UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Commission

In the Matter of **Entergy Nuclear Generation Company** **Entergy Nuclear Operations, Inc.** **(Pilgrim Nuclear Power Station)**	**Docket No. 50-293-LR** **ASLBP No. 06-848-02-LR**

AFFIDAVIT OF MICHAEL D. SCHERER, Ph.D. IN SUPPORT OF ENTERGY'S ANSWER OPPOSING JONES RIVER WATERSHED ASSOCIATION'S AND PILGRIM WATCH'S MOTION TO REOPEN AND HEARING REQUEST

I, Michael D. Scherer, Ph.D., do hereby depose and say on the basis of personal knowledge and my professional opinion, and under penalties of perjury, that:

BACKGROUND AND QUALIFICATIONS

1. I am a Vice President and Senior Marine Scientist with Normandeau Associates, Inc. ("Normandeau"), a professional consulting firm that specializes in ecological, environmental and natural resources management services. I hold a Ph.D. degree with a Fisheries Biology major and Biometrics minor from the University of Massachusetts, a Master of Science degree in Fisheries Biology from the University of Massachusetts, and a Bachelor of Science degree in Fisheries Biology from Cornell University. My most recent curriculum vitae, including a list of my peer-reviewed scientific publications and professional society presentations, is attached hereto as **Exhibit 1**.

2. Prior to joining Normandeau Associates, I was President (1993-2006) and a principal (1979-2006) of Marine Research, Inc. ("MRI"). Normandeau acquired MRI in 2006.

3. My expertise is in marine fisheries biology and the application of field sampling design and analytical methods to evaluate anthropogenic influences on population and community dynamics of aquatic ecosystems. During my career, I have supervised at least twelve (12) site-specific assessments of potential impacts from power plant thermal discharges or cooling water intakes on aquatic ecosystems, and actively have participated in at least thirty-five (35) such assessments performed by Marine Research, Inc. (now Normandeau) over the past thirty four (34) years, mostly in the northeastern United States. These assessments have included several studies in Cape Cod Bay and Massachusetts Bay within the Gulf of Maine.

4. MRI, and as of 2006 Normandeau, have been managing certain aspects of the biological monitoring program at the Pilgrim Nuclear Power Station located in Plymouth, Massachusetts ("PNPS") since 1973, and Normandeau continues to do so. As a result, I have supervised and participated in the aquatic studies that MRI and Normandeau have performed at PNPS since 1974. I have studied river herring (a term which reflects both alewife [*Alosa pseudoharengus*] and blueback herring [*Alosa aestivalis*] species) populations throughout my graduate and professional career, most recently in the Charles River basin in Boston where I have directed studies from 1999 to present.

PURPOSE AND METHODOLOGY

5. This declaration is made in response to (1) the Jones River Watershed Association's Petitions for Leave to Intervene and File New Contentions under 10 C.F.R. § 2.309(a), (d) or in the Alternative 10 C.F.R. § 2.309(e) and Jones River Watershed Association and Pilgrim Watch's Motion to Reopen Under 10 C.F.R. § 2.326 and Request for a Hearing Under 10 C.F.R. §2.309(a) and (d) filed March 8, 2012, (2) the Correction and Supplement to the Petition filed on March 15, 2012 (the "Supplement"), and (3) the technical affidavits submitted therewith (collectively, "the Petition"). The Petition alleges certain deficiencies in the NRC's

evaluation of the potential impacts of continued operation of PNPS on marine species listed as threatened or endangered under the federal Endangered Species Act ("ESA"). In this declaration, I will offer my expert opinion that potential impacts of the continued operation of PNPS will have no discernible effects on ESA-listed species. It is my further opinion that, although not ESA-listed species, PNPS is expected to have no discernible effect on river herring or winter flounder populations.

6. The opinions expressed in this declaration are in part based on a review of the sources identified in **Exhibit 2**. To the best of my knowledge, the factual statements in this declaration are true and accurate, and the opinions expressed therein are based on my best professional judgment.

DISCUSSION

Description of PNPS and its Environment

7. PNPS is located in Plymouth, Massachusetts on the northwestern coast of Cape Cod Bay (alternatively, the "Bay"). The Bay is enclosed by Cape Cod (Barnstable County) to the south and east, and Plymouth County to the west. (NRC 2006a [hereinafter BA] at E-54). The northern portion of the Bay opens to the larger Massachusetts Bay and the Gulf of Maine in the Atlantic Ocean. (BA at E-54). The Bay exchanges water with Massachusetts Bay in a well-documented fashion. In general, near shore currents carry water from Massachusetts Bay and the Gulf of Maine southward along the coast, requiring about 15 days for water from Boston, and 30 days for water from the Gulf of Maine, to reach Cape Cod Bay.

8. Extensive oceanographic research shows that the movement of water within the Bay is largely controlled by ocean circulation patterns, tidal fluctuations, and wind-induced motion (Davis 1984, ENSR 2000). These effects control the hydrodynamics of the Bay to varying degrees and together control the exchange of water between the Bay and the much larger

Massachusetts Bay. Residual ocean currents in the vicinity of PNPS are generally toward the south and represent a part of the large-scale counterclockwise circulation pattern within Massachusetts Bay.

9. Several studies of currents have been conducted in the Bay, using fixed velocity profilers as well as drogues (free floating buoys). These studies demonstrate that as water moves southward in the Bay, it gradually turns eastward and ultimately passes the tip of Cape Cod toward Georges Bank, creating a counterclockwise circulation pattern within the Bay. (Davis 1984). Early drift bottle studies by Bigelow (1924) showed an average speed to the south of 1.9 nautical miles per day (2.8 ft per sec; Ayers, 1956). A 1983 seabed drifter study (Marine Research Inc., 1984, 1986) undertaken to determine the transit time between Plymouth Bay and PNPS near the bottom of the water column confirmed the counterclockwise flow reported by Bigelow (1924) and Fish (1928). In 1994, the U.S. Geological Survey used a three-dimensional model to conduct current investigations of the Massachusetts and Cape Cod Bay system. This model predicted net or residual currents in the vicinity of PNPS during the spring that were towards the south in the range of 2 to 8 cm per sec (0.07 to 0.26 ft per sec). Although significant wind-driven current fluctuations can occasionally affect the general circulation pattern in the Bay (ENSR 2000), such disruptions are typically short lived and the circulation pattern described here prevails.

10. PNPS utilizes once-through cooling, in which water is withdrawn from the Bay through a cooling water intake structure ("CWIS"), and returned to the Bay through a nearby discharge canal. PNPS's CWIS is located at the northwest end of a small embayment created by two manufactured stone breakwaters. The larger of the two breakwaters extends approximately 1400 feet from the northwest in a southeast direction in front of PNPS; the smaller breakwater extends approximately 700 feet from the southeast in a northeast direction. (BA at Figure 3-1).

The breakwaters create an opening to the Bay approximately 800 feet wide that faces east, with the result that the water flowing past PNPS in a southerly direction does not directly funnel into the intake embayment. As a result, the breakwaters not only isolate PNPS's CWIS from the Bay, but also create a hydraulic dynamic that limits the entrance of organisms into the intake embayment.

11. The average velocity of flow at the intake embayment opening is approximately 0.05 ft per sec at mid-tide. (BA at E-59). This is approximately equal to, or slower than, the velocity of the south-flowing surface water currents outside the embayment. Thus, the water flow at the intake embayment opening is not stronger than the ambient currents in the Bay, and aquatic organisms in the ambient Bay currents are not differentially drawn into the intake embayment. The intake current's lack of influence on the currents in the Bay is corroborated by a study conducted in the 1970s of PNPS's "hydraulic zone of influence," which delineates the portion of the Bay that is potentially affected by the intake flow at PNPS. (Chau and Pierce 1977). This study showed that PNPS's intake had "negligible modification on tidal flow" near PNPS.

