAMA analysis. The Level 3 model is discussed in Section F.3.4.

Seabrook PRA Model History

PRA Model Update	Internal & External Events Full Power Results		Comments
	CDF	LERF	
1983	2.3E-04	-	Original SSPSA model
1986	2.9E-04	-	First update to model
1989	1.4E-04	-	Update to IE and CCF modeling
1990	1.1E-04	2.2E-07	Updated to support IPE
1993	8.0E-05	1.6E-08	Updated to support IPEEE, data
1996	4.3E-05	3.7E-08	Updated initiating event models, data
1999	4.6E-05	5.1E-08	Updated top event modeling and incorporated plant changes, data
2000	4.6E-05	5.1E-08	Restructure modeling of train-related top events
2001	4.8E-05	5.1E-08	Updated initiating event models
2002	4.5E-05	6.8E-08	Updated to address peer review comments, data
2004	3.0E-05	1.0E-07	Updated to incorporate plant changes and improve event sequence models/diagrams
2005	1.4E-05	1.1E-07	Updates to improve PRA quality for success criteria, HRA, Seismic, and Level 2 PRA
2006	1.44E-05	1.2E-07	Updated modeling of initiating events, split fractions. Also updated shutdown PRA model.

<u>Seabrook Station 1983 Update (SSPSA – PLG-0300)</u>

In December 1983, a full scope Level 3 PSA was completed for Seabrook Station. The purpose of the Seabrook Station Probabilistic Safety Assessment (SSPSA) was to provide a base line risk assessment and an integrated plant and site model for use as a risk management tool. The study was provided to the NRC and the public for information in January 1984.

The key findings of the SSPSA were:

- The mean severe core damage frequency was 2.3E-04 events per reactor year.

- Both the societal and individual risk provisions of the NRC safety goals were met by wide margins; therefore, the risk to public health and safety was estimated to be extremely small.
- Different risk factors were found to have different key contributors. Interfacing systems Loss of Coolant Accident (LOCA) events and, to a lesser extent, seismically-induced transient events with failure of containment isolation were the principal contributors to early risk. The contributors to core melt frequency and latent risk comprised a large group of initiators, including loss of off-site power, transient events, fires, and seismic events. A common event in many dominant sequences and in more than two thirds of the total severe core damage frequency was the reactor coolant pump seal LOCA.
- The dominant contributors to severe core damage frequency were support system faults, external events, and internal hazards that affected both the core cooling and containment heat removal systems. As a result, a major fraction of the severe core damage frequency, about 73 percent, was associated with sequences in which long- term containment over-pressurization was indicated.
- Only about 1percent of the core melt frequency was associated with early containment failure or bypass. This percentage is more than 30 times less than that assumed in the Reactor Safety Study for PWR plants. Its low value is the result of the high strength of the Seabrook Station containment as determined by more detailed analysis.
- In contrast with previous PSA containment analyses, the time of containment over-pressurization due to failure to remove decay heat was found to be very long (several days instead of several hours).

<u>Seabrook 1986 Update (SSPSS-1986)</u>

This update was the first effort to update the entire PSA to reflect the plant configuration as of mid-1986. A number of changes had been made from the SSPSA to this study to reflect changes in the plant design from 1983 to 1986 and to accommodate model changes and enhancements in documentation. Significant changes are listed below:

<u>Plant Changes</u>:.

- Technical Specifications - The allowed outage times were changed for a number of systems, including Service Water System and Primary Component Cooling Water System (the standby pumps are now in the Technical Specifications), ECCS (AOT extended from 72 hours to 7 days), Emergency Feedwater System (startup feed pump was included along with 2 EFW pumps), containment on line purge valves (allowed open time changed from 1,000 hr per year to unlimited duration but open only within guidelines).

- IST Pump Test Frequency - For all safety pumps except EFW pumps, the test frequency was extended from monthly to quarterly.
- Startup Feed Pump - The startup feed pump became self-cooled, rather than cooled by Secondary Component Cooling Water (SCC); tested monthly with other EFW pumps.
- Turbine Driven EFW Pump - New AOVs were added to the steam admission lines to the turbine driver.
- Atmospheric Relief Valves - ARVs were modified to be powered by instrument air with gas accumulator backup rather than electro-hydraulic.
- Boron Injection Tank and Associated Recirculation Pump and Bypass Line - These components were removed.
- Enclosure Building Air Handling System - New one out of two standby fans were added in the RHR vault return flow path.
- Reactor Trip Breakers - Shunt trip coil became actuated by the automatic trip signal as well as the UV device.
- RCP Thermal Barrier Cooling System - The design was finalized, including several manual valves not in the SSPSA model.

Model Changes:

- Event Tree Qualification - The documentation and traceability of the event tree split fractions back to systems and operator action were enhanced by the use of unique split fraction identifiers. Also, the method for binning event tree quantification was better documented.
- Seismic Analysis - The seismic fragilities of important components to the seismic risk were reanalyzed based on actual seismic qualification reports.
- Systems Analysis - Quantification was done using RISKMAN 3 software. This enhances the traceability of the systems analysis back to the data as well as improves transcription errors.
- Systems Analysis - Common cause treatment was expanded in this study to include more than two components failing together in common cause.

Other parts of the risk model - data, human action, containment, and consequence analyses - were unchanged from the original SSPSA model.

Seabrook Station1989 Update (SSPSS-1989)

This update revised the 1986 update with plant changes made through July of 1989. This update also included enhanced system modeling, advanced PC based software, and the containment failure/source term enhancements.

The results of this study indicated a reduction in the core damage frequency by a factor of approximately two from the original SSPSA results due to the changes listed below. However, the importance of the RCP seal LOCA remains the same - contributing 70 percent of the core damage frequency total. The estimate of early containment failure was decreased by a factor of 5 to 0.2 percent of the core damage frequency. This change was due to the incorporation of containment failure and source term enhancements.

This update included the following significant changes from the 1986 update:

No significant plant design changes that impacted the risk model were found.

Model Changes:

- Initiating event frequencies were updated with data through 1987.
- Common cause and maintenance distributions were updated based on additional industry data.
- RISKMAN Release 2 software was used for system and plant models.
- Electric power recovery model was updated with current power recovery data.
- Recovery actions were integrated into the event tree model via a recovery tree at the end of the plant model.

Seabrook Station 1990 Update (SSPSS-1990)

This update replaced the 1989 update, and included plant changes through July 1990. The results were summarized in the IPE Report. The significant changes are described below:

Plant Changes:

- An ATWS Mitigation System was implemented which provides a diverse turbine trip and EFW actuation signal. This hardware update and an update of the ATWS analysis based on WCAP 11993 were included in this update.

Model Changes:

- Electric power recovery model was updated based on more current PSNH-specific data for recovery of 345 kV grid, update of off-site power data, battery lifetime analysis update, and an update of the RCP seal LOCA analysis.
- RISKMAN Release 2 software was used to create a fully-integrated plant containment model from initiating event to release category.
- New recovery actions were added (OS, Signal Failure Recovery and RM, RWST makeup).
- Present recovery actions were moved in plant model - EFW recovery and SWS recovery were added to the event trees.

- Containment event tree was updated to explicitly model Induced Steam Generator Tube Rupture and Direct Containment Heating.

Seabrook Station 1993 Update (SSPSS-1993) - IPEEE

This update replaced the 1990 update, with plant changes through the end of the second cycle, November 1992. A number of changes were made to the model. A summary of changes is given below.

No significant plant design changes that impacted the risk model were made.

Model Changes:

- Seabrook Station-specific data were included for the main safety pumps and the diesel generators.
- Control Room Fire - operator actions were modeled in more detail, as part of the IPEEE analysis.
- New fire hazard Initiating Events were added to the plant model.
- Event Tree Modeling - the event tree logic was streamlined, corrected in some cases, and placed almost exclusively in the logic rules.
- StartUp Feed Pump was modeled conservatively to always require manual start.
- Modeling of High Pressure Injection (HPI) was expanded to include separate top events for all four HPI pumps.

Seabrook Station 1996 Update (SSPSS-1996)

This update replaced the 1993 update, with plant changes through the end of the fourth cycle, January 1996. A number of changes were made in the model. A summary of changes is given below.

Plant Changes:

- The ATWS Mitigation System modification was completed during this update period. A component level fault tree model of AMS was added.
- Revised the ATWS model to account for 24-month fuel cycle.

Model Changes:

- Seabrook Station-specific data were included for the main safety pumps and the diesel generators.
- Upgraded the RISKMAN software to Release 8.0.
- Expanded the system fault trees to more accurately model systems (additional components and more realistic alignments for normally operating systems).
- Additional and expanded initiating event models based on loss of trains of support systems.

- Expanded several initiating event models from a single value to a fault tree.
- Combined transient initiators into two.
- More accurate modeling of ventilation.

Seabrook Station 1999 Update (SSPSS-1999)

This update replaced the 1996 update, with plant changes through the end of the sixth cycle, March 1999.
Plant Changes:

- Alternate cooling modification (ALT) to provide charging pump cooling in the event of loss of PCCW, was completed during this update period. A component level fault tree model of ALT was added.
- Revised ATWS model to account for 18-month fuel cycle.

Model Changes:

- Added an explicit top event (SEAL) in the General Transient tree to model the sizes of RCP seal LOCAs and the impact on sequence timing.
- Added new top event in the General Transient tree to model recovery of PCCW, EDGs, and off-site power. These series of top events replace the off-line electric power recovery model.
- Component failure rates associated with reactor trip breaker model were updated to a more current generic data source.
- Initiating event frequencies were updated with plant-specific data and updated to a more current generic data source.
- Plant specific data were gathered and used to update generic distributions for major pumps and SWS motor-operated valves.
- The mission time for EFW was changed from 24 hours to 9 hours to be consistent with UFSAR analysis.
- Air handling dampers in the charging pump cubicles were moved from the air- handling model to the charging-pump A/B model because they impact a single pump.
- Changes were made to operator action quantification and to event tree rules to more carefully model operator dependencies.
- The common cause failure (CCF) modeling for SWS and PCCW system initiators was revised to change the mission time for CCF terms to 1 year and by generating new CCF parameters.

Seabrook Station 2000 Update (SSPSS-2000)

This update replaced the 1999 update. This minor update to SSPSS-1999 was based on conversion of the RISKMAN model from Version 9.2 (DOS-based) to Version 3.0 (Windows-based). The change in software allowed lower truncation limits in solving fault trees, which resulted in some slight increases in the results for SWS and PCCW systems. Also, the system-model structure in RISKMAN was modified to support migrating the model to the Safety Monitor for on-line maintenance evaluations.

No significant plant design changes that impacted the risk model were made.

Model Changes:

The structure for two train top events was revised so that only the system top event contains the fault tree, common cause modeling, and alignment definitions. Train-level top events were redefined as conditional split fractions, based on system level split fractions. This did not change the system results, but supported the migration of the model to the Safety Monitor.

Seabrook Station 2001 Update (SSPSS-2001)

This update replaced the 2000 update. This minor update to the SSPSS-2000 was made to incorporate changes to support export to the Safety Monitor. No significant plant design changes that impacted the risk model were made.

Model Changes:

Minor changes were made to the system initiator models.

Seabrook Station 2002 Update (SSPSS-2002)

This updatereplaced the 2001 update, with plant changes through the end of the eighth cycle, June 2002. No significant plant design changes that impacted the risk model were made.

Model Changes:

Modeling and documentation changes were made, many to close out Peer Review comments. These included operator action analysis (e.g., adding a dependency matrix for actions), systems analysis (e.g., expanding the SWS alignment model to include one train on ocean, one train on cooling tower), and event tree analysis (e.g., added steam line break initiators and event tree logic).

Seabrook Station 2004 Update (SSPSS-2004)

This update replaced the 2002 update, with plant changes through the end of the ninth cycle, December 2004.

Plant Changes:

- Addition of Supplemental Electric Power System (third emergency diesel generator).
- Startup Feedwater Pump normal alignment changed from Bus 4 to Bus E5.

Model Changes:

Modeling and documentation changes were made to improve the quality and usefulness of the PRA. The following were the most significant changes:

- Event sequence diagrams for all Mode 1 – 3 sequences were completely redone, with references added to related Emergency Operating Procedure steps and modeled operator action top events.
- The entire human action analysis was revised, using the new event sequence diagrams and the EPRI HRA tool.
- The SGTR event sequence model was entirely revised based on the latest Westinghouse analysis.
- The loss of off-site power model was revised by adding a new initiator to account for grid-related events and updating the off-site power recovery analysis to the latest EPRI report.

Seabrook Station 2005 Update (SSPSS-2005)

This update replaced the 2004 update, with plant changes through the end of cycle 10, April 2005.

Plant Changes:

- SEPS main control board switch and related modifications.
- Power uprate related changes to operator timing from MAAP runs
- DC Battery lifetime was updated to design analysis
- Diesel Generator failure rate and unavailability data

Model Changes:

Modeling and documentation changes were made to improve the quality and usefulness of the PRA. The following were the most significant changes:

- Success criteria update based on a series of MAAP runs
- HRA update with revised sequence timing and other changes
- Revision to operator dependency analysis
- Revision to Plant Operating States for shutdown model
- Major update to seismic PRA
- Major update to Level 2 analysis

Seabrook Station 2006 Update

This update replaced the 2005 update. The 2006 update incorporated changes in the shutdown PRA model based on insights from outage risk management during the Cycle 11 refueling outage. It also made a few minor clean-up changes to the full-power model.

No significant plant design changes that impacted the risk model were made.

Model Changes:

Modeling and documentation changes were made to improve the quality and usefulness of the PRA. The following were the most significant changes:

- Major update to shutdown PRA
- Revision to modeling of PCC and SWS initiators
- Renamed several initiators for clarity in reviewing models
- Revision to SEPS split fraction definitions to account for dependencies with EDGs.

F.3.1.2 EXTERNAL EVENTS

F.3.1.2.1 Internal Fires and Seismic Events

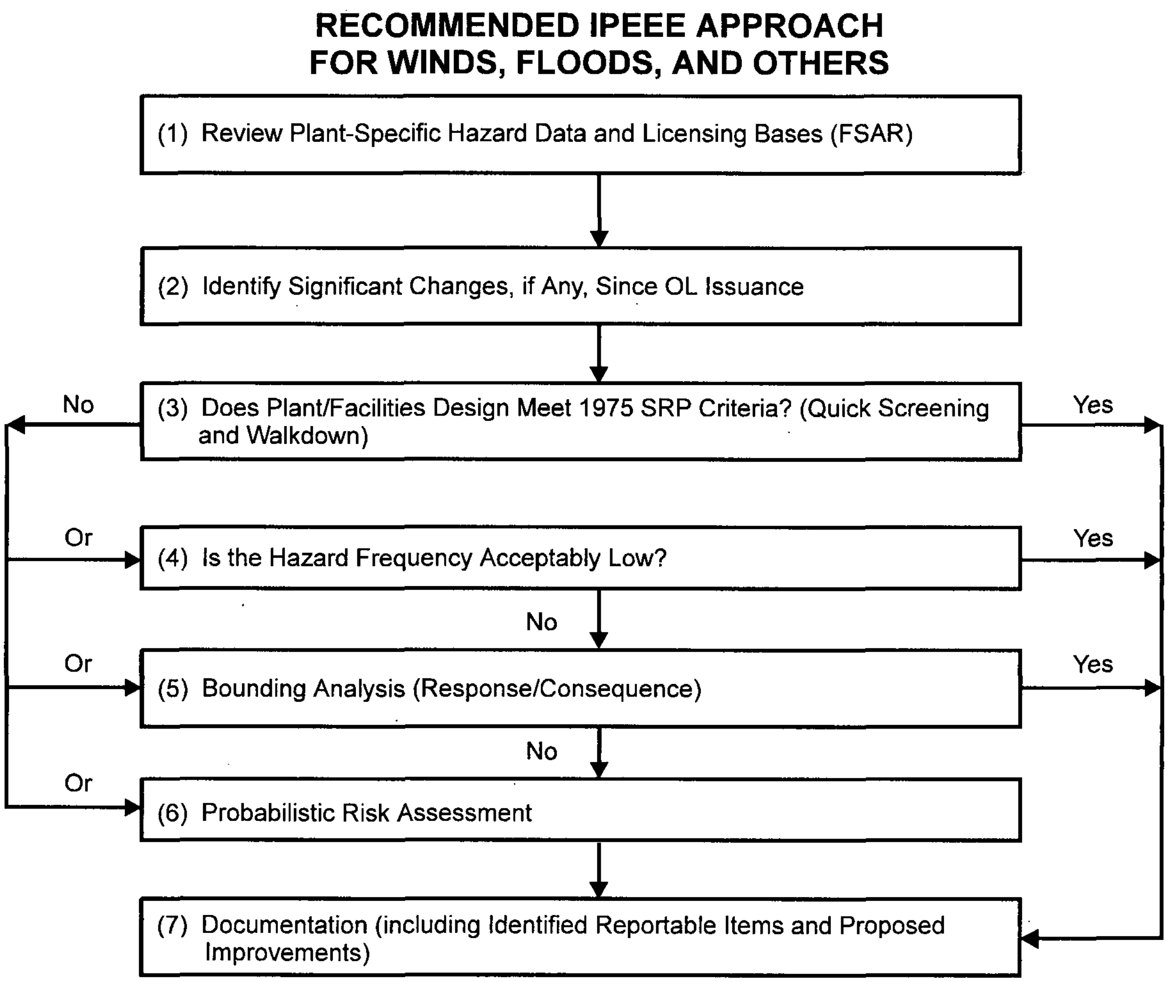
Internal fires and seismic events are explicitly modeled and included in the Seabrook Station PRA model discussed in the previous section.

F.3.1.2.2 Other External Events

NUREG 1407 recommends a screening type approach, as shown in Figure F.3.1.2.3-1 (taken from Figure 5-1 of NUREG-1407). The general methodology used at Seabrook Station follows the approach recommended by NUREG-1407 and consists of the following steps:

- Establishing a list of plant-specific other external events
- Progressive Screening
- Walkdown
- Documentation

FIGURE F.3.1.2.3-1 NUREG-1407 SCREENING APPROACH



Note: Steps 4 through 6 are optional.

Based on the results of the Seabrook Station IPEEE, it was concluded that the plant structures at the site are well designed to withstand the hazards associated with high wind and that no potential vulnerability was identified.

With respect to external flooding, the Seabrook Station plant design meets the 1975 SRP criteria and no plant vulnerabilities were identified. However, the PRA model includes a conservative quantitative assessment of external flooding. The current model considers a storm-related external flood initiating event EXFLSW occurring at a frequency of 1.6E-06/yr. The external flood initiator is assumed to cause failure of the ocean SW pumps. However, the cooling tower SW pumps, which are located in the cooling tower structure and at an elevation higher than the ocean SW pumphouse, remain available following the initiating event. The core damage frequency from this event is ~2E-08/yr. This quantitative assessment supports the conclusion that there are no design vulnerabilities from an external flooding perspective.

The NRC staff concluded, in the Seabrook Station IPEEE SER, that, according to GDC 4, GDC 19, and SRP Section 2.2.3, the Seabrook Station is adequately protected and with acceptable risks with respect to transportation and nearby facility hazards.

Based on a review of the lightning strikes at the site, it was concluded that the impacts of lightning strikes were less severe to Seabrook Station than a complete loss of off-site power. Also, according to Section 2.6 of NUREG-1407, the probability of a severe accident caused by lightning is relatively low. Therefore, lightning is not a significant contributor to core damage frequency for Seabrook Station.

The contribution to the Seabrook Station total CDF from the other external events is less than 1.0E-06 per year, and as concluded in the Seabrook Station IPEEE, there are no vulnerabilities to other external events at Seabrook.

F.3.1.2.3 External Event Severe Accident Risk

An external event severe accident risk assessment is integrated with the internal events risk; the PRA includes both internal and external event risks. This assessment approach provides the means to evaluate SAMAs for both internal and external events simultaneously without the need to separately estimate the impact of the potential improvements on external events.

F.3.2 LEVEL 2 PLANT-SPECIFIC PRA MODEL

The Level 2 PRA model determines release frequency, severity, and timing based on the Level 1 PRA, containment performance, and accident progression analyses.

F.3.2.1 DESCRIPTION OF LEVEL 2 PRA MODEL

The accident sequence analysis defines the manner in which the expected plant response to each identified initiating event or initiating event category is represented and quantified. The analysis considers successes and failures of safety functions and related systems, and human actions to determine whether or not core damage occurs. The result of the Level 1 accident sequence analysis is a set of event trees that represent and quantify the accident sequences.

The Level 2 analysis extends the Level 1 analysis to the release category potential for the Level 1 core damage end states. A containment event tree represents and quantifies the release category potential when evaluated with the Level 1 event trees.

The containment model was significantly revised in the 2005 update to reflect current state-of-the-art understanding of containment phenomena and operator actions directed by Severe Accident Management Guidelines (SAMGs). The basis for this updated model is documented in WCAP-16600, Seabrook Station Probabilistic Risk Assessment: Level 2 PRA Update, Volume 1 and 2, Revision 0, June 2006 (Reference 2). The following is a summary of the Level 2 model from that reference.

The containment model (Level 2) analysis provides the interface between the Plant (Level 1) analysis and the site / consequence (Level 3) analysis by assigning core damage sequences to various release categories. The model defines the various phenomena which potentially could cause containment structural failure and then quantifies the magnitude of the challenge and the resulting probability of containment failure. If failure is predicted, the analysis also determines the mode of failure and the magnitude and timing of the radiological release from the failed containment.

The inputs to the Level 2 analysis are core damage sequences. These sequences are considered in groups of accident sequences that exhibit similar thermal-hydraulic behavior. It is expected that sequences with similar thermal-hydraulic responses would impose similar stresses on the containment. Grouping this way allows the analyst to focus on a limited number of representative sequences instead of the large number of possible Level 1 sequences. The output of the Level 2 analysis is the frequency of Release Categories which define the magnitude and timing of radiological releases from the failed containment.

The mapping of sequences between the Level 1 model and release categories is governed by the CET. The CET top events question the occurrence of certain physical processes and, depending on these occurrences, determine the containment failure or bypass probability from that mechanism. The CET also includes containment-related hardware (spray, isolation) and operator actions, both early and late in the event.

The CET evaluates containment performance. The inputs to the CET are core damage sequences from the Level 1 model. The CET contains the logic regarding the response of the containment to pressure challenges from the various sequences. The CET top event logic primarily represents the occurrence of physical processes, associated containment mitigation systems and operator actions. The containment analysis covers all conceivable failure modes of the containment, including pre-existing leaks, containment bypass sequences, external hazards impacting the structure, and internal loads that have the potential to fail the containment early (shortly after the core melt) or late (many hours after the melt). The Level 2 analysis considers the combined response of the reactor coolant system, containment structure, and engineered safeguards systems. Representative Level 1 sequences are used to evaluate the thermal-hydraulic response of the core and containment in order to determine whether certain phenomena would be expected to occur. The MAAP 4.0.5 severe accident simulation code was used to investigate the severe accident progression for the updated Seabrook Level 2.

The CET is linked directly with the Level 1 event trees to generate the frequencies of each release category bin. These release category bins are defined based on containment failure modes, and distinguish between the size of the release (large vs small) and the timing of the release (early vs late). For reporting purposes, Table F.3.2.1-1 defines the release categories by release type (size, timing) and by containment failure mode. Basic Event Importance for Level 2 basic events that contribute to a large early release frequency (LERF) is provided for information in Table F.3.2.1-2.

Table F.3.2.1-1 Release Category Bin Definition

Release Category Bin	Frequency (per yr)	Bin Description
INTACT	9.13E-06	INTACT – Containment intact with less than Tech. Spec. - allowed leakage (nominal leakage). Includes containment intact with great than Tec. Spec. leakage but less leakage than failure of small containment penetration.
LL3	2.95E-06	LL3 – LARGE, LATE – Vented containment.
SE3	1.04E-06	SE3 – SMALL, EARLY – Small containment penetration leak that may progress to large late failure. Includes contribution of large containment penetration failure to isolate with spray injection/scrubbed release.
SE1	4.67E-07	SE1 – SMALL, EARLY – Early SGTR-initiated core melt with feed to the faulted steam generator.
SE2	3.33E-07	SE2 – SMALL, EARLY – Interfacing LOCA through RHR pump seals (submerged release).
LL5	3.32E-07	LL5 – LARGE, LATE – Basemat melt-through.
LE1	1.10E-07	LE1 – LARGE, EARLY – SGTR-initiated (or pressure-induced tube ruptures) core melt with NO feed to faulted steam generator (failure of EFW/SUFP or operator does not restore flow). Includes contribution from thermally-induced SGTR.
LL4	7.47E-08	LL4 – LARGE, LATE – Long-term containment overpressure failure. Includes contribution of small, late containment failure.
LE2	4.01E-09	LE2 – LARGE, EARLY – Interfacing LOCA with RHR pipe rupture (V-sequence)
LE3	9.71E-10	LE3 – LARGE, EARLY – Failure of large containment penetration to isolate (COP valves) or large pre-existing leakage.
Total	1.44E-05	Core Damage Frequency (CDF)

Table F.3.2.1-2 Basic Event Importances for Total Plant LERF by Risk Reduction Worth

Basic Event	Description	BE Risk Reduction	Associated SAMA
CBSV11.FC	CBS Pump P-9A Discharge MOV CBS-V-11 fails to open on demand	1.0215	Containment SAMAs
CBSV17.FC	CBS Pump P-9B Discharge MOV CBS-V-17 fails to open on demand	1.0210	Containment SAMAs
DGDG1A.FR2	DG-1A fails to run for 6 hours	1.0086	AC Power SAMAs
DGDG1A.FR3	DG-1A fails to run for 24 hours	1.0103	AC Power SAMAs
DGDG1A.FS	DG-1A fails to start on demand	1.0052	AC Power SAMAs
DGDG1B.FR2	DG-1B fails to run for 6 hours	1.0087	AC Power SAMAs
DGDG1B.FR3	DG-1B fails to run for 24 hours	1.0083	AC Power SAMAs
DGDG1B.FS	DG-1B fails to start on demand	1.0051	AC Power SAMAs
FWP37A.FS2	Turbine Driven Pump FW-P-37A fails to start on demand	1.0091	Feedwater & Condensate SAMAs
FWP37B.FS	Motor Driven Pump FW-P-37B fails to start on demand	1.0913	Feedwater & Condensate SAMAs
FWV70.FC	MDP Discharge Check Valve FW-V-70 fails to open on demand	1.0075	Feedwater & Condensate SAMAs
RCPCV456A.FC	PORV Train A Spray Valve fails to open on demand	1.0055	Depressurization SAMAs
RCPCV456B.FC	PORV Spray Valve Train B fails to open on demand	1.0054	Depressurization SAMAs
COTK25.RT	Condensate Storage Tank CO-TK-25 ruptures/excessive leakage dur	1.0189	SAMA 162
DGP115A.FS	DG-1A Engine Driven Lube Oil Pump fails to start on demand	1.0054	AC Power SAMAs
DGP115B.FS	DG-1B Engine Driven Lube Oil Pump fails to start on demand	1.0052	AC Power SAMAs
FWP113.FR	Startup Feed Pump FW-P113 fails to run	1.0190	Feedwater & Condensate SAMAs
FWP113.FS	Startup Feed Pump FW-P113 fails to start on demand	1.0510	Feedwater & Condensate SAMAs
FWP161.FS	Startup Prelube Oil Pump FW-P-161 fails to start on demand	1.0886	Feedwater & Condensate SAMAs
FWP37A.FR	Turbine Driven Pump FW-P-37A fails to run	1.4231	Feedwater & Condensate SAMAs

Table F.3.2.1-2 Basic Event Importances for Total Plant LERF by Risk Reduction Worth (Continued)

Basic Event	Description	BE Risk Reduction	Associated SAMA
FWP37A.FS1	Turbine Driven Pump Turbine FW-P-37A fails to start on demand	1.0796	Feedwater & Condensate SAMAs
FWP37B.FR	Motor Driven Pump FW-P-37B fails to run	1.0426	Feedwater & Condensate SAMAs
FWPCV4326.FC	1-FW-PCV-4326 SUFP Recirc fails to open on demand	1.0387	Feedwater & Condensate SAMAs
FWV127.CL	Manual Valve FW-V-127 transfers closed	1.0142	Feedwater & Condensate SAMAs
FWV156.FC	SUFP to EFW Header MOV FW-V-156 fails to open on demand	1.1186	Feedwater & Condensate SAMAs
FWV163.FC	SUFP to EFW Header MOV FW-V-163 fails to open on demand	1.1186	Feedwater & Condensate SAMAs
FWV347.OP	MDP Recirc MOV FW-V-347 transfers open (flow diversion)	1.0317	Feedwater & Condensate SAMAs
FWV71.CL	MDP Discharge VALVE FW-V-71 transfers closed	1.0142	Feedwater & Condensate SAMAs
HH.ODDSG1.FA	OPERATOR Fails to Diagnose SG Rupture Event	1.0291	See text Section F.5.1
HH.OIMSV1.FA	OPERATOR fails to isolate MS valves from ruptured SG	1.0113	See text Section F.5.1
HH.ORHCD7.FA	OPERATOR cools/dep. RCS for RHR S/D cooling; for SGTR w/ OSGRD	1.0310	See text Section F.5.1
HH.ORWCD1.FA	OPERATOR depressurizes RCS to minimize leakage w/ recirc failure	1.0099	See text Section F.5.1
HH.ORWIN1.FA	OPERATOR initiates makeup to RWST; given LOCA w/ recirc failure	1.0075	See text Section F.5.1
HH.ORWLT1.FA	OPERATOR maintains stable plant conditions w/ long term makeup	1.0057	See text Section F.5.1
HH.ORWMZ1.FA	OPERATOR minimizes ECCS flow w/ recirc failure	1.0621	See text Section F.5.1
HH.OSEP2.FA	OPERATOR fails to close SEPS breaker from MCB; given SI signal	1.0102	See text Section F.5.1
HH.OSGRC1.FA	OPERATOR fails to cool down RCS (SGTR)	1.0060	See text Section F.5.1
HH.OSGRD1.FA	OPERATOR fails to Depressurize RCS to Stop Break Flow from Rupture	1.0156	See text Section F.5.1
HH.OSIG3.FA	OPERATOR fails to manually actuate HPI pumps; given SLOCA w/ ES	1.0276	See text Section F.5.1

Table F.3.2.1-2 Basic Event Importances for Total Plant LERF by Risk Reduction Worth (Continued)

Basic Event	Description	BE Risk Reduction	Associated SAMA
HH.OSIG7.FA	OPERATOR fails to manually initiate SI signal; given SLB w/ SSP	1.0053	See text Section F.5.1
HH.OSIG8.FA	OPERATOR fails to manually close MSIV & start HPI pumps	1.0266	See text Section F.5.1
HH.OSUFP2.FA	OPERATOR fails to start on demand SUFP; given SI initiator	1.0517	See text Section F.5.1
HH.OTEFW3.FA	OPERATOR Fails to Terminate EFW Feedflow to isolate ruptured SG	1.0071	See text Section F.5.1
HH.OTSI3.FA	OPERATOR fails to terminate SI from E-3; given SGTR	1.0861	See text Section F.5.1
HH.XOEFW1.FA	Operator establishes feed flow to faulted SG	1.1873	See text Section F.5.1
MSV395.FC	Steam Admission Valve MS-V-395 fails to open on demand	1.0056	See text Section F.5.1
ZZ.RCCA.FP	Control Rod Assembly fail to insert due to mechanical binding	1.0184	ATWS SAMAs
ZZ.SY2.FX	Loss of Offsite Power subsequent to LOCA initiator	1.1777	AC Power SAMAs

F.3.2.2 LEVEL 2 PRA MODEL CHANGES SINCE IPE SUBMITTAL

The major Level 2 changes incorporated into each revision of the Seabrook Station PRA model are provided in Section F.3.1.1.2.

