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Millstone Power Station
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Dominion

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U.S. Nuclear Regulatory Commission
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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
2010 ANNUAL ENVIRONMENTAL PROTECTION PLAN OPERATING REPORT

In accordance with Section 5.4.1 of the Environmental Protection Plan (EPP), Appendix B to the Millstone Power Station Unit 3 Operating License, Dominion Nuclear Connecticut, Inc. hereby submits the Annual Environmental Protection Plan Operating Report (AEPPOR), describing implementation of the EPP for the previous year. Enclosure 1 transmits information for the period of January 1, 2010 to December 31, 2010.

Should you have any questions regarding this report, please contact Mr. William Bartron, at (860) 447-1791, extension 4301.

Sincerely,

R. K. MacManus
Director, Nuclear Station Safety and Licensing

IE25
NRR

Enclosures: 1

Commitments made in this letter: None.

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Enclosure 1

MILLSTONE POWER STATION UNIT 3
2010 ANNUAL ENVIRONMENTAL PROTECTION PLAN OPERATING REPORT
JANUARY 1 – DECEMBER 31, 2010

MILLSTONE POWER STATION UNIT 3
DOMINION NUCLEAR CONNECTICUT, INC. (DNC)

2010 Annual Environmental Protection Plan Operating Report (AEPPOR)

1. Introduction:

   This report covers the period January 1, 2010 through December 31, 2010. During 2010, Millstone Power Station Unit 3 (MPS3) completed refueling outage 3R13 (April 10 – May 20). Since the refueling outage (through December 31, 2010), MPS3 has operated at a capacity factor of 98.6%; overall capacity for 2010 was 87.5%.

   As required by the MPS3 Environmental Protection Plan (EPP), Appendix B to the MPS3 Operating License, this AEPPOR includes:

   - summaries and analyses of the results of environmental protection activities,
   - a list of EPP noncompliances,
   - a list of all changes in station design or operation which involved a potentially significant unreviewed environmental question, and
   - a list of non-routine reports, describing events that could have resulted in significant environmental impact.

2. Environmental Protection Activities:

   2.1 Annual National Pollutant Discharge Elimination System (NPDES) Report of Ecological Monitoring (EPP Section 4.2).

   Section 10(A) of Millstone Power Station's (MPS) NPDES permit, as issued to Dominion Nuclear Connecticut, Inc. (DNC) by the Connecticut Department of Environmental Protection (DEP) on September 1, 2010 (the Permit), requires continuation of biological studies of supplying and receiving waters, entrainment, and intake impingement monitoring. These studies include analyses of intertidal and subtidal benthic communities, finfish communities, entrained plankton, lobster populations, and winter flounder populations. Section 10(A)(2) of the Permit requires an annual report of these studies to be sent to the DEP Commissioner on or before July 31st of each year. The latest report that fulfills these requirements, "Annual Report 2009 - Monitoring the Marine Environment of Long Island Sound at Millstone Power Station, Waterford, Connecticut" (Annual Report), presents results from studies performed during construction and operation of MPS, emphasizing those of the latest sampling year. Changes to the biological communities noted in these studies are summarized in the Executive Summary section of the Annual Report, which is attached as part of this report.

   2.2 Effluent Water Quality Monitoring:

   Sections 1 and 5 of the Permit require monitoring and recording of various water quality parameters at MPS intakes and at multiple monitoring points within the plant, including outfalls of each unit to the effluent quarry, and outfall of the quarry to Long Island Sound. Section 8 of the Permit requires that a monthly report of this monitoring be submitted to the DEP. The report that fulfills these requirements, the "Monthly Discharge Monitoring Report" (DMR), includes discharge data from all MPS units. Consistent with prior annual AEPPOR submissions, water flow, temperature, pH, and chlorine data pertaining to MPS3 are summarized in Table 1.