12. PNPS's CWIS is located at the northwestern end of the embayment, and is comprised of a screen well that takes in seawater at its northern wall through four bays topped by a skimmer wall. (BA at E-56) The average flow velocity in the embayment just in front of the CWIS is approximately 1 ft per sec at all tides. (BA at E-59). The openings to the bays are fully submerged at mean low water level, and are protected by the skimmer wall, the bottom of which is located at 12 ft below mean sea level. (BA at E-56). The skimmer wall is designed to restrict floating materials at or just below the surface from entering the CWIS, and also restricts aquatic organism entry. Fish are able to escape the system through a series of six to twelve 10-inch

circular openings located in the skimmer walls and at each end of the intake structure. (BA at E-56).

13. PNPS's CWIS has two independent screening systems that protect the circulating water pumps from material floating in the water. The primary barrier is a set of trash racks (also known as bar racks) installed in a vertical orientation just inside the skimmer wall. (BA at E-56). The trash racks are constructed of 3-inch by 3/8-inch rectangular bars, with a 3-inch opening between bars. (BA at E-56). The trash racks thus prevent objects larger than 3 inches in smallest dimension from passing through.

14. PNPS employs a team of surface-air divers to inspect and clean the trash racks on an as needed basis, e.g., whenever a drop in water level in the CWIS indicates they require cleaning. In addition to cleaning the trash racks, divers also periodically remove accumulated sand from the concrete apron at the base of the CWIS using a large suction hose and ancillary equipment. During these cleanings, any material that accumulates on the trash racks, at the base of the trash racks, and on the concrete intake apron is visible to the divers. Consequently, both the trash rack cleanings and the sand vacuuming efforts provide subsurface, confirmatory information on potential impingement of organisms larger than 3 inches in smallest dimension on the trash racks. From 1997 through 2011, the years for which records are available, divers worked on the trash racks from 15 to 55 times per year, averaging approximately 36 dives per year. Despite their consistent presence in the vicinity of the trash racks, no CWIS diver has ever observed or reported any ESA-listed species in the vicinity of the trash racks, or within the intake embayment.

15. Divers also periodically enter the intake embayment to collect fish and shellfish along the northern and southern breakwaters as part of PNPS's required radiological environmental monitoring program ("REMP"). REMP monitoring requires periodic sampling of

various potential environmental pathways to establish that radionuclide levels in the surrounding environment meet NRC regulatory standards. The REMP dives provide an opportunity to directly observe whether free swimming organisms are present in the vicinity of PNPS. From 2001 through 2011, the years for which records are available, REMP dives ranged from 4 to 13 per year on the northern breakwater, averaging approximately 7 dives per year. On the southern breakwater, REMP dives occurred in 2009 (one), 2010 (two), and 2011 (one). No REMP diver has ever observed or reported any ESA-listed species within the intake embayment or in the immediate vicinity of PNPS, offering added support to the information provided by the CWIS divers.

16. Downstream of the trash racks are four traveling water screens, two for each circulating water pump bay. (BA at Figure 3-2). The traveling water screens consist of a continuous series of rotating wire mesh panels. Each screen is approximately 10 ft wide, oriented perpendicular to the water flow, and typically screens out any material in the water larger than ½ by ¼ inch. (BA at E-59). The traveling screens are always in place, and are operated (i.e., rotated) routinely whenever a certain pressure (or water level) differential exists between the upstream and downstream sides of the screen assembly, indicating that the screens are becoming clogged with material. (BA at E-60). In addition, when seawater temperatures drop below 30°F, the screens are operated continuously to prevent freezing. Through-screen velocity at mean low water is calculated to be 1.57 ft per sec. (Enercon 2008). PNPS employs three scheduled, dual (high and low)-pressure nozzle screen washes per week to monitor fish impingement at the travelling screens during three different times of day: morning, afternoon, and evening. (Entergy 2011). As elaborated below, operators and the biologists who monitor the screens have never in the history of PNPS's operation observed an ESA-listed species in the impingement monitoring.

Potential Impacts of PNPS on Endangered and Threatened Species

17. As noted in the 2006 Biological Assessment ("BA") and 2007 Final Supplemental Environmental Impact Statement ("FSEIS") prepared by NRC in connection with PNPS's license renewal, ten (10) ESA-listed species were known to occur in Cape Cod Bay at that time: the shortnose sturgeon; four species of sea turtles; and five species of whales. (NRC 2007, [hereinafter FSEIS] at § 4.6, BA at E-65). Since the 2006 BA, one additional species, the Atlantic sturgeon, has been designated for listing as threatened in the Gulf of Maine, effective April 6, 2012. In February 2012, the NRC prepared a Supplemental Biological Assessment for the Atlantic sturgeon ("Supplemental BA"). (NRC 2012). Each of these listed species is discussed below. As the information discussed below demonstrates, NRC's conclusion in the 2006 BA and the Supplemental BA that the continued operation of PNPS will have no effect on listed species is well-founded.

Shortnose Sturgeon

18. The potential effects of PNPS on shortnose sturgeon (*Acipenser brevirostrum*) were evaluated by NRC in the 2006 BA, which found that PNPS's relicensing would have "no effect" on this listed species. Based on its biology, life history, and more than 30 years of monitoring showing no impingement or entrainment of shortnose sturgeon, the NRC's conclusion with respect to PNPS is technically supported and sound.

19. The shortnose sturgeon is federally listed as endangered throughout its range, and was placed on the endangered species list in 1967. (BA at E-72). Shortnose sturgeon are the smallest North American sturgeon species, reaching adult size at 45 to 50 cm (15.7 to 19.7 inches) and a maximum total length of 143 cm (56.3 inches). (Dadswell 1979, Dadswell et. al. 1984). They are "amphidromous," living in freshwater and estuarine reaches of large river systems that drain into the Atlantic. Shortnose sturgeon spawn upstream, typically in freshwater

above the zone of tidal influence. (BA at E-73). Eggs, larvae and young-of-the-year (fish one year old and younger) are benthic, remaining in deeper channels of freshwater reaches of the rivers in a manner that would not allow their entrainment at PNPS. (Dadswell et. al. 1984). Although some older juvenile and adult shortnose sturgeon may move short distances into marine waters, they do not perform extensive migrations in coastal marine waters. (Dadswell et. al. 1984, Dovel et al. 1992). The river nearest PNPS supporting a breeding population of shortnose sturgeon is the Merrimack River some 62 miles to the north. (Kynard 1997). As a result, shortnose sturgeon are not believed to be present in the Bay in significant numbers. Moreover, their swimming ability as late juveniles and adults is such that none are expected to be subject to impingement. It is, thus, not surprising that no shortnose sturgeon has ever been observed in the trash rack or travelling screen monitoring performed at PNPS, nor have any been observed in the intake embayment or the immediate vicinity of PNPS by REMP divers.

20. Because: 1) shortnose sturgeon generally do not migrate beyond the estuary associated with their natal river; 2) the nearest river supporting a breeding population is 62 miles away; and 3) the life history, habitat preference and swimming ability, in conjunction with the absence of impingement information at PNPS, militate against encounter with PNPS's CWIS, there is no credible technical evidence of any potential impact of PNPS on shortnose sturgeon. Therefore, the NRC's conclusion in the 2006 BA that PNPS will have no effect on shortnose sturgeon is well-founded.

Atlantic Sturgeon

21. As noted above, when NMFS prepared its BA for PNPS in 2006, Atlantic sturgeon were not a federally listed species. However, Atlantic sturgeon are identified in the FSEIS as a marine aquatic species with "the potential to occur in the vicinity of PNPS site…." and as one that "could occur in Cape Cod Bay in the vicinity of PNPS…." (FSEIS at 2-83). On

February 6, 2012, NMFS issued a regulation designating a distinct population segment of the Atlantic sturgeon (*Acipenser oxyrhynchus*) in the Gulf of Maine, which includes Cape Cod Bay, as threatened under the ESA. (NMFS 2012). Unless successfully challenged, this designation will become effective on April 6, 2012.