F.3.3 MODEL REVIEW SUMMARY

Regulatory Guide (RG) 1.174 (Reference 24), Section 2.2.3, states that the quality of a PRA analysis used to support an application is measured in terms of its appropriateness with respect to scope, level of detail, and technical acceptability, and that these are to be commensurate with the application for which it is intended.

The PRA technical acceptability of the model used in the development of this SAMA application has been demonstrated by a peer review process. The initial certification peer review was conducted in 1999 under the direction of the [former] Westinghouse Owner's Group. An additional focused peer review was conducted in 2005, which assessed the Seabrook PRA against the ASME Standard.

The overall conclusions of the peer review were:

- All of the technical elements were sufficient to support applications requiring the capabilities defined for grade 2. The Seabrook Station PRA provides an appropriate and robust tool to support such activities as Maintenance Rule implementation, supported as necessary by deterministic insights and plant expert panel input.

- All of the elements were determined sufficient to support applications requiring the capabilities defined for grade 3, e.g., risk-informed applications supported by deterministic insights, but in some cases this is contingent upon implementation of recommended enhancements.

After the peer review, the preliminary Category A and B facts and observations that potentially impacted the model were dispositioned and incorporated into the updated PRA model. All Category A and B facts and observations (F&O) were implemented. The PRA model has since undergone additional revision, but the incorporated resolution of Category A and B F&O has been maintained. The Seabrook Station Category A and B F&O and resolutions are summarized below.

F&Os from the 1999 Certification Peer Review

F&O 1

Summary: The frequencies of initiators L2CCA and L2CCB are under estimated due to the common cause model. The common cause term should include T=1 year (rather than 24 hours).

Resolution: Changes were made to the CCF models in PCC and SWS initiators to use 1 year as the mission time.

F&O 2

Summary: The existing analyses for ISLOCA should be reviewed for consistency with a methodology for identification and quantification of ISLOCA pathways such as that provided in NUREG/CR-5744, and updated if appropriate.

Resolution: Reviewed NUREG/CR-5744 for ISLOCA methodology and revised the ISLOCA assessment.

F&O 3

Summary: Within the SBO sequence, operation of turbine-driven EFW pump beyond the 8-hour battery life has been modeled. This implies considerable reliance on the turbine-driven EFW pump operating in manual control without benefit of SG level instrumentation. This is not consistent with industry practice unless operators practice and are comfortable with the associated procedures. The ability of the operators to successfully cool the core using this pump without underfeeding the SG, resulting in undercooling of the core and eventual core damage, or overfeeding the SG, resulting in water carry-over to the EFW pump turbine, and its subsequent failure, should be addressed.

Resolution: Battery lifetime was recalculated, going back to the electrical calculations. The 4-hour value is well established; aggressive load shedding and cross tie can provide battery power out beyond 12 hours.

The time to core uncovering at 12 hours was calculated. The total time (battery + TCU) was used as the maximum available time.

F&O 4

Summary: The emergency diesel generator recovery failure probability seems optimistic for the medium RCP seal LOCA event. The data for recovery of an EDG is based on data taken from LERs based on EDG failures. This data is used to develop a recovery curve. However, this recovery is applied in conditions very different than the conditions in the LER - common cause failure of both EDGs resulting in SBO conditions. The EDG recovery is based on generic data composed of EDG single failures during normal operation. This data needs to be reviewed to ensure applicability to CCF events, particularly events during more adverse SBO conditions (i.e., where stress, crew availability, and so forth, are more limiting). In addition, plant-specific evidence should be used to support this recovery probability.

Resolution: Evaluated Seabrook Station EDG failure data. Of the four failures, two could easily be recovered within 4 hours. The other two failures were considered long-term failures. Based on SB data, a non-recovery probability of 0.5 was used for DG recovery.

F&O 5

Summary: The small LOCA event sequence includes credit for refilling the RWST to allow continued high pressure injection if the RHR pumps fail and AC power and secondary side cooling are available. The credit appears to be considerable, with an operator failure probability of approximately of 0.01. If the action is successful, the sequence is considered successful. There is little detail regarding the time available to perform this action. Few PSAs take credit for this. The scenario implies an indefinite (or at least undefined) period of operation in this mode, and might require additional refilling or other mitigative actions later on. These actions may be expected and realistic (although it appeared to the reviewers that this contradicts the operator action description provided in the HRA section); however, such credit may not be appropriate without extending the entire PRA model to include severe accident management issues, procedures, and guidance, and/or adjusting the mission times for functions such as secondary side cooling to match the required mission time (if it can be defined) for injection.

Evaluate the impact of credit for RWST refill in the PRA model. Consider either revising the model to not credit this action (or to properly account for the potential ramifications noted above), or including a sensitivity case with each PRA update to identify the effects of this credit. If retained, provide additional documentation as to the feasibility of this action, based on thermal hydraulic analysis and procedural compliance.

Resolution: The event tree top event for reactor water makeup-long term (RMLT) was deleted from the event tree because of the concern for operator dependencies. For event tree top event reactor makeup (RM), a detailed dependency analysis was performed, including RM, to assure that multiple operator actions were not included inappropriately.

F&O 6

Summary: Following a large break LOCA, the operator action and hardware required to isolate the RWST-to-RHR-pump suction valves is not modeled. (Opening of the sump-to-RWST suction on low-low RWST level is automatic but closure of the RWST valves is not.) Justification was not provided for this assumption.

Resolution: Reviewed design basis information to understand when the operator action is required. Evaluated a new operator action for sump recirculation switchover for a large LOCA using the EPRI HRA Tool. Added new rule to the LOCA event tree to require this action for successful large LOCA sequences.

F&O 7

Summary: The EFW mission time is defined as 9 hours, but no justification is provided to "stop" the scenario at a successful end state prior to the traditional 24-hour mission time. No calculation was found to justify availability of EFW supply for 24 hours, and there is no modeling (or evaluation of the adequacy) of alternative decay heat removal beyond 9 hours. Ensure that the accident sequences adequately address 24-hour mission time, preferably either using thermal hydraulic calculations or explicit PRA modeling.

Resolution: The EFW mission time basis was reviewed and additional documentation was added to the PRA to support the use of 9 hours for the mission time.

F&O 8

Summary: Continued operation of the RCPs is credited for the small LOCA scenario. The EOP directs the operators to trip RCPs if RCS subcooling is less than 40°F. Is there a calculation for the PRA that determines the subcooling? If not, then it is possible that the RCPs would need to be tripped during this scenario, with the need to be re-started if credited later in scenario; however, RCP hardware failures are not modeled. Re-evaluate the success criteria for and modeling of continued RCP operation in this scenario, and add RCP hardware failures to the analysis if appropriate.

Resolution: The only impact of RCPs in the small LOCA model is on top event OLR - RHR shutdown cooling. Failure of OLR leads to sump recirculation. RCPs may need to be tripped depending on the size of the small LOCA (based on the 40°F subcooling criterion). However, if the operator successfully depressurizes and cools down the primary system (OLR), subcooling should be restored. The EOPs instruct the operator to restart the RCPs given subcooling is restored. The RCPs are modeled through top event OG, offsite power available, since they are powered from Bus 1 & 2 (non-emergency powered). Only one of four RCPs is needed for adequate flow. Thus, as long as power is available, the hardware failure is insignificant in comparison to the operator failure rate in OLR.

F&O 9

Summary: The model includes credit for "automatic bleed and feed" cooling following a loss of secondary side heat removal, as long as both charging pumps are available. The basis for its usage in the Seabrook Station PRA is a calculation which has relatively simplistic T&H analysis, which does not address potential factors such as eventually filling the RCS via the charging pumps, leading to water relief from the PORVs (thereby significantly reducing heat removal capability via latent heat); increasing containment back-pressure (thereby affecting the flow rate through the PORVs); or the potential for resultant high containment humidity and temperatures to affect the automatic control features that are being relied upon in this scenario. If credit for automatic bleed and feed is to be taken in the models, a more thorough analysis should be done, addressing potential environmental, control system, thermal-hydraulic, and other factors that could affect the decay heat removal capability being credited.

Resolution: Credit for auto feed and bleed was removed from the PRA model.

F&O 10

Summary: Room cooling - the assumption of a greater-than-5-hour heat-up as acceptable should have a clearer basis. This appears to be potentially important in at least one set of cases (switchgear, battery room, electrical tunnels), where the exclusion of room cooling is on the basis of an ~ 6-hour heat-up time.

Consider tying any screening value to a more physical basis, such as timing of operator (NSO) rounds. Consider investigating the relative importance of room cooling for cases in which the estimated timing is close to the screening value.

Resolution: Evaluated the background for 6-hour room heatup. Regarding the NSO rounds/actions, multiple MCB alarms would have to fail for this event to go undetected. Once detected the MCB Dpoint alarm procedure directs action.

F&O 11

Summary: The values for BETA2, GAMMA2, and DELTA2 are not derived as recommended in NUREG/CR-5485 as stated in the text. That document (p.76) recommends that "the values of $_{2}$, $_{3}$, and $_{4}$ in Table 5-11 be reduced by a factor of 2 when applied to frequency of failure during operation." The effect of reducing theses values (and adding the difference to *1) is to reduce only the Beta factor - the gamma factors and delta factors are unchanged since the factor of one-half factors out. Contrary to this guidance, the MGL factors corresponding to the alpha factors in Table 5-11 were calculated, then the Beta factors were reduced by a factor of 2. Note these values were used in the PCC system and initiating event analyses, resulting in some factors being under-estimated by a factor of 4. The discussion in 6.3.3 regarding variable BETA1 is in error - 5 CCFs and 100 independent failures provides a beta factor of 5/105 if staggered testing is used, not the .05 indicated. A lognormal distribution is not appropriate for the GAMMA1 and DELTA1 - they should be modeled using beta distributions.

Resolution: The values for GAMMA2 and DELTA2 were recalculated using the correct equations. Also beta distributions were developed for these generic distributions. With regard to the comment that BETA1 should be 5/105 rather than 0.05, these are essentially the same number.

F&O 12

Summary: Examine dependencies of HEPs embedded within recovery models with other human actions included in the plant model. Examine most recent component failure data to ensure recoverable failure fraction remains valid. Develop appropriate procedures for identifying and evaluating dependencies.

Resolution: Operator dependencies were examined, resulting in changes made to the logic rules and HEP quantification.

F&O 13

Summary: The updated Seabrook Station Probabilistic Safety Assessment (SSPSA) uses several Human Reliability Analysis (HRA) methods (HCR, THERP and ASEP) for evaluating HEPs. In some cases the original SSPSA HEPs are referenced. No guidance is provided which clearly identifies the rationale for selecting one particular methodology over another when evaluating particular operator actions.

Develop an approach and guidance for appropriately and consistently selecting the HRA methodology to be applied.

Resolution: Developed a methodology for when to apply various HRA methods. Evaluated all operator actions for proper application of the methodology.

F&O 14

Summary: The plant model includes operator actions which are not evaluated in the current HRA analysis. These include potentially important actions for SG isolation and RCS depressurization (including SL, O4, O5 and OD, as well as failure to transfer SW from cooling towers to ocean and vice versa).

The HEPs for these actions are derived from the 1983 SSPSA. While that analysis provides extensive discussions of the actions in question, the HEPs themselves appear to be based on judgment only, rather than the application of any formal HRA technique. Thus, specific event timings and procedural guidance are not explicitly reflected in the HEPs. There are also other examples of time-available windows used without referenced supporting thermal-hydraulic analysis (e.g., manual transfer to cooling tower pumps, provide makeup to RWST following extended bleed and feed).

The HRA analyses of the events in question should be updated to account for current HRA techniques and should be supported by appropriate T/H analysis. Appropriate T/H references should be added to the existing (new) HRA analysis. It may be possible to prioritize the actions to be updated by comparing the existing HEPs with those for similar actions in other plant PRAs and evaluating the relative potential for impact on the Seabrook PRA results.

Resolution: Reviewed all human actions modeled to look for HEPs that are inconsistent and/or not well documented. Operator actions were considered together to evaluate the self-.consistency of the HEPs. As a result of this review, several action HEPs were revised.

F&O 15

Summary: While operator and simulator experience has clearly been included in the evaluation of some of the actions modeled using the HCR model, there has been no formal and documented process for obtaining operations review and input into the base case HEP and update process. Have operations/ training review base case HEP analysis and updates on a periodic basis.

Resolution: Reviewed all human actions modeled to look for HEPs that are inconsistent and/or not well documented. Operator actions were considered together to evaluate the self-consistency of the HEPs. As a result of this review, several action HEPs were revised. Operations review of HEPs completed.

F&O 16

Summary: There is no formal approach for identifying and evaluating dependencies of operator actions within accident sequences. There are many sequences in which multiple redundant operator actions appear with no justification of rationale for de-coupling. Of particular concern are SGTR sequences (failure of early and late depressurization) and transient sequences with failure to initiate ESFAS, recover TD EFW pump, align start up feed pump, and initiate feed and bleed. It is recognized that some dependencies have been addressed via the split fraction logic (e.g., failure to initiate reactor trip given preceding failure to initiate SSPS). While no specific cases where such operator action dependencies might significantly impact CDF were identified during the review, no conclusive position is possible without the implementation and description of a formal process to address this issue. Develop and implement an appropriate process for identifying and evaluating dependencies.

Resolution: Evaluated operator action dependencies to determine whether multiple actions in the same sequence are justifiable. Changes were made to the event tree logic rules and HEP quantification to account for dependent events.

F&O 17

Summary: Consider adding an HEP-sensitivity to the set of analyses normally performed to evaluate quantification results. In such a sensitivity, all HEPs should be set to 0.1 (including those embedded within equipment recovery events) and the accident sequence quantification repeated. Appropriate insights should be deciphered and acted upon.

Resolution: A sensitivity case was run where all operator action split fractions with value less than 0.1 were set to 0.1. This also included recovery actions with values less than 0.1. This sensitivity was limited to post-initiator actions. The conclusion was the only multiple operator action sequences that were significant contributors with all actions set to 0.1 were actions where the dependencies had already been addressed.

F&O 18

Summary: Recovery actions were included in the sequences but not treated within the HRA analysis. Examples are the recovery of the turbine-driven AFW pump and the recovery of an EDG. The reviewer concern is that it is important to understand whether or not there are human action dependencies within the modeled recoveries, and, if so, to ensure that dependencies are tracked and correctly treated. Ensure all modeled recovery actions are consistent with the HRA so that potential dependencies are addressed.

Resolution: Operator dependencies were examined, resulting in changes made to logic rules and the HEP quantification.

F&O 19

Summary: A discussion of the limitations of using the saved sequences as a PRA model of the plant was not located. Although a very low cutoff is used to generate saved sequences, it is important that all analysts understand where limitations may exist so that they can be evaluated for specific applications

Resolution: This issue of truncation has been addressed in the PRA documentation along with general guidance for setting the truncation level. Practically, this issue must be evaluated for each analysis. It is not possible to give general guidance that addresses every application.

F&O 20

Summary: Following a reactor trip, loss of all DC, and success of off-site power, RCP seal integrity questions are asked without determining the probability of failure of the operating charging and PCCW pumps. Include hardware faults of the running pumps as part of the necessary logic for RCP seal LOCA. This appears to lead to overestimating reactor trip contribution to CDF.

Resolution: In the 2002 model, the sequence "reactor trip -and- loss of all DC power" leads to core melt because EFW and SUFP require at least one train of DC power. Also, the PORVs are failed given loss of DC power. Thus, this sequence goes to core melt because both AFW and feed and bleed cooling are unavailable (not the seal LOCA sequence). While there is opportunity for recovery of an AFW pump (by locally starting either pump), the probability of loss of both DC buses is extremely small (3E-7). Also, this may cause other plant conditions that would confuse the operator. Thus, no operator recovery credit is taken.

F&O 21

Summary: There are split fractions defined in the master frequency file that include operator recovery actions. Instances of sequences that have multiple operator actions were identified with products in the 1E-05 range. Without documentation regarding operator dependencies, this may lead to underestimating operator contribution.

Resolution: Operator dependencies were examined. This resulted in changes made to logic rules and HEP quantification.

F&O 22

Summary: At present no parametric uncertainty analysis exists based on the current plant model. While such studies were performed for earlier versions of the SSPSA, the results have significantly changed (internals are far less dominant) and the uncertainty distribution may no longer be valid.

At present there is no formal analysis which addresses plant specific uncertainty or sensitivity issues. For example, cases where thermal hydraulic analyses predict only small margins for success in terms of the number of trains required, or the time available for operator actions, are prime candidates. Other examples might be cases where unique success criteria or modeling have been applied such as for feed and bleed and for RWST make up following LOCA. Perform a set of sensitivity runs and a qualitative or quantitative uncertainty analysis for the model. Risk achievement analyses may be used to focus the search for potentially significant cases.

Resolution: Performed an uncertainty analysis to address this F&O. Ensured that all split fractions have an uncertainty distribution associated with them and quantified all event tree top events with Monte Carlo. Also quantified all system initiating events with Monte Carlo. Quantified uncertainty for dominant sequences for CDF and LERF.

F&O 23

Summary: The PRA assessment of Level 2 phenomena is based on pre-1990 knowledge and methodologies. This leads to several important phenomena not being explicitly addressed in the PSA (e.g., transition to detonation for hydrogen burns) and conservative treatment of other phenomena (e.g., alpha mode steam explosion containment failure, DCH containment failure, etc.). All of these can impact the LERF calculated in the PRA. Since the LERF is dominated by interfacing system LOCA and SG tube rupture, it is not expected to make a significant numerical difference, but the study needs to be updated for completeness and accuracy. Upgrading the analysis from MAAP 3.0b to 4.0 would be helpful in this regard.

Resolution: Addressed in the MAAP Phase 2 project and PRA 2005 Update.

F&O 24

Summary: The Level 2 analyses are based primarily on MAAP 3.0b analyses performed in the 1980's. There have been significant changes to code models, particularly MAAP 3b, Version 15 to MAAP 4.0, dealing with, among other items, in-vessel recovery and induced SG creep rupture damage.

(a) A change in the modeling of in-vessel recovery could impact the PSA results, because the newer code/models mechanistically predict additional hydrogen generation during recovery (which was seen at TMI-2). This could lead to a hydrogen challenge to the containment integrity and, in turn, the LERF.

(b) A change in modeling the potential for creep failure of the SG tubes (induced tube rupture) could impact the PSA results because the newer code models mechanistically predict creep failure of SG tubes. Also, significant information is now available on creep failure with SG tube degradation. This could lead to a change in the predicted occurrence of creep failure bypass and, in turn, the LERF.

(c) The latest expert opinion on direct containment heating (DCH) has changed since the early 1990's and Seabrook Station should NOT be susceptible to DCH. The PSA is still based on the "old" DCH viewpoint reflected in NUREG/CR-4551.

The high level issue here is PSA maintenance – whether there is a process inplace for assessing changes to PSA models, updating applicable PSA models to reflect current knowledge, and the frequency this is done.

Resolution: Addressed in the MAAP Phase 2 project and PRA 2005 Update.

F&O 25

Summary: The PRA includes some post-core damage operator actions (e.g., RCS depressurization and in-vessel recovery for a station blackout) that are generally not modeled in the Level 2 PSA for other plants.

While this is a plus, the Level 2 analyses do not include all severe accident management guidance (SAMG) activities. While SAMG is generally viewed as something new, it is really just a formalized structure of considering what to do if the core melts and the EOPs are no longer valid. Previously, PSA considered that no actions would be taken under the premise that this was conservative. The real problem was the lack of procedures for the HRA model to consider. Now with SAMG we can quantify the change from a passive operator status and could find that LERF increases while small late release frequency decreases. The reason for the increase in LERF is the chance of wrong operator actions. Assess SAMG impact and update Level 2 analysis at next scheduled update.

Resolution: Addressed in the MAAP Phase 2 project and PRA 2005 Update.

F&O 26

Summary: Many of the CET top event probabilities cannot be traced to the quoted references of the PRA.

Resolution: Reviewed and revised CET split fraction values.

F&O 27

Summary: In many cases, release categorization (release magnitudes and timings) were based on IDCOR analyses for Zion core-melt sequences and the results were adjusted for Seabrook Station. In other cases, the release magnitudes and timings were based on WASH-1400. For example:

(a) For release category S3-A-R, MAAP results based on IDCOR analysis for Zion were adjusted and used for Seabrook Station. See also, for release category S6-R where a Zion case for SBO with a single puff release were adjusted and applied to Seabrook Station SBO sequence with a three puff release.

(b) For release category S& A, the release fractions and timing were taken directly from WASH-1400. Similarly, release category S1W was based on WASH-1400 results.

(c) For release category S6B, IDCOR Zion's MAAP results for a containment bypass sequence "V-Sequence" were applied to Seabrook Station's containment failure to isolate sequence after adjusting the release magnitudes.

Note that the results of WASH-1400 study and the results of IDCOR analyses (which used earlier versions of the MAAP code, possibly 2.0 or 1.0) do not represent the state of the art or current state of knowledge in severe accident phenomenology. Update the thermal hydraulic simulation of the dominant accident sequences using the most recent version of MAAP 4.0

Resolution: Addressed in the MAAP Phase 2 project and Level 2 PRA upgrade (Westinghouse). Seabrook Station MAAP deck updated to 4.0.5. A significant MAAP library has been populated, Level 2 success criteria defined and the containment event tree revised. Event timing and impacts have been revised.

F&O 28

Summary: For release category S4V, the source term release magnitudes of a basemat melt-through SBO sequence was modeled as a long-term over-pressurization failure of the containment at the time of basemat melt-through. Use MAAP code to run the SBO sequence that leads to basemat melt-though. MAAP code will calculate the basemat ablation rate and the depth of basemat ablation as a function of time. When the fission products are filtered through the soil, only the noble gases could potentially be released to the environment.

Resolution: Addressed in the MAAP Phase 2 project and Level 2 PRA upgrade (Westinghouse). Seabrook Station MAAP deck updated to 4.0.5. A significant MAAP library has been populated, Level 2 success criteria defined and the containment event tree revised. Event timing and impacts have been revised.

F&O 29

Summary: Based on the literature, volatile and nonvolatile releases above 10% mass fraction are considered large in severity. Volatile and nonvolatile releases below 1% mass fraction are considered small in severity. The moderate releases correspond to a mass fraction ranging from 1% to 10% for both volatiles and non-volatiles. As can be seen in the Seabrook Source Terms, a more conservative approach was used to calculate the LERF than the above described methodology. Update the source term categorization as described above.

Resolution: Addressed in the MAAP Phase 2 project and Level 2 PRA upgrade (Westinghouse). Seabrook Station MAAP deck updated to 4.0.5. A significant MAAP library has been populated, Level 2 success criteria defined and the containment event tree revised. Event timing and impacts have been revised.

F&O 30

Summary: During a review of plant design changes incorporated into the 1999 PRA models, it appeared that Design Change Request (DCR) 89-061 had not been incorporated into the service water fault tree. This DCR deleted the cooling tower fan auto-start feature. Therefore, a human error basic event was to be added to the service water fault tree. The service water fault tree did not appear to have been modified. Also, the PRA documentation still includes the cooling tower fans being actuated by a TA signal. It is believed that this is an isolated occurrence. However, the host utility should check for any others. Incorporate this DCR into the system fault tree / notebook.

Resolution: A review of the PRA documentation (Service Water Notebook) indicated that this DCR had indeed been incorporated in the PRA model. In fact, the system notebook describes the modeling of the cooling tower and indicates that the operator must manually initiate CT operation and provides a justification for why this action is not modeled. The Service Water notebook was updated to ensure completeness. Also, a review of DCRs for the 1999 update was performed to ensure that all DCRs that impact the PRA model were addressed.

F&Os from the 2005 Focused Peer Review

F&O 31

Summary: The ASME Category II capability for this SR requires the use of realistic, applicable T/H analyses for accident sequence parameters. Category III requires use of realistic, plant specific T/H analyses. Although most of the SSPSS parameters have supporting calculations that are plant specific, it appears that some would benefit from more realistic analyses. In at least one case (i.e., CST depletion) more realistic analyses may impact sequence development (and are dependent on whether the EFW pump or SUFP is running). Expectation for future applications is more extensive use of realistic codes (e.g., MAAP), as applicable.