Each monthly DMR identifies NPDES permit exceedances (i.e., events where a parameter value was beyond permitted limits) or exceptions (i.e., events where Permit conditions were not met) for the month. During 2010, there were four MPS3 events that were reported as NPDES exceedances; the descriptions below are summarized from the monthly DMRs.

a) *MPS3 Condensate Polishing Facility Discharge (DSN 001C-6)*

On July 22, 2010 at 1700 hours, during a review of field data logs for the bench-top pH meter used for recording discharge serial number (DSN) 001C-6 hourly readings, several instances were identified where the sample temperature, recorded in conjunction with the NPDES permit in effect prior to reissuance on September 1, 2010, exceeded the 100ºF permit limit. Elevated temperatures are the result of exothermic acid-caustic reactions during the neutralization of waste from ion exchange resin bed regeneration. The maximum temperature recorded was 120.4ºF on July 21, 2010. Corrective actions included steps to assure that temperature is monitored before and during DSN 001C-6 discharges with a calibrated thermometer.

b) *MPS2 and MPS3 Non-Contaminated Floor Drains (DSN 006)*

On August 5, 2010 at 1024 hours, the MPS3 control room received an alarm indicating an impending out-of-range pH reading from the continuous monitor at DSN 006. The DSN 006 outfall at MPS discharges both process waters from the plant and surface water runoff from the yard drain system. Station Chemistry was dispatched to the monitoring point and verified through the analysis of a grab sample that the pH had exceeded the NPDES allowed range of 6.0 to 9.0 s.u. The grab sample result was 9.45 s.u. The pH readings at DSN 006 were intermittently above 9.0 s.u. over a period of one hour from 1025 to 1125 and ranged from 9.01 to 9.45 s.u. Samples were taken along the discharge flow path and the source of the high pH was traced back to residue from on-going concrete work which had entered the yard drain system after a heavy rain. The residue within the catch basin had a pH level of > 11.0 s.u. The remaining water and sediments in the catch basin which had the high pH were removed from the catch basin on August 10, 2010 and were properly disposed of off-site.

c) *MPS3 Service Water Discharge (DSN 001C-5)*

On September 29, 2010 at 1000 hours, the flow proportioned DSN 001C-5 discharge free available chlorine (FAC) average concentration yielded a 0.33 mg/L result. The instantaneous Permit limit at this discharge for FAC is 0.25 mg/L. Upon discovery, Chemistry personnel reduced the sodium hypochlorite injection to the service water system from the metering pumps and the average concentration was reduced to 0.065 mg/l. A subsequent system walkdown and valve lineup check revealed no abnormalities.

d) *Millstone Power Station (MPS) Quarry Cut Discharge (DSN 001-1)*

On October 13, 2010 at 1455 hours, MPS personnel sampled DSN 001-1 for total residual chlorine (TRC) during circulating water system chlorination as required by the NPDES permit. The result of the analysis was 0.15 mg/L TRC. The Permit limit at DSN 001-1 is 0.10 mg/L TRC. Subsequent samples were taken and the indicated TRC concentration peaked at 0.22

mg/L at 1550. At 1555 hours, the TRC had returned to < 0.10 mg/L. As the TRC concentration was more than twice the Permit limit, a prompt notification was made to the DEP Water Bureau on October 14, 2010. A follow-up letter was forwarded to the DEP Water Bureau on October 20, 2010 (D18161).

Efforts to better understand the factors that might have caused the chlorine exceedances included the following:

- On October 21, 2010, MPS personnel collected DSN 001-1 samples for TRC analysis during hydrolazing activities on the trash racks of the MPS3 intake. Circulating water chlorination was not in progress at the time, however, continuous service water chlorination was 0.10 mg/L FAC in the MPS3 service water discharge (DSN 001C-5). Despite the absence of chlorination in the MPS3 circulating water system, TRC analyses at DSN 001-1 revealed a maximum TRC concentration of 0.14 mg/L during hydrolazing activities. A MPS3 intake sample (between the trash rack and traveling screens) analyzed after the DSN 001-1 discharge results of 0.14 mg/L was measured at 0.10 mg/L TRC. Hydrolazing activities concluded at 1511 hours. At 1747 hours, samples analyzed at DSN001-1 for TRC were all < 0.02 mg/L.
- On November 3, 2010, additional TRC analyses were performed using independent approved standard methods for TRC at the MPS3 Intake, MPS2 Discharge, MPS3 Discharge and DSN 001-1 discharge, as well as control samples approximately 1 km from MPS, during MPS3 intake hydrolazing. All results were undetectable for TRC.
- Plant procedures called for the operation of the screen wash pump whenever a diver is in the MPS3 intake for hydrolazing activities. Based on the review of plant conditions and sample results, the most likely cause for the October event was site activities which may have caused a reduction in the pressure of the domestic water used as dilution flow for service water chlorination. This may have resulted in increased service water chlorine concentration. When the screen wash pump operates, it also provides dilution flow to the service water chlorine supply header, with a pressure twice that of normal domestic water pressure. This higher pressure dilution flow and increased chlorine concentration would have combined with the organics generated by the hydrolazing at the MPS3 intake as the service water commingled with circulating water, and could generate false positives results for TRC when using the Hach Test Kit.