22. In a letter dated February 29, 2012, NRC requested NMFS's concurrence, pursuant to 40 CFR 40.12(j), with the conclusions in its February 2012 Supplemental BA addressing potential effects of PNPS's license renewal on Atlantic sturgeon. (NRC 2012a [hereinafter Supplemental BA]). The Supplemental BA reviewed the life history, distribution and population status of Atlantic sturgeon and stated "based on the available information on the distribution and the absence of any record of incidental takes of the species at Pilgrim since it began operating, the NRC concludes that the proposed license renewal of Pilgrim will have no effect on the Atlantic sturgeon." (Supplemental BA at 3). Available information supports this conclusion.

23. The Atlantic sturgeon is anadromous, with adults living primarily in marine waters and spawning in freshwater reaches of large river systems. (Murawski and Pacheco 1977, Bain 1997, Bain et al. 2000, Collette and Klein-MacPhee 2002). In contrast to the shortnose sturgeon, adult Atlantic sturgeon are known to migrate significant distances along the Atlantic coast. (Smith 1985, Savory and Pacileo 2003).

24. Atlantic sturgeon eggs and larvae are intolerant of brackish water and remain at or near the bottom in upstream freshwater reaches of rivers. (Van Eenennaam et al. 1996, Greene et al. 2009). The river systems nearest to PNPS that are large enough to support Atlantic sturgeon are the Merrimack River in northern Massachusetts, located approximately 62 miles north of PNPS, and the Piscataqua River in New Hampshire, located approximately 77 miles north of PNPS, though neither of these rivers currently support a spawning population. Thus,

spawning populations nearest to PNPS that currently exist include the Hudson River in New York, located approximately 200 miles south of PNPS, and likely the Kennebec River in Maine, located approximately 130 miles northeast of PNPS. (ASSRT 2007, Greene et al. 2009). Consequently, eggs and larvae of Atlantic sturgeon do not occur, and due to their salinity intolerance cannot survive, in the vicinity of PNPS.

25. After hatching, Atlantic sturgeon spend approximately a year living at the river bottom near their upstream hatching location. (Secor et al. 2000). At between 2 and 6 years of age, juvenile Atlantic sturgeon gradually begin to move downriver to marine waters. (Bain 1997). When juvenile Atlantic sturgeon leave their natal river and move into coastal waters, they are generally between 70 and 150 cm in length with commensurate swimming abilities. (Bain 1997, ASSRT 2007).

26. While it cannot be ruled out that Atlantic sturgeon are present in the Bay, in more than thirty years of continuous monitoring through various mechanisms, a total of only two Atlantic sturgeon have been caught and recorded in the vicinity of PNPS. One fish measuring 82.8 cm (2.7 feet) in length was caught in a gill net by the PNPS biological monitoring conducted by the Massachusetts Division of Marine Fisheries in November 1982 (Lawton et al. 1983), and a second sturgeon measuring 180 cm (5.9 feet) was caught in a bottom trawl tow conducted by Normandeau Associates in May 2009.

27. Any Atlantic sturgeon that found its way into the Bay would not be expected to be affected by PNPS. Coastal migrant Atlantic sturgeon are large, powerful fish, exceeding 70 cm in length and growing up to 4.3 m (approximately 14 feet) in length as adults. (Smith and Clugston 1997). Consequently, Atlantic sturgeon that travel into or through Cape Cod Bay and encounter PNPS have substantial swimming abilities, and would be able to overcome the CWIS intake flow and avoid impingement. Even a moribund or dead fish that drifted into the intake

embayment would be visible to the CWIS divers. As with the shortnose sturgeon, no Atlantic sturgeon has ever been observed in impingement monitoring or CWIS dives conducted at PNPS, nor has one been observed by the REMP divers in the intake embayment or immediate vicinity of PNPS.

28. Because: 1) Atlantic sturgeon eggs and larvae cannot survive in the waters near PNPS; 2) migrating Atlantic sturgeon are large, powerful swimmers that should not be susceptible to impingement at PNPS's CWIS; and 3) no Atlantic sturgeon has ever been observed impinged at PNPS' CWIS, there is no credible technical evidence of any potential impact of PNPS on Atlantic sturgeon. Therefore, NRC's conclusions in the 2012 Supplemental BA that PNPS will have no effect on Atlantic sturgeon is well-founded.

Sea Turtles

29. As described in the 2006 BA and the 2007 FSEIS, four (4) species of sea turtles are known to forage in Cape Cod Bay during the summer months. (BA at E-65, FSEIS at § 2.2.5.3.7). Three species – the green turtle (*Chelonia mydas*), the loggerhead turtle (*Caretta caretta*), and the Kemp's ridley turtle (*Lepidochelys kempi*) – forage from May to October. The fourth species, the leatherback turtle (*Dermochelys coriacea*), may be present in August and September. (Mass Audubon 2012). The 2006 BA found that continued operation of PNPS would have no effect on any of the four species. Briefly, early life stages of sea turtles are not present in the vicinity of PNPS. Healthy juvenile sea turtles are present in the Bay, but are not reasonably expected in the immediate vicinity of PNPS, as a function of habitat preferences and swimming abilities. Impaired sea turtles, as a function of cold stunning, move with prevailing currents away from PNPS, and therefore also are not credibly expected to encounter PNPS's CWIS. Monitoring of PNPS's CWIS, including through CWIS dives, establishes no such

encounters with sea turtles. The following sections provide the detailed information supporting each of these conclusions.

30. Sea turtles' nesting locations vary with species, but are generally in warmer, tropical regions far south of Cape Cod Bay (i.e., beaches of the southern United States Atlantic shore, the Gulf of Mexico, or the Caribbean). After hatching, neonatal turtles crawl to the ocean and swim offshore until they encounter offshore current systems which eventually carry them to larger gyres, in particular the Gulf Stream, which is located far off the U.S. Atlantic coast. Once in the Gulf Stream, they live and forage among floating rafts of *Sargassum* sea weed for a period of two (2) to 35 years, depending on species, while they develop into juveniles. As such, early life stages of sea turtles are not reasonably expected in the vicinity of PNPS and therefore could not reasonably be expected to encounter PNPS's CWIS.

31. When sea turtles reach the juvenile stage, they are ready to change their foraging habits, and begin returning to coastal areas along the U.S. eastern seaboard as far north as New England. (NMFS, USFWS, and SEMARNAT 2011). As noted above, the four species of juvenile turtles at issue may spend the summer months foraging in and around the Bay. As their extended migratory behavior reflects, juvenile sea turtles have substantial swimming abilities. Also, given their habitat preferences, juvenile sea turtles are not expected to be present in the immediate vicinity of PNPS. Finally, given their swimming abilities, it is not expected that their swimming abilities would result in their encountering the PNPS CWIS. For all of these reasons, encounters with PNPS' CWIS is not reasonably expected for unimpaired juvenile sea turtles.

32. Even for impaired sea turtles, which may occur as a result of cold stunning, encounters with PNPS's CWIS is not reasonably expected. In the fall, when water temperatures begin to decline, the sea turtles leave New England and the Bay, and travel south to warmer waters to overwinter. If during the fall, the water temperature declines too quickly, sea turtles

may become "cold stunned." (Morreale et al. 1992). Beginning in November, when the water temperature in the Bay nears 50°F, some sea turtles can become cold stunned, at which point they may travel with prevailing winds and currents, often washing up on shore, an event known as "stranding." Stranded turtles may be rescued, rehabilitated and subsequently released to sea.