Resolution: The SSPSS-2005 update effort used MAAP to provide substantial additional plant-specific, realistic support. In some cases such as the CST example noted above, hand calculations were considered to be appropriate and were reviewed to assure adequate realism. The actions below were taken to address realistic/plant-specific success criteria:

(1) Listed all current Level 1 success criteria, including impact of power uprate, RCPs, IA, etc.

(2) Identified current basis for success criteria.

(3) Ran series of MAAP runs where needed to provide basis.

F&O 32

Summary: While simulator exercises were observed, there is no evidence of specific talk-throughs with Operations/Training. Interaction with Operations and/or Training is important regarding the assumptions used in the HRA, especially response times and performance shaping factors (PSFs), to confirm that the interpretation and implementation of the procedures are consistent with plant training and expected responses.

Resolution: Walkthroughs / talk-throughs with Operations and/or Training were used to confirm modeling of operator actions and accident sequences.

F&O 33

Summary: In general, the time available to complete actions is based on either generic T/H analyses for similar Westinghouse 4-loop plants or plant-specific analyses. Several issues were identified that may point to the need for establishing a more thorough and realistic basis. For example:

- The write-up for the operator action ODEP1 for SBO events states that 8.8 hours are available to perform this action, which is based on 9.8 hours to core damage from WCAP-16141, less one hour to restore equipment. However, WCAP-16141 states that without depressurization, core damage can occur as early as 2.7 hours. Therefore, the time available to perform this action should not exceed the time to core damage without credit for the action. It should be noted that WCAP-16141 does not specifically mention when depressurization must begin, but it seems to be assumed that depressurization will typically begin within 30 – 45 minutes. Since this action has a low F-V and RAW importance, SR HR-G4 is judged to be satisfied.

- WCAP-16141, which is used as a basis, assumes that the turbine-driven AFW pump supplies 1145 gpm, which seems to exceed the capacity of the Seabrook Station TD AFWP.
- The basis of the time available for operator action ODEP3 does not appear to be realistic. SSPSS-2004 credits post-LOCA cooldown and depressurization for MLOCA with high head injection (HHI) success. Operator Action timing (3.8 hours) is based on a small LOCA, not MLOCA. The success criteria indicates that only 42.8 minutes are available before reaching low-low level for MLOCA. While it is true that MLOCAs at the high end of the spectrum should not require this action and MLOCAs on the low end of the spectrum behave more like a small LOCA, the majority of MLOCAs will be in between. Using the average timing between the high end (42.8 minutes) and low end (3.8 hours) would not leave enough time to successfully establish low pressure recirculation prior to reaching the RWST low-low level switchover setpoint.
- The time assumed to be available for feed and bleed using the Safety Injection (SI) pumps, which is based on the time until SG dryout, may not be realistic. It would seem that establishing feed and bleed with the charging pumps would have different timing than establishing feed and bleed with the SI pumps due to the lower shutoff head of the SI pumps. In particular, while waiting until SG dryout could allow successful feed and bleed cooling using the charging pumps, it isn't clear that waiting until SG dryout would allow successful feed and bleed cooling using the SI pumps.
- The time available for operator action HH.ORSGC2.FL is 2.3 hours, which is based on time to core damage. However, restoring secondary cooling at the time of core damage will not prevent core damage. In order to prevent core damage, secondary cooling must be completed earlier (e.g., core uncovery)

With respect to the items identified:

(1) Re-evaluate the time available to perform RCS cooldown and depressurization following an SBO. Also evaluate the applicability of WCAP-14161 assumptions regarding flow from the turbine-driven AFW pump.

(2) Re-evaluate the time available used to quantify operator actions for depressurization and feed and bleed by performing sequence-specific MAAP (or other) thermal-hydraulic runs. In the case of operator action to perform depressurization for MLOCA sequences, T/H runs may need to be performed for an "average" MLOCA break size.

(3) Use MAAP or some other calculations to determine the latest time at which secondary cooling can be restored and still prevent core damage.

More generally, complete the ongoing effort to establish appropriate timeframes using realistic codes (e.g. MAAP).

Resolution: Revised the HRA Calculator quantification using time windows from Seabrook Station-specific MAAP runs.

F&O 34

Summary: Dependency between multiple human actions was considered, and the process for quantifying dependencies is described in SSPSS-2002. This appears to be a good approach. However, there is no guidance as to how to identify sequences with multiple operator actions for inclusion in the dependency analysis. Also, while the matrix showing dependency between two operator actions is good, it does not include new actions since the 2002 update. The review discovered at least two examples where dependencies appear to be inadequately addressed:

(1) The dependency between operator actions ORSGC and OFB does not appear to be modeled, other than time consumed associated with responding to feed and bleed criteria. There is also some dependency in diagnosing the loss of secondary heat sink for these two actions.

(2) The procedural guidance in Functional Restoration Procedure FR-H.1 for aligning fire water is contained in the RNO column of Step 14, which is predicated on not being able to open the PORVs. However, if the PORVs are opened too late, the procedure will not direct the operator to establish fire water to the SGs. This dependency is not modeled.

Although significant progress has been made in this area since the 1999 peer review, it appears that there remains a need to develop an overall process for identifying multiple operator actions that need to be addressed in the dependency analysis.

Resolution: The following actions were taken during the PRA update:

1. Identified all dynamic actions embedded in hardware top events.
2. Created new Operator Action top events, separate from hardware where appropriate.
3. For PCCW, redefined System split fractions to be conditional on Operator Action OPCC and added house events.
4. Added new top events to event trees
5. Modified logic rules to account for operator action dependency to system.

F.3.4 LEVEL 3 PRA MODEL

The Seabrook Station Level 3 PRA model, "Calculation of Severe Accident Risks for Seabrook Station License Renewal," Revision 0, May 2009 (Reference 4) determines off-site dose and economic impacts of severe accidents based on the Level 1 PRA results, the Level 2 PRA results, atmospheric transport, mitigating actions, dose accumulation, and economic analyses.

The MELCOR Accident Consequence Code System (MACCS2) Version 1.13.1 was used to perform the calculations of the off-site consequences of a severe accident. This code is documented in NUREG/CR-6613, "Code Manual for MACCS2: Volumes 1 and 2" (Reference 23).

Plant-specific release data included the time-dependent nuclide distribution of releases and release frequencies. The behavior of the population during a release (evacuation parameters) was based on plant- and site-specific set points. These data were used in combination with site-specific meteorology to simulate the probability distribution of impact risks (both exposures and economic effects) to the surrounding 50-mile radius population as a result of the release accident sequences at Seabrook Station.

The following sections describe input data for the MACCS2 analysis tool.

F.3.4.1 POPULATION DISTRIBUTION

The population in the 50-mile radius surrounding the Seabrook Station site was estimated based on the 2000 United States census data, as accessed by SECPOP2000, NUREG/CR-6525, Revision 1 (Reference 25). The population distribution was estimated in 10 concentric bands at 0 to 1 mile, 1 to 2 miles, 2 to 3 miles, 3 to 4 miles, 4 to 5 miles, 5 to 10 miles, 10 to 20 miles, 20 to 30 miles, 30 to 40 miles, and 40 to 50 miles distant from the site, and 16 directional sectors with each sector consisting of 22.5 degrees. The population was projected to the year 2050 by calculating an annual growth rate derived from state and national population projections for each county that fell entirely or partially in the 50-mile radius. The peak transient population within 10 miles of the site was added to the resident population. The population distribution used in this analysis is provided in Table F.3.4.1-1.

Table F.3.4.1-1 Population Projections Used in SAMA Analysis

From Radius	To Radius	Direction	Code	2000 Population	2050 Population
0	1	N	1	24	37
0	1	NNE	2	0	0
0	1	NE	3	29	44
0	1	ENE	4	0	0
0	1	E	5	0	0
0	1	ESE	6	0	0
0	1	SE	7	163	249
0	1	SSE	8	68	104
0	1	S	9	139	213
0	1	SSW	10	65	99
0	1	SW	11	10	15
0	1	WSW	12	234	358
0	1	W	13	0	0
0	1	WNW	14	144	220
0	1	NW	15	0	0
0	1	NNW	16	12	18
1	2	N	17	48	73
1	2	NNE	18	36	55
1	2	NE	19	143	219
1	2	ENE	20	12889	19720
1	2	E	21	4241	6489
1	2	ESE	22	5178	7922
1	2	SE	23	180	275
1	2	SSE	24	160	245
1	2	S	25	852	1304
1	2	SSW	26	1177	1789
1	2	SW	27	1372	2085
1	2	WSW	28	463	708
1	2	W	29	546	835
1	2	WNW	30	410	627
1	2	NW	31	385	589
1	2	NNW	32	232	355
2	3	N	33	462	707
2	3	NNE	34	1876	2870
2	3	NE	35	2385	3649
2	3	ENE	36	1530	2341

Table F.3.4.1-1 Population Projections Used in SAMA Analysis (Continued)

From Radius	To Radius	Direction	Code	2000 Population	2050 Population
2	3	E	37	83	127
2	3	ESE	38	0	0
2	3	SE	39	1084	1480
2	3	SSE	40	563	746
2	3	S	41	890	1174
2	3	SSW	42	1149	1417
2	3	SW	43	469	586
2	3	WSW	44	843	1199
2	3	W	45	5180	7925
2	3	WNW	46	122	187
2	3	NW	47	283	433
2	3	NNW	48	247	378
3	4	N	49	1477	2260
3	4	NNE	50	3075	4705
3	4	NE	51	3744	5728
3	4	ENE	52	788	0
3	4	E	53	0	0
3	4	ESE	54	0	0
3	4	SE	55	475	584
3	4	SSE	56	17035	20953
3	4	S	57	677	833
3	4	SSW	58	772	950
3	4	SW	59	412	507
3	4	WSW	60	512	677
3	4	W	61	398	609
3	4	WNW	62	165	252
3	4	NW	63	265	405
3	4	NNW	64	584	894
4	5	N	65	1290	1974
4	5	NNE	66	946	1447
4	5	NE	67	1967	3010
4	5	ENE	68	0	0
4	5	E	69	0	0
4	5	ESE	70	0	0
4	5	SE	71	907	0

Table F.3.4.1-1 Population Projections Used in SAMA Analysis (Continued)

From Radius	To Radius	Direction	Code	2000 Population	2050 Population
4	5	SSE	72	570	701
4	5	S	73	1727	2124
4	5	SSW	74	481	592
4	5	SW	75	3965	4877
4	5	WSW	76	2720	3627
4	5	W	77	383	586
4	5	WNW	78	460	704
4	5	NW	79	195	298
4	5	NNW	80	640	979
5	10	N	81	4740	7252
5	10	NNE	82	12234	18718
5	10	NE	83	1824	2791
5	10	ENE	84	0	0
5	10	E	85	0	0
5	10	ESE	86	0	0
5	10	SE	87	0	0
5	10	SSE	88	8149	10023
5	10	S	89	8579	10552
5	10	SSW	90	13747	16909
5	10	SW	91	9131	11231
5	10	WSW	92	10967	15048
5	10	W	93	3420	5233
5	10	WNW	94	2917	4463
5	10	NW	95	12776	19547
5	10	NNW	96	6103	9338
10	20	N	97	18631	30655
10	20	NNE	98	35979	64058
10	20	NE	99	1257	0
10	20	ENE	100	0	0
10	20	E	101	0	0
10	20	ESE	102	0	0
10	20	SE	103	2645	3253
10	20	SSE	104	6834	8406
10	20	S	105	24275	29858
10	20	SSW	106	25776	31704

Table F.3.4.1-1 Population Projections Used in SAMA Analysis (Continued)

From Radius	To Radius	Direction	Code	2000 Population	2050 Population
10	20	SW	107	83246	102583
10	20	WSW	108	57428	83797
10	20	W	109	23379	35770
10	20	WNW	110	17121	26195
10	20	NW	111	9286	14219
10	20	NNW	112	26180	40239
10	20	N	113	48853	87821
20	30	NNE	114	13515	25408
20	30	NE	115	404	0
20	30	ENE	116	0	0
20	30	E	117	0	0
20	30	ESE	118	0	0
20	30	SE	119	3723	4579
20	30	SSE	120	28230	34723
20	30	S	121	194637	239404
20	30	SSW	122	131825	148885
20	30	SW	123	243606	274789
20	30	WSW	124	67459	101033
20	30	W	125	66566	101297
20	30	WNW	126	21229	32729
20	30	NW	127	8059	12347
20	30	NNW	128	26311	40534
30	40	N	129	29456	55377
30	40	NNE	130	24528	46113
30	40	NE	131	1	0
30	40	ENE	132	0	0
30	40	E	133	0	0
30	40	ESE	134	0	0
30	40	SE	135	0	0
30	40	SSE	136	0	0
30	40	S	137	55193	72028
30	40	SSW	138	854916	880481
30	40	SW	139	164382	166026
30	40	WSW	140	146505	195879
30	40	W	141	104996	154390

Table F.3.4.1-1 Population Projections Used in SAMA Analysis (Continued)

From Radius	To Radius	Direction	Code	2000 Population	2050 Population
30	40	WNW	142	95248	156828
30	40	NW	143	18505	30158
30	40	NNW	144	16317	26107
40	50	N	145	11669	21936
40	50	NNE	146	54518	102494
40	50	NE	147	158	0
40	50	ENE	148	0	0
40	50	E	149	0	0
40	50	ESE	150	0	0
40	50	SE	151	0	0
40	50	SSE	152	0	0
40	50	S	153	189524	213707
40	50	SSW	154	818677	869864
40	50	SW	155	121411	133277
40	50	WSW	156	52404	65728
40	50	W	157	27385	40263
40	50	WNW	158	37532	61054
40	50	NW	159	24473	40248
40	50	NNW	160	10559	17711
			Total	4232394	5185206

F.3.4.2 ECONOMIC DATA

The agricultural and economic data for the Seabrook offsite evaluations were derived from the SECPOP2000 program, NUREG/CR-6525, Revision 1 (Reference 25). This code utilized county economic factors derived from the 2000 census. For the Seabrook model, the county data files were updated with circa 2000 data for the 13 counties within 50 miles of the plant. The following specific economic parameters are used in the Seabrook Station SAMA.

Variable	Description	Seabrook Value
DPRATE(1)	Property depreciation rate (per yr)	0.20
DSRATE(1)	Investment rate of return (per yr)	0.12
EVACST	Daily cost for a person who has been evacuated ($/person-day)	$52
POPCST	Population relocation cost ($/person)	$9632
RELCST	Daily cost for a person who is relocated ($/person-day)	$52
CDFRM	Cost of farm decontamination for various levels of decontamination ($/hectare) (2)	$1,084 & $2,408
CDNFRM	Cost of non-farm decontamination per resident person for various levels of decontamination ($/person)	$5,779 & $15,412
DLBCST	Average cost of decontamination labor ($/man-year)	$67,427
VALWF	Value of farm wealth ($/hectare) (2)	$22,880
VALWNF	Value of non-farm wealth average in US ($/person)	$193,003

(1) DPRATE and DSRATE are based on MACCS2 Users Manual (Reference 23)
(2) 1 hectare = 10,000 m^2 = 2.47 acres

F.3.4.3 NUCLIDE RELEASE

The core inventory corresponds to the end-off-cycle values for projected future 3,659 MWt Seabrook Station operations, as determined by the ORIGEN2.1 code.

Table F.3.4.3-1 provides the estimated inventory of the core at shutdown used in this analysis. Cobalt inventory (Co-58 and Co-60) are based on the PWR inventory in MACCS2 sample problem A multiplied by 3659/3412 (the ratio of the Seabrook power level to the power level in sample problem A).

Table F.3.4.3-2, Accident Category Frequencies and Release Fractions, provides a description of the release characteristics evaluated in the SAMA analysis. Table F.3.4.3-2 provides the release frequencies, nuclide release fractions of the core inventory, and the time distribution of the release (for noble gases and Cs) analyzed to determine the sum of the exposure (50-mile dose) and economic (50-mile economic costs) risks from the Seabrook Level 2 accident release category bins. Release fractions and associated times for accident categories LE-2, LE-3, SE-2, SE-3, and LL-5 were taken from Seabrook original analyses of releases for these accident categories. All other category release fractions and times are from Seabrook MAAP simulations.

Table F.3.4.3-1 Core Inventory

Nuclide	Core Inventory (Curies)
Co-58	9.34E+05
Co-60	7.14E+05
Kr-83m	1.19E+07
Kr-85	1.26E+06
Kr-85m	2.49E+07
Kr-87	4.77E+07
Kr-88	6.70E+07
Rb-86	3.03E+05
Sr-89	9.25E+07
Sr-90	1.00E+07
Sr-91	1.13E+08
Sr-92	1.23E+08
Y-90	1.05E+07
Y-91	1.20E+08
Y-92	1.24E+08
Y-93	1.43E+08
Zr-95	1.64E+08
Zr-97	1.61E+08
Nb-95	1.66E+08
Mo-99	1.89E+08
Tc-99m	1.66E+08
Ru-103	1.88E+08
Ru-105	1.51E+08
Ru-106	1.00E+08
Rh-105	1.34E+08
Sb-127	1.39E+07
Sb-129	3.78E+07
Te-127	1.38E+07
Te-127m	1.87E+06
Te-129	3.72E+07
Te-129m	5.52E+06
Te-131m	1.60E+07
Te-132	1.46E+08
I-131	1.05E+08
I-132	1.49E+08
I-133	1.99E+08
I-134	2.15E+08

Table F.3.4.3-1 Core Inventory (Continued)

Nuclide	Core Inventory (Curies)
I-135	1.87E+08
Xe-131m	1.18E+06
Xe-133	1.99E+08
Xe-133m	6.45E+06
Xe-135	5.01E+07
Xe-135m	4.22E+07
Xe-138	1.61E+08
Cs-134	3.26E+07
Cs-136	8.35E+06
Cs-137	1.37E+07
Ba-139	1.75E+08
Ba-140	1.68E+08
La-140	1.75E+08
La-141	1.59E+08
La-142	1.54E+08
Ce-141	1.62E+08
Ce-143	1.48E+08
Ce-144	1.34E+08
Pr-143	1.46E+08
Nd-147	6.39E+07
Np-239	2.92E+09
Pu-238	5.15E+05
Pu-239	3.99E+04
Pu-240	7.07E+04
Pu-241	1.87E+07
Am-241	1.85E+04
Cm-242	8.77E+06
Cm-244	2.60E+06
Br-82	8.71E+05
Br-83	1.18E+07
Br-84	2.04E+07
Rb-88	6.82E+07
Rb-89	8.73E+07
Y-94	1.45E+08
Y-95	1.56E+08
Nb-95m	1.18E+06
Tc-101	1.76E+08

Table F.3.4.3-1 Core Inventory (Continued)

Nuclide	Core Inventory (Curies)
Pd-109	6.30E+07
Sb-124	3.73E+05
Sb-125	2.41E+06
Sb-126	2.11E+05
Te-125m	5.26E+05
Te-133	1.18E+08
Te-133m	7.13E+07
Te-134	1.61E+08
I-130	7.59E+06
Cs-134m	8.44E+06
Cs-138	1.79E+08
Ba-141	1.59E+08
La-143	1.47E+08
Pm-147	1.38E+07
Pm-148	2.97E+07
Pm-148m	3.43E+06
Pm-149	6.83E+07
Pm-151	2.41E+07
Sm-153	7.82E+07
Eu-154	2.00E+06
Eu-155	1.39E+06
Eu-156	4.77E+07
Np-238	7.06E+07
Pu-243	1.27E+08
Am-242	1.29E+07

Table F.3.4.3-2 Accident Category Frequencies and Release Fractions

Accident Category	LE-1	LE-2	LE-3	SE-1	SE-2	SE-3	LL-3	LL-4	LL-5	Intact
Frequency	1.10E-07	4.01E-09	9.71E-10	4.67E-07	3.33E-07	1.04E-06	2.95E-06	7.47E-08	3.32E-07	9.13E-06
Release Fraction by Release Category										
Xe/Kr	6.99E-01	9.00E-01	1.00E+00	4.04E-02	9.00E-01	1.00E+00	6.89E-01	1.00E+00	1.00E+00	3.46E-03
I	2.99E-02	7.00E-01	1.00E-02	4.70E-03	7.00E-04	1.30E-02	2.82E-03	3.51E-01	1.00E-03	1.02E-07
Cs	2.67E-02	5.00E-01	1.00E-02	4.58E-03	5.00E-04	1.30E-02	1.37E-03	2.21E-01	1.00E-03	6.83E-08
Te	2.54E-02	3.00E-01	2.80E-04	1.44E-03	3.00E-04	3.50E-03	4.41E-04	2.04E-01	2.00E-03	8.32E-08
Sr	6.90E-05	6.00E-02	6.20E-04	7.68E-06	6.00E-05	1.50E-03	4.61E-06	3.63E-05	1.00E-05	1.47E-10
Ru	1.03E-02	2.00E-02	6.00E-05	3.29E-04	2.00E-05	9.00E-04	3.06E-06	4.07E-05	1.00E-05	1.06E-08
La	1.64E-05	4.00E-03	6.00E-05	6.29E-07	4.00E-06	1.40E-04	1.79E-07	3.37E-05	1.00E-05	3.21E-11
Ce	2.92E-05	4.00E-03	6.00E-05	2.49E-06	4.00E-06	1.40E-04	3.56E-06	4.42E-05	1.00E-05	7.02E-11
Ba	1.18E-03	6.00E-02	6.20E-04	9.23E-05	6.00E-05	1.50E-03	4.67E-06	5.73E-05	1.00E-05	3.74E-09
Sb	7.35E-02	3.00E-01	2.80E-04	2.42E-03	3.00E-04	3.50E-03	1.92E-03	4.03E-02	2.00E-03	5.23E-08
Release time (hr from scram) of bulk of noble gas/Cs release										
	2.7-4.7 / 2.7-4.7	2.5-3 / 2.5-3	4-20 / 4-20	2.7-5.6 / 2.7-5.6	8.5-15.5 / 8.5-15.5	22-66 / 22-66	34-58 / 34-58	36-60 / 36-60	89-90 / 89-90	3.4-33 / 2.6-8.9

F.3.4.4 EMERGENCY RESPONSE

A reactor scram signal begins each evaluated accident sequence. A General Emergency is declared when plant conditions degrade to the point where they are judged to be a credible risk to the public. Therefore, the timing of the General Emergency declaration is sequence-specific and declarations generally range from 1 to 4 hours for the release sequences evaluated.

The MACCS2 User's Guide input parameters of 95 percent of the population within 10 miles of the plant [Emergency Planning Zone (EPZ)] evacuating and 5 percent not evacuating were employed. These values have been used in similar studies (e.g., Hatch, Calvert Cliffs, [SNOC 2000] and [BGE 1998]) and are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the EPZ.

The evacuees are assumed to begin evacuation 120 minutes (MACCS2 Sample Problem A) after a General Emergency has been declared, at a radial speed of 0.58 m/sec. This speed is derived from the projected time to evacuate the entire Seabrook EPZ under adverse weather conditions during the year 2000, the year of the evacuation study, Seabrook Station Radiological Emergency Plan, SSREP, (Reference 26). The evacuation speed was projected to year 2050 conditions by conservatively assuming that all of the roads in 2000 transported traffic at their maximum throughput and that no new roads would be constructed (although the roads would be maintained at 2000 conditions). The 2050 evacuation speed was then the 2000 speed multiplied by the ratio of 2000 to projected 2050 EPZ (10-mile) populations. That estimated 2050 evacuation speed, 0.41 m/sec, was used in the risk analysis. Both the evacuation speed and the time from emergency declaration to the start of evacuation was considered further in the sensitivity analyses presented in Section F.8.

F.3.4.5 METEOROLOGICAL DATA

Each year of meteorological data consists of 8,760 weather data sets of hourly recordings of wind direction, wind speed, atmospheric stability, and accumulated precipitation. The data were from the Seabrook Station site weather facility for the years 2004 through 2008. MACCS2 does not permit missing data, so bad or missing data were filled in by (in order of preference): using corresponding data from meteorological tower instruments at another level (taking the relationship between the levels as determined from immediately preceding hours), interpolation (if the data gap was less than 4 hours), or using data from the same hour and a nearby day of a previous year.

The 2005 data set was found to result in the maximum economic cost and dose risks (see subsequent discussion of sensitivity analysis). Therefore, the 2005 sequential-hourly meteorology was used to create the one-year sequential-hourly data set used in the baseline MACCS2 runs. Ten-meter wind speed (adjusted from the data facility 43-foot measurements) and 10-meter wind direction (taken equivalent to the 43-foot measurements) were combined with precipitation and atmospheric stability (specified according to the vertical temperature gradient as measured between the 209- and 43-foot levels) to create the hourly data. Hourly stability was classified according to the scheme used by the NRC.

F.4 COST OF SEVERE ACCIDENT RISK / MAXIMUM BENEFIT

Cost/benefit evaluations of SAMAs are based on the cost of implementing a SAMA compared to the averted onsite and offsite costs resulting from the implementation of that SAMA. The methodology was based on the NRC's guidance for the performance of cost-benefit analyses (Reference 16). This guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) – COE

Where: APE = present value of averted public exposure ($),
AOC = present value of averted offsite property damage costs ($),
AOE = present value of averted occupational exposure ($),
AOSC = present value of averted onsite costs ($)
COE = cost of enhancement ($).

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and is not considered beneficial. The derivation of each of these costs is described in below.

The following specific values were used for various terms in the analyses:

Present Worth

The present worth was determined by:

$$PW = \frac{1 - e^{-rt}}{r}$$

Where: r is the **discount rate = 7%** (assumed throughout these analyses)
t is the **duration of the license renewal = 20 years**
PW is the present worth of a string of annual payments = **10.76**

Dollars per REM

The conversion factor used for assigning a monetary value to on-site and off-site exposures was $2,000/person-rem averted. This is consistent with the NRC's regulatory analysis guidelines presented in and used throughout NUREG/BR-0184 (Reference 16).

On-site Person REM per Accident

The occupational exposure associated with severe accidents was assumed to be **23,300 person-rem/accident**. This value includes a short-term component of 3,300 person-rem/accident and a long-term component of

20,000 person-rem/accident. These estimates are consistent with the "best estimate" values presented in Section 5.7.3 of Reference 16. In the cost/benefit analyses, the accident-related on-site exposures were calculated using the best estimate exposure components applied over the on-site cleanup period.

<u>On-site Cleanup Period</u>

In the cost/benefit analyses, the accident-related on-site exposures were calculated over a **10-year cleanup period.**

<u>Present Worth On-site Cleanup Cost per Accident</u>

The estimated cleanup cost for severe accidents was assumed to be \$1.5E+09/accident (undiscounted). This value was derived by the NRC in Reference 16, Section 5.7.6.1, Cleanup and Decontamination. This cost is the sum of equal annual costs over a 10-year cleanup period. At a 7% discount rate, the present value of this stream of costs is approximately \$1.1E+09.

F.4.1 OFF-SITE EXPOSURE COST

<u>Accident-Related Off-Site Dose Costs</u>

Off-site doses were determined using the MACCS2 model developed for Seabrook Station. Costs associated with these doses were calculated using the following equation:

$$APE = \left(F_S D_{P_S} - F_A D_{P_A}\right) R \frac{1 - e^{-rt_f}}{r} \qquad (1)$$

Where: APE = monetary value of accident risk avoided due to population doses, after discounting

R = monetary equivalent of unit dose, (\$/person-rem)

F = accident frequency (events/yr)

D_P = population dose factor (person-rems/event)

S = status quo (current conditions)

A = after implementation of proposed action

r = real discount rate

t_f = analysis period (years).

