AmerGen

AmerGen Energy Company, LLC
Oyster Creek
US Route 9 South
PO Box 388
Forked River, NJ 08731-0388

An Exelon/British Energy Company

Technical Specifications, Appendix B - 3.5.2

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United States Nuclear Regulatory Commission
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Subject: Oyster Creek Generating Station
Docket 50-219
Non - Routine Environmental Operating Report

On September 23, 2002, the Oyster Creek Generating Station dilution plant was secured to facilitate performing maintenance on an electrical transformer. This resulted in non-compliance with the New Jersey Pollutant Discharge Elimination System permit. The results of this occurrence are detailed in the enclosure to this cover letter.

If you should require any further information, please contact Mr. John Rogers, of my staff, at 609.971.4893

Very truly yours,

Ron J. DeGregorio, Vice President
Oyster Creek Generating Station

RJD/JJR

Enclosure
cc: New Jersey Department of Environmental Protection (3 addressees)
NRC Administrator, Region I
NRC Senior Project Manager
NRC Senior Resident Inspector

IE25

ENCLOSURE 1

OYSTER CREEK GENERATING STATION

FISH KILL MONITORING REPORT

AmerGen Energy Company, LLC

September 2002

Executive Summary

On the morning of September 23, 2002, the Oyster Creek Generating Station (OCGS) was operating at 100% power. The dilution plant had been secured to facilitate taking the Bank 5 Transformer out of service to perform maintenance. This maintenance would increase both the level of safety during the upcoming refueling outage, and the reliability of a transformer and associated electrical equipment which tie the OCGS to the offsite electrical grid. The dilution pumps were secured and the Bank 5 Transformer was taken out of service by 2:37 AM. This resulted in a condition which is not allowed by the New Jersey Pollutant Discharge Elimination System (NJPDES) permit. Upon discovery of the non-compliance, immediate and uninterrupted actions were taken to restore the dilution plant to service.

Prior to the shutdown of the dilution pumps, Main Condenser Discharge temperatures were approximately 38.9 °C (102 °F) and Route 9 Bridge surface water temperatures were approximately 32.7 °C (90.9 °F). Subsequently, in the absence of thermal mixing from dilution pump operation, downstream water temperatures within the discharge canal began rising. Water temperatures at the Route 9 Bridge surface water remained at about 32.8 °C (91 °F) for 45 minutes after the dilution pumps were secured. At 3:25 AM, Route 9 Bridge surface water temperatures began rising rapidly, reaching 36.1 °C (97 °F) by 3:43 AM, and 37.8 °C (100 °F.) by 4:13 AM. The maximum water temperature observed at the Route 9 Bridge was 38.3 °C (101.0 °F) which occurred at 5:38 AM, approximately three hours after shutdown of the dilution pumps. Route 9 Bridge surface water temperatures remained about 37.8 °C (100 °F) for much of the day until dilution pump operation was restored, which later reduced temperatures at Route 9 Bridge surface water to under 30.6 °C (87 °F).

Approximately one hour after the dilution pumps were shut off, a Plant Equipment Operator notified the Control Room that approximately 50 to 100 dead or distressed fish were observed in the discharge canal near the dilution pump discharge. In order to document this fish kill event a fish sampling program was conducted by AmerGen Energy on the day of the dilution pump shutdown and the days immediately following the shutdown. The results of that monitoring effort indicated that several species of fish were affected, and that a total of approximately 5876 individuals died due to thermal shock. The majority of the fish which died as a result of the dilution pump shutdown suffered lethal heat shock relatively rapidly.

Nearly three-quarters of the fish collected from the discharge canal and Oyster Creek were striped bass, Atlantic menhaden and white perch. Spot and American eel each comprised approximately five percent of the fish collected. Although 17 other fish species and two invertebrate species were also involved in the fish kill, most of these species comprised less than one percent of the total number collected.

The cause of the permit violation was determined to be the lack of integration of applicable environmental requirements into the planning, scheduling, and work processes.

Immediate corrective actions taken included restoring the Bank 5 transformers to service and restarting the Dilution Plant. Interim corrective actions were taken to review the NJPDES permit with site management and key on-shift personnel. Long term corrective actions to prevent occurrence included creating a formal site policy for interactions with the State of New Jersey to provide more effective communications for activities which could potentially challenge the NJPDES permit. Numerous internal communication sessions will be held, and procedure revisions will be issued to ensure future compliance with the permit.

Introduction

This report documents the results of aquatic sampling conducted by AmerGen Energy Company, LLC (AmerGen) following a thermal shock fish kill which occurred on September 23, 2002, in the discharge canal of Oyster Creek Generating Station (OCGS), subsequent to a shutdown of the plant's dilution pumps. The objectives of the sampling program were to:

1) determine the species composition, relative abundance and distribution of fishes in Oyster Creek which may have suffered thermal stress following the OCGS dilution pump shutdown, and

2) quantify the extent of any fish mortalities.

The monitoring effort took place from September 23 through September 25, 2002.

On the morning of September 23, 2002, OCGS, which had operated continuously for the previous 307 days, was operating at 100% power with four circulating water and two dilution pumps in operation. Operators secured the Dilution Plant and took the Bank 5 Transformer out of service 2:37 AM. The Bank 5 Transformer outage was intended to