33. From year to year, the largest percentage of strandings in the Bay is attributable to Kemp's ridleys (approximately 77%), followed by loggerheads (20%) and green turtles (3%). (Dodge et al. 2003). The same pattern holds true for most individual years, with Kemp's ridleys comprising the largest percentage of strandings each fall (as high as 90%), followed by loggerhead and green sea turtles. (Mass Audubon 2012a). Leatherbacks are able to thermoregulate to some extent and, although they are known to strand, it is generally not due to cold stunning. (New England Aquarium 2012). It is not known whether stranded turtles are stunned inside the Bay or are swept into the Bay already in cold stunned condition. However, well-known studies of currents in Massachusetts Bay and Cape Cod Bay readily explain observed stranding patterns, and offer a clear and cohesive understanding of how cold-stunned turtles are carried in Cape Cod Bay, including in the vicinity of PNPS.

34. As discussed above, the Cape Cod Bay's prevailing circulation pattern creates a net south flowing current in front of PNPS, which should carry cold stunned turtles south past PNPS and to the southeastern shore, where they would wash ashore.

35. Specifically, sea turtle stranding data for Massachusetts for the more than twenty-year period from 1986 through 2007 indicate that, during this period, sea turtles have only rarely stranded in Plymouth County, where PNPS is located, as compared to Barnstable County, which comprises the Cape Cod portion of the Bay. (NMFS SEFSC 2012.). Of the turtles that have stranded in the Bay, only 3 of 1,149 (0.3%) Kemp's ridley, 2 of 258 (0.8%) loggerhead, 3 of 97 (3.0%) leatherback; and 1 of 40 (2.5%) green turtle strandings have occurred in Plymouth

County. (NMFS SEFSC 2012). Consistent with this twenty-year dataset, stranding locations for the years 2003 and 2010 indicate that the vast majority of sea turtles stranded in Cape Cod occur on the south east shore of Cape Cod Bay. (Dodge et al. 2003, Mass Audubon 2012b).

36. As described below, the conclusions above are borne out by the more than thirty years of operation during which no sea turtle has ever been observed impinged or swimming in the PNPS intake embayment.

37. The following sections of this affidavit provide additional information on the four species of sea turtle found in the Bay. In each case, this information supports the NRC's conclusion in the 2006 BA that continued operation of PNPS will have no effect on the sea turtles.

Kemps Ridley Turtle

38. The range for the Kemp's ridley turtle includes the Gulf of Mexico and the western Atlantic coast from the Gulf of Mexico to Newfoundland. (BA at E-67). Kemp's ridley turtles nest primarily on beaches in the Gulf of Mexico, in Mexico, though a few nesting sites exist in the United States from Texas to North Carolina.

39. Once the hatchlings reach a carapace (shell) length of about 20 cm (7.9 inches), they are considered juveniles, and they begin their movement toward shore to forage. (NMFS 2012a). Juvenile Kemp's ridleys can range in size from approximately 20 to 60 cm (7.9 to 23.6 inches) in carapace length. (Renaud 1995). During the summer and early fall, adult Kemp's ridleys can be found inshore along the Atlantic seaboard from Florida to New England, but, for the most part, only juveniles have been reported in New England. (Mass Audubon 2012a). Adult Kemp's ridley turtles are very rare in New England. (TEWG 2000).

40. Most of the Kemp's ridleys stranded in Cape Cod Bay are comparably sized to two-year old turtles, with the great majority ranging in size from 20 to 34 cm (7.9 to 13.4 inches)

in length, with a mean carapace length of 28 cm (11 inches). (Dodge et al. 2003). Consequently, if a Kemp's ridley turtle were to become impinged on the trash racks at PNPS's CWIS, it would be observed by CWIS divers, given the periodicity of their dives. Even if the turtle were to remain impinged long enough that its flesh fully decomposed, it is expected that the shell of a turtle of this size would remain on the trash racks or fall to the apron at the base of the trash racks, where it would be clearly visible to the CWIS divers. Thus, the CWIS diver information provides confirmatory data regarding potential impingement of sea turtles, including Kemp's ridley turtles, at PNPS. No Kemp's ridley turtle or remains ever have been observed in the vicinity of PNPS's CWIS or embayment. Therefore, NRC's conclusion in the 2006 BA that PNPS will have no effect on the Kemp's ridley turtle is technically supported.

Loggerhead Turtle

41. The loggerhead turtle is the most abundant species of sea turtle found in U.S. coastal waters. (BA at E-66). The species is federally listed as threatened throughout its range, which includes temperate and tropical regions in the Atlantic, Pacific, and Indian Oceans. (BA at E-66). Loggerhead sea turtles are separated into nine distinct population segments (DPS), and as of October 25, 2011, the northwestern Atlantic DPS, which includes Cape Cod Bay, is listed as threatened. (NMFS 2011a). Adults and juveniles of this species can be found foraging in coastal areas around Cape Cod from June to mid-September and into the fall. However, most loggerheads in southern New England waters, including the Bay, are juveniles ranging from 15 to 36 inches in carapace length and 25 to 100 pounds in weight, with substantial swimming abilities. Thus, it is not reasonably expected that loggerhead turtles would encounter PNPS's CWIS.

42. Loggerhead turtles make up a minor proportion of strandings in Cape Cod Bay. (Mass Audubon 2012b). The low stranding rate suggests that loggerhead turtles are not cold

stunned at a high rate. As discussed above, given the prevailing currents in the Bay, it is not reasonably expected that a loggerhead turtle would encounter PNPS's CWIS. In addition, no loggerhead turtle or remains ever have been observed in the vicinity of PNPS's CWIS or embayment. Therefore, NRC's conclusion in the 2006 BA that PNPS will have no effect on the loggerhead turtle is technically supported.

Green Turtles

43. The green turtle is listed as endangered in breeding populations in Florida, and as threatened in other areas of the U.S. (BA at E-68). The green turtle has a worldwide distribution, including coastal areas in tropical and subtropical climates. (BA at E-68). In the U.S., they are found in inshore and nearshore waters from Texas to Massachusetts. (BA at E-68).

44. Only juvenile green turtles have been recorded in New England, ranging in size from 12 to 20 inches and weighing approximately 10 pounds, with substantial swimming abilities. Thus, it is not reasonably expected that green turtles would encounter PNPS's CWIS.

45. On average, only one green turtle strands per year in the Bay, indicating that this species is likewise not particularly susceptible to cold stunning. (NMFS SEFSC 2012). As discussed above, given the prevailing currents in the Bay, it is not reasonably expected that a cold stunned green turtle, an infrequent occurrence, would encounter PNPS's CWIS. In addition, no green turtle or remains ever have been observed in the vicinity of PNPS's CWIS or embayment. Therefore, NRC's conclusion in the 2006 BA that PNPS will have no effect on the green turtle is technically supported.

Leatherback Turtles

46. The leatherback sea turtle is the largest of the sea turtles, with adults reaching a weight of up to 2,000 pounds. (BA at E-68). Leatherback turtles are listed as endangered

throughout their range, which is global. (BA at E-68). In the U.S., leatherback turtles nest in the tropics (Puerto Rico, the U.S. Virgin Islands and southeast Florida), and they have been found along the Atlantic coast as far north as the Gulf of Maine. (BA at E-68). Leatherback turtles remain in warmer southern waters as juveniles and once they become sub-adults or adults, they travel north to feeding grounds near the Arctic Sea where they feed primarily on jellyfish. In late summer to fall, adult begin to head south and can be seen in Cape Cod Bay in August and September. Adult leatherback turtles possess substantial swimming abilities. Thus, it is not reasonably expected that leatherback turtles would encounter PNPS's CWIS.

47. Leatherback turtles can regulate their body temperature to some degree, and generally do not strand as a result of cold stunning. Even if they were susceptible to cold stunning, as discussed above, given the prevailing currents in the Bay, it is not reasonably expected that a cold stunned leatherback turtle would encounter PNPS's CWIS. In addition, no leatherback turtle or remains ever have been observed in the vicinity of PNPS's CWIS or embayment. Therefore, NRC's conclusion in the 2006 BA that PNPS will have no effect on the leatherback turtle is technically supported.