Using the values for r, t_f, and R given above, the present worth of accident-related off-site dose costs is:

$$W_P = (\$2.15E+04)\left(F_S D_{P_S} - F_A D_{P_A}\right)$$

F.4.2 OFF-SITE ECONOMIC COST

Accident-Related Off-site Property Damage Costs

Off-site damage was determined using the MACCS2 model developed for Seabrook Station. Costs associated with accident-related off-site property damages were calculated using the following equation:

$$AOC = \left(F_S P_{D_S} - F_A P_{D_A}\right)\frac{1-e^{-rt_f}}{r}$$

Where: AOC = monetary value of accident risk avoided due to offsite property damage, after discounting
F = accident frequency (events/yr)
P_D = offsite property loss factor (dollars/event)
r = real discount rate
t_f = analysis period (years).

F.4.3 ON-SITE EXPOSURE COST

Methods for Calculating Averted Costs Associated with Onsite Accident Dose Costs

a) **Immediate Doses** (at time of accident and for immediate management of emergency)

For the case where the plant is in operation, the equations in Reference 16 can be expressed as:

$$W_{IO} = \left(F_S D_{IO_S} - F_A D_{IO_A}\right) R \frac{1-e^{-rt_f}}{r} \qquad (1)$$

Where: W_{IO} = monetary value of accident-risk avoided due to immediate doses, after discounting
R = monetary equivalent of unit dose, ($/person-rem)
F = accident frequency (events/yr)
D_{IO} = immediate occupational dose (person-rems/event)
S = status quo (current conditions)
A = after implementation of proposed action
r = real discount rate
t_f = analysis period (years).

The values used are:

R = $2000/person rem
r = 0.07
D_{IO} = 3,300 person-rems /accident (best estimate)

The license extension time of 20 years is used for t_f.

For the basis discount rate, assuming F_A is zero, the best estimate of the limiting savings is:

$$W_{IO} = \left(F_S D_{IO_S}\right) R \frac{1-e^{-rt_f}}{r}$$

$$= 3300 * F * \$2000 * \frac{1-e^{-.07*20}}{.07}$$

$$= F * \$6{,}600{,}000 * 10.763$$

$$= F * \$0.71E+08 \text{, (\$).}$$

b) **<u>Long-Term Doses</u>** (process of cleanup and refurbishment or decontamination)

For the case where the plant is in operation, the equations in Reference 16 can be expressed as:

$$W_{LTO} = \left(F_S D_{LTO_S} - F_A D_{LTO_A}\right) R * \frac{1-e^{-rt_f}}{r} * \frac{1-e^{-rm}}{rm} \qquad (2)$$

Where: W_{IO} = monetary value of accident risk avoided long-term doses, after discounting, $

M = years over which long-term doses accrue.

The values used are:

R = $2000/person rem
r = 0.07
D_{LTO} = 20,000 person-rem /accident (best estimate)
m = "as long as 10 years"

The license extension period of 20 years is used for t_f.

For the discount rate of 7%, assuming F_A is zero, the best estimate of the limiting savings is:

$$W_{LTO} = \left(F_S D_{LTO_S}\right) R * \frac{1-e^{-rt_f}}{r} * \frac{1-e^{-rm}}{rm}$$
$$= \left(F_S 20000\right) \$2000 * \frac{1-e^{-.07*20}}{.07} * \frac{1-e^{-.07*10}}{.07*10}$$
$$= F_S * \$40{,}000{,}000 * 10.763 * 0.719$$
$$= F_S * \$3.10E+08 \text{, (\$).}$$

c) **<u>Total Accident-Related Occupational (On-site) Exposures</u>**

Combining equations (1) and (2) above, using delta (Δ) to signify the difference in accident frequency resulting from the proposed actions, and using the above numerical values, the long term accident related on-site (occupational) exposure avoided (AOE) is:

<u>Best Estimate:</u>

$$AOE = W_{IO} + W_{LTO} = F * \$(0.71 + 3.1)E+08 = F * \$3.81E+08 \text{ (\$)}$$

F.4.4 ON-SITE ECONOMIC COST

<u>Methods for Calculation of Averted Costs Associated with Accident-Related On-Site Property Damage</u>

a) **<u>Cleanup/Decontamination</u>**

Reference 16 assumes a total cleanup/decontamination cost of $1.5E+09 as a reasonable estimate and this same value was adopted for these analyses. Considering a 10-year cleanup period, the present value of this cost is:

$$PV_{CD} = \left(\frac{C_{CD}}{m}\right)\left(\frac{1-e^{-rm}}{r}\right)$$

Where: PV_{CD} = Present value of the cost of cleanup/decontamination.
C_{CD} = Total cost of the cleanup/decontamination effort.
m = Cleanup period.
r = Discount rate.

Based upon the values previously assumed:

$$PV_{CD} = \left(\frac{\$1.5E+9}{10}\right)\left(\frac{1-e^{-.07*10}}{.07}\right)$$

$$PV_{CD} = \$1.079E+09$$

This cost is integrated over the term of the proposed license extension as follows:

$$U_{CD} = PV_{CD}\frac{1-e^{-rt_f}}{r}$$

Based upon the values previously assumed:

$$U_{CD} = \$1.079E+09\ [10.763]$$

$$U_{CD} = \$1.161E+10$$

b) **Replacement Power Costs**

Replacement power costs, U_{RP}, are an additional contributor to onsite costs. These are calculated in accordance with NUREG/BR-0184, Section 5.6.7.2.[(1)] Since replacement power will be needed for the remainder of the anticipated generating plant life following a severe accident, long-term power replacement calculations have been used. The calculations are based on the 910 MWe reference plant, and are appropriately scaled for the 1,290 MWe Seabrook Station. The calculation conservatively used the gross electrical output of 1,290 MWe rather than the net electrical output of 1,245 MWe. The present value of replacement power is calculated as follows:

$$PV_{RP} = \left(\frac{(\$1.2E+08)\frac{(Ratepwr)}{(910MWe)}}{r}\right)\left(1-e^{-rt_f}\right)^2$$

[(1)] The section number for Section 5.6.7.2 apparently contains a typographical error. This section is a subsection of 5.7.6 and follows 5.7.6.1. However, the section number as it appears in the NUREG will be used in this document.

Where: PVRP = Present value of the cost of replacement power for a single event.
t_f = Analysis period (years).
R = Discount rate.
Ratepwr = Rated power of the unit

The $1.2E+08 value has no intrinsic meaning but is a substitute for a string of non-constant replacement power costs that occur over the lifetime of a "generic" reactor after an event (from Reference 16). This equation was developed per NUREG/BR-0184 for discount rates between 5% and 10% only.

For discount rates between 1% and 5%, Reference 16 indicates that a linear interpolation is appropriate between present values of $1.2E+09 at 5% and $1.6E+09 at 1%. So for discount rates in this range the following equation was used to perform this linear interpolation.

$$PV_{RP} = \left\{(\$1.6E+09) - \left(\frac{[(\$1.6E+09) - (\$1.2E+09)]}{[5\% - 1\%]} * [r_s - 1\%]\right)\right\} * \left\{\frac{Ratepwr}{910MWe}\right\}$$

Where: r_s = Discount rate (small), between 1% and 5%.
Ratepwr = Rated power of the unit

To account for the entire lifetime of the facility, U_{RP} was then calculated from PV_{RP}, as follows:

$$U_{RP} = \frac{PV_{RP}}{r}\left(1 - e^{-rt_f}\right)^2$$

Where: U_{RP} = Present value of the cost of replacement power over the life of the facility.

Again, this equation is only applicable in the range of discount rates from 5% to 10%. NUREG/BR-0184 states that for lower discount rates, linear interpolations for U_{RP} are recommended between $1.9E+10 at 1% and $1.2E+10 at 5%. The following equation was used to perform these linear interpolations:

$$U_{RP} = \left\{(\$1.9E+10) - \left(\frac{[(\$1.9E+10) - (\$1.2E+10)]}{[5\% - 1\%]} * [r_s - 1\%]\right)\right\} * \left\{\frac{Ratepwr}{910MWe}\right\}$$

Where: r_s = Discount rate (small), between 1% and 5%.
Ratepwr = Rated power of the unit

c) **<u>Repair and Refurbishment</u>**

It is assumed that the plant would not be repaired or refurbished; therefore, there is no contribution to averted onsite costs from this source.

d) **Total Onsite Property Damage Costs**

The net present value of averted onsite damage costs is, therefore:

$$AOSC = F * (U_{CD} + U_{RP})$$

Where: F = Annual frequency of the event.

U_{CD} = Present value cost of clean up/decontamination

U_{RP} = Present value cost of replacement power

F.4.5 TOTAL COST OF SEVERE ACCIDENT RISK / MAXIMUM BENEFIT

Cost/benefit evaluation of the maximum benefit is baseline risk of the plant converted dollars by summing the contributors to cost.

Maximum Benefit Value = (APE + AOC + AOE + AOSC)

Where: APE = present value of averted public exposure ($),
AOC = present value of averted offsite property damage costs ($),
AOE = present value of averted occupational exposure ($),
AOSC = present value of averted onsite costs ($)

For Seabrook Station, this value is $818,721 as shown below.

Parameter	Present Dollar Value ($)
Averted Public Exposure	$230,433
Averted Offsite Costs	$253,299
Averted Occupational Exposure	$5498
Averted Onsite Costs	$329,492
Total	$818,721

The costs are dominated by the late large release category. The dominant accident sequences that result in these release categories are largely the result of loss of off-site power, fire, and seismic-initiating events. These initiating events are explicitly modeled in the PRA.

F.5 SAMA IDENTIFICATION

A list of SAMA candidates was developed by reviewing the major contributors to CDF and population dose based on the plant-specific risk assessment and the standard PWR list of enhancements from NEI 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document," November 2005 (Reference 20). This section discusses the SAMA selection process and its results.

F.5.1 PRA IMPORTANCE

The top core damage sequences and the components/systems having the greatest potential for risk reduction were examined to determine whether additional SAMAs could be identified from these sources.

The current plant procedures and training meet current industry standards. There were no additional specific procedure improvements identified that would affect the result of the HEP calculations. Therefore, no SAMA items were added to the plant-specific list of SAMAs as a result of the human actions with risk reduction worth (RRW) greater than 1.005. The human actions shown on Tables F.3.1.1.1-2 and F.3.2.1-2 are, therefore, not identified as potential SAMA candidates.

Use of Importance Measures

Risk reduction worth (RRW) of the components in the baseline model was used to identify the basic events that could have a significant potential for reducing risk. Components with RRW >1.005 were identified as the most important components. A similar review was performed on a systems basis. The components and systems were reviewed to ensure that each component and system is covered by an existing SAMA item or was added to the list if not covered by an existing SAMA.

Use of the Top Sequences

The top sequences leading to core melt were reviewed. A key result is that no single PRA sequence makes up a large fraction of the core damage frequency. The sequences were reviewed to ensure that initiators and failures identified in the sequences were either covered by existing SAMAs or were added to the list of plant- specific SAMAs.

F.5.2 PLANT IPE

The Seabrook Station IPE concluded that there are no fundamental weaknesses or vulnerabilities with regard to severe accidents at Seabrook Station. Several potential improvements were identified that could reduce overall risk. These items are included in the list of SAMA candidates.

F.5.3 PLANT IPEEE

The IPEEE concluded that there are no vulnerabilities to severe accident risk from external events. Several potential improvements were identified that could reduce overall risk. These items are included in the list of SAMA candidates.

F.5.4 INDUSTRY SAMA CANDIDATES

The generic PWR enhancement list from Table 14 of Reference 20 was included in the list of Phase I SAMA candidates to ensure adequate consideration of potential enhancements identified by other industry studies.

F.5.5 PLANT STAFF INPUT TO SAMA CANDIDATES

The plant staff provided plant-specific items that were included in the evaluation. The process used to identify plant-specific SAMA candidates included a detailed review of the IPE and IPEEE reports and associated potential plant enhancements to reduce severe accident risk, presentation of the license renewal and SAMA processes to plant engineering and plant management personnel and general solicitation of possible SAMA candidates, convening expert panel to review/discuss both industry-generic and plant-specific SAMA candidates. Plant-specific SAMA candidates are identified in the list of SAMA candidates by their source reference.

F.5.6 LIST OF PHASE I SAMA CANDIDATES

Table F.5.6-1 provides the combined list of potential SAMA candidates considered in the Seabrook Station SAMA analysis. One hundred-ninety SAMA candidates were identified for consideration.

Table F.5.6-1 List of SAMA Candidates

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
1	Provide additional DC battery capacity.	Extended DC power availability during an SBO.	AC/DC	1, 3, 6, 10, 11, 12, 17
2	Replace lead-acid batteries with fuel cells.	Extended DC power availability during an SBO.	AC/DC	6, 10
3	Add additional battery charger or portable, diesel-driven battery charger to existing DC system.	Improved availability of DC power system.	AC/DC	5
4	Improve DC bus load shedding.	Extended DC power availability during an SBO.	AC/DC	1, 7
5	Provide DC bus cross-ties.	Improved availability of DC power system.	AC/DC	6
6	Provide additional DC power to the 120/240V vital AC system.	Increased availability of the 120 V vital AC bus.	AC/DC	3
7	Add an automatic feature to transfer the 120V vital AC bus from normal to standby power.	Increased availability of the 120 V vital AC bus.	AC/DC	5
8	Increase training on response to loss of two 120V AC buses which causes inadvertent actuation signals.	Improved chances of successful response to loss of two 120V AC buses.	AC/DC	5
9	Provide an additional diesel generator.	Increased availability of on-site emergency AC power.	AC/DC	1, 6, 10, 11, 12
10	Revise procedure to allow bypass of diesel generator trips.	Extended diesel generator operation.	AC/DC	15
11	Improve 4.16-kV bus cross-tie ability.	Increased availability of on-site AC power.	AC/DC	1, 6, 11, 12
12	Create AC power cross-tie capability with other unit (multi-unit site).	Increased availability of on-site AC power.	AC/DC	1, 7, 13
13	Install an additional, buried off-site power source.	Reduced probability of loss of ofF.site power.	AC/DC	1
14	Install a gas turbine generator.	Increased availability of on-site AC power.	AC/DC	1, 6

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
15	Install tornado protection on gas turbine generator.	Increased availability of on-site AC power.	AC/DC	18
16	Improve uninterruptible power supplies.	Increased availability of power supplies supporting front-line equipment.	AC/DC	6
17	Create a cross-tie for diesel fuel oil (multi-unit site).	Increased diesel generator availability.	AC/DC	1
18	Develop procedures for replenishing diesel fuel oil.	Increased diesel generator availability.	AC/DC	1
19	Use fire water system as a backup source for diesel cooling.	Increased diesel generator availability.	AC/DC	1
20	Add a new backup source of diesel cooling.	Increased diesel generator availability.	AC/DC	1
21	Develop procedures to repair or replace failed 4 KV breakers.	Increased probability of recovery from failure of breakers that transfer 4.16 kV non-emergency buses from unit station service transformers.	AC/DC	1
22	In training, emphasize steps in recovery of off-site power after an SBO.	Reduced human error probability during off-site power recovery.	AC/DC	1
23	Develop a severe weather conditions procedure.	Improved ofF.site power recovery following external weather-related events.	AC/DC	1, 3, 17
24	Bury off-site power lines.	Improved off-site power reliability during severe weather.	AC/DC	1
25	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	Core Cooling	5, 6

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
26	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	Core Cooling	5
27	Revise procedure to allow operators to inhibit automatic vessel depressurization in non-ATWS scenarios.	Extended HPCI and RCIC operation.	Core Cooling	5
28	Add a diverse low pressure injection system.	Improved injection capability.	Core Cooling	5, 6
29	Provide capability for alternate injection via diesel-driven fire pump.	Improved injection capability.	Core Cooling	5
30	Improve ECCS suction strainers.	Enhanced reliability of ECCS suction.	Core Cooling	22
31	Add the ability to manually align emergency core cooling system recirculation.	Enhanced reliability of ECCS suction.	Core Cooling	5
32	Add the ability to automatically align emergency core cooling system to recirculation mode upon refueling water storage tank depletion.	Enhanced reliability of ECCS suction.	Core Cooling	5
33	Provide hardware and procedure to refill the reactor water storage tank once it reaches a specified low level.	Extended reactor water storage tank capacity in the event of a steam generator tube rupture (or other LOCAs challenging RWST capacity) .	Core Cooling	5, 10
34	Provide an in-containment reactor water storage tank.	Continuous source of water to the safety injection pumps during a LOCA event, since water released from a breach of the primary system collects in the in-containment reactor water storage tank, and thereby eliminates the need to realign the safety injection pumps for long-term post-LOCA recirculation.	Core Cooling	10
35	Throttle low pressure injection pumps earlier in medium or large-break LOCAs to maintain reactor water storage tank inventory.	Extended reactor water storage tank capacity.	Core Cooling	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
36	Emphasize timely recirculation alignment in operator training.	Reduced human error probability associated with recirculation failure.	Core Cooling	5
37	Upgrade the chemical and volume control system to mitigate small LOCAs.	For a plant like the Westinghouse AP600, where the chemical and volume control system cannot mitigate a small LOCA, an upgrade would decrease the frequency of core damage.	Core Cooling	5
38	Change the in-containment reactor water storage tank suction from four check valves to two check and two air-operated valves.	Reduced common mode failure of injection paths.	Core Cooling	5
39	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high- and low-pressure safety injections systems.	Core Cooling	5, 10
40	Provide capability for remote, manual operation of secondary side pilot-operated relief valves in a station blackout.	Improved chance of successful operation during station blackout events in which high area temperatures may be encountered (no ventilation to main steam areas).	Core Cooling	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
41	Create a reactor coolant depressurization system.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	Core Cooling	5, 10
42	Make procedure changes for reactor coolant system depressurization.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	Core Cooling	5
43	Add redundant DC control power for SW pumps.	Increased availability of SW.	Cooling Water	3
44	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	Cooling Water	1
45	Enhance procedural guidance for use of cross-tied component cooling or service water pumps.	Reduced frequency of loss of component cooling water and service water.	Cooling Water	1
46	Add a service water pump.	Increased availability of cooling water.	Cooling Water	6
47	Enhance the screen wash system.	Reduced potential for loss of SW due to clogging of screens.	Cooling Water	23
48	Cap downstream piping of normally closed component cooling water drain and vent valves.	Reduced frequency of loss of component cooling water initiating events, some of which can be attributed to catastrophic failure of one of the many single isolation valves.	Cooling Water	5
49	Enhance loss of component cooling water (or loss of service water) procedures to facilitate stopping the reactor coolant pumps.	Reduced potential for reactor coolant pump seal damage due to pump bearing failure.	Cooling Water	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
50	Enhance loss of component cooling water procedure to underscore the desirability of cooling down the reactor coolant system prior to seal LOCA.	Reduced probability of reactor coolant pump seal failure.	Cooling Water	5
51	Additional training on loss of component cooling water.	Improved success of operator actions after a loss of component cooling water.	Cooling Water	5
52	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	Reduced effect of loss of component cooling water by providing a means to maintain the charging pump seal injection following a loss of normal cooling water.	Cooling Water	5
53	On loss of essential raw cooling water, proceduralize shedding component cooling water loads to extend the component cooling water heat-up time.	Increased time before loss of component cooling water (and reactor coolant pump seal failure) during loss of essential raw cooling water sequences.	Cooling Water	5
54	Increase charging pump lube oil capacity.	Increased time before charging pump failure due to lube oil overheating in loss of cooling water sequences.	Cooling Water	5
55	Install an independent reactor coolant pump seal injection system, with dedicated diesel.	Reduced frequency of core damage from loss of component cooling water, service water, or station blackout.	Cooling Water	5, 10
56	Install an independent reactor coolant pump seal injection system, without dedicated diesel.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout.	Cooling Water	5, 10

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
57	Use existing hydro test pump for reactor coolant pump seal injection.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout, unless an alternate power source is used.	Cooling Water	5
58	Install improved reactor coolant pump seals.	Reduced likelihood of reactor coolant pump seal LOCA.	Cooling Water	5
59	Install an additional component cooling water pump.	Reduced likelihood of loss of component cooling water leading to a reactor coolant pump seal LOCA.	Cooling Water	5
60	Prevent makeup pump flow diversion through the relief valves.	Reduced frequency of loss of reactor coolant pump seal cooling if spurious high pressure injection relief valve opening creates a flow diversion large enough to prevent reactor coolant pump seal injection.	Cooling Water	5
61	Change procedures to isolate reactor coolant pump seal return flow on loss of component cooling water, and provide (or enhance) guidance on loss of injection during seal LOCA.	Reduced frequency of core damage due to loss of seal cooling.	Cooling Water	5
62	Implement procedures to stagger high pressure safety injection pump use after a loss of service water.	Extended high pressure injection prior to overheating following a loss of service water.	Cooling Water	5
63	Use fire prevention system pumps as a backup seal injection and high pressure makeup source.	Reduced frequency of reactor coolant pump seal LOCA.	Cooling Water	5
64	Implement procedure and hardware modifications to allow manual alignment of the fire water system to the component cooling water system, or install a component cooling water header cross-tie.	Improved ability to cool residual heat removal heat exchangers.	Cooling Water	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
65	Install a digital feed water upgrade.	Reduced chance of loss of main feed water following a plant trip.	Feedwater/ Condensate	1
66	Create ability for emergency connection of existing or new water sources to feedwater and condensate systems.	Increased availability of feedwater.	Feedwater/ Condensate	5
67	Install an independent diesel for the condensate storage tank makeup pumps.	Extended inventory in CST during an SBO.	Feedwater/ Condensate	5
68	Add a motor-driven feedwater pump.	Increased availability of feedwater.	Feedwater/ Condensate	1, 3
69	Install manual isolation valves around auxiliary feedwater turbine-driven steam admission valves.	Reduced dual turbine-driven pump maintenance unavailability.	Feedwater/ Condensate	5
70	Install accumulators for turbine-driven auxiliary feedwater pump flow control valves.	Eliminates the need for local manual action to align nitrogen bottles for control air following a loss of off-site power.	Feedwater/ Condensate	5
71	Install a new condensate storage tank (auxiliary feedwater storage tank).	Increased availability of the auxiliary feedwater system.	Feedwater/ Condensate	5, 10
72	Modify the turbine-driven auxiliary feedwater pump to be self-cooled.	Improved success probability during a station blackout.	Feedwater/ Condensate	5
73	Proceduralize local manual operation of auxiliary feedwater system when control power is lost.	Extended auxiliary feedwater availability during a station blackout. Also provides a success path should auxiliary feedwater control power be lost in non-station blackout sequences.	Feedwater/ Condensate	5
74	Provide hookup for portable generators to power the turbine-driven auxiliary feedwater pump after station batteries are depleted.	Extended auxiliary feedwater availability.	Feedwater/ Condensate	5, 10
75	Use fire water system as a backup for steam generator inventory.	Increased availability of steam generator water supply.	Feedwater/ Condensate	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
76	Change failure position of condenser makeup valve if the condenser makeup valve fails open on loss of air or power.	Allows greater inventory for the auxiliary feedwater pumps by preventing condensate storage tank flow diversion to the condenser.	Feedwater/ Condensate	5
77	Provide a passive, secondary-side heat-rejection loop consisting of a condenser and heat sink.	Reduced potential for core damage due to loss-of-feedwater events.	Feedwater/ Condensate	5
78	Modify the startup feedwater pump so that it can be used as a backup to the emergency feedwater system, including during a station blackout scenario.	Increased reliability of decay heat removal.	Feedwater/ Condensate	10
79	Replace existing pilot-operated relief valves with larger ones, such that only one is required for successful feed and bleed.	Increased probability of successful feed and bleed.	Feedwater/ Condensate	5
80	Provide a redundant train or means of ventilation.	Increased availability of components dependent on room cooling.	HVAC	1
81	Add a diesel building high temperature alarm or redundant louver and thermostat.	Improved diagnosis of a loss of diesel building HVAC.	HVAC	1
82	Stage backup fans in switchgear rooms.	Increased availability of ventilation in the event of a loss of switchgear ventilation.	HVAC	5
83	Add a switchgear room high temperature alarm.	Improved diagnosis of a loss of switchgear HVAC.	HVAC	5
84	Create ability to switch emergency feedwater room fan power supply to station batteries in a station blackout.	Continued fan operation in a station blackout.	HVAC	5
85	Provide cross-unit connection of uninterruptible compressed air supply.	Increased ability to vent containment using the hardened vent.	IA/Nitrogen	3
86	Modify procedure to provide ability to align diesel power to more air compressors.	Increased availability of instrument air after a LOOP.	IA/Nitrogen	18
87	Replace service and instrument air compressors with more reliable compressors which have self-contained air cooling by shaft driven fans.	Elimination of instrument air system dependence on service water cooling.	IA/Nitrogen	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
88	Install nitrogen bottles as backup gas supply for safety relief valves.	Extended SRV operation time.	IA/Nitrogen	18
89	Improve SRV and MSIV pneumatic components.	Improved availability of SRVs and MSIVs.	IA/Nitrogen	6
90	Create a reactor cavity flooding system.	Enhanced debris cool ability, reduced core concrete interaction, and increased fission product scrubbing.	Containment Phenomena	1, 7, 11, 12
91	Install a passive containment spray system.	Improved containment spray capability.	Containment Phenomena	6, 14
92	Use the fire water system as a backup source for the containment spray system.	Improved containment spray capability.	Containment Phenomena	4, 6
93	Install an unfiltered, hardened containment vent.	Increased decay heat removal capability for non-ATWS events, without scrubbing released fission products.	Containment Phenomena	6, 8, 9
94	Install a filtered containment vent to remove decay heat. Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Increased decay heat removal capability for non-ATWS events, with scrubbing of released fission products.	Containment Phenomena	6, 8, 9, 14
95	Enhance fire protection system and standby gas treatment system hardware and procedures.	Improved fission product scrubbing in severe accidents.	Containment Phenomena	9
96	Provide post-accident containment inserting capability.	Reduced likelihood of hydrogen and carbon monoxide gas combustion.	Containment Phenomena	6, 7, 12
97	Create a large concrete crucible with heat removal potential to contain molten core debris.	Increased cooling and containment of molten core debris. Molten core debris escaping from the vessel is contained within the crucible and a water cooling mechanism cools the molten core in the crucible, preventing melt-through of the base mat.	Containment Phenomena	6, 8, 9

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
98	Create a core melt source reduction system.	Increased cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur.	Containment Phenomena	13
99	Strengthen primary/secondary containment (e.g., add ribbing to containment shell).	Reduced probability of containment over-pressurization.	Containment Phenomena	5, 6, 10, 14
100	Increase depth of the concrete base mat or use an alternate concrete material to ensure melt-through does not occur.	Reduced probability of base mat melt-through.	Containment Phenomena	10
101	Provide a reactor vessel exterior cooling system.	Increased potential to cool a molten core before it causes vessel failure, by submerging the lower head in water.	Containment Phenomena	10
102	Construct a building to be connected to primary/secondary containment and maintained at a vacuum.	Reduced probability of containment over-pressurization.	Containment Phenomena	6, 10
103	Institute simulator training for severe accident scenarios.	Improved arrest of core melt progress and prevention of containment failure.	Containment Phenomena	6
104	Improve leak detection procedures.	Increased piping surveillance to identify leaks prior to complete failure. Improved leak detection would reduce LOCA frequency.	Containment Phenomena	6

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
105	Delay containment spray actuation after a large LOCA.	Extended reactor water storage tank availability.	Containment Phenomena	5
106	Install automatic containment spray pump header throttle valves.	Extended time over which water remains in the reactor water storage tank, when full containment spray flow is not needed.	Containment Phenomena	5
107	Install a redundant containment spray system.	Increased containment heat removal ability.	Containment Phenomena	5, 10
108	Install an independent power supply to the hydrogen control system using either new batteries, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel.	Reduced hydrogen detonation potential.	Containment Phenomena	5, 10
109	Install a passive hydrogen control system.	Reduced hydrogen detonation potential.	Containment Phenomena	5, 10
110	Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure.	Reduced probability of containment failure.	Containment Phenomena	5
111	Install additional pressure or leak monitoring instruments for detection of ISLOCAs.	Reduced ISLOCA frequency.	Containment Bypass	4, 7, 11, 12, 15
112	Add redundant and diverse limit switches to each containment isolation valve.	Reduced frequency of containment isolation failure and ISLOCAs.	Containment Bypass	1
113	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	Containment Bypass	1
114	Install selF.actuating containment isolation valves.	Reduced frequency of isolation failure.	Containment Bypass	5
115	Locate residual heat removal (RHR) inside containment	Reduced frequency of ISLOCA outside containment.	Containment Bypass	14
116	Ensure ISLOCA releases are scrubbed. One method is to plug drains in potential break areas so that break point will be covered with water.	Scrubbed ISLOCA releases.	Containment Bypass	1