2.3 NPDES Permit Renewal Process:

As discussed above, the MPS NPDES permit was reissued by the DEP on September 1, 2010. DNC notified the NRC of the renewed permit via letter (10-554) dated September 23, 2010.

3. Environmental Protection Plan (EPP) Noncompliances:

No EPP noncompliances were identified for MPS3 in 2010.

4. Environmentally Significant Changes to Station Design or Operation:

   During 2010, MPS3 installed, tested, and began operation of the variable frequency drives (VFDs) associated with the MPS3 circulating water pumps, consistent with NPDES Permit requirements. As of December 31, 2010, one of the six MPS3 VFDs continued to experience voltage oscillations that preclude acceptable operation of that VFD.

5. Non-Routine Reports of Environmentally Significant Events:

   No MPS3 events met the criteria for inclusion in this year's report, i.e.,

   - required the submittal of a Licensee Event Report (LER), and
   - involved a situation that could result in a significant environmental impact.

   Only four licensee events that constituted a reportable occurrence at MPS3 occurred in 2010; none were determined to cause a significant environmental impact.

Table 1

MPS3 NPDES Data Summary, Jan. 1 - Dec. 31, 2010. Selected water quality parameters for MPS3[(1)]. Values in **bold** represent reported exceedances, discussed in Section 2.2.

	Discharge Flow (max) (10^6 gpd)	Discharge pH Range	Discharge Temp. Range (°F)	Discharge Temp. (avg) (°F)	Avg ΔT (°F)	Max FAC (ppm)	Max TRC (ppm)	Max SWS FAC (ppm)
Jan.	1356.9	7.9-8.1	38.2-65.8	54.2	15.6	0.13	< 0.03	0.23
Feb.	1357.0	7.9-8.1	52.8-59.0	55.2	18.8	0.11	< 0.03	0.20
Mar.	1356.8	7.8-8.0	54.6-66.3	58.3	17.0	0.14	< 0.03	0.17
Apr.	1356.9	7.3-8.1	44.6-69.1	54.6	6.5	0.09	0.03	0.17
May	1356.9	7.9-8.1	49.7-80.5	61.1	6.9	0.13	0.03	0.18
June	1356.5	7.9-8.2	75.6-85.9	80.7	17.6	0.10	0.03	0.19
July	1357.0	8.0-8.2	81.3-90.5	85.8	17.2	0.09	0.03	0.19
Aug.	1357.3	7.9-8.2	68.8-91.6	85.8	15.5	0.09	0.06	0.22
Sep.	1362.2	8.0-8.2	84.0-95.0	87.8	19.1	0.08	0.05	**0.33**
Oct.	1361.4	7.9-8.1	74.9-89.7	80.5	18.1	0.10	**0.22**	0.16
Nov.	1360.6	7.8-8.0	65.1-80.3	71.8	19.0	0.06	0.03	0.15
Dec.	1360.6	7.8-8.0	54.5-74.2	63.0	19.8	0.09	0.03	0.18

Notes:

(1) Parameters are measured at MPS3 discharge (DSN 001C), except for TRC, which is measured at MPS discharge (quarry cuts; DSN 001-1), and SWS FAC (service water system; DSN 001C-5).