Whales

48. The NRC's 2006 BA identifies five federally listed species of whale that are known to occur in the Bay: the Northern Atlantic right whale (*Eubalaena glacialis*); the humpback whale (*Megaptera novaengliae*); the fin whale (*Balaenoptera physalis*); the sei whale (*Balaenoptera borealis*); and the sperm whale (*Physeter catadon*). As correctly stated by NRC, whales are generally endangered due to historic overharvesting, and currently are threatened by mortality from ship collisions and entanglement in fishing gear. (BA at E-69 to E-72). On the basis of this information, the NRC concluded that continued operation of PNPS would have no direct effect on any of the five whale species. (BA at E-69 to E-72). Because all life stages of

whales are powerful swimmers, the sole credible potential for PNPS's continued operations – on a theoretical basis – to affect whales rests solely on the question of potential impacts to food sources. Implicit in NRC's no effect finding is a conclusion that PNPS will have no discernible impacts on the availability of prey to relevant whale species. The following sections of this declaration provide information on the relevant biology of whales and their food sources that confirms the NRC's conclusion that the listed whales found in the Bay also will not indirectly be affected by the continued operation of PNPS.

North Atlantic Right Whales

49. The North Atlantic right whale is the most critically endangered of the large whale species, and is federally listed as endangered throughout its range. (Waring et al. 2011). The International Whaling Commission has identified four categories of right whale habitats, including feeding, calving, nursery, and breeding areas. (BA at E-69). In 1994, NMFS designated three areas as critical habitat for the western population of the North Atlantic right whale, one of which includes portions of Cape Cod Bay. (BA at E-69). During winter, calving occurs in southern latitudes, including the southeastern U.S. (BA at E-69). In spring and summer, the whales migrate to northern latitudes, including the New England coast, for feeding. (BA at E-69). New England waters are considered to be an important feeding ground for the North Atlantic right whale, with the main food source being copepods of the species *Calanus finmarchicus* and of the genera *Pseudocalanus* and *Centropages*. (Leeney et al. 2009). As noted in the 2006 BA, critical feeding habitat for the North Atlantic right whale in the Bay begins approximately 3 miles east of PNPS, and extends south and east to the coastline and north beyond the tip of Cape Cod. (BA at E-69).

50. Recently, Nichols et al. standardized NOAA's sighting data for right whales, based on Sightings Per Unit Effort ("SPUE"), the measure by which sightings are placed in

context and therefore validated. (Nichols et al. 2008). These data demonstrate that North Atlantic right whales are not typically present in the vicinity of PNPS. Rather, the whales concentrate in the eastern portion of the Bay. Indeed, the SPUE data show that between 1998 and 2002, each of the quadrants in the immediate vicinity of PNPS (covering an area extending approximately 6 to 10 km, or 3.72 to 6.2 miles) has a mean SPUE of zero, representing no presence of right whales. (Nichols et al. 2008). The Nichols et al. data are consistent with current scientific understanding of North Atlantic right whale foraging and the designation of right whale critical habitat approximately 3 miles east of PNPS, as discussed in the NRC's BA. (BA at E-69). In other words, given that right whales would not typically be expected to feed in the vicinity of PNPS, it is not reasonable to expect a potential impact to their food sources.

51. Additional information about right whale feeding habitat underscores the absence of an effect as a result of PNPS's continued operation. North Atlantic right whales feed on dense patches of copepods (small, shrimp-like crustaceans). Recent studies show that North Atlantic right whales feed on three specific copepods in the Bay (*Calanus finmarchicus*, *Centropages* spp., and *Pseudocalanus* spp.) with a threshold (i.e., minimum) feeding density of at least 4000 organisms per cubic meter. (Baumgartner et al. 2011, Nichols et al. 2008). The threshold feeding density represents the density of prey organisms, which are very small (on the order of a few mm in length), at which the concentration is sufficient to make foraging worthwhile energetically for these large animals, and therefore amounts to a biological limitation in their feeding behavior.

52. The copepod prey of the North Atlantic right whale are planktonic (i.e., drifters), meaning they can move about the water column to some degree, but their location within the Bay is determined primarily by currents and prevailing winds. (DeLorenzo Costa et al. 2006). The prevailing counterclockwise circulation pattern and dominant wind direction in the Bay,

discussed above, result in generally more abundant and dense copepod populations in the northeast and southern portion of the Bay (analogous to where turtle strandings are highest) (Jiang et al. 2007; Leeney et al. 2009). As one might expect, the northeast and southern portion of the Bay is also where North Atlantic right whale SPUE is highest. (NCCOS 2006).

53. These more recent studies corroborate the NRC's statement in the BA that North Atlantic right whales have not been observed in the Bay near PNPS during the duration of Entergy's aquatic monitoring studies. (BA at E-66).

54. In addition, in order to impact North Atlantic right whale foraging, entrainment at PNPS would need to cause significant mortality of its zooplankton prey. A study performed in 1984 looked at the potential mortality to zooplankton that pass through PNPS's CWIS, and found that under most operating conditions, greater than 95% of individuals survive entrainment unless the system is being actively chlorinated to eliminate biofouling organisms. (Bridges and Anderson 1984). Chlorination activities are well-defined, carefully regulated activities during the period when the whales might be present in the Bay, December through April. Each chlorination event, whether from once a day to once a week, lasts approximately two hours only. Therefore, chlorination would cause additional mortality to a maximum of 8.3% (2/24ths) of zooplankton entrained during any given day or week during the relevant period. This extremely low level of zooplankton mortality on the fraction entrained at PNPS is not reasonably expected to affect right whales. Thus, continued operation of PNPS is not reasonably expected to have a discernible indirect effect on right whales. Consequently, the NRC's conclusion in the 2006 BA that the continued operation of PNPS will have no effect on the North American right whale is sound.

55. Finally, I have reviewed the North Atlantic right whale sighting data reported in NOAA's Sighting Survey and Sighting Advisory System database (http://www.nefsc.noaa.gov

/psb/surveys/) that are cited by Alex Mansfield at ¶¶ 12-15 of his affidavit. These data are potentially misleading because they do not account for sighting effort, and therefore, do not provide an accurate understanding of the North Atlantic right whale's presence within the Bay throughout the year. Specifically, sighting data uncorrected for sighting effort may overstate or understate the actual abundance of whales in an area because the number of sightings in an area is necessarily correlated with the amount of time people spend looking for whales in that area. For example, if whales are evenly distributed throughout the Bay, one would expect more sightings in an area where sighting effort is greater, and fewer sightings in an area where sighting effort is lower. Thus, unless accounted for, sighting effort has the potential to skew whale observation data such that it no longer represents the true distribution of whales in a given area. To avoid this potential source of error, scientists generally correct for sighting effort by reporting the number as SPUE. SPUE is calculated as the number of whales sighted divided by the total effort spent looking for whales, represented in units of time or distance surveyed by boat or plane. Thus, SPUE data are more appropriate for drawing conclusions about whale distributions than the uncorrected sighting data referred to by Mr. Mansfield in his affidavit.

Humpback Whales

56. The humpback whale is federally listed as endangered throughout its range, though no critical habitat has been designated for the species. (BA at E-70). The Gulf of Maine stock is one of four distinct stocks in U.S. waters. (BA at E-70). Humpback whales inhabit shallow water on continental shelves, with summer ranges close to shore, including major coastal embayments. (BA at E-70). Humpback whales may be found off of the coast of Massachusetts during the period from March 15 to November 30, with peak abundance in May and June. (BA at E-70).