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
117	Revise EOPs to improve ISLOCA identification.	Increased likelihood that LOCAs outside containment are identified as such. A plant had a scenario in which an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside containment.	Containment Bypass	1
118	Improve operator training on ISLOCA coping.	Decreased ISLOCA consequences.	Containment Bypass	1
119	Institute a maintenance practice to perform a 100% inspection of steam generator tubes during each refueling outage.	Reduced frequency of steam generator tube ruptures.	Containment Bypass	5, 10
120	Replace steam generators with a new design.	Reduced frequency of steam generator tube ruptures.	Containment Bypass	5
121	Increase the pressure capacity of the secondary side so that a steam generator tube rupture would not cause the relief valves to lift.	Eliminates release pathway to the environment following a steam generator tube rupture.	Containment Bypass	5, 10
122	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture.	Enhanced depressurization capabilities during steam generator tube rupture.	Containment Bypass	5, 10
123	Proceduralize use of pressurizer vent valves during steam generator tube rupture sequences.	Backup method to using pressurizer sprays to reduce primary system pressure following a steam generator tube rupture.	Containment Bypass	5
124	Provide improved instrumentation to detect steam generator tube ruptures, such as Nitrogen-16 monitors.	Improved mitigation of steam generator tube ruptures.	Containment Bypass	5, 10
125	Route the discharge from the main steam safety valves through a structure where a water spray would condense the steam and remove most of the fission products.	Reduced consequences of a steam generator tube rupture.	Containment Bypass	10
126	Install a highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources	Reduced consequences of a steam generator tube rupture.	Containment Bypass	5

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source (1)
127	Revise emergency operating procedures to direct isolation of a faulted steam generator.	Reduced consequences of a steam generator tube rupture.	Containment Bypass	5
128	Direct steam generator flooding after a steam generator tube rupture, prior to core damage.	Improved scrubbing of steam generator tube rupture releases.	Containment Bypass	5
129	Vent main steam safety valves in containment.	Reduced consequences of a steam generator tube rupture.	Containment Bypass	5, 10
130	Add an independent boron injection system.	Improved availability of boron injection during ATWS.	ATWS	18
131	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	ATWS	19
132	Provide an additional control system for rod insertion (e.g., AMSAC).	Improved redundancy and reduced ATWS frequency.	ATWS	18
133	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	ATWS	6
134	Revise procedure to bypass MSIV isolation in turbine trip ATWS scenarios.	Affords operators more time to perform actions. Discharge of a substantial fraction of steam to the main condenser (i.e., as opposed to into the primary containment) affords the operator more time to perform actions (e.g., SLC injection, lower water level, depressurize RPV) than if the main condenser was unavailable, resulting in lower human error probabilities.	ATWS	1, 20

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
135	Revise procedure to allow override of low pressure core injection during an ATWS event.	Allows immediate control of low pressure core injection. On failure of high pressure core injection and condensate, some plants direct reactor depressurization followed by five minutes of automatic low pressure core injection.	ATWS	16
136	Install motor generator set trip breakers in control room.	Reduced frequency of core damage due to an ATWS.	ATWS	5
137	Provide capability to remove power from the bus powering the control rods.	Decreased time required to insert control rods if the reactor trip breakers fail (during a loss of feedwater ATWS which has rapid pressure excursion).	ATWS	5
138	Improve inspection of rubber expansion joints on main condenser.	Reduced frequency of internal flooding due to failure of circulating water system expansion joints.	Internal Flooding	1
139	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	Prevents flood propagation.	Internal Flooding	5
140	Increase seismic ruggedness of plant components.	Increased availability of necessary plant equipment during and after seismic events.	Seismic Risk	3, 10
141	Provide additional restraints for CO2 tanks.	Increased availability of fire protection given a seismic event.	Seismic Risk	17
142	Replace mercury switches in fire protection system.	Decreased probability of spurious fire suppression system actuation.	Fire Risk	7
143	Upgrade fire compartment barriers.	Decreased consequences of a fire.	Fire Risk	7

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
144	Install additional transfer and isolation switches.	Reduced number of spurious actuations during a fire.	Fire Risk	18
145	Enhance fire brigade awareness.	Decreased consequences of a fire.	Fire Risk	7
146	Enhance control of combustibles and ignition sources.	Decreased fire frequency and consequences.	Fire Risk	7
147	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	Other	5
148	Enhance procedures to mitigate large break LOCA.	Reduced consequences of a large break LOCA.	Other	7
149	Install computer aided instrumentation system to assist the operator in assessing post-accident plant status.	Improved prevention of core melt sequences by making operator actions more reliable.	Other	6
150	Improve maintenance procedures.	Improved prevention of core melt sequences by increasing reliability of important equipment.	Other	6
151	Increase training and operating experience feedback to improve operator response.	Improved likelihood of success of operator actions taken in response to abnormal conditions.	Other	6
152	Develop procedures for transportation and nearby facility accidents.	Reduced consequences of transportation and nearby facility accidents.	Other	7

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source (1)
153	Install secondary side guard pipes up to the main steam isolation valves.	Prevents secondary side depressurization should a steam line break occur upstream of the main steam isolation valves. Also guards against or prevents consequential multiple steam generator tube ruptures following a main steam line break event.	Other	5, 10
154	Modify SEPS design to accommodate: (a) automatic bus loading, (b) automatic bus alignment.	Improve reliability of onsite power; reduce SBO CDF contribution; remove dependence on operator action.	AC/DC	A
155	Install alternate emergency AC power source (e.g., swing diesel).	SEPS DG installed and credited in PRA to power Bus E5 or Bus E6.	AC/DC	A
156	Install alternate offsite power source that bypasses the switchyard. For example, use campus power source to energize Bus E5 or E6.	Improve offsite power reliability and independence of switchyard and SF6 bus duct; allow restoration of offsite power within a few hours.	AC/DC	A
157	Provide independent AC power source for battery chargers. For example, provide portable generator to charge station battery.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	AC/DC	A
158	Provide enhanced procedural direction for cross-tie of batteries within each train.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	AC/DC	A
159	Install additional batteries.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	AC/DC	A

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
160	Enhancements to address loss of SF6-type sequences.	SF6 enhancements improve offsite power reliability.	AC/DC	A
161	Modify EDG jacket heat exchanger service water supply and return to allow timely alignment of alternate cooling water source (supply & drain) from firewater, RMW, DW, etc.	Alternate cooling to both EDGs would reduce CDF long term sequences involving LOOP and loss of SW /cooling tower. A loss of service water / cooling tower with a LOOP could result in EDG failure and non-recovery.	AC/DC	A
162	Increase the capacity margin of the CST.	Extend long term operation of EFW without operator action for CST makeup for sequences that do not go to cold shutdown. Enhance CST margin for design-basis seismic event with cooldown via SG and transition to RHR.	Core Cooling	A
163	Install third EFW pump (steam-driven).	Reduce CDF of SBO sequences by improving overall reliability of EFW system independent of AC power. An additional pump might also have a Level 2 benefit by maintaining coverage of SG tubes thus reducing the release potential for induced SGTR given high pressure core melt sequence.	Core Cooling	A
164	Modify 10" Condensate Filter Flange to have a 2½-inch female fire hose adapter with isolation valve.	Possible enhancement of long term core damage sequences that credit CST makeup.	Core Cooling	A

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
165	RWST fill from firewater during containment injection - Modify 6" RWST Flush Flange to have a 2½-inch female fire hose adapter with isolation valve.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	Core/Containment Cooling	A
166	Fabricate attachment to fill the RWST via the Silica skid; mod would include a 2½-inch to 2-inch adapter.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	Core/Containment Cooling	A
167	Install independent seal injection pump (low volume pump) with automatic start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	IE Freq	A
168	Install independent seal injection pump (low volume pump) with manual start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	IE Freq	A
169	Install independent charging pump (high volume pump) with manual start	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures; improve decay heat removal using feed & bleed.	IE Freq	A
170	Replace the Positive Displacement Pump (PDP) with a 3rd centrifugal charging pump. Consider low volume and cooling water independence.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	IE Freq	A
171	Install high temperature O-rings in RCPs.	Complete. High temperature o-rings installed and credited in PRA as applicable.	IE Freq	A
172	Evaluate installation of a "shutdown seal" in the RCPs being developed by Westinghouse.	Reduce CDF contribution from transients with seal cooling hardware failures resulting in RCP seal LOCA events.	IE Freq	A

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [1]
173	Improve procedural guidance for directing depressurization of RCS.	Complete. RCS depressurization procedures complete and credited in PRA as applicable. This reduces CDF contribution from RCP seal LOCA during SBO-type sequences.	IE Freq	A
174	Provide alternate scram button to remove power from MG sets to CR drives.	Improve reliability of reactor scram by providing remote-manual capability to remove rod drive power should the reactor trip breakers fail; reduce ATWS contribution.	IE Freq	A
175	Install fire detection in turbine building relay room.	Improve fire detection and manual suppression actions.	Fire Risk	A
176	Install additional suppression at west wall of turbine building.	Complete. Combustible materials control improved and credited in PRA as applicable.	Fire Risk	A
177	Improve fire response procedure to indicate that PCCW can be impacted by PAB fire event.	Complete. Addressed in Fire Protection Maintenance Manual.	Fire Risk	A
178	Improve fire response procedure to indicate important fire areas including control room, PCCW pump area and cable spreading room.	Complete. Addressed in Fire Protection Manual.	Fire Risk	A
179	Fire induced LOCA response procedure from Alternate Shutdown Panel.	Possible reduction in CDF if mitigating fire-induced LOCA. Judged marginal benefit due to existing design and guidance to minimize potential for inadvertent PORV interaction. Thus, likelihood of LOCA with control room uninhabitable for a long period of time is judged low.	Fire Risk	A

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source [(1)]
180	Modify SW pump house roof to allow scuppers to function properly.	Proper scupper openings provided to limit accumulation of precipitation on roof.	Other Ext	A
181	Improve relay chatter fragility.	Relay chatter fragility judged low contributor to CDF. Significant uncertainty in hazard and fragility not easily removed and beyond state-of-the-art as stated in IPEEE. No further actions needed.	Other Ext	A
182	Improve seismic capacity of EDGs and steam-driven EFW pump.	Improve component fragility and reduce seismic event contribution to CDF.	Other Ext	A
183	Turbine Building internal flooding improvements.	Reduce CDF impact as a result of postulated CW break resulting in loss of offsite power and loss of vital switchgear.	Other Ext	A
184	Control/reduce time that the containment purge valves are in open position.	Purge path is large opening. Reduce exposure time of open path, improve reliability/availability of CI, reduce CI failure contribution to large release.	Containment Phenomena	A
185	Improve procedural guidance for directing depressurization of RCS.	Improvements to depressurization to reduce potential for high pressure core melt ejection and DCH challenge.	Containment Phenomena	A
186	Install containment leakage monitoring system.	Improve containment reliability by reducing the potential for pre-existing containment leakage.	Containment Phenomena	A

Table F.5.6-1 List of SAMA Candidates (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Focus of SAMA	Source (1)
187	Install RHR isolation valve leakage monitoring system.	Reduce ISLOCA challenge to RHR by identification of upstream valve failure.	Containment Phenomena	A
188	Containment flooding - Modify the containment ILRT10-inch test flange to include a 5-inch adapter with isolation valve.	Improve the time to align to Fire Protection system to flood containment.	Containment Phenomena	A
189	Modify or analyze SEPS capability; 1 of 2 SEPS for LOSP non-SI loads, 2 of 2 for LOSP SI loads.	Allow all equipment to be run following LOSP with EDG failure but successful start and load of SEPS.	Other	A
190	Add synchronization capability to SEPS Diesel.	Eliminate current requirement for dead bus transfer from SEPS to normal power.	Other	A
191	Remove the 135F temperature trip of the PCCW pumps.	Potential for some improvement in PCCW reliability by eliminating consideration of spurious trip.	Other	A

Note 1: Source reference numbers are from NEI 05-01 (Reference 20)

A - Plant-specific SAMA candidates based on review of IPE, IPEEE, presentation and solicitation of plant personnel and expert panel.

F.6 PHASE I ANALYSIS

A preliminary screening of the complete list of SAMA candidates was performed to limit the number of SAMAs for which detailed analysis in Phase II was necessary. The screening criteria used in the Phase I analysis are described below.

- ***Screening Criterion A - Not Applicable:*** If a SAMA candidate did not apply to the Seabrook Unit 1 plant design, it was not retained.
- ***Screening Criterion B - Already Implemented or Intent Met:*** If a SAMA candidate had already been implemented at the Seabrook Station or the intent of the candidate is met, it was not retained.
- ***Screening Criterion C - Combined:*** If a SAMA candidate was similar in nature to and could be combined with another SAMA candidate to develop a more comprehensive or plant-specific SAMA candidate, only the combined SAMA candidate was retained.
- ***Screening Criterion D - Excessive Implementation Cost:*** If a SAMA required extensive changes that would obviously exceed the maximum benefit (Section F.4.5), even without an implementation cost estimate, it was not retained.
- ***Screening Criterion E - Very Low Benefit:*** If a SAMA from an industry document was related to a non-risk significant system for which change in reliability is known to have negligible impact on the risk profile, it was not retained. (No SAMAs were screened using this criterion.)

Table F.6-1 presents the list of Phase I SAMA candidates and provides the disposition of each candidate, and any applicable screening criterion. Those candidates that were not screened out by these criteria are evaluated further in the Phase II analysis (Section F.7). One hundred-seventeen SAMAs were screened from the analysis during Phase I and 74 SAMAs passed into the next phase of the analysis.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
2	Replace lead-acid batteries with fuel cells.	Extended DC power availability during an SBO.	No		Retain for Phase II.
13	Install an additional, buried off- site power source.	Reduced probability of loss of off-site power.	No		Retain for Phase II.
14	Install a gas turbine generator.	Increased availability of on-site AC power.	No		Retain for Phase II.
16	Improve uninterruptible power supplies.	Increased availability of power supplies supporting front-line equipment.	No		Retain for Phase II.
20	Add a new backup source of diesel cooling.	Increased diesel generator availability.	No		Note that supplemental diesel (SEPS) is air cooled. Retain for Phase II.
21	Develop procedures to repair or replace failed 4 KV breakers.	Increased probability of recovery from failure of breakers that transfer 4.16 kV non-emergency buses from unit station service transformers.	No		Revisit as part of Phase II screening. Trip test every 3 years, inspections every 6 years, refurbish every 12 years. Each bus has two in feeds. Emergency buses have three in feeds. Spare breaker for ECCS. Fast transfer.
24	Bury off-site power lines.	Improved off-site power reliability during severe weather.	No		Retain for Phase II.
25	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	No		Retain for Phase II.
26	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	No		Retain for Phase II.
28	Add a diverse low pressure injection system.	Improved injection capability.	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
35	Throttle low pressure injection pumps earlier in medium or large-break LOCAs to maintain reactor water storage tank inventory.	Extended reactor water storage tank capacity.	No		Retain for Phase II.
39	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high- and low-pressure safety injections systems.	No		Retain for Phase II.
41	Create a reactor coolant depressurization system.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	No		Retain for Phase II.
43	Add redundant DC control power for SW pumps.	Increased availability of SW.	No		Retain for Phase II.
44	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	No		ECCS pump motors are currently air-cooled. ECCS pumps require component cooling. Elimination of component cooling dependency is evaluated in Phase II.
55	Install an independent reactor coolant pump seal injection system, with dedicated diesel.	Reduced frequency of core damage from loss of component cooling water, service water, or station blackout.	No		Retain for Phase II.
59	Install an additional component cooling water pump.	Reduced likelihood of loss of component cooling water leading to a reactor coolant pump seal LOCA.	No		Currently have 2, 100% capacity pumps in each division of PCCW. Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
65	Install a digital feed water upgrade.	Reduced chance of loss of main feed water following a plant trip.	No		Plant upgrade to incorporate digital feedwater control system is in progress.
77	Provide a passive, secondary-side heat-rejection loop consisting of a condenser and heat sink.	Reduced potential for core damage due to loss-of-feedwater events.	No		Retain for Phase II.
80	Provide a redundant train or means of ventilation.	Increased availability of components dependent on room cooling.	No		Except for RHR, charging, and diesels there are proceduralized compensatory ventilation actions (open doors/dampers/fans). Retain for Phase II evaluation.
90	Create a reactor cavity flooding system.	Enhanced debris cool ability, reduced core concrete interaction, and increased fission product scrubbing.	No		Retain for Phase II.
91	Install a passive containment spray system.	Improved containment spray capability.	No		Retain for Phase II.
93	Install an unfiltered, hardened containment vent.	Increased decay heat removal capability for non-ATWS events, without scrubbing released fission products.	No		Retain for Phase II.
94	Install a filtered containment vent to remove decay heat. Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Increased decay heat removal capability for non-ATWS events, with scrubbing of released fission products.	No		Retain for Phase II.
96	Provide post-accident containment inserting capability.	Reduced likelihood of hydrogen and carbon monoxide gas combustion.	No		Retain for Phase II.
97	Create a large concrete crucible with heat removal potential to contain molten core debris.	Increased cooling and containment of molten core debris. Molten core debris escaping from the vessel is contained within the crucible and a water cooling mechanism cools the molten core in the crucible, preventing melt-through of the base mat.	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
98	Create a core melt source reduction system.	Increased cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur.	No		Retain for Phase II.
99	Strengthen primary/secondary containment (e.g., add ribbing to containment shell).	Reduced probability of containment over-pressurization.	No		Retain for Phase II.
100	Increase depth of the concrete base mat or use an alternate concrete material to ensure melt-through does not occur.	Reduced probability of base mat melt-through.	No		Retain for Phase II.
101	Provide a reactor vessel exterior cooling system.	Increased potential to cool a molten core before it causes vessel failure, by submerging the lower head in water.	No		Retain for Phase II.
102	Construct a building to be connected to primary/secondary containment and maintained at a vacuum.	Reduced probability of containment over-pressurization.	No		Retain for Phase II.
106	Install automatic containment spray pump header throttle valves.	Extended time over which water remains in the reactor water storage tank, when full containment spray flow is not needed.	No		Retain for Phase II.
107	Install a redundant containment spray system.	Increased containment heat removal ability.	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
108	Install an independent power supply to the hydrogen control system using either new batteries, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel.	Reduced hydrogen detonation potential.	No		Retain for Phase II.
109	Install a passive hydrogen control system.	Reduced hydrogen detonation potential.	No		Retain for Phase II.
110	Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure.	Reduced probability of containment failure.	No		Retain for Phase II.
112	Add redundant and diverse limit switches to each containment isolation valve.	Reduced frequency of containment isolation failure and ISLOCAs.	No		Retain for Phase II.
113	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	No		Retain for Phase II.
114	Install self-actuating containment isolation valves.	Reduced frequency of isolation failure.	No		Retain for Phase II.
115	Locate residual heat removal (RHR) inside containment	Reduced frequency of ISLOCA outside containment.	No		Retain for Phase II.
119	Institute a maintenance practice to perform a 100% inspection of steam generator tubes during each refueling outage.	Reduced frequency of steam generator tube ruptures.	No		All four steam generators are currently planned for inspection every other outage. Foreign object search and retrieval is performed on generators that are open for inspection. Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
121	Increase the pressure capacity of the secondary side so that a steam generator tube rupture would not cause the relief valves to lift.	Eliminates release pathway to the environment following a steam generator tube rupture.	No		Retain for Phase II.
125	Route the discharge from the main steam safety valves through a structure where a water spray would condense the steam and remove most of the fission products.	Reduced consequences of a steam generator tube rupture.	No		Retain for Phase II.
126	Install a highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources	Reduced consequences of a steam generator tube rupture.	No		Retain for Phase II.
129	Vent main steam safety valves in containment.	Reduced consequences of a steam generator tube rupture.	No		Retain for Phase II.
130	Add an independent boron injection system.	Improved availability of boron injection during ATWS.	No		Currently have a boron injection system, but do not have one that is independent. Review as part of Phase II screening.
131	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	No		Retain for Phase II.
133	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	No		Retain for Phase II.
147	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
153	Install secondary side guard pipes up to the main steam isolation valves.	Prevents secondary side depressurization should a steam line break occur upstream of the main steam isolation valves. Also guards against or prevents consequential multiple steam generator tube ruptures following a main steam line break event.	No		Retain for Phase II.
154	Modify SEPS design to accommodate: (a) automatic bus loading, (b) automatic bus alignment.	Improve reliability of onsite power; reduce SBO CDF contribution; remove dependence on operator action.	No		Retain for Phase II.
156	Install alternate offsite power source that bypasses the switchyard. For example, use campus power source to energize Bus E5 or E6.	Improve offsite power reliability and independence of switchyard and SF6 bus duct; allow restoration of offsite power within a few hours.	No		Retain for Phase II.
157	Provide independent AC power source for battery chargers. For example, provide portable generator to charge station battery.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	No		Retain for Phase II.
159	Install additional batteries.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	No		Retain for Phase II.
161	Modify EDG jacket heat exchanger service water supply and return to allow timely alignment of alternate cooling water source (supply & drain) from firewater, RMW, DW, etc.	Alternate cooling to both EDGs would reduce CDF long term sequences involving LOOP and loss of SW /cooling tower. A loss of service water / cooling tower with a LOOP could result in EDG failure and non-recovery.	No		Review as part of Phase II screening. This SAMA includes consideration of SAMA 19.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
162	Increase the capacity margin of the CST.	Extend long term operation of EFW without operator action for CST makeup for sequences that do not go to cold shutdown. Enhance CST margin for design-basis seismic event with cooldown via SG and transition to RHR.	No		Review as part of Phase II screening. This SAMA includes consideration of SAMA 71.
163	Install third EFW pump (steam-driven).	Reduce CDF of SBO sequences by improving overall reliability of EFW system independent of AC power. An additional pump might also have a Level 2 benefit by maintaining coverage of SG tubes thus reducing the release potential for induced SGTR given high pressure core melt sequence.	No		Retain for Phase II.
164	Modify 10" Condensate Filter Flange to have a 2½-inch female fire hose adapter with isolation valve.	Possible enhancement of long term core damage sequences that credit CST makeup.	No		Retain for Phase II.
165	RWST fill from firewater during containment injection - Modify 6" RWST Flush Flange to have a 2½-inch female fire hose adapter with isolation valve.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	No		Retain for Phase II.
167	Install independent seal injection pump (low volume pump) with automatic start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	No		Retain for Phase II.
168	Install independent seal injection pump (low volume pump) with manual start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	No		Retain for Phase II.
169	Install independent charging pump (high volume pump) with manual start	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures; improve decay heat removal using feed & bleed.	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
170	Replace the Positive Displacement Pump (PDP) with a 3rd centrifugal charging pump. Consider low volume and cooling water independence.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	No		Currently have to administrative control PDP. Used in emergencies (as a back-up). Retain for Phase II.
172	Evaluate installation of a "shutdown seal" in the RCPs being developed by Westinghouse.	Reduce CDF contribution from transients with seal cooling hardware failures resulting in RCP seal LOCA events.	No		RCP shutdown seal not yet available.
174	Provide alternate scram button to remove power from MG sets to CR drives.	Improve reliability of reactor scram by providing remote-manual capability to remove rod drive power should the reactor trip breakers fail; reduce ATWS contribution.	No		Retain for Phase II. This SAMA considers assessment of SAMA 136.
175	Install fire detection in turbine building relay room.	Improve fire detection and manual suppression actions.	No		Retain for Phase II.
179	Fire induced LOCA response procedure from Alternate Shutdown Panel.	Possible reduction in CDF if mitigating fire-induced LOCA. Judged marginal benefit due to existing design and guidance to minimize potential for inadvertent PORV interaction. Thus, likelihood of LOCA with control room uninhabitable for a long period of time is judged low.	No		Addressed in App. R (limit). Would not increase the risk probability. Retain for Phase II.
181	Improve relay chatter fragility.	Relay chatter fragility judged low contributor to CDF. Significant uncertainty in hazard and fragility not easily removed and beyond state-of-the-art as stated in IPEEE. No further actions needed.	No		Low contributor. Retain for Phase II.
182	Improve seismic capacity of EDGs and steam-driven EFW pump.	Improve component fragility and reduce seismic event contribution to CDF.	No		Retain for Phase II.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
184	Control/reduce time that the containment purge valves are in open position.	Purge path is large opening. Reduce exposure time of open path, improve reliability/availability of CI, reduce CI failure contribution to large release.	No		Retain for Phase II.
186	Install containment leakage monitoring system.	Improve containment reliability by reducing the potential for pre-existing containment leakage.	No		Retain for Phase II.
187	Install RHR isolation valve leakage monitoring system.	Reduce ISLOCA challenge to RHR by identification of upstream valve failure.	No		Retain for Phase II.
189	Modify or analyze SEPS capability; 1 of 2 SEPS for LOSP non-SI loads, 2 of 2 for LOSP SI loads.	Allow all equipment to be run following LOSP with EDG failure but successful start and load of SEPS.	No		Retain for Phase II.
190	Add synchronization capability to SEPS Diesel.	Eliminate current requirement for dead bus transfer from SEPS to normal power.	No		Retain for Phase II.
8	Increase training on response to loss of two 120V AC buses which causes inadvertent actuation signals.	Improved chances of successful response to loss of two 120V AC buses.	Yes	A - Not Applicable	Loss of any one 120 V Vital bus will result in plant trip. AOPs exist for loss of power supplies.
12	Create AC power cross-tie capability with other unit (multi-unit site).	Increased availability of on-site AC power.	Yes	A - Not Applicable	Single unit site.
15	Install tornado protection on gas turbine generator.	Increased availability of on-site AC power.	Yes	A - Not Applicable	No gas turbine.
27	Revise procedure to allow operators to inhibit automatic vessel depressurization in non-ATWS scenarios.	Extended HPCI and RCIC operation.	Yes	A - Not Applicable	BWR Item.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
34	Provide an in-containment reactor water storage tank.	Continuous source of water to the safety injection pumps during a LOCA event, since water released from a breach of the primary system collects in the in-containment reactor water storage tank, and thereby eliminates the need to realign the safety injection pumps for long-term post-LOCA recirculation.	Yes	A - Not Applicable	Item for new construction plant only.
38	Change the in-containment reactor water storage tank suction from four check valves to two check and two air-operated valves.	Reduced common mode failure of injection paths.	Yes	A - Not Applicable	Advanced reactor item.
63	Use fire prevention system pumps as a backup seal injection and high pressure makeup source.	Reduced frequency of reactor coolant pump seal LOCA.	Yes	A - Not Applicable	Discharge pressure is too low.
69	Install manual isolation valves around auxiliary feedwater turbine-driven steam admission valves.	Reduced dual turbine-driven pump maintenance unavailability.	Yes	A - Not Applicable	Not a dual turbine design.
82	Stage backup fans in switchgear rooms.	Increased availability of ventilation in the event of a loss of switchgear ventilation.	Yes	A - Not Applicable	There is no requirement for backup fans. Compensatory ventilation procedures are used to ensure adequate ventilation.
84	Create ability to switch emergency feedwater room fan power supply to station batteries in a station blackout.	Continued fan operation in a station blackout.	Yes	A - Not Applicable	EFW turbine driven pump is self-cooled and remains functional during SBO conditions. Compensatory ventilation procedures are used during SBO to ensure adequate ventilation.
85	Provide cross-unit connection of uninterruptible compressed air supply.	Increased ability to vent containment using the hardened vent.	Yes	A - Not Applicable	No second unit.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
95	Enhance fire protection system and standby gas treatment system hardware and procedures.	Improved fission product scrubbing in severe accidents.	Yes	A - Not Applicable	BWR item.
105	Delay containment spray actuation after a large LOCA.	Extended reactor water storage tank availability.	Yes	A - Not Applicable	A delay of containment spray would violate Seabrook's licensing basis. Therefore, this generic SAMA not pursued and is screened in Phase 1.
134	Revise procedure to bypass MSIV isolation in turbine trip ATWS scenarios.	Affords operators more time to perform actions. Discharge of a substantial fraction of steam to the main condenser (i.e., as opposed to into the primary containment) affords the operator more time to perform actions (e.g., SLC injection, lower water level, depressurize RPV) than if the main condenser was unavailable, resulting in lower human error probabilities.	Yes	A - Not Applicable	BWR item.
135	Revise procedure to allow override of low pressure core injection during an ATWS event.	Allows immediate control of low pressure core injection. On failure of high pressure core injection and condensate, some plants direct reactor depressurization followed by five minutes of automatic low pressure core injection.	Yes	A - Not Applicable	BWR item.
141	Provide additional restraints for CO2 tanks.	Increased availability of fire protection given a seismic event.	Yes	A - Not Applicable	Currently have no CO2 systems. Halon systems are used and are installed to industry codes and standards. All Halon systems are located in non-safety related areas (e.g., main plant computer room).