Abbreviations Used:

Temp. = Water Temperature
ΔT = Delta-T (difference between discharge and intake water temperature)
FAC = Free Available Chlorine
TRC = Total Residual Chlorine
SWS = Service Water System

Attachment to the
2010 Annual Environmental Protection Plan Operating Report
January 1 – December 31, 2010

Executive Summary Section of
"Annual Report 2009 - Monitoring the Marine Environment of Long Island Sound at Millstone Power Station, Waterford, Connecticut"
dated April 2010

Executive Summary – 2009 Environmental Monitoring Annual Report

Winter Flounder Studies

The local Niantic River winter flounder population is potentially affected by the operation of Millstone Power Station (MPS) primarily through entrainment of larvae in the condenser cooling-water systems. To assess possible effects, the abundance of adult spawners is measured within the Niantic River and larvae are sampled at the plant discharges and in the Niantic River and Bay during late winter and early spring. Settled age-0 juveniles are collected in the river in summer. Winter flounder are also collected year-round in the trawl monitoring program.

The relative abundance of adult spawners in 2009 was 0.3 fish per trawl tow (catch-per-unit-effort; CPUE), which is the lowest value since these studies began in 1976. Over the past 15 years, CPUE of winter flounder spawners in the Niantic River has remained at a relatively low level, but similar to levels found throughout Long Island Sound (LIS) by the Connecticut Department of Environmental Protection. During the past 28 years, annual Niantic River winter flounder abundance represented an estimated 0.4 to 3.3% of the entire LIS winter flounder resource (mean = 1.34%).

An absolute abundance of the 2008 spawning population (the latest year for which an estimate could be made) using the Jolly model could not be made due to a lack of recaptures of previously marked fish. The last three absolute abundance calculations made were imprecise, having large 95% confidence intervals, and are not considered reliable.

Using another methodology termed standardized catch, female spawner abundance in 2009 was estimated at only 323 fish that produced about 238 million eggs. Other annual standardized catch estimates ranged from approximately 987 females in 2008 to 75 thousand in 1982 and corresponding total egg production estimates were 0.7 to 44.8 billion.

In 2009, overall abundance of winter flounder larvae in the Niantic River was the second lowest since 1983, exceeding only 2008. The Niantic Bay abundance index ranked within the lower one-third of its time-series. In most years since 1995, more Stage 1 larvae were found than expected from low adult spawner abundance, suggesting a density-dependent compensatory mechanism during the egg stage that enhanced survival. This was attributed to reduced predation on eggs by sevenspine bay shrimp, such that when egg densities are low, higher egg survival produces more Stage 1 larvae. Density-dependent mortality is also present throughout the larval period of life, as an analysis suggested that mortality decreases with decreasing egg production (a measure of early larval abundance), which is further moderated by warmer spring water temperatures allowing for faster larval development. This year, Stage 2 larval abundance was particularly low, indicating high mortality in that stage, perhaps exacerbated by high densities of jellyfish in the Niantic River. In each of the past 2 years, both egg production and Stage 1 larval abundance were low as were the numbers of metamorphosing larvae. However, relative to the Niantic River, larval abundance in Niantic Bay has increased in recent years, suggesting higher production in LIS rather than in estuaries such as the Niantic River.

With the exception of a few years, densities of age-0 young in the Niantic River following larval metamorphosis and settlement were linearly related to Stage 4 larval abundance. However, at higher larval abundance juvenile densities apparently reached an asymptote of about 250 young per 100 m^2 of bottom, which could represent the carrying capacity of the river habitat. As expected from low larval abundance in 2009, initial settled juvenile abundance was very low. Even with a lower than average mortality rate, late summer abundance was the second lowest on record, exceeding only 2006. CPUE indices of age-0 fish were either not significantly correlated or were negatively correlated with the abundance of female adult spawners 3 to 5 years later. Conversely, positive correlations were found between age-1 abundance indices and older fish.

The number of larvae entrained is a measure of potential impact to winter flounder. In most years, Stage 3 larvae dominated entrainment collections. Annual estimates of entrainment are related to both larval densities in Niantic Bay and MPS operation. With no spring refueling outage in 2009, the 2009 entrainment estimate of about 152 million reflected moderate Niantic Bay larval densities.