57. SPUE data demonstrate that humpback whales are present in the Bay in relatively low numbers, and instead heavily congregate to the north in proximity to Georges Bank and Stellwagen Bank, a National Marine Sanctuary, and to the south in the Great South Channel. (NCCOS 2006). These SPUE data are consistent with NMFS's 2005 humpback whale stock assessment relied on by the NRC in drafting the BA and with the NRC's statement that humpback whales have not been observed in Cape Cod Bay in the vicinity of PNPS during the duration of Entergy's aquatic monitoring studies. (BA at E-66, NMFS 2005).

58. Similar to the North Atlantic right whale, humpback whales are typically found associated with their food source. The Gulf of Maine stock of humpback whales is known to feed primarily on schooling fish, including Atlantic herring, capelin, sand lance, mackerel, and euphausiids. (NMFS 2005). While PNPS impinges Atlantic herring and sand lance, these species are impinged in relatively low numbers, with mean *annual* impingements estimated to be 1,014 sand lance, 978 Atlantic herring. (Entergy 2012). Even assuming 100% impingement mortality, these annual impingement numbers are insignificant, compared to the *daily* consumption of an individual humpback, which is estimated to be 471 kg/day. (Roman and McCarthy 2010). By way of comparison, 471 kg/day equals approximately 34,600 age 1 herring or 7,864 sand lance per day. In other words, a single humpback whale consumes far more herring and/or sand lance in a day than would be expected to be impinged at PNPS on an annual basis.

59. The SPUE data indicate that humpback whales frequent the Bay in relatively low numbers. Further, impingement of a fraction of their prey species is *de minimis*. Thus, continued operation of PNPS is not reasonably expected to have a discernible indirect effect on humpback whales. Consequently, the NRC's conclusion in the 2006 BA that the continued operation of PNPS will have no effect on the humpback whale is sound.

Fin Whales

60. The fin whale is federally listed as endangered throughout its range and is commonly found from Cape Hatteras to Nova Scotia. (BA at E-71). Information on the calving, mating, and feeding grounds for fin whales is limited, but New England waters are known to be an important feeding ground for the species. (BA at E-71). Fin whales are the most frequently sighted endangered whale species found in Massachusetts and the Bay, and are present in the Bay throughout the year. (BA at E-71).

61. Although sightings in the Bay are common, SPUE data establish that fin whales are present in the Bay in relatively low numbers, and instead congregate primarily outside the Bay near Provincetown, and on Georges Bank, Stellwagen Bank and the Great South Channel. (NCCOS 2006). These SPUE data are consistent with NMFS's 2005 fin whale stock assessment relied on by the NRC in drafting the BA and with the NRC's statement that fin whales have not been observed in Cape Cod Bay near PNPS, or in the facility intake and discharge areas, during the duration of Entergy's aquatic monitoring studies. (BA at E-66, NMFS 2005).

62. The fin whale diet consists overwhelmingly of small, schooling fish, including Atlantic herring, capelin, sand lance, and squid, and incidentally of krill (shrimp-like crustaceans on the order of 1 to 2 cm in length). (Kenney et al. 1997). While PNPS impinges Atlantic herring and sand lance, these *annual* impingement numbers are insignificant, compared to the *daily* consumption of an individual fin whale, which is estimated to be at approximately 751 kg/day. (Roman and McCarthy 2010).

63. The SPUE data indicate that fin whales frequent the Bay in relatively low numbers. Further, impingement of a fraction of their prey species is *de minimis*. Thus, continued operation of PNPS is not reasonably expected to have a discernible indirect effect on

fin whales. Consequently, the NRC's conclusion in the 2006 BA that the continued operation of PNPS will have no effect on the fin whale is sound.

Sei Whales

64. The sei whale is federally listed as endangered throughout its range, but no critical habitat has been designated for this species. (BA at E-71). The sei whale ranges from Cape Hatteras to Nova Scotia, with a concentration of spring, summer, and fall feeding in the Georges Bank area. (BA at E-71). Sei whales typically inhabit deep waters of the outer continental shelf, in areas of water depth of about 2,000 m (6,560 ft), and are only rarely sighted in Massachusetts and the Bay. (BA at E-72).

65. SPUE data confirm that sei whales are present in the Bay in relatively low numbers, and instead congregate offshore over the continental shelf waters. (NCCOS 2006). These data are consistent with the NRC's BA and statement that sei whales have not been observed in Cape Cod Bay near PNPS, or in the facility intake and discharge areas, during the duration of Entergy's aquatic monitoring studies. (BA at E-66, E-71).

66. Like the North Atlantic right whale, sei whales primarily feed on zooplankton such as calanoid copepods and euphausiids (NMFS 2011), which as discussed above are not reasonably considered affected by PNPS.

67. The SPUE data indicate that sei whales only rarely frequent the Bay. Further, impacts to prey species are not expected. Thus, continued operation of PNPS is not reasonably expected to have a discernible indirect effect on sei whales. Consequently, the NRC's conclusion in the 2006 BA that the continued operation of PNPS will have no effect on the sei whale is sound.

Sperm Whales

68. The sperm whale is federally listed as endangered throughout its range, but no critical habitat has been designated for this species. (BA at E-72). Five different stocks of sperm whales are recognized in U.S. waters, including a North Atlantic stock estimated at approximately 4,700 individuals that is concentrated east and northeast of Cape Hatteras in the winter, shifts northward to east of Delaware and Virginia in the spring, and is located offshore of New England in the summer and fall. (BA at E-72). The sperm whale is primarily found in water greater than 600 m (1970 ft) deep, and is rarely found in water less than 300 m (984 ft) deep. (BA at E-72). The Bay has a maximum depth of less than 200 feet. (BA at E-64) As such, while the sperm whale seasonally may be present in New England waters, it is typically found in deeper offshore waters. (BA at E-72).

69. Unlike the other species of whales discussed above, which feed by straining organisms out of the water with baleen, sperm whales are a toothed whale that eat primarily deepwater denizens, such as medium-sized squid and fish, and occasionally giant squid. (Waring 2011). Such prey species either possess sufficient swimming abilities, or have habitat preferences, that make it unreasonable to conclude that they are likely to encounter the PNPS CWIS in any meaningful manner.

70. The SPUE data indicates that sperm whales rarely frequent the Bay. Further, impacts to prey species are not expected. Thus, continued operation of PNPS is not reasonably expected to have a discernible indirect effect on sperm whales. Consequently, the NRC's conclusion in the 2006 BA that the continued operation of PNPS will have no effect on the sperm whale is sound.

Potential Impacts of PNPS on Non-ESA-Listed Species

River Herring

71. It is my understanding that river herring, the collective term used to describe the closely related and difficult to distinguish blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*), are not a listed or proposed-listed species under the ESA. Nonetheless, insomuch as Petitioners address this candidate species, this declaration provides the requisite technical information to support the NRC's FSEIS.

72. River herring are infrequently entrained at PNPS. Monitoring records from PNPS indicate that, dating back to 1980, larvae have been identified in PNPS entrainment samples in only five years out of thirty years, those years being 1985, 1990, 1996, 2005, and 2009. In each of those five years, larval entrainment was minimal. For example, a total of two larvae was found in 1996, and just a single larva in 2005. This minimal entrainment cannot reasonably be said as having any discernible effect on river herring populations.

73. River herring impingement is likewise minimal. From 1980 to 2010, annual impingement at PNPS of alewives and blueback herring averaged 2,150 and 735 respectively, most, if not all, of which were young-of-the-year fish. Due to the high natural mortality rates of these species, the number of adult fish (i.e., maturing at age 3) that would be expected to survive from that number of juveniles is 38 and 2, respectively. Therefore, PNPS's effect on river herring populations through impingement is also negligible at best.