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
142	Replace mercury switches in fire protection system.	Decreased probability of spurious fire suppression system actuation.	Yes	A - Not Applicable	Currently do not have any mercury switches in the fire protection system.
143	Upgrade fire compartment barriers.	Decreased consequences of a fire.	Yes	A - Not Applicable	Seabrook plant design includes 3-hour rated fire barriers.
191	Remove the 135F temperature trip of the PCCW pumps.	Potential for some improvement in PCCW reliability by eliminating consideration of spurious trip.	Yes	A - Not Applicable	Removal of the PCCW high temperature trip would violate the current licensing basis for the plant.
3	Add additional battery charger or portable, diesel-driven battery charger to existing DC system.	Improved availability of DC power system.	Yes	B - Intent Met	Each vital DC battery division has a spare (portable) battery charger that can be connected in place of a main battery charger. Refer to SAMA 157 for evaluation of portable battery charger.
4	Improve DC bus load shedding.	Extended DC power availability during an SBO.	Yes	B - Intent Met	Load shedding is proceduralized.
6	Provide additional DC power to the 120/240V vital AC system.	Increased availability of the 120 V vital AC bus.	Yes	B - Intent Met	Intent met due to the configuration of the existing station vital battery divisions. Each division has two batteries, A/C and B/D.
7	Add an automatic feature to transfer the 120V vital AC bus from normal to standby power.	Increased availability of the 120 V vital AC bus.	Yes	B - Intent Met	120 V Inverters have AC and DC inputs, which provide uninterrupted power to the associated vital buses.
9	Provide an additional diesel generator.	Increased availability of on-site emergency AC power.	Yes	B - Intent Met	Currently have 2 safety related diesels (EDGs) and 1 supplemental diesel (SEPS) that can be tied to either train.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
10	Revise procedure to allow bypass of diesel generator trips.	Extended diesel generator operation.	Yes	B - Intent Met	Non-essential trips bypassed during emergency starts.
11	Improve 4.16-kV bus cross-tie ability.	Increased availability of on-site AC power.	Yes	B - Intent Met	Currently have two AC divisions, each with an emergency diesel generator. In addition a backup swing diesel, is available and can supply power to either electrical division.
17	Create a cross-tie for diesel fuel oil (multi-unit site).	Increased diesel generator availability.	Yes	B - Intent Met	Currently able to cross-tie diesel storage tanks, but not from Unit 2 storage tanks.
18	Develop procedures for replenishing diesel fuel oil.	Increased diesel generator availability.	Yes	B - Intent Met	Currently have 7 days of supply at full load. Sufficient time to order and replenish.
22	In training, emphasize steps in recovery of off-site power after an SBO.	Reduced human error probability during off-site power recovery.	Yes	B - Intent Met	Included in operator training.
23	Develop a severe weather conditions procedure.	Improved off-site power recovery following external weather-related events.	Yes	B - Intent Met	Procedures for station severe weather conditions exist.
29	Provide capability for alternate injection via diesel-driven fire pump.	Improved injection capability.	Yes	B - Intent Met	Implemented through alternate mitigation strategy.
30	Improve ECCS suction strainers.	Enhanced reliability of ECCS suction.	Yes	B - Intent Met	New and improved strainers installed.
31	Add the ability to manually align emergency core cooling system recirculation.	Enhanced reliability of ECCS suction.	Yes	B - Intent Met	Suction valves open automatically and the pumps have to be aligned manually (w/time restraints).

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
32	Add the ability to automatically align emergency core cooling system to recirculation mode upon refueling water storage tank depletion.	Enhanced reliability of ECCS suction.	Yes	B - Intent Met	Suction valves open automatically and the pumps have to be aligned manually (w/time restraints).
33	Provide hardware and procedure to refill the reactor water storage tank once it reaches a specified low level.	Extended reactor water storage tank capacity in the event of a steam generator tube rupture (or other LOCAs challenging RWST capacity).	Yes	B - Intent Met	Implemented through SAMG and alternate mitigation strategy.
36	Emphasize timely recirculation alignment in operator training.	Reduced human error probability associated with recirculation failure.	Yes	B - Intent Met	Suction valves open automatically and the pumps have to be aligned manually (with time restraints). Training and procedures include timing requirements.
37	Upgrade the chemical and volume control system to mitigate small LOCAs.	For a plant like the Westinghouse AP600, where the chemical and volume control system cannot mitigate a small LOCA, an upgrade would decrease the frequency of core damage.	Yes	B - Intent Met	Charging pumps are the high head safety injection pumps.
40	Provide capability for remote, manual operation of secondary side pilot-operated relief valves in a station blackout.	Improved chance of successful operation during station blackout events in which high area temperatures may be encountered (no ventilation to main steam areas).	Yes	B - Intent Met	Local and remote capability is provided and is identified in plant procedures.
42	Make procedure changes for reactor coolant system depressurization.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	Yes	B - Intent Met	Current EOPs provide guidance for RCS depressurization.
45	Enhance procedural guidance for use of cross-tied component cooling or service water pumps.	Reduced frequency of loss of component cooling water and service water.	Yes	B - Intent Met	PCCW procedures currently provide a maintenance cross-tie capability.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
46	Add a service water pump.	Increased availability of cooling water.	Yes	B - Intent Met	Currently have 2 trains, with 3 pumps per train (2 ocean water cooling pumps and 1 cooling tower).
47	Enhance the screen wash system.	Reduced potential for loss of SW due to clogging of screens.	Yes	B - Intent Met	SBK currently has two separate heat sinks. Ocean SW (two divisions) and the Cooling Tower SW system (two divisions). The Ocean SW divisions are equipped with suction bay screens and screen wash systems. The Cooling Tower SW divisions are independent of Ocean SW and do not require screens/screen wash.
48	Cap downstream piping of normally closed component cooling water drain and vent valves.	Reduced frequency of loss of component cooling water initiating events, some of which can be attributed to catastrophic failure of one of the many single isolation valves.	Yes	B - Intent Met	PCCW drawings show vents and drains to be capped. Also procedure OS-1012.01, PCCW Fill and Vent, refers to uncapping and capping of vent and drain valves.
49	Enhance loss of component cooling water (or loss of service water) procedures to facilitate stopping the reactor coolant pumps.	Reduced potential for reactor coolant pump seal damage due to pump bearing failure.	Yes	B - Intent Met	Included in plant procedure.
50	Enhance loss of component cooling water procedure to underscore the desirability of cooling down the reactor coolant system prior to seal LOCA.	Reduced probability of reactor coolant pump seal failure.	Yes	B - Intent Met	Included in procedure.
51	Additional training on loss of component cooling water.	Improved success of operator actions after a loss of component cooling water.	Yes	B - Intent Met	Loss of CCW is included in the operator training program.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
52	Provide hardware connections to allow another essential raw cooling water system to cool charging pump seals.	Reduced effect of loss of component cooling water by providing a means to maintain the charging pump seal injection following a loss of normal cooling water.	Yes	B - Intent Met	Currently have two alternate cooling methods for charging pump cooling. These methods include cooling from Fire Water or Demineralized Water.
53	On loss of essential raw cooling water, proceduralize shedding component cooling water loads to extend the component cooling water heat-up time.	Increased time before loss of component cooling water (and reactor coolant pump seal failure) during loss of essential raw cooling water sequences.	Yes	B - Intent Met	PCCW Abnormal Procedure OS1212.01 provides guidance actions depending on the abnormal condition. Guidance exists for isolating CVCS letdown, transferring charging pump cooling to alternate cooling, and tripping of RCPs. The procedure includes monitoring of equipment cooled by PCCW.
54	Increase charging pump lube oil capacity.	Increased time before charging pump failure due to lube oil overheating in loss of cooling water sequences.	Yes	B - Intent Met	The charging pump lube oil coolers at Seabrook Station have alternate cooling capability manually aligned from Demineralized Water system or from the Fire Water system.
57	Use existing hydro test pump for reactor coolant pump seal injection.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout, unless an alternate power source is used.	Yes	B - Intent Met	EOPs provide guidance to align PDP for RCP seal injection. Use of the PDP should not degrade seal integrity in the short term.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
60	Prevent makeup pump flow diversion through the relief valves.	Reduced frequency of loss of reactor coolant pump seal cooling if spurious high pressure injection relief valve opening creates a flow diversion large enough to prevent reactor coolant pump seal injection.	Yes	B - Intent Met	There are no relief valves on the "supply" side of seal injection (only on return side). In addition, there are no relief valves in high pressure injection or charging system piping that would create a potential for flow diversion of seal injection.
61	Change procedures to isolate reactor coolant pump seal return flow on loss of component cooling water, and provide (or enhance) guidance on loss of injection during seal LOCA.	Reduced frequency of core damage due to loss of seal cooling.	Yes	B - Intent Met	Operator guidance is provided in existing plant procedures.
62	Implement procedures to stagger high pressure safety injection pump use after a loss of service water.	Extended high pressure injection prior to overheating following a loss of service water.	Yes	B - Intent Met	At Seabrook, the charging pumps provide the high pressure safety injection function. The charging pumps are cooled by PCCW, which is in-turn cooled by SW. Should SW or PCC fail, alternate cooling alignment to the charging pumps is available via hard piped connection from DM water and/or fire protection. Procedural guidance is provided for the realignment.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
64	Implement procedure and hardware modifications to allow manual alignment of the fire water system to the component cooling water system, or install a component cooling water header cross-tie.	Improved ability to cool residual heat removal heat exchangers.	Yes	B - Intent Met	The PCCW system is designed with a header cross-tie between divisions A and B. Although the primary function of the cross-tie is to support a maintenance activity, it is recognized that the cross-tie could be aligned to provide a plant heat sink in the unlikely event that only one SW train is available at the same time that only the opposite division PCCW is available.
66	Create ability for emergency connection of existing or new water sources to feedwater and condensate systems.	Increased availability of feedwater.	Yes	B - Intent Met	Included in SAMG and alternate mitigation strategies.
67	Install an independent diesel for the condensate storage tank makeup pumps.	Extended inventory in CST during an SBO.	Yes	B - Intent Met	Included in SAMG and alternate mitigation strategies.
68	Add a motor-driven feedwater pump.	Increased availability of feedwater.	Yes	B - Intent Met	Currently have two steam driven main feedwater pumps and one motor-driven startup feedwater pump, powered from Emergency Bus 5 or non-emergency bus 4. EFW consists of one steam driven pump and one motor-driven pump powered from Emergency Bus 6.
70	Install accumulators for turbine-driven auxiliary feedwater pump flow control valves.	Eliminates the need for local manual action to align nitrogen bottles for control air following a loss of off-site power.	Yes	B - Intent Met	Flow control valves are all AC MOVs (aligned as open).

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
72	Modify the turbine-driven auxiliary feedwater pump to be self-cooled.	Improved success probability during a station blackout.	Yes	B - Intent Met	EFW turbine driven pump is self-cooled and remains functional during SBO conditions. Compensatory ventilation procedures are used during SBO to ensure adequate ventilation.
73	Proceduralize local manual operation of auxiliary feedwater system when control power is lost.	Extended auxiliary feedwater availability during a station blackout. Also provides a success path should auxiliary feedwater control power be lost in non-station blackout sequences.	Yes	B - Intent Met	Included in SAMG and alternate mitigation strategies.
74	Provide hookup for portable generators to power the turbine-driven auxiliary feedwater pump after station batteries are depleted.	Extended auxiliary feedwater availability.	Yes	B - Intent Met	Intent met through alternate mitigation strategy for use of fire water to feed SGs.
75	Use fire water system as a backup for steam generator inventory.	Increased availability of steam generator water supply.	Yes	B - Intent Met	Steam generator emergency feed from fire water system available from fire pumps via plant procedures.
76	Change failure position of condenser makeup valve if the condenser makeup valve fails open on loss of air or power.	Allows greater inventory for the auxiliary feedwater pumps by preventing condensate storage tank flow diversion to the condenser.	Yes	B - Intent Met	Valve fails closed.
78	Modify the startup feedwater pump so that it can be used as a backup to the emergency feedwater system, including during a station blackout scenario.	Increased reliability of decay heat removal.	Yes	B - Intent Met	Start-up feedwater pump fills this function. The startup feedwater pump is normally powered from Emergency Bus 5. The EFW steam-driven feedwater pump provided feedwater during SBO conditions.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
79	Replace existing pilot-operated relief valves with larger ones, such that only one is required for successful feed and bleed.	Increased probability of successful feed and bleed.	Yes	B - Intent Met	The current Seabrook design meets the intent of this SAMA. Seabrook has two PORVs consistent with other PWR designs. In current PRA, the feed and bleed decay heat removal success criteria applies the following combinations of PORVs and injection pumps: 1-of-2 PORVs with 1-of-2 charging pumps (high head SI) with eventual containment long term recirc. 2-of-2 PORVs with 1-of-2 SI pumps (intermediate head SI) with eventual containment long term recirc. Loss of feedwater sequences contribute about 29% to the internal events CDF.
81	Add a diesel building high temperature alarm or redundant louver and thermostat.	Improved diagnosis of a loss of diesel building HVAC.	Yes	B - Intent Met	High temperature alarm is currently provided in each diesel room.
83	Add a switchgear room high temperature alarm.	Improved diagnosis of a loss of switchgear HVAC.	Yes	B - Intent Met	High temperature alarm is currently provided in each essential switchgear room.
86	Modify procedure to provide ability to align diesel power to more air compressors.	Increased availability of instrument air after a LOOP.	Yes	B - Intent Met	Air compressors powered from diesel-backed emergency buses. In addition, Seabrook design includes a diesel-powered air compressor if needed.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
87	Replace service and instrument air compressors with more reliable compressors which have self-contained air cooling by shaft driven fans.	Elimination of instrument air system dependence on service water cooling.	Yes	B - Intent Met	Air compressors have been updated to be centrifugals.
88	Install nitrogen bottles as backup gas supply for safety relief valves.	Extended SRV operation time.	Yes	B - Intent Met	ASDVs have nitrogen bottle backup. PORVs are electrically operated and their design does not rely on a pneumatic supply.
89	Improve SRV and MSIV pneumatic components.	Improved availability of SRVs and MSIVs.	Yes	B - Intent Met	Currently have no issues with component performance (currently the MSIVs are replaced every 6 years).
92	Use the fire water system as a backup source for the containment spray system.	Improved containment spray capability.	Yes	B - Intent Met	Seabrook has a relatively large containment and as a result, the containment spray function is not important early.
103	Institute simulator training for severe accident scenarios.	Improved arrest of core melt progress and prevention of containment failure.	Yes	B - Intent Met	Classroom training is provided on severe accident management guidelines. Plant simulator used for accident scenario support during emergency plan training.
104	Improve leak detection procedures.	Increased piping surveillance to identify leaks prior to complete failure. Improved leak detection would reduce LOCA frequency.	Yes	B - Intent Met	Current leak detection capability is continuous monitoring. Alarms provided for identified and unidentified leak rates.
111	Install additional pressure or leak monitoring instruments for detection of ISLOCAs.	Reduced ISLOCA frequency.	Yes	B - Intent Met	Current RCS leak detection capability is continuous monitoring. Alarms provided for identified and unidentified leak rates.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
116	Ensure ISLOCA releases are scrubbed. One method is to plug drains in potential break areas so that break point will be covered with water.	Scrubbed ISLOCA releases.	Yes	B - Intent Met	The only ISLOCA path of concern is into the RHR equipment vaults. For these ISLOCA scenarios the RHR equipment vaults flood and provides scrubbing of potential releases.
117	Revise EOPs to improve ISLOCA identification.	Increased likelihood that LOCAs outside containment are identified as such. A plant had a scenario in which an RHR ISLOCA could direct initial leakage back to the pressurizer relief tank, giving indication that the LOCA was inside containment.	Yes	B - Intent Met	Guidance in EOPs.
118	Improve operator training on ISLOCA coping.	Decreased ISLOCA consequences.	Yes	B - Intent Met	Included in EOP procedures and operator training program.
120	Replace steam generators with a new design.	Reduced frequency of steam generator tube ruptures.	Yes	B - Intent Met	Currently have less than 1% of tubes plugged and good steam generator performance.
122	Install a redundant spray system to depressurize the primary system during a steam generator tube rupture.	Enhanced depressurization capabilities during steam generator tube rupture.	Yes	B - Intent Met	There are currently three methods to perform depressurization including use of PORVs, Pressurizer Spray, or Pressurizer Auxiliary Spray.
123	Proceduralize use of pressurizer vent valves during steam generator tube rupture sequences.	Backup method to using pressurizer sprays to reduce primary system pressure following a steam generator tube rupture.	Yes	B - Intent Met	Existing process to depressurize via PORVs, but backup is use of sprays and aux sprays. There are currently three methods to perform depressurization including use of PORVs, Pressurizer Spray, or Pressurizer Auxiliary Spray.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
124	Provide improved instrumentation to detect steam generator tube ruptures, such as Nitrogen-16 monitors.	Improved mitigation of steam generator tube ruptures.	Yes	B - Intent Met	Steam lines are equipped with radiation monitors.
127	Revise emergency operating procedures to direct isolation of a faulted steam generator.	Reduced consequences of a steam generator tube rupture.	Yes	B - Intent Met	Faulted SG refers to steam line break Ruptured SG refers to SG tube rupture
128	Direct steam generator flooding after a steam generator tube rupture, prior to core damage.	Improved scrubbing of steam generator tube rupture releases.	Yes	B - Intent Met	EOPs direct maintaining level in a ruptured steam generator.
132	Provide an additional control system for rod insertion (e.g., AMSAC).	Improved redundancy and reduced ATWS frequency.	Yes	B - Intent Met	Currently have AMSAC.
138	Improve inspection of rubber expansion joints on main condenser.	Reduced frequency of internal flooding due to failure of circulating water system expansion joints.	Yes	B - Intent Met	Circulating Water inlet/outlet expansion joints in the Turbine Building are internally inspected each refueling outage when the condenser is opened for maintenance. Also, the exterior of the Turbine Building CW expansion joints (and others) is inspected semi-annually during plant walkdowns.
144	Install additional transfer and isolation switches.	Reduced number of spurious actuations during a fire.	Yes	B - Intent Met	Transfer switches installed at Remote Shutdown Panel.
145	Enhance fire brigade awareness.	Decreased consequences of a fire.	Yes	B - Intent Met	Captured in operator/personnel requals (for fire brigade) - combination of fight fire and preserve water.
146	Enhance control of combustibles and ignition sources.	Decreased fire frequency and consequences.	Yes	B - Intent Met	Currently contained in the Fire Protection Manual.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
148	Enhance procedures to mitigate large break LOCA.	Reduced consequences of a large break LOCA.	Yes	B - Intent Met	EOPs currently meet WOG recommendations.
149	Install computer aided instrumentation system to assist the operator in assessing post-accident plant status.	Improved prevention of core melt sequences by making operator actions more reliable.	Yes	B - Intent Met	Currently have a Safety Parameter Display System (SDS).
150	Improve maintenance procedures.	Improved prevention of core melt sequences by increasing reliability of important equipment.	Yes	B - Intent Met	Procedures exist and reflect industry standards and practices.
151	Increase training and operating experience feedback to improve operator response.	Improved likelihood of success of operator actions taken in response to abnormal conditions.	Yes	B - Intent Met	Time Critical Action (TCA) Policy provides the training requirements and feedback process for improving operator response.
152	Develop procedures for transportation and nearby facility accidents.	Reduced consequences of transportation and nearby facility accidents.	Yes	B - Intent Met	The Seabrook UFSAR and IPEEE do not identify any plant vulnerability from transportation or nearby facility accidents. In addition, Seabrook Station performs a periodic review and assessment (every 3 years) of off-site chemical hazards associated with transportation and nearby facilities.
155	Install alternate emergency AC power source (e.g., swing diesel).	SEPS DG installed and credited in PRA to power Bus E5 or Bus E6.	Yes	B - Intent Met	SEPS diesel generator installed and incorporated into plant procedures.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
158	Provide enhanced procedural direction for cross-tie of batteries within each train.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	Yes	B - Intent Met	Enhancement complete. Procedures exist to delineate the necessary steps for connecting each DC bus to its alternate (cross-tie) battery supply. This SAMA includes consideration of SAMA 1 and 5.
160	Enhancements to address loss of SF6-type sequences.	SF6 enhancements improve offsite power reliability.	Yes	B - Intent Met	Complete. SF6 enhancements are credited in PRA as applicable.
171	Install high temperature O-rings in RCPs.	Complete. High temperature o-rings installed and credited in PRA as applicable.	Yes	B - Intent Met	Complete. High temp O-rings are installed.
173	Improve procedural guidance for directing depressurization of RCS.	Complete. RCS depressurization procedures complete and credited in PRA as applicable. This reduces CDF contribution from RCP seal LOCA during SBO-type sequences.	Yes	B - Intent Met	Complete.
176	Install additional suppression at west wall of turbine building.	Complete. Combustible materials control improved and credited in PRA as applicable.	Yes	B - Intent Met	Complete. Controlling combustibles in the area via the Fire Protection Manual.
177	Improve fire response procedure to indicate that PCCW can be impacted by PAB fire event.	Complete. Addressed in Fire Protection Maintenance Manual.	Yes	B - Intent Met	Complete. Addressed in Fire Protection Maintenance Manual.
178	Improve fire response procedure to indicate important fire areas including control room, PCCW pump area and cable spreading room.	Complete. Addressed in Fire Protection Manual.	Yes	B - Intent Met	Complete. Addressed in Fire Protection Maintenance Manual.
180	Modify SW pump house roof to allow scuppers to function properly.	Proper scupper openings provided to limit accumulation of precipitation on roof.	Yes	B - Intent Met	Enhancement complete, scuppers installed.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
183	Turbine Building internal flooding improvements.	Reduce CDF impact as a result of postulated CW break resulting in loss of offsite power and loss of vital switchgear.	Yes	B - Intent Met	Turbine building flood improvements have been implemented.
185	Improve procedural guidance for directing depressurization of RCS.	Improvements to depressurization to reduce potential for high pressure core melt ejection and DCH challenge.	Yes	B - Intent Met	Complete. RCS depressurization methods are proceduralized.
188	Containment flooding - Modify the containment ILRT10-inch test flange to include a 5-inch adapter with isolation valve.	Improve the time to align to Fire Protection system to flood containment.	Yes	B - Intent Met	Flange and procedures exist.
1	Provide additional DC battery capacity.	Extended DC power availability during an SBO.	Yes	C - Combined	Combined with SAMA 158.
5	Provide DC bus cross-ties.	Improved availability of DC power system.	Yes	C - Combined	Combined with SAMA 158.
19	Use fire water system as a backup source for diesel cooling.	Increased diesel generator availability.	Yes	C - Combined	Combine with SAMA 161.
56	Install an independent reactor coolant pump seal injection system, without dedicated diesel.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout.	No	C - Combined	Combine with SAMA 167 and 168.
58	Install improved reactor coolant pump seals.	Reduced likelihood of reactor coolant pump seal LOCA.	Yes	C - Combined	Combine with SAMA 172.
71	Install a new condensate storage tank (auxiliary feedwater storage tank).	Increased availability of the auxiliary feedwater system.	Yes	C - Combined	Combine with SAMA 162.
136	Install motor generator set trip breakers in control room.	Reduced frequency of core damage due to an ATWS.	Yes	C - Combined	Combine with SAMA 174.
137	Provide capability to remove power from the bus powering the control rods.	Decreased time required to insert control rods if the reactor trip breakers fail (during a loss of feedwater ATWS which has rapid pressure excursion).	Yes	C - Combined	Combine with SAMA 174.

Table F.6-1 Seabrook Station Phase 1 SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	Screened Out Phase 1?	Screening Criterion	Phase I Disposition
139	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	Prevents flood propagation.	Yes	C - Combined	Swing direction of TB door to essential switchgear room not an issue. Plant specific flooding items are addressed in the plant specific SAMA 183.
140	Increase seismic ruggedness of plant components.	Increased availability of necessary plant equipment during and after seismic events.	Yes	C - Combined	Refer to plant specific seismic SAMAs 181 and 182.
166	Fabricate attachment to fill the RWST via the Silica skid; mod would include a 2½-inch to 2-inch adapter.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	Yes	C - Combined	Combine with SAMA 165.

F.7 PHASE II SAMA ANALYSIS

A cost-benefit analysis was performed on each of the SAMA candidates remaining after the Phase I screening. The benefit of a SAMA candidate is the difference between the baseline cost of severe accident risk (maximum benefit from Section F.4.5) and the cost of severe accident risk with the SAMA implemented (Section F.7.1). The cost used is the estimated cost to implement the specific SAMA. If the estimated cost of implementation exceeds the benefit of implementation, the SAMA is not cost-beneficial.

F.7.1 SAMA BENEFIT

F.7.1.1 SEVERE ACCIDENT RISK WITH SAMA IMPLEMENTED

Bounding analyses were used to determine the change in risk following implementation of SAMA candidates or groups of similar SAMA candidates. For each analysis case, the Level 1 internal events or Level 2 PRA models were altered to conservatively consider implementation of the SAMA candidate(s). Then, severe accident risk measures were calculated using the same procedure used for the baseline case described in Section F.3. The changes made to the PRA models for each analysis case are described in Appendix F.A.

Two example cases of a "bounding analysis" are provided below:

LBLOCA

This analysis case example evaluates the change in plant risk profile that would be achieved if a proposed digital large break LOCA protection system was installed. Although the proposed change would not completely eliminate the potential for a large break LOCA, a bounding benefit is estimated by removing the entire large break LOCA initiating event, thus eliminating its contribution to core damage and to containment release

DCPWR

This analysis case example evaluates plant modifications proposed to increase the availability of Class 1E DC power (e.g., increased battery capacity or the installation of a diesel-powered generator that would effectively increase battery capacity). Although the proposed SAMAs would not completely eliminate the potential failure, a bounding benefit is estimated by removing the entire battery discharge and failure events, thus eliminating their contribution to core damage and to containment release.

The severe accident risk measures were obtained for each analysis case by modifying the baseline model in a simple manner to capture the effect of implementation of the SAMA in a bounding manner. Bounding analyses are very conservative and result in overestimation of the benefit of the candidate analyzed. If this bounding assessment yields a benefit that is smaller than the cost of implementation, then refining the PRA modeling approach for the

SAMA would be unnecessary because it would only yield a lower benefit result. If the benefit is greater than the cost when modeled in this bounding approach, it is necessary to refine the PRA model of the SAMA to remove conservatism. As a result of this modeling approach, models representing the Phase II SAMAs will not all be at the same level of detail and if any are implemented, the PRA result after implementation of the final installed design will differ from the screening analyses done to support this evaluation.