Annual entrainment density (abundance index divided by total seawater volume) has varied without trend since 1976, indicating that larval production and availability in Niantic Bay remained relatively stable despite increased water use during the 1986-95 period of three-unit operation and reduced cooling-water demand in 1995-97. Correlations between entrainment estimates and abundance indices of post-entrainment age-0 juveniles were positive. This implies no entrainment effect, as the more larvae that were available to be entrained, the more larvae that metamorphosed and settled in Niantic River and Bay. This was also demonstrated by a comparison of annual entrainment and juvenile year-class abundance, which suggested that entrainment estimates were simply a measure of emerging year-class strength. Thus, entrainment is not an important factor in determining juvenile abundance.

The potential impact of larval entrainment on the Niantic River stock depends upon the fraction of the annual winter flounder reproduction entrained each year (termed production loss in this report), which was calculated as equivalent eggs removed by entrainment. Empirical mass-balance model calculations showed that a large number of entrained larvae came from a number of sources in LIS besides the Niantic River. In 2009, approximately 22% of the entrained larvae were attributed to the river. Based on the increase in egg survival noted in recent years, a factor that was not originally incorporated into the mass-balance model, most production loss estimates made after 1994 were conservatively high. Correcting the post-1994 estimates by using a higher egg survival rate resulted in lower production loss estimates (long-term mean = 10.7%). However, 2009 production loss estimates were implausibly large, suggesting an underestimate of egg production or an overestimate of the fraction of entrained larvae attributed to the Niantic River due to the conservative nature of the calculations. Increasing larval production in LIS and importation into local waters could have accounted for much of this discrepancy.

A small adult spawning stock in the river has nonetheless resulted in relatively large numbers of larvae and young fish in several recent years, probably from population compensatory mechanisms. Despite relatively good abundance of age-0 winter flounder (a life stage not entrained) in some recent years, significant recruitment to the adult spawning population has not occurred. Processes that are unrelated to MPS operation and which occur after juvenile winter flounder leave shallow nursery waters during the fall of their first year of life seem to be operating to produce fewer adults. A bottleneck appears to be occurring during the late juvenile life stage (ages-1 and 2), probably from predation. Environmental effects, including changes to the Niantic River habitat (e.g., increased eelgrass abundance), a warming trend in regional seawater temperature, and interactions with other species (e.g., predation), especially during early life history, are also important processes affecting winter flounder population dynamics. Weak year-classes produced in 2006-09 are indications of continued poor recruitment to the Niantic River spawning population in forthcoming years.

Fish Ecology Studies

Monitoring during 2009 indicated that no long-term abundance trends in various life stages of seven selected taxa could be directly related to the operation of MPS. No significant long-term trends were detected in populations of juvenile or adult silversides collected by trawl or seine. Similarly, no long-term trends were identified in various life stages of grubby, cunner, and tautog. Atlantic menhaden larvae showed a significantly increasing trend in abundance, as did juveniles taken by seine and trawl. Densities of both anchovy eggs and larvae and American sand lance larvae continued to show significant negative trends. The bay anchovy has experienced a regional decline in abundance. This species is important forage for predatory fishes and birds. In particular, the striped bass has recently increased in abundance along the Atlantic coast and may have contributed to reduced numbers of bay anchovy. Abundance of American sand lance larvae has been relatively stable over the past 25 years following a decline that occurred during the early 1980s. These changes were most likely due to interactions with fishes that prey upon larval sand lance.

Data collected in 2009 continue to show no long-term abundance trends in the numbers of entrained cunner eggs and larvae. Juvenile and adult cunner have significantly decreased at the Intake trawl station, but the decline was attributed to the 1983 removal of the Unit 3 intake cofferdam, a preferred reef-like habitat for this species. Since that time, no significant abundance trend was found from 1984 through 2009. Cunner abundance significantly increased at the Niantic River trawl station and continued to fluctuate without trend at Jordan Cove. Tautog larvae showed a significant increasing trend in abundance and a significant rise in the abundance of juveniles and adults was also noted in the trawl and lobster pot catches.

Changes in the species composition and temporal and spatial abundance of fishes and shellfishes collected by trawl over the past 33 years were unrelated to MPS operation. Shifts in the dominance of individual taxa were attributed to changes in habitat, range extensions or contractions, and a warming trend in ambient seawater temperature that has occurred over the past 3 decades.