Winter Flounder

74. Winter flounder is not an ESA-listed species. Nonetheless, in their Supplement, Petitioners cite to a June 27, 2000 letter to the U.S. Environmental Protection Agency from the Massachusetts Office of Coastal Zone Management ("MCZM"), which alludes to data from 1997 and 1998 indicating that PNPS caused the mortality of almost "40% of the annual total

recreational and commercial catch" of winter flounder. (Supplement at 5). It is my understanding that Petitioners mean to use this letter and its contents as evidence of the "extensive destruction of marine life in Cape Cod Bay," and in particular to winter flounder, that Petitioners say is caused by operation of PNPS. (Supplement at 5). For each of the reasons set forth below, the Supplement is incorrect.

75. PNPS extensively monitors winter flounder, and therefore has a thorough understanding of this species and PNPS's potential effects.

76. Most recently, in June 2008, Normandeau Associates, in collaboration with LWB Environmental Services, Inc., prepared a document entitled *Adverse Environmental Impact Assessment for Pilgrim Nuclear Power Station* (the "AEI Assessment"). (Normandeau 2008). The AEI Assessment, as summarized below, presents three lines of evidence indicating that impingement and entrainment of winter flounder at PNPS has negligible impact on the population of winter flounder in the Bay.

77. First, available evidence shows that the potential for entrainment of winter flounder larvae in the vicinity of PNPS is very low. Entergy Nuclear Generating Company ("ENGC") conducted a three-year study of the flux of winter flounder larvae passing by the PNPS CWIS in the nearfield water currents. (ENGC 2000, 2002, and 2004). The study design consisted of three components: field sampling of the four stages of winter flounder larvae at five or more transects in the western part of the Bay; water velocity measurements at these transects; and coincident sampling of winter flounder larvae entrained at the PNPS CWIS. The objective of these studies was to estimate the percent of winter flounder larvae passing PNPS that may be entrained. The results of these studies indicate that, converting all larvae to stage 4 larvae to account for high natural mortality of earlier stages, the percent of larvae that are in the vicinity of

PNPS that are actually entrained is very low, ranging from 0.45% to 2.03%, with an average of 1.23%.

78. Second, the total annual mortality of winter flounder from entrainment and impingement at PNPS, when expressed as adult (age 3) equivalents to account for high natural mortality of early life stages, is a minor fraction of winter flounder abundance in the Gulf of Maine (including Cape Cod Bay). NMFS's estimates of the population of age 3 winter flounder in the Gulf of Maine are available for the years 1982 through 2005. (Normandeau 2008). Winter flounder entrained or impinged at PNPS in 1980 would have been three years old in 1983. Winter flounder entrained or impinged at PNPS is 2002 would have been three years old in 2005. Therefore, the relevant comparison to make is between average adult mortality for the years 1980 to 2002 and average age 3 abundance in the Gulf of Maine for the years 1983 to 2005. From 1983 to 2005, the NMFS's stock assessment indicates that an average of more than 3.4 million age 3 winter flounder were present in the Gulf of Maine. (Normandeau 2008). From 1980 to 2002, an average of 8,452 equivalent age 3 winter flounder per year were entrained or impinged at PNPS. Based on these estimates, entrainment and impingement at PNPS represents on average only 0.25% of the age 3 winter flounder population present in the Gulf of Maine.

79. As the third line of evidence, a standard model used in fisheries management, known as a "Spawning Stock Biomass Per Recruit" or "SSBPR" model, indicates that impingement and entrainment mortality at PNPS does not rise to a level that threatens the ability of the Bay's winter flounder population to sustain itself. The SSBPR model uses information on age-specific mortality (i.e., the proportion of the population that dies, or conversely, lives, to a given age) and fecundity (i.e., the number of eggs produced by a female fish of a given age) to calculate the expected lifetime reproductive output of a one-year old fish. (Normandeau 2008). This information can be used to determine the importance of the loss of reproductive capacity in

the winter flounder population caused by entrainment and impingement mortality at PNPS relative to the loss of reproductive capacity caused by fishing. Application of the SSBPR method indicates that the influence of PNPS is only a fraction (less than one [1] percent) of the influence of fishing on the winter flounder population in the Gulf of Maine (including Cape Cod Bay).

80. Thus, as the AEI Assessment concludes, "the impact of the PNPS CWIS, either alone or in combination with all other existing power plants affecting the [Gulf of Maine] winter flounder stock, is only a minor contributor to overall human influences on this stock and does not threaten the sustainability of the susceptible winter flounder populations."

81. In summary, the extensive research presented in the AEI Assessment demonstrates that: 1) only a small fraction of the winter flounder larvae drifting past the intake are actually entrained; 2) equivalent adult losses from entrainment and impingement at PNPS are very small compared to the size of the winter flounder population in the Gulf of Maine (including Cape Cod Bay); and 3) fisheries management models indicate that the impacts of entrainment and impingement at PNPS are very small compared to impacts of fishing and have a negligible impact on the sustainability of winter flounder populations. Therefore, the continued operation of PNPS will have no discernible effect on winter flounder populations.

CONCLUSION

82. The information detailed above demonstrates that the NRC's conclusion in the 2006 BA and Supplemental BA that continued operation of PNPS will have no effect on the relevant ESA-listed species is well founded. The information also demonstrates that continued operation of PNPS would have no discernible effect on river herring or winter flounder populations.

I declare under penalty of perjury that the foregoing is true and correct.

Executed in Accord with 10 C.F.R. § 2.304(d)
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Dated: March 19, 2012

EXHIBIT ONE

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

MICHAEL D. SCHERER, Ph.D

Vice President/Senior Marine Scientist

Dr. Scherer is a Vice President and senior marine scientist at Normandeau Associates, Inc. He is an expert in marine fisheries science. He manages entrainment and impingement studies at several power plant facilities and oversees diverse fisheries studies related to dredging, desalination, LNG and other projects associated with shore line and offshore developments.

EDUCATION

Ph.D.	1974, Fisheries Biology major, Biometrics minor, University of Massachusetts
M.S.	1972, Fisheries Biology, University of Massachusetts
B.S.	1969, Fisheries Biology, Cornell University

PROFESSIONAL EXPERIENCE

2006-Present	Normandeau Associates
1993-2006.	President, Marine Research, Inc.
1974-1993	Marine Research, Inc.
1970-1975	Massachusetts Cooperative Fishery Research Unit

PROFESSIONAL AFFILIATIONS

American Fisheries Society

SELECTED PROJECT EXPERIENCE

Wheelabrator Saugus (2010-2011) – Impingement and entrainment studies for an open-cycle refuse to energy electric power facility on the Saugus River. Project Manager.

Entergy Nuclear Generation Company (2001-2010) - Winter flounder hatchery release and survival feasibility study designed to determine whether stock enhancement can be used as a mitigation tool for 316a and b compliance. Project Manager.

Entergy Nuclear Generation Company (2001–2011) - Sediment, shellfish, and irish moss collections for the radiological environmental monitoring program at Pilgrim Nuclear Power Station.

Entergy Nuclear Generation Company (2000-2011) - Bottom trawl-based population estimate of adult winter flounder in Western Cape Cod Bay designed to improve the impact assessment of entrainment and impingement for Pilgrim Nuclear Power Station.

New England Power Company, U.S. Generating, Dominion Energy (1974-2011) - Studies of the Mount Hope Bay portion of Narragansett Bay in the vicinity of Brayton Point Station to evaluate the effects of the open cycle cooling system for New England's largest fossil fuel power plant. Project Manager.

Boston Edison Company, Entergy Nuclear Generation Company (1974-2011) - Studies designed to determine the potential impacts of Pilgrim Nuclear Power Station on the abundance and distribution of ichthyoplankton and key finfish in Cape Cod Bay. Project Manager.

New England Power Company, U.S. Generating, Dominion Energy (1992-2011) - Entrainment and impingement studies at Manchester Street Generating Station in Providence Rhode Island. River-wide ecological studies associated with inplant work included phytoplankton, periphyton, epibenthos, zooplankton, water quality, and fisheries monitoring programs. Project Manager.