F.7.1.2 COST OF SEVERE ACCIDENT RISK WITH SAMA IMPLEMENTED

Using the risk measures determined as described in Section F.7.1.1, severe accident impacts in four areas (off-site exposure cost, off-site economic cost, on-site exposure cost, and on-site economic cost) were calculated using the same procedure used for the baseline case described in Section F.4. As in Section F.4.5, the severe accident impacts were summed to estimate the total cost of severe accident risk with the SAMA implemented.

F.7.1.3 SAMA BENEFIT CALCULATION

The respective SAMA benefit was calculated by subtracting the total cost of severe accident risk with the SAMA implemented from the baseline cost of severe accident risk (maximum benefit from Section F.4.5). The estimated benefit for each SAMA candidate is listed in Table F.7-1. The calculation of the benefit is done in an Excel spreadsheet.

F.7.2 COST OF SAMA IMPLEMENTATION

The final step in the evaluation of the SAMAs is estimating the cost of implementation for comparison with the benefit. For the purpose of this analysis the Seabrook Station staff has estimated that the cost of making a change to a procedure and for conducting the necessary training on a procedure change is expected to exceed $15,000 depending upon the scope of change. Similarly, the minimum cost associated with development and implementation of an integrated hardware modification package (including post-implementation costs, e.g. training) is expected to exceed $100,000. These values were used for initial comparison with the benefit of SAMAs.

The benefits resulting from the bounding estimates presented in the benefit analysis are in some cases rather low. In those cases for which the benefits are so low that it is obvious that the implementation costs would exceed the benefit, a detailed cost estimate was not warranted. Plant staff judgment is applied in assessing whether the benefit approaches the expected implementation costs in many cases.

Plant staff judgment was obtained from an independent, expert panel consisting of senior staff members from the PRA group, the design group, operations and license renewal. This panel reviewed the benefit calculation results and, based on their experience with developing and implementing modifications at the plant, judged if a modification would be cost beneficial in comparison with the calculated benefit. The purpose of this approach was to minimize the effort expended on detailed cost estimation. The cost estimations provided by the expert panel are included in Table F.7-1 along with the conclusions reached for each SAMA evaluated for cost/benefit.

The results of the sensitivities of Section F.8 influenced the decisions of whether a SAMA was considered to be potentially cost beneficial. If the benefits calculated in the sensitivity analyses exceeded the estimated cost of the SAMA, it was considered potentially cost beneficial.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
2	Replace lead-acid batteries with fuel cells.	Extended DC power availability during an SBO.	27.08%	12.19%	NOSBO	This case is used to determine the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the Diesel Generators do not fail.	$155K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
13	Install an additional, buried off-site power source.	Reduced probability of loss of off-site power.	42.08%	36.20%	NOLOSP	This case was used to determine the benefit of eliminating all loss of offsite power events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with loss of offsite power events. For the purposes of the analysis, a single bounding analysis was performed which assumed that loss of offsite power events do not occur, both as an initiating event and subsequent to a different initiating event.	$335K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
14	Install a gas turbine generator.	Increased availability of on-site AC power.	42.08%	36.20%	NOLOSP	This case was used to determine the benefit of eliminating all loss of offsite power events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with loss of offsite power events. For the purposes of the analysis, a single bounding analysis was performed which assumed that loss of offsite power events do not occur, both as an initiating event and subsequent to a different initiating event.	$335K	$>1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
16	Improve uninterruptible power supplies.	Increased availability of power supplies supporting front-line equipment.	42.08%	36.20%	NOLOSP	This case was used to determine the benefit of eliminating all loss of offsite power events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with loss of offsite power events. For the purposes of the analysis, a single bounding analysis was performed which assumed that loss of offsite power events do not occur, both as an initiating event and subsequent to a different initiating event.	$335K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
20	Add a new backup source of diesel cooling.	Increased diesel generator availability.	27.08%	12.19%	NOSBO	This case is used to determine the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the Diesel Generators do not fail.	$155K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
21	Develop procedures to repair or replace failed 4 KV breakers.	Increased probability of recovery from failure of breakers that transfer 4.16 kV non-emergency buses from unit station service transformers.	1.39%	0.42%	BREAKER	Assume no failures of 4KV bus infeed breakers	$8K	>$25K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
24	Bury off-site power lines.	Improved off-site power reliability during severe weather.	42.08%	36.20%	NOLOSP	This case was used to determine the benefit of eliminating all loss of offsite power events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with loss of offsite power events. For the purposes of the analysis, a single bounding analysis was performed which assumed that loss of offsite power events do not occur, both as an initiating event and subsequent to a different initiating event.	$335K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
25	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	67.71%	51.61%	LOCA02	Assume High Pressure Injection system does not fail.	$470K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
26	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	67.71%	51.61%	LOCA02	Assume High Pressure Injection system does not fail.	$470K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
28	Add a diverse low pressure injection system.	Improved injection capability.	11.11%	28.63%	LOCA03	Assume Low Pressure injection system does not fail.	$160K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
35	Throttle low pressure injection pumps earlier in medium or large-break LOCAs to maintain reactor water storage tank inventory.	Extended reactor water storage tank capacity.	28.47%	12.47%	LOCA04	Assume RWST does not run out of water.	$158K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Current valve & controls do not allow throttling. Modification required.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
39	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high- and low-pressure safety injections systems.	67.71%	51.61%	LOCA02	Assume High Pressure Injection system does not fail.	$470K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
41	Create a reactor coolant depressurization system.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	6.94%	1.82%	LOCA01	Eliminate all small LOCA events.	$33.3K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
43	Add redundant DC control power for SW pumps.	Increased availability of SW.	0.69%	1.45%	SW01	Remove the dependency of the Service Water pumps on DC power. This case is used to determine the benefit of enhancing the DC control power to the service water pumps.	$9.8K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
44	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	25.00%	22.56%	CCW01	Assume the CCW pumps do not fail. This case was used to determine the benefit of improvements to the CCW system.	$183K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
55	Install an independent reactor coolant pump seal injection system, with dedicated diesel.	Reduced frequency of core damage from loss of component cooling water, service water, or station blackout.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
56	Install an independent reactor coolant pump seal injection system, without dedicated diesel.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
59	Install an additional component cooling water pump.	Reduced likelihood of loss of component cooling water leading to a reactor coolant pump seal LOCA.	25.00%	22.56%	CCW01	Assume the CCW pumps do not fail. This case was used to determine the benefit of improvements to the CCW system.	$183K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
65	Install a digital feed water upgrade.	Reduced chance of loss of main feed water following a plant trip.						$30M	Current estimate for cost of installation	Not Cost-Beneficial	Cost is greater than MAB Note (1)
77	Provide a passive, secondary-side heat-rejection loop consisting of a condenser and heat sink.	Reduced potential for core damage due to loss-of-feedwater events.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
80	Provide a redundant train or means of ventilation.	Increased availability of components dependent on room cooling.	7.64%	0.98%	HVAC2	Remove HVAC dependency for CS, SI, RH and CBSpray pumps.	$32K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
90	Create a reactor cavity flooding system.	Enhanced debris cool ability, reduced core concrete interaction, and increased fission product scrubbing.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
91	Install a passive containment spray system.	Improved containment spray capability.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
93	Install an unfiltered, hardened containment vent.	Increased decay heat removal capability for non-ATWS events, without scrubbing released fission products.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
94	Install a filtered containment vent to remove decay heat. Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Increased decay heat removal capability for non-ATWS events, with scrubbing of released fission products.	0.00%	35.92%	CONT01	Eliminate all containment failures due to overpressurization from all causes.	$163K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
96	Provide post-accident containment inserting capability.	Reduced likelihood of hydrogen and carbon monoxide gas combustion.	0.00%	-0.05%	H2BURN	Eliminate all hydrogen ignition/burns.	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
97	Create a large concrete crucible with heat removal potential to contain molten core debris.	Increased cooling and containment of molten core debris. Molten core debris escaping from the vessel is contained within the crucible and a water cooling mechanism cools the molten core in the crucible, preventing melt-through of the base mat.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
98	Create a core melt source reduction system.	Increased cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
99	Strengthen primary/secondary containment (e.g., add ribbing to containment shell).	Reduced probability of containment over-pressurization.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
100	Increase depth of the concrete base mat or use an alternate concrete material to ensure melt-through does not occur.	Reduced probability of base mat melt-through.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
101	Provide a reactor vessel exterior cooling system.	Increased potential to cool a molten core before it causes vessel failure, by submerging the lower head in water.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
102	Construct a building to be connected to primary/ secondary containment and maintained at a vacuum.	Reduced probability of containment over-pressurization.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
106	Install automatic containment spray pump header throttle valves.	Extended time over which water remains in the reactor water storage tank, when full containment spray flow is not needed.	28.47%	12.47%	LOCA04	Assume RWST does not run out of water.	$158K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
107	Install a redundant containment spray system.	Increased containment heat removal ability.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
108	Install an independent power supply to the hydrogen control system using either new batteries, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel.	Reduced hydrogen detonation potential.	0.00%	-0.05%	H2BURN	Eliminate all hydrogen ignition/burns.	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
109	Install a passive hydrogen control system.	Reduced hydrogen detonation potential.	0.00%	-0.05%	H2BURN	Eliminate all hydrogen ignition/burns.	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
110	Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure.	Reduced probability of containment failure.						>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
112	Add redundant and diverse limit switches to each containment isolation valve.	Reduced frequency of containment isolation failure and ISLOCAs.	0.00%	37.41%	CONT02	Eliminate all containment isolation failures.	$209K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
113	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	2.08%	6.96%	LOCA06	Eliminate all ISLOCA events.	$28.0K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
114	Install self-actuating containment isolation valves.	Reduced frequency of isolation failure.	0.00%	37.41%	CONT02	Eliminate all containment isolation failures.	$209K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
115	Locate residual heat removal (RHR) inside containment	Reduced frequency of ISLOCA outside containment.	2.08%	6.96%	LOCA06	Eliminate all ISLOCA events.	$28.0K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
119	Institute a maintenance practice to perform a 100% inspection of steam generator tubes during each refueling outage.	Reduced frequency of steam generator tube ruptures.	3.47%	16.72%	NOSGTR	This case was used to determine the benefit of eliminating all SGTR events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of the analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.	$86.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost exceeds benefit.
121	Increase the pressure capacity of the secondary side so that a steam generator tube rupture would not cause the relief valves to lift.	Eliminates release pathway to the environment following a steam generator tube rupture.	3.47%	16.72%	NOSGTR	This case was used to determine the benefit of eliminating all SGTR events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of the analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.	$86.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
125	Route the discharge from the main steam safety valves through a structure where a water spray would condense the steam and remove most of the fission products.	Reduced consequences of a steam generator tube rupture.	3.47%	16.72%	NOSGTR	This case was used to determine the benefit of eliminating all SGTR events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of the analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.	$86.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
126	Install a highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources	Reduced consequences of a steam generator tube rupture.	3.47%	16.72%	NOSGTR	This case was used to determine the benefit of eliminating all SGTR events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of the analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.	$86.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
129	Vent main steam safety valves in containment.	Reduced consequences of a steam generator tube rupture.	3.47%	16.72%	NOSGTR	This case was used to determine the benefit of eliminating all SGTR events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of the analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.	$86.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
130	Add an independent boron injection system.	Improved availability of boron injection during ATWS.	2.78%	10.98%	NOATWS	This case was used to determine the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis was performed which assumed that ATWS events do not occur.	$70.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
131	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	2.78%	10.98%	NOATWS	This case was used to determine the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis was performed which assumed that ATWS events do not occur.	$70.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
133	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	2.78%	10.98%	NOATWS	This case was used to determine the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis was performed which assumed that ATWS events do not occur.	$70.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
147	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	9.72%	12.38%	LOCA05	Eliminate all piping failure LOCAs. No change to non-piping failure LOCAs, such as SGTR, RCP seal LOCA, stuck open SRV/PORV, or ISLOCA.	$103K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
153	Install secondary side guard pipes up to the main steam isolation valves.	Prevents secondary side depressurization should a steam line break occur upstream of the main steam isolation valves. Also guards against or prevents consequential multiple steam generator tube ruptures following a main steam line break event.	0.00%	0.42%	NOSLB	This case was used to determine the benefit of installing secondary side guard pipes up to the MSIVs. This would prevent secondary side depressurization should a steam line break occur upstream of the MSIVs. For the purposes of the analysis, a single bounding analysis was performed which assumed that no steam line break events occur.	$3.1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
154	Modify SEPS design to accommodate: (a) automatic bus loading, (b) automatic bus alignment.	Improve reliability of onsite power; reduce SBO CDF contribution; remove dependence on operator action.	27.08%	12.19%	NOSBO	This case is used to determine the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the Diesel Generators do not fail.	$155K	>$750k	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
156	Install alternate offsite power source that bypasses the switchyard. For example, use campus power source to energize Bus E5 or E6.	Improve offsite power reliability and independence o switchyard and SF6 bus duct; allow restoratio of offsite power within a few hours.	42.08%	36.20%	NOLOSP	This case was used to determine the benefit of eliminating all loss of offsite power events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with loss of offsite power events. For the purposes of the analysis, a single bounding analysis was performed which assumed that loss of offsite power events do not occur, both as an initiating event and subsequent to a different initiating event.	$335K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
157	Provide independent AC power source for battery chargers. For example, provide portable generator to charge station battery.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	4.17%	1.91%	INDEPAC	benefit of independent AC power to battery chargers, applicable to SAMA 157	$23K	$30K	Cost for 480V generator, cables, procedure for use, and training.	Potentially Cost-Beneficial	Case benefit for uncertainty sensitivity case is $45K. Independent AC power source for battery chargers is a plant-specific item identified via the IPE.
159	Install additional batteries.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	4.17%	1.91%	INDEPAC	benefit of independent AC power to battery chargers, applicable to SAMA 157	$23K	>$1M	Batteries, charger, cabling, new building to house batteries ongoing maintenance costs.	Not Cost-Beneficial	Cost will exceed benefit.
161	Modify EDG jacket heat exchanger service water supply and return to allow timely alignment of alternate cooling water source (supply & drain) from firewater, RMW, DW, etc.	Alternate cooling to both EDGs would reduce CDF long term sequences involving LOOP and loss of SW /cooling tower. A loss of service water / cooling tower with a LOOP could result in EDG failure and non-recovery.	27.08%	12.19%	NOSBO	This case is used to determine the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the Diesel Generators do not fail.	$155K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
162	Increase the capacity margin of the CST.	Extend long term operation of EFW without operator action for CST makeup for sequences that do not go to cold shutdown. Enhance CST margin for design-basis seismic event with cooldown via SG and transition to RHR.	1.39%	0.51%	CST01	Assume the CST does not run out of water and thus does not need to be refilled. This case is used to evaluate methods of CST refill.	$8.6K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
163	Install third EFW pump (steam-driven).	Reduce CDF of SBO sequences by improving overall reliability of EFW system independent of AC power. An additional pump might also have a Level 2 benefit by maintaining coverage of SG tubes thus reducing the release potential for induced SGTR given high pressure core melt sequence.	18.75%	8.64%	TDAFW	Assume TDAFW train does not fail	$100K	>$250K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
164	Modify 10" Condensate Filter Flange to have a 2½-inch female fire hose adapter with isolation valve.	Possible enhancement of long term core damage sequences that credit CST makeup.	1.39%	0.51%	CST01	Assume the CST does not run out of water and thus does not need to be refilled. This case is used to evaluate methods of CST refill.	$8.6K	$40k	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
165	RWST fill from firewater during containment injection - Modify 6" RWST Flush Flange to have a 2½-inch female fire hose adapter with isolation valve.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	10.42%	7.52%	NORMW	PRA case assumes that RWST makeup for long term sequences without recirculation are guaranteed success.	$75K	$50K	Expert Panel	Potentially Cost-Beneficial	
167	Install independent seal injection pump (low volume pump) with automatic start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
168	Install independent seal injection pump (low volume pump) with manual start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
169	Install independent charging pump (high volume pump) with manual start	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures; improve decay heat removal using feed & bleed.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
170	Replace the Positive Displacement Pump (PDP) with a 3rd centrifugal charging pump Consider low volume and cooling water independence.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
172	Evaluate installation of a "shutdown seal" in the RCPs being developed by Westinghouse.	Reduce CDF contribution from transients with seal cooling hardware failures resulting in RCP seal LOCA events.	11.81%	12.28%	RCPLOCA	This case was used to determine the benefit of eliminating all RCP seal LOCA events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.	$82.2K	>$1M	Expert Panel	Not Cost-Beneficial	PRA case RCPLOCA which has a best estimate benefit of $92K and an upper bound benefit of $176K. This will not be cost beneficial, but Seabrook can take credit for following shutdown seal developments and industry initiatives to lower risk of RCP seal LOCA events. The budgetary estimated cost to replace 4 RCP seals with new shutdown seal when available is >$1M.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
174	Provide alternate scram button to remove power from MG sets to CR drives.	Improve reliability of reactor scram by providing remote-manual capability to remove rod drive power should the reactor trip breakers fail; reduce ATWS contribution.	2.78%	10.98%	NOATWS	This case was used to determine the benefit of eliminating all ATWS events. For the purposes of the analysis, a single bounding analysis was performed which assumed that ATWS events do not occur.	$70.2K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
175	Install fire detection in turbine building relay room.	Improve fire detection and manual suppression actions.	0.00%	0.14%	FIRE2	SAMA#175- This case eliminates initiator FTBLP, turbine building fire at west wall or relay room causing opening of UAT/RAT breakers and loss of power to emergency buses, to conservatively assess the benefit of installing fire detection in the Relay Room.	$3K	>$10K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
179	Fire induced LOCA response procedure from Alternate Shutdown Panel.	Possible reduction in CDF if mitigating fire-induced LOCA. Judged marginal benefit due to existing design and guidance to minimize potential for inadvertent PORV interaction. Thus, likelihood of LOCA with control room uninhabitable for a long period of time is judged low.	0.69%	0.14%	FIRE1	SAMA#179 - This case eliminates initiator FCRPL, control room fire-induced LOCA (PORV), to assess possible benefit of procedure enhancement for handling LOCA at RSS Panel.	$4K	>$10K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
181	Improve relay chatter fragility.	Closed. Relay chatter fragility judged low contributor to CDF. Significant uncertainty in hazard and fragility not easily removed and beyond state-of-the-art as stated in IPEEE. No further actions needed.	9.03%	12.19%	SEISMIC01	Assume no seismic relay chatter failures occur, split fraction QK. This case is used to evaluate the impact of improvements that would eliminate seismic relay chatter events.	$102K	>$300K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
182	Improve seismic capacity of EDGs and steam-driven EFW pump.	Improve component fragility and reduce seismic event contribution to CDF.	0.00%	0.00%	SEISMIC02	Assume no seismic failures of diesel generators or turbine driven EFW (split fractions QDG and QCST).	$<1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
184	Control/reduce time that the containment purge valves are in open position.	Purge path is large opening. Reduce exposure time of open path, improve reliability/availability of CI, reduce CI failure contribution to large release.	0.00%	0.05%	PURGE	Eliminate possibility of containment purge valves being open at the time of an event (assume purge valves always closed).	$<1K	$20K	Cost of Procedure Change	Not Cost-Beneficial	Cost will exceed benefit.
186	Install containment leakage monitoring system.	Improve containment reliability by reducing the potential for pre-existing containment leakage.	0.00%	35.92%	CONT01	Eliminate all containment failures due to overpressurization from all causes.	$163K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
187	Install RHR isolation valve leakage monitoring system.	Reduce ISLOCA challenge to RHR by identification of upstream valve failure.	2.08%	6.96%	LOCA06	Eliminate all ISLOCA events.	$28.0K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.7-1 Seabrook Station 1 Phase II SAMA Analysis (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	% Red. In CDF	% Red. In OS Dose	SAMA Case	SAMA Case Description	Benefit at 7% Discount Rate	Cost	Cost Basis	Evaluation	Basis for Evaluation
189	Modify or analyze SEPS capability; 1 of 2 SEPS for LOSP non-SI loads, 2 of 2 for LOSP SI loads.	Allow all equipment to be run following LOSP with EDG failure but successful start and load of SEPS.	6.94%	0.98%	1of2SEPS	benefit of SEPS success criteria change, from 2 of 2 SEPS DGs to 1 of 2 SEPS DGs, applicable to SAMA 192	$30K	>$300K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
190	Add synchronization capability to SEPS Diesel.	Eliminate current requirement for dead bus transfer from SEPS to normal power.	27.08%	12.19%	NOSBO	This case is used to determine the benefit of eliminating all Station Blackout events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the Diesel Generators do not fail.	$155K	$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Note (1): Risk reduction not specifically evaluated because estimated cost exceeds the possible maximum averted cost-risk.

F.8 SENSITIVITY ANALYSES

Sensitivity analyses examine the impact of analysis assumptions on the results of the SAMA evaluation. This section identifies several sensitivities that can be performed during SAMA (Reference 20, NEI 05-01) and discusses the sensitivity as it applies to Seabrook Station and the impact of the sensitivity on the results of the Phase II SAMA analysis at Seabrook Station.

Unless it was otherwise noted, it is assumed in these sensitivity analyses that sufficient margin existed in the maximum benefit estimation that the Phase I screening would not have to be repeated in the sensitivity analyses.

F.8.1 PLANT MODIFICATIONS

There are no plant modifications currently pending that would be expected to impact the results of this SAMA evaluation.

F.8.2 UNCERTAINTY

Because the inputs to PRA cannot be known with complete certainty, there is the possibility that the actual plant risk is greater than the mean values used in the evaluation of the SAMA described in the previous sections. To consider this uncertainty, a sensitivity analysis was performed in which an uncertainty factor was applied to the frequencies calculated by the PRA and the subsequent upper bound (UB) benefits were calculated based upon the mean risk values multiplied by this uncertainty factor. The uncertainty factor applied is the ratio of the 95th percentile value of the CDF from the PRA uncertainty analysis to the mean value of the CDF. For Seabrook Station, the 95th percentile value of the CDF is 2.75E-05/yr; therefore, the uncertainty factor is 1.90. Table F.8-1 provides the benefit results from each of the sensitivities for each of the SAMA cases evaluated.

F.8.3 PEER REVIEW FACTS/OBSERVATIONS

The model used in this SAMA analysis includes the resolution of the Facts-and-Observations (F&Os) identified during the PRA Peer Review. Therefore, no specific sensitivities were performed related to this issue.

F.8.4 SENSITIVITY TO LEVEL 3 OFFSITE PARAMETERS

Sensitivity to some of the Level 3 MACCS2 inputs was investigated to determine their effects on annual risk. The parameters analyzed in the sensitivity investigation included those identified below.

Annual Met Data Set – Five years of site meteorological data was evaluated, 2004 through 2008. Meteorological data from year 2005 resulted in the maximum dose and cost risk compared to other years. The 2005 data was used as the baseline case input for meteorology data. Insight gained: Other meteorological data in years 2004, 2006, 2007 and 2008 resulted in decreases to dose and economic risks when compared to the 2005 baseline case.

Release Height – Baseline case release was considered at the top height of the containment building. Sensitivity cases considered releases at ground height and at 25%, 50% and 75% of containment height. Insight gained: Decrease in release height increases close-in deposition of nuclides released. With the decrease in release height, the larger population located downwind would be affected by a depleted plume relative to the baseline case release height. Risks are minimum at ground level; risk increases as release height increases to top of containment.

Release Heat - Baseline case assumed ambient release conditions. Investigated release heat of 1 and 10 MW released with each of 4 plume segments for each accident category. Insight gained: Buoyancy associated with increasing heat results in less ground level consequences near release. Risk from some accident categories is relatively more important near the release point.

Wake Effects – The effect of building wake on the risk was analyzed because the proximity of other buildings to the Seabrook containment introduces uncertainty as to local air flow around these buildings. Baseline case wake effects were determined based on the large containment building structure. The wake size was assumed at one-half the baseline and at double the baseline to address uncertainty of impact from other buildings. Insight gained: Risk is not sensitive to building wake effects.

Evacuation Speed – Baseline case evacuation speed is based on the Seabrook Station Radiological Emergency Plan evaluation considering adverse weather conditions, projected to 2050. Two evacuation sensitivity cases were performed to determine the impact of evacuation speed assumptions. One sensitivity case used one-half the base case evacuation speed and the second sensitivity case doubled the base case evacuation speed. Insight gained: Dose risk increases as evacuation speed decreases. Change in dose risk not significant.

Evacuation Preparation Time – Baseline case preparation time is 2 hours based on the MACCS2 sample problem A. Sensitivity cases considered one-half the baseline time to prepare for evacuation and a doubling of the baseline time. Insight gained: Changing the preparation time had a minor effect on most accident category risks; a slightly larger effect was noted on late containment release categories with risk concentrated near the release.

Evacuation Warning Time – Baseline case emergency declaration time is dependent on the accident progression. Sensitivity cases considered one-half the baseline time to warn to evacuate (declaration of general emergency) and a doubling of the baseline time. Insight gained: Similar behavior as changes in evacuation preparation time.

Fraction of Population Evacuating – The baseline case for population evacuation considers 95% percent of the population within 10 miles of the plant evacuating and 5 percent not evacuating. This is judged conservative relative to the NUREG 1150 study, which assumed evacuation of 99.5 percent of the population within the emergency planning zone. Release category SE-3 is identified as a risk-dominant release category. An important contributor to SE-3 is a seismically-induced severe accident event. A sensitivity case was performed which conservatively assumed that the population does not evacuate for the SE-3 release category. Insight gained: Assumed no evacuation for release category SE-3 results in a small increase to the overall total accident dose-risk, no change to economic risk.

Meteorology in Last Spatial Ring Segment – The baseline case considers rain fall imposed within the 40 to 50 mile ring segment from release for all cases to force conservative population exposure, that is, to ensure that a conservatively large quantity of nuclides released in each scenario were deposited via wet deposition. The sensitivity case allows the meteorology within the 40 to 50 mile ring segment to temporally follow the site meteorology. Insight gained: Decrease in risk due to removing assumed perpetual rainfall and its resulting wet deposition and instead assumed measured meteorology.

Level 3 Input Sensitivity Investigation Conclusions

With the baseline case conservative assumption for meteorology (the maximum risk year 2005 was chosen for the Level-3 analysis), the risks to severe accidents can increase up to approximately 4% as a result of any of the considered parameter changes. The conservatism in the baseline case of specifying perpetual rainfall in the spatial ring from 40 to 50 miles is judged to more than balance any risk increases that might result from alternate release parameters. Based on the baseline case assumptions and the sensitivity investigations performed, it is concluded that the offsite dose and economic risks are adequately accounted for and are relatively insensitive to reasonable variations in the individual input parameters. No changes to the evaluation of SAMA candidates are judged necessary based on the Level 3 input sensitivity investigation.

F.8.5 REAL DISCOUNT RATE

Calculation of severe accident impacts in the Seabrook SAMA analysis was performed using a "real discount rate" of 7% (0.07/year) as recommended in NUREG/BR-0184 (Reference 16). Use of both a 7% and 3% real discount rate in regulatory analysis is specified in Office of Management Budget (OMB) guidance (Reference 21) and in NUREG/BR-0058 (Reference 22). Therefore, a sensitivity analysis was performed using a 3% real discount rate.

In this sensitivity analysis, the real discount rate in the Level 3 PRA model was changed to 3% from 7% and the Phase II analysis was repeated with the lower interest rate.

A sensitivity analysis was also performed using the "best estimate" (BE) discount rate of 8.5%. This represents the discount rate that could be expected for Seabrook Station.

The results of the sensitivity analyses are presented in Table F.8-1. The sensitivity results do not challenge any decisions made regarding the SAMAs.

F.8.6 ANALYSIS PERIOD

As described in Section F.4, calculation of severe accident impacts involves an analysis period term, t_f, which could have been defined as either the period of extended operation (20 years), or the years remaining until the end of facility life (from the time of the SAMA analysis to the end of the period of extended operation is 41 years).