Cooling-water use at MPS was reduced 23% because of the shutdown of Unit 1 in November 1995, resulting in less entrainment and impingement. Fish return systems at Units 2 (2000) and 3 (1986) further reduce impingement mortality at MPS. Increasing trends in abundance or the lack of decreasing trends suggests that MPS has had minimal, if any, effect on local fish and shellfish assemblages.

Lobster Studies

Impacts associated with recent MPS operations on the local lobster population were assessed by comparing results of the 2009 study to data collected from 1978 through 2008. Emphasis has been placed on assessing long-term trends in the abundance and population characteristics of lobsters collected in the Millstone Point area.

Throughout LIS, the lobster population was stable or increasing from 1978 through 1999. The abundance of lobsters in LIS was lower from 2000 to 2009, but unrelated to MPS operations. Rather, the lobster abundance declines were attributed to a significant mortality event in western LIS and to an outbreak of shell disease affecting lobster populations from eastern LIS to the Gulf of Maine. In the MPS area, no significant long-term trends were identified in the annual CPUE of lobsters (combined over all sizes and stations) collected either in pots or by trawl. The total pot-CPUE of lobsters at the three monitoring stations has varied without trend since 1978. However, annual CPUE of legal-size lobster has exhibited a significant declining trend at the Jordan Cove and Twotree stations, but not at the Intake station located nearby MPS. Significant declines in the abundance of legal-size lobsters were attributed in part to shell disease and to a 3 mm increase in the minimum legal size since 1978.

Long-term trends observed in lobster population characteristics over the past three decades (growth, female maturity and egg-bearing lobsters) appear related to warmer ambient seawater temperatures and/or the recent outbreak of shell disease, and not MPS operation. Increased ambient water temperature may be responsible for the increased susceptibility and transmission of diseases affecting lobsters in LIS, which are near their southern range of distribution in nearshore waters.

The number of lobster larvae entrained through the MPS cooling water systems was highly variable and has not resulted in a decrease in local lobster abundance. Impacts associated with entrainment and impingement of lobsters at MPS have been greatly reduced by the shutdown of Unit 1, which eliminated 23% of the cooling water used, and the installation of aquatic organism return systems at Units 2 and 3, which return impinged lobsters to Niantic Bay.

Rocky Intertidal Studies

Rocky intertidal monitoring studies during 2009 continued to document ecological changes to the shore community near, and associated with, the MPS thermal discharge. These changes are not widespread, and remain restricted to approximately 150 m of shore-line on the east side of the power station discharge to LIS. Seasonal shifts in occurrence of annual algal species were noted at Fox Island-Exposed (FE) during 2009. These shifts included abbreviated season for cold-water species (e.g., *Monostroma grevillei, Spongomorpha arcta,* and *Dumontia contorta*) and extended season for warm-water species (e.g., *Grinnellia americana, Dasya baillouviana,* and *Bryopsis hypnoides*). Similar shifts have been observed in most years since Unit 3 began operation (1986), with the exception of the extended shutdown of all MPS reactors from March 1996 to June 1998 when seasonality of these species at FE during the recent shutdown period was more typical of other sites.

Thermal effects on dominant species abundance and distribution patterns were also evident at FE in 2009 and most apparent in the low intertidal zone. Seasonally high abundance of *Hypnea musciformis*, a species observed for the first time in 2001, and expanded populations of *Sargassum filipendula, Corallina officinalis,* and *Gelidium pusillum* now characterize the lower shore community at FE. Polysiphonia spp. maintained a perennial population at FE in 2009, but occurred mainly as a summer annual at sites unaffected by MPS.

Ascophyllum nodosum growth during 2008-09 continued to exhibit no clear relationships among our monitoring stations, or correlation with MPS operating conditions, indicating that the thermal plume from MPS has had little effect on local populations. Natural influences of other factors, such as ambient temperature conditions, storms and wave action, nutrients and light, play the dominant role in determining *Ascophyllum* growing conditions in the Millstone area.