Southern Company, Mirant and TRC Environmental Corp (1999–2010) - Fisheries and eutrophication studies in the Charles River for Kendall Square Station repowering project. Work included ichthyoplankton sampling in the lower basin as well as the lakes region and fish sampling with gill nets and push nets. Hydroacoustics and multiyear sonic tracking programs were employed to learn about adult river herring movements near a thermal discharge. Project Manager.

Aquaria Desalination Facility, Dighton, MA (2007-2009) – Impact assessment resulting from entrainment and impingement on a Filtrex Filtration System intake, alternative to an Aquatic Filter Barrier.

Sconset Beach Nourishment Project (2005-2007) - Impact assessment related to the use of a dredge site off the east coast of Nantucket for nourishment of Sconset Beach. Studies included ichthyoplankton, nearshore and offshore fisheries sampling, habitat assessment dive surveys, and mitigation studies. Project Manager.

Town of Swansea, MA. with Epsilon Associates (2004-2007) - Benthos, ichthyoplankton, and fisheries studies related to a proposed desalination facility on the Palmer River. Project Manager.

Northeast Gateway LNG Terminal with Woods Hole Group (2005-2006) - Equivalent adult, equivalent yield modeling and fisheries support for a proposed LNG terminal off the coast of Gloucester in Massachusetts Bay. Project Manager.

Wheelabrator Saugus, G. E. Lynn Aircraft Division (1984-1997, 2005-2006) - Fisheries studies of the Saugus and Pines River estuaries, Saugus and Lynn, Massachusetts related to the impact of the open-cycle cooling systems of two industrial facilities. Project Manager.

Weaver's Cove Energy and Epsilon Associates (2003-2006) - Benthic sampling, analysis, and fisheries support related to dredging plans for a liquid natural gas terminal in Fall River, Massachusetts.

Massachusetts DCR/Parsons Brinckerhoff Quade & Douglas/Applied Coastal Research and Engineering (2001-2006) - Impact assessment related to the use of a Massachusetts Bay dredge site for beach nourishment in Winthrop. The project included an expanded essential fish habitat (EFH) assessment. Project Manager.

Commonwealth Engineers/ Rhode Island Dept. of Transportation (2000-2001, 2006) - Sakonnet River Bridge replacement project, environmental impact statement designed to assess impacts to local fish populations.

Keyspan LNG and Natural Resource Group, Inc. (2003-2004) - Fisheries support related to an LNG facility upgrade project in Providence, R.I.

Taunton Municipal Power and Light and EarthTech (2002-2003) - Fisheries and benthic invertebrate analyses and preparation of 316a and 316b document for a utility on the Taunton River. Project Manager.

ConEdison and TRC Environmental (2000-2003) - Preoperational and post operation studies for the Newington Power Facility on the Piscataqua River, New Hampshire and Maine that included ichthyoplankton, larval lobster and impingement sampling programs. Benthic sampling programs were conducted to assess construction and habitat related impacts of the facilities submerged diffuser. Project Manager.

Sverdrup-Jacobs, Inc./MBTA/ Town of Weymouth (2001) - Rainbow smelt migration and spawning study in Smelt Brook for the Weymouth Landing, Greenbush commuter railroad line. Project Manager.

Southern Company, Mirant and TRC Environmental Corp. (1999-2001) - Aquatic ecology studies for the Cape Cod Canal power plant located in Sandwich, MA. Work included entrainment and impingement sampling as well as ichthyoplankton sampling in the Cape Cod Canal, Cape Cod Bay, and Buzzards Bay. Sampling for larval lobster was also completed. Project Manager.

Raytheon Environmental Services/ Washington Group International/Sunset Energy (1999-2001) - Ichthyoplankton study in Gowanis Bay, New York for a proposed barge-mounted power station with once-through cooling system. Project Manager.

Sithe Edgar Development LLC. In conjunction Epsilon Associates, Inc. (1998-1999) - Fisheries studies in the Weymouth Fore, Smelt Brook, and Town River required for the proposed repowering of a fossil fuel power station. Project Manager.

Boston Edison Company, Sithe Energy (1989-1993, 1998-1999) - Studies of the Weymouth Fore River, Mass. including ichthyoplankton, fish, benthos, and water quality as part of a monitoring program for a proposed power station. Preparation of 316a and 316b documents was included. Project Manager

Bluestone Energy Services, Inc. and Epsilon Associates, Inc. (1997) - Assessment of fish population issues related to a proposed desalination plant on the Taunton River in Deighton, MA. Project Manager.

General Electric Company (1994-1997) - Impingement and entrainment monitoring studies at G.E's Lynn, Massachusetts aircraft engine plant including ichthyoplankton studies in the Saugus River source water. Project Manager.

Camp, Dresser and McKee (1996) - Assessment of potential fisheries impacts associated with a proposed water diversion facility on the Taunton River for the City of Brockton, MA. Project Manager.

Boston Edison Company (1993) - Fish impingement study at Mystic Station in Everett, MA. Project Manager.

HMM Associates (1990-1992) - Entrainment and impingement studies at B. F. Cleary Station and multiphased in-river sampling of fish and benthos in connection with Taunton Cogeneration Facility Project. Project Manager.

Continental Shelf Associates (1990) - Analysis of ichthyoplankton samples from Mobil drilling site on Continental Shelf off Cape Hatteras. Project Manager.

National Park Service (1984-1986) - Ecological study of the upper Pamet River, Truro, Mass. including nutrient cycling, eutrophication, groundwater analyses, and river hydrology. Principal Investigator.

Lynn Massachusetts Sewer Commission (1982) - Study of the impact of sewage outflow after a rainstorm on the benthic invertebrate and water column plankton populations of Lynn Harbor. Principal Investigator.

Yankee Atomic Electric Company, New England Power Co (1974-1979) - Studies of Block Island Sound, Charlestown Pond, Quonochontog Pond, and Point Judith Pond, R.I. to assess possible environmental effects of a proposed power plant. Principal Investigator.

SELECTED PRESENTATIONS

Scherer, M.D. and D. Lawrence. 2002. Macroalgal impacts on the nursery habitat of young-of-the-year winter flounder (*Pleuronectes americanus*), Mount Hope Bay. Poster presented at the NEER/SNECAFS joint meeting, May 8-10, 2003.

Scherer, M.D. and B. Morgan. 2001. Winter flounder stock enhancement. Poster presented at the Flatfish Biology Conference, December 2002. Mystic CT.

Scherer, M.D., with G. Klein-MacPhee, R. Satchwill, A. Keller, and C. Vasconcelas. 2000. Increase in numbers of smallmouth flounder, Etropus microstomus, in the ichthyoplankton of Narragansett Bay and Mount Hope Bay, Rhode Island. Poster presented at the Flatfish Biology Conference, December 5-6, 2000. Mystic Ct.

Scherer, M.D., with D. Galya., J. Herberich, S. Kelly, J. Scheffer. Assessment of Power Plant Entrainment in Comparison to Long-Shore Ichthyoplankton Transport. Presented at the 134th Annual Meeting of the American Fisheries Society, Madison, WI. August 22-26, 2004.

Scherer, M.D., with D. Rutecki, D. 2006. Assessment of hatchery reared winter flounder, *Pseudopleuronectes americanus*, as a mitigation tool in Cape Cod Bay, MA. Presented at the New England Estuarine Research Society, Spring 2006 Meeting.

Scherer, M.D., with D. A. Rutecki, J. F. Battaglia. 2009. A preliminary assessment of finfish and invertebrates on the east side of Nantucket, MA. Presented at the 3rd Nantucket Biodiversity Initiative Conference.

SELECTED PEER-REVIEWED ARTICLES AND PUBLICATIONS

Author or co-author of seven scientific papers related to fish and larval lobsters.

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