The value used for this term was the period of extended operation (20 years). This sensitivity analysis was performed using the period from the time of the SAMA analysis to the end of the period of extended operation to determine if SAMAs would be potentially cost-beneficial if performed immediately.

In this sensitivity analysis, the analysis period in the calculation of severe accident risk was modified to 41 years and the Phase II analysis was repeated with the revised analysis period. The cost of additional years of maintenance, surveillance, calibrations, and training were included appropriately in the cost estimates for SAMAs in this Phase II analysis.

The results of this sensitivity analysis are presented in Table F.8-1. This sensitivity analysis does not challenge any decisions made regarding the SAMAs.

Table F.8-1 Seabrook Station Sensitivity Evaluation[a]

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
2	Replace lead-acid batteries with fuel cells.	Extended DC power availability during an SBO.	NOSBO	$155K	$255K	$138K	$247K	$295K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
13	Install an additional, buried off-site power source.	Reduced probability of loss of off-site power.	NOLOSP	$335K	$527K	$298K	$502K	$638K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
14	Install a gas turbine generator.	Increased availability of on-site AC power.	NOLOSP	$335K	$527K	$298K	$502K	$638K	$>1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
16	Improve uninterruptible power supplies.	Increased availability of power supplies supporting front-line equipment.	NOLOSP	$335K	$527K	$298K	$502K	$638K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
20	Add a new backup source of diesel cooling.	Increased diesel generator availability.	NOSBO	$155K	$255K	$138K	$247K	$295K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
21	Develop procedures to repair or replace failed 4 KV breakers.	Increased probability of recovery from failure of breakers that transfer 4.16 kV non-emergency buses from unit station service transformers.	BREAKER	$8K	$13K	$7K	$13K	$15	>$25K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
24	Bury off-site power lines.	Improved off-site power reliability during severe weather.	NOLOSP	$335K	$527K	$298K	$502K	$638K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
25	Install an independent active or passive high pressure injection system.	Improved prevention of core melt sequences.	LOCA02	$470K	$751K	$418K	$720K	$894K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
26	Provide an additional high pressure injection pump with independent diesel.	Reduced frequency of core melt from small LOCA and SBO sequences.	LOCA02	$470K	$751K	$418K	$720K	$894K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
28	Add a diverse low pressure injection system.	Improved injection capability.	LOCA03	$160K	$240K	$142K	$222K	$304K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
35	Throttle low pressure injection pumps earlier in medium or large-break LOCAs to maintain reactor water storage tank inventory.	Extended reactor water storage tank capacity.	LOCA04	$158K	$260K	$140K	$253K	$300K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Current valve & controls do not allow throttling. Modification required.
39	Replace two of the four electric safety injection pumps with diesel-powered pumps.	Reduced common cause failure of the safety injection system. This SAMA was originally intended for the Westinghouse-CE System 80+, which has four trains of safety injection. However, the intent of this SAMA is to provide diversity within the high- and low-pressure safety injections systems.	LOCA02	$470K	$751K	$418K	$720K	$894K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
41	Create a reactor coolant depressurization system.	Allows low pressure emergency core cooling system injection in the event of small LOCA and high-pressure safety injection failure.	LOCA01	$33.3K	$57K	$30K	$56K	$63K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
43	Add redundant DC control power for SW pumps.	Increased availability of SW.	SW01	$9.8K	$15K	$9K	$14K	$19K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
44	Replace ECCS pump motors with air-cooled motors.	Elimination of ECCS dependency on component cooling system.	CCW01	$183K	$290K	$163K	$277K	$348K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
55	Install an independent reactor coolant pump seal injection system, with dedicated diesel.	Reduced frequency of core damage from loss of component cooling water, service water, or station blackout.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
56	Install an independent reactor coolant pump seal injection system, without dedicated diesel.	Reduced frequency of core damage from loss of component cooling water or service water, but not a station blackout.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
59	Install an additional component cooling water pump.	Reduced likelihood of loss of component cooling water leading to a reactor coolant pump seal LOCA.	CCW01	$183K	$290K	$163K	$277K	$348K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
65	Install a digital feed water upgrade.	Reduced chance of loss of main feed water following a plant trip.							$30M	Current estimate for cost of installation	Not Cost-Beneficial	Cost is greater than MAB Note (1)
77	Provide a passive, secondary-side heat-rejection loop consisting of a condenser and heat sink.	Reduced potential for core damage due to loss-of-feedwater events.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
80	Provide a redundant train or means of ventilation.	Increased availability of components dependent on room cooling.	HVAC2	$32K	$56K	$29K	$56K	$61K	>$500k	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
90	Create a reactor cavity flooding system.	Enhanced debris cool ability, reduced core concrete interaction, and increased fission product scrubbing.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
91	Install a passive containment spray system.	Improved containment spray capability.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
93	Install an unfiltered, hardened containment vent.	Increased decay heat removal capability for non-ATWS events, without scrubbing released fission products.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
94	Install a filtered containment vent to remove decay heat. Option 1: Gravel Bed Filter; Option 2: Multiple Venturi Scrubber	Increased decay heat removal capability for non-ATWS events, with scrubbing of released fission products.	CONT01	$163K	$227K	$145K	$204K	$310K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
96	Provide post-accident containment inserting capability.	Reduced likelihood of hydrogen and carbon monoxide gas combustion.	H2BURN	$<1K	$<1K	$<1K	$<1K	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
97	Create a large concrete crucible with heat removal potential to contain molten core debris.	Increased cooling and containment of molten core debris. Molten core debris escaping from the vessel is contained within the crucible and a water cooling mechanism cools the molten core in the crucible, preventing melt-through of the base mat.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
98	Create a core melt source reduction system.	Increased cooling and containment of molten core debris. Refractory material would be placed underneath the reactor vessel such that a molten core falling on the material would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit Note (1)
99	Strengthen primary/secondary containment (e.g., add ribbing to containment shell).	Reduced probability of containment over-pressurization.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
100	Increase depth of the concrete base mat or use an alternate concrete material to ensure melt-through does not occur.	Reduced probability of base mat melt-through.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
101	Provide a reactor vessel exterior cooling system.	Increased potential to cool a molten core before it causes vessel failure, by submerging the lower head in water.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
102	Construct a building to be connected to primary/secondary containment and maintained at a vacuum.	Reduced probability of containment over-pressurization.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
106	Install automatic containment spray pump header throttle valves.	Extended time over which water remains in the reactor water storage tank, when full containment spray flow is not needed.	LOCA04	$158K	$260K	$140K	$253K	$300K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
107	Install a redundant containment spray system.	Increased containment heat removal ability.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
108	Install an independent power supply to the hydrogen control system using either new batteries, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel.	Reduced hydrogen detonation potential.	H2BURN	$<1K	$<1K	$<1K	$<1K	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
109	Install a passive hydrogen control system.	Reduced hydrogen detonation potential.	H2BURN	$<1K	$<1K	$<1K	$<1K	$<1K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
110	Erect a barrier that would provide enhanced protection of the containment walls (shell) from ejected core debris following a core melt scenario at high pressure.	Reduced probability of containment failure.							>$3M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit. Note (1)
112	Add redundant and diverse limit switches to each containment isolation valve.	Reduced frequency of containment isolation failure and ISLOCAs.	CONT02	$209K	$292K	$186K	$261K	$397K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
113	Increase leak testing of valves in ISLOCA paths.	Reduced ISLOCA frequency.	LOCA06	$28.0K	$43K	$25K	$40K	$53K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
114	Install self-actuating containment isolation valves.	Reduced frequency of isolation failure.	CONT02	$209K	$292K	$186K	$261K	$397K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
115	Locate residual heat removal (RHR) inside containment	Reduced frequency of ISLOCA outside containment.	LOCA06	$28.0K	$43K	$25K	$40K	$53K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
119	Institute a maintenance practice to perform a 100% inspection of steam generator tubes during each refueling outage.	Reduced frequency of steam generator tube ruptures.	NOSGTR	$86.1K	$126K	$77K	$116K	$164K	>$500K	Expert Panel	Not Cost-Beneficial	Cost exceeds benefit.
121	Increase the pressure capacity of the secondary side so that a steam generator tube rupture would not cause the relief valves to lift.	Eliminates release pathway to the environment following a steam generator tube rupture.	NOSGTR	$86.1K	$126K	$77K	$116K	$164K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
125	Route the discharge from the main steam safety valves through a structure where a water spray would condense the steam and remove most of the fission products.	Reduced consequences of a steam generator tube rupture.	NOSGTR	$86.1K	$126K	$77K	$116K	$164K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
126	Install a highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources	Reduced consequences of a steam generator tube rupture.	NOSGTR	$86.1K	$126K	$77K	$116K	$164K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
129	Vent main steam safety valves in containment.	Reduced consequences of a steam generator tube rupture.	NOSGTR	$86.1K	$126K	$77K	$116K	$164K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
130	Add an independent boron injection system.	Improved availability of boron injection during ATWS.	NOATWS	$70.2K	$103K	$63K	$94K	$134K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
131	Add a system of relief valves to prevent equipment damage from pressure spikes during an ATWS.	Improved equipment availability after an ATWS.	NOATWS	$70.2K	$103K	$63K	$94K	$134K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
133	Install an ATWS sized filtered containment vent to remove decay heat.	Increased ability to remove reactor heat from ATWS events.	NOATWS	$70.2K	$103K	$63K	$94K	$134K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
147	Install digital large break LOCA protection system.	Reduced probability of a large break LOCA (a leak before break).	LOCA05	$103K	$158K	$92K	$148K	$196K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
153	Install secondary side guard pipes up to the main steam isolation valves.	Prevents secondary side depressurization should a steam line break occur upstream of the main steam isolation valves. Also guards against or prevents consequential multiple steam generator tube ruptures following a main steam line break event.	NOSLB	$3.1K	$5K	$3K	$5K	$6K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
154	Modify SEPS design to accommodate: (a) automatic bus loading, (b) automatic bus alignment.	Improve reliability of onsite power; reduce SBO CDF contribution; remove dependence on operator action.	NOSBO	$155K	$255K	$138K	$247K	$295K	>$750k	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
156	Install alternate offsite power source that bypasses the switchyard. For example, use campus power source to energize Bus E5 or E6.	Improve offsite power reliability and independence of switchyard and SF6 bus duct; allow restoration of offsite power within a few hours.	NOLOSP	$335K	$527K	$298K	$502K	$638K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
157	Provide independent AC power source for battery chargers. For example, provide portable generator to charge station battery.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	INDEPAC	$23K	$39K	$21K	$38K	$45K	$30K	Cost for 480V generator, cables, procedure for use, and training.	Potentially Cost-Beneficial	Case benefit for uncertainty sensitivity case is $45K. Independent AC power source for battery chargers is a plant-specific item identified via the IPE.
159	Install additional batteries.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery.	INDEPAC	$23K	$39K	$21K	$38K	$45K	>$1M	Batteries, charger, cabling, new building to house batteries, ongoing maintenance costs.	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
161	Modify EDG jacket heat exchanger service water supply and return to allow timely alignment of alternate cooling water source (supply & drain) from firewater, RMW, DW, etc.	Alternate cooling to both EDGs would reduce CDF long term sequences involving LOOP and loss of SW /cooling tower. A loss of service water / cooling tower with a LOOP could result in EDG failure and non-recovery.	NOSBO	$155K	$255K	$138K	$247K	$295K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
162	Increase the capacity margin of the CST.	Extend long term operation of EFW without operator action for CST makeup for sequences that do not go to cold shutdown. Enhance CST margin for design-basis seismic event with cooldown via SG and transition to RHR.	CST01	$8.6K	$15K	$8K	$14K	$16K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
163	Install third EFW pump (steam-driven).	Reduce CDF of SBO sequences by improving overall reliability of EFW system independent of AC power. An additional pump might also have a Level 2 benefit by maintaining coverage of SG tubes thus reducing the release potential for induced SGTR given high pressure core melt sequence.	TDAFW	$100K	$166K	$89K	$162K	$190K	>$250K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
164	Modify 10" Condensate Filter Flange to have a 2½-inch female fire hose adapter with isolation valve.	Possible enhancement of long term core damage sequences that credit CST makeup.	CST01	$8.6K	$15K	$8K	$14K	$16K	$40k	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
165	RWST fill from firewater during containment injection - Modify 6" RWST Flush Flange to have a 2½-inch female fire hose adapter with isolation valve.	Could enhance long term containment injection sequences that would benefit from RWST makeup.	NORMW	$75	$120K	$66K	$115K	$142K	$50K	Expert Panel	Potentially Cost-Beneficial	
167	Install independent seal injection pump (low volume pump) with automatic start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
168	Install independent seal injection pump (low volume pump) with manual start.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
169	Install independent charging pump (high volume pump) with manual start	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures; improve decay heat removal using feed & bleed.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
170	Replace the Positive Displacement Pump (PDP) with a 3rd centrifugal charging pump. Consider low volume and cooling water independence.	Reduce CDF contribution from RCP seal LOCA events driven by seal cooling hardware failures.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
172	Evaluate installation of a "shutdown seal" in the RCPs being developed by Westinghouse.	Reduce CDF contribution from transients with seal cooling hardware failures resulting in RCP seal LOCA events.	RCPLOCA	$82.2K	$145K	$82K	$138K	$176K	>$1M	Expert Panel	Not Cost-Beneficial	PRA case RCPLOCA which has a best estimate benefit of $92K and an upper bound benefit of $176K. This will not be cost beneficial, but Seabrook can take credit for following shutdown seal developments and industry initiatives to lower risk of RCP seal LOCA events. The budgetary estimated cost to replace 4 RCP seals with new shutdown seal when available is >$1M.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
174	Provide alternate scram button to remove power from MG sets to CR drives.	Improve reliability of reactor scram by providing remote-manual capability to remove rod drive power should the reactor trip breakers fail; reduce ATWS contribution.	NOATWS	$70.2K	$103K	$63K	$94K	$134K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
175	Install fire detection in turbine building relay room.	Improve fire detection and manual suppression actions.	FIRE2	$3K	$5K	$2K	$5K	$5K	>$10K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
179	Fire induced LOCA response procedure from Alternate Shutdown Panel.	Possible reduction in CDF if mitigating fire-induced LOCA. Judged marginal benefit due to existing design and guidance to minimize potential for inadvertent PORV interaction. Thus, likelihood of LOCA with control room uninhabitable for a long period of time is judged low.	FIRE1	$4K	$7K	$3K	$7K	$7K	>$10K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
181	Improve relay chatter fragility.	Closed. Relay chatter fragility judged low contributor to CDF. Significant uncertainty in hazard and fragility not easily removed and beyond state-of-the-art as stated in IPEEE. No further actions needed.	SEISMIC01	$102K	$156K	$91K	$146K	$195K	>$300K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
182	Improve seismic capacity of EDGs and steam-driven EFW pump.	Improve component fragility and reduce seismic event contribution to CDF.	SEISMIC02	$<1K	$<1K	$<1K	$<1K	$<1K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
184	Control/reduce time that the containment purge valves are in open position.	Purge path is large opening. Reduce exposure time of open path, improve reliability/availability of CI, reduce CI failure contribution to large release.	PURGE	$<1K	$<1K	$<1K	$<1K	$<1K	$20K	Cost of Procedure Change	Not Cost-Beneficial	Cost will exceed benefit.

Table F.8-1 Seabrook Station Sensitivity Evaluation (Continued)

Seabrook SAMA Number	Potential Improvement	Discussion	SAMA Case	Benefit at 7% Discount Rate	Benefit at 3% Discount Rate	Benefit at BE Discount Rate of 8.5%	Benefit at 41 yrs	Benefit at UB	Cost	Cost Basis	Evaluation	Basis for Evaluation
186	Install containment leakage monitoring system.	Improve containment reliability by reducing the potential for pre-existing containment leakage.	CONT01	$163K	$227K	$145K	$204K	$310K	>$500K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
187	Install RHR isolation valve leakage monitoring system.	Reduce ISLOCA challenge to RHR by identification of upstream valve failure.	LOCA06	$28.0K	$43K	$25K	$40K	$53K	>$100K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
189	Modify or analyze SEPS capability; 1 of 2 SEPS for LOSP non-SI loads, 2 of 2 for LOSP SI loads.	Allow all equipment to be run following LOSP with EDG failure but successful start and load of SEPS.	1of2SEPS	$30K	$52K	$27K	$52K	$57K	>$300K	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.
190	Add synchronizatio n capability to SEPS Diesel.	Eliminate current requirement for dead bus transfer from SEPS to normal power.	NOSBO	$155K	$255K	$138K	$247K	$295K	$1M	Expert Panel	Not Cost-Beneficial	Cost will exceed benefit.

[a] The benefits in this table are provided for 5 cases: (1) Benefit at 7% discount rate – baseline benefit calculated using nominal values for all parameters; (2) Benefit at 3% discount rate – benefit calculated using 3% discount rate rather than the nominal 7%; (3) Benefit at BE discount rate of 8.5% – benefit calculated using the best estimate discount rate provided by Seabrook Station rather than the nominal 7%; (4) Benefit at 41 yrs – benefit using a 41-year calculation period rather than the nominal 20 years; and (5) Benefit at UB – benefit calculated using the upper bound of CDF as defined by Seabrook Station rather than the point estimate for CDF.

Note (1): Risk reduction not specifically evaluated because estimated cost exceeds the possible maximum averted cost-risk.

F.9 CONCLUSIONS

As a result of this analysis, two SAMAs have been identified in Table F.9-1 as potentially cost beneficial (SAMAs 157 and 165), either directly or as a result of the sensitivity analyses. These SAMA are not aging-related and are therefore not required to be resolved as part of the License Renewal effort. However, because these potential improvements could result in a reduction in public risk, these SAMAs will be entered into the Seabrook Station long-range plan development process for further consideration.

Implementation of SAMA 157 would involve the purchase of a portable 480V AC generator, installation of connections to allow use of the generator, development of a procedure for use, and training for personnel.

Implementation of SAMA 165 involves installation of a permanent hose connection on the flush flange for the RWST, development of procedures for use, and training of personnel.

None of the SAMAs identified in Table F.9-1 are aging-related.

Table F.9-1: Seabrook Station Potentially Cost Beneficial SAMAs

Seabrook SAMA Number	Potential Improvement	Discussion
157	Provide independent AC power source for battery chargers - example: provide portable generator to charge station battery.	Reduce CDF of long term SBO sequences; extend battery life to allow additional time for recovery of offsite power.
165	RWST fill from firewater during containment injection - Modify 6" RWST Flush Flange to have a 2½-inch female fire hose adapter with isolation valve.	Could enhance long term containment injection sequences that would benefit from RWST makeup. Installing permanent valve connection would improve alignment efficiency.

F.10 REFERENCES

1. New Hampshire Yankee, "Individual Plant Examination Report for Seabrook Station," March 1991.

2. WCAP-16600, Seabrook Station Probabilistic Risk Assessment: Level 2 PRA Update, Volume 1 and 2, Revision 0, June 2006.

3. New Hampshire Yankee, "Individual Plant Examination External Events Report for Seabrook Station," September 1992.

4. Tetra Tech, "Calculation of Severe Accident Risks for Seabrook Station License Renewal," Revision 0, May 2009.

5. Electric Power Research Institute TR-105396, "PSA Applications Guide", August 1995.

6. Westinghouse WCAP-15603, "WOG2000 Reactor Coolant Pump Seal Leakage Model for Westinghouse PWRs", Revision 1-A, June 2003.

7. U. S. NRC NUREG/CR-5496, "Evaluation of Loss of Offsite Power Events at Nuclear Power Plants: 1980-1996", November 1998.

8. U. S. NRC NUREG/CR-INEEL/EXT-04-02326, "Evaluation of Loss of Offsite Power Events at Nuclear Power Plants: 1986 - 2003 (Draft)", Draft.

9. U. S. NRC NUREG-1407, "Procedural and submittal Guidance for the Individual Plant Examination of external Events (IPEEE) for Severe Accident Vulnerabilities", June 1991.

10. U. S. NRC Title 10 Code of Federal Regulations Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979".

11. U. S. NRC NUREG/CR-2300, "PRA Procedures Guide", January 1983.

12. U. S. NRC NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants".

13. U. S. NRC NUREG/CR-6109, "The Probability of Containment Failure by Direct Containment Heating In Surry", May 1995.

14. U. S. NRC NUREG/CR-6338, "Resolution of Direct Containment Heating Issue for All Westinghouse Plants with Large Dry Containments or Subatmospheric Containments", February 1996.

15. Westinghouse WCAP-15955, "Steam Generator Tube Rupture PSA Notebook", December 2002.

16. U. S. NRC NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," 1997.

17. Westinghouse WCAP-15603, "WOG2000 Reactor Coolant Pump Seal Leakage Model for Westinghouse PWRs", Revision 0, December 2000.

18. INEEL, "Reliability Study: Westinghouse Reactor Protection System, 1984-1995," NUREG/CR-5500, Vol. 2, INEEL/EXT-97-00740, April 1999.

19. U. S. NRC NUREG-1715, Volume 4, "Component Performance Study – Motor Operated Valves, 1987 - 1998", September 2001.

20. Nuclear Energy Institute NEI 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document," November 2005.

21. Office of Management and Budget, "Regulator Analysis," Circular No. A-4, September 17, 2003.

22. U. S. NRC NUREG/BR-0058, Revision 4, "Regulatory Analysis Guidelines of the U. S. Nuclear Regulatory Commission," September 2004.

23. U. S. NRC NUREG/CR-6613, "Code Manual for MACCS2, User's Guide," May 1998.

24. U. S. NRC, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1, November 2002.

25. U.S. NRC NUREG/CR-6525, Revision 1, SECPOP2000: Sector Population, Land Fraction, and Economic Estimation Program, Sandia National Laboratories, August 2003.

26. Seabrook Station Radiological Emergency Plan, SSREP, Revision 56, July 2008.

APPENDIX F.A

PRA CASE DESCRIPTIONS FOR SELECTED SAMA CASES

PRA CASE DESCRIPTIONS FOR SELECTED SAMA CASES

Explanation of Appendix F.A Contents

This appendix describes each of the SAMA evaluation cases. An evaluation case is an evaluation of plant risk using a plant PRA model that considers implementation of the evaluated SAMA. The case-specific plant configuration is defined as the plant in its baseline configuration with the model modified to represent the plant after the implementation of a particular SAMA. As indicated in the main report, these model changes were performed in a manner expected to bound the change in risk that would actually be expected if the SAMA were implemented. This approach was taken because the actual designs for the SAMAs have not been developed.

Each analysis case is described. Each case includes a description of the physical change that the case represents and a description of the SAMAs that are being evaluated by this specific case.

Case INSTAIR1

Description: This case is used to determine the benefit of replacing the air compressors. For the purposes of the analysis, a single bounding condition was performed, which assumed the station and containment instrument air systems do not fail.

Case NOATWS

Description: This case is used to determine the benefit of eliminating all Anticipated Transient without Scram (ATWS) events. For the purposes of the analysis, a single bounding analysis was performed which assumed that ATWS events do not occur.

Case NOSGTR

Description: This case is used to determine the benefit of eliminating all Steam Generator Tube Rupture (SGTR) events. This allows evaluation of various possible improvements that could reduce the risk associated with SGTR events. For the purposes of this analysis, a single bounding analysis was performed which assumed that SGTR events do not occur.

Case RCPLOCA

Description: This case is used to determine the benefit of eliminating all Reactor Coolant Pump (RCP) seal loss of coolant accident (LOCA) events. This allows evaluation of various possible improvements that could reduce the risk associated with RCP seal LOCA and other small LOCA events.

Case NOLOSP

Description: This case is used to determine the benefit of eliminating all Loss of Off-Site Power (LOSP) events, both as the initiating event and subsequent to a different initiating event. This allows evaluation of various possible improvements that could reduce the risk associated with LOSP events. For the purposes of the analysis, a single bounding analysis was performed which assumed that LOSP events do not occur, both as an initiating event and subsequent to a different initiating event.

Case NOSBO

Description: This case is used to determine the benefit of eliminating all Station Blackout (SBO) events. This allows evaluation of possible improvements related to SBO sequences. For the purpose of the analysis, a single bounding analysis is performed that assumes the emergency AC power supplies do not fail.

Case NOSLB

Description: This case is used to determine the benefit of installing secondary side guard pipes to the Main Steam Isolation Valves (MSIVs). This would prevent secondary side depressurization should a Steam Line Break (SLB) occur upstream of the MSIVs. For the purposes of the analysis, a single bounding analysis was performed which assumed that no SLB events occur (inside or outside of containment).

Case CHG01

Description: Assumes the charging pumps are not dependent on cooling water. This case is used to determine the benefit of removing the charging pumps dependency on cooling water.

Case SW01

Description: Assumes the service water pumps are not dependent on DC power. This case is used to determine the benefit of enhancing the DC control power to the service water pumps.

Case CCW01

Description: This case is used to determine the benefit of improvement to the CCW system by assuming that CCW pumps do not fail.

Case FW01

Description: Eliminates loss of feedwater initiating events. This case is used to determine the benefit of improvements to the feedwater and feedwater control systems.

Case LOCA01

Description: Assumes small LOCA events do not occur. This case is used to determine the benefit of eliminating all small LOCA events.

Case LOCA02

Description: Assumes the high pressure injection system does not fail. This case is used to determine the benefit of improvements to the High Pressure Injection Systems.

Case LOCA03

Description: Assumes failures of the low pressure injection system do not occur. This case is used to determine the benefit of improving the Low Pressure Injection Systems.

Case LOCA04

Description: This case assumes that the RWST cannot be depleted and is used to determine the impact of refilling or backup of the water supply for the RWST.

Case LOCA05

Description: Assumes that piping system LOCAs do not occur. This case is used to determine the benefit of eliminating all LOCA events related to piping failure (no change to non-piping failure is considered).

Case LOCA06

Description: Assumes ISLOCA events do not occur. This case is used to determine the benefit of eliminating all ISLOCA events.

Case CONT01

Description: Assumes that the containment does not fail due to overpressurization. This case is used to determine the benefit of eliminating all containment failures due to overpressurization.

Case H2BURN

Description: Assumes hydrogen burns and detonations do not occur. This case is used to determine the benefit of eliminating all hydrogen ignition and burns.

Case CONT02

Description: Assumes there are no failures of containment isolation. This case is used to determine the benefit of eliminating all containment isolation failures.

Case CCW02

Description: Eliminates the dependence of cooling water on the CCW heat exchangers. This case is used to determine the benefit of alternate cooling methods to the CCW heat exchangers.

Case CST01

Description: Assumes the CST does not run out of water and thus does not need to be refilled. This case is used to evaluate methods of CST refill.

Case SEISMIC1

Description: Assumes no seismic relay chatter failures occur. This case is used to evaluate the impact of improvements that would eliminate seismic relay chatter events.

Case SEISMIC2

Description: Assumes no seismic failures of diesel generators or turbine driven EFW.

Case PURGE

Description: Eliminates possibility of containment purge valves being open at the time of an event (assume purge valves always closed).

Case HVAC2

Description: Removes HVAC dependency for CS, SI, RH and CB Spray pumps.

Case TDAFW

Description: Assumes TDAFW train does not fail.

Case BREAKER

Description: Assumes no failures of 4KV bus infeed breakers.

Case FIRE1

Description: This case eliminates initiator FCRPL, control room fire-induced LOCA (PORV), to assess possible benefit of procedure enhancement for handling LOCA at RSS Panel.

Case FIRE2

Description: This case eliminates initiator FTBLP, turbine building fire at west wall or relay room, causing opening of UAT/RAT breakers and loss of power to emergency buses, to conservatively assess the benefit of installing fire detection in the Relay Room.

Case INDEPAC

Description: Benefits of independent AC power to battery chargers, applicable to SAMA 157.

Case 1of2SEPS

Description: Benefits of SEPS success criteria change, from 2 of 2 SEPS DGs to 1 of 2 SEPS DGs, applicable to SAMA 189.

Case NORMW

Description: This PRA case assumes that RWST makeup for long term sequences without recirculation are guaranteed success.