The rocky intertidal monitoring program has also documented regional patterns and modifications to shore communities unrelated to MPS operation. These include the introduction to the region of two exotic red algae (*Antithamnion pectinatum* in 1986 and *Grateloupia turuturu* in 2004), decreases in barnacle abundance in recent years, and long-term increases in abundance of the common seaweeds *Fucus vesiculosus* and *Chondrus crispus.*

Eelgrass

Eelgrass (*Zostera marina* L.) population dynamics were monitored from 1985 to 2009 at three locations in the vicinity of MPS. Some long-term declines in one or more eelgrass population parameters (e.g., shoot density, shoot length, and standing stock biomass) were observed at all three areas monitored over the entire 25-year study period. Eelgrass populations at two monitoring sites to the east of MPS (JC and WP) near the fringes of the thermal plume (<1.5 km from the MPS discharge to LIS) have exhibited subtle declines in some population parameters since 1985. These declines were not associated with MPS operation, as thermal input from the cooling water discharge to these sites is at most minimal (<1°C above ambient conditions). Results from the 2009 mapping survey of Jordan Cove indicated extensive eelgrass beds have persisted in the vicinity of the JC and WP sampling sites since 2002, with expansive high density areas since 2007.

By comparison, complete and often sudden eelgrass bed losses were documented on five separate occasions prior to 2000 in the Niantic River. This estuary is located well beyond (>2 km) waters influenced by the MPS thermal discharge. Since 2001, eelgrass distribution in the Niantic River has expanded, with a gradual, steady increase in shoot density through 2009. Ongoing extensions of municipal sewerage lines in the Niantic River watershed, possibly coupled with depletion of nutrient inputs from old septic systems, may be contributing to population recovery during the last 8 years.

In previous years, three short-term declines in eelgrass abundance have been directly associated with fouling and overgrowth of eelgrass: once by blue mussels (*Mytilus edulis*) at the Niantic River in 1992 and twice by blooms of green algae (*Cladophora* spp.) at White Point in 1991 and 2004. Recent research from New England and Mid-Atlantic States suggests nutrient loading from land-based sources as the cause of eelgrass disappearance in LIS to the west and elsewhere. Excess nutrients, coupled with increases in regional water temperatures and waterfowl grazing, may factor strongly in declines of populations near MPS. Eelgrass distribution once extended over the entire Connecticut coastline, but has constricted from west to east such that populations around Millstone Point now represent the western range limit of eelgrass in LIS.

Benthic Infauna

Benthic infaunal monitoring during 2009 documented continuation of long-term trends in sediment composition at the Effluent (EF) and Intake (IN) stations in the vicinity of MPS. Sediments at these stations have become coarser (larger mean grain size) and the silt/clay fraction smaller. This coarsening of sediments was attributed to MPS-influenced water flow characteristic at each site: intake of cooling water at IN and discharge of cooling water at EF. Mean grain size and silt/clay estimates at Jordan Cove (JC) have remained relatively consistent since the siltation event, related to sediment scouring near the MPS discharge, was observed in 1986. Sedimentary parameters at the reference station Giants Neck (GN) in 2009 were within the limits of previous observations, and have varied without trends since 1980.

Community abundance and numbers of species at all sampling stations in 2009 were generally intermediate when compared to historical ranges. Surface deposit-feeding oligochaetes and polychaetes were the dominant organisms at all stations in 2009. The suspension-feeders *Mytilus edulis* and *Spiochaetoperus oculatus* were a notable feeding type only at EF in 2009. Observed changes in abundance of infaunal taxa resulted in rank order changes among the dominant taxa at all stations, but overall, benthic communities sampled in 2009 were generally comprised of fauna that had been present in previous years. Multivariate analyses showed higher community similarity among recent years and illustrated more abrupt changes in community composition in earlier study years related to sediment disturbances related to MPS construction (dredging and cofferdam removal at IN) and operation (silt deposition from increased discharge flow at JC). Steady temporal changes in community composition were observed at EF, a location that has been continuously affected by MPS cooling water discharge flow since 1986. The GN reference station, beyond any MPS influence, has also exhibited temporal changes in benthic community structure during the study period. These changes were related to natural variability and other factors unrelated to MPS operation (e.g., ambient seawater temperature increase, storm events). Temporal and spatial variation in the MPS benthic communities observed is typical of near-shore marine environments. Local conditions in the MPS area maintain a degree of environmental stability at all study sites, with only minor changes in benthic communities observed from year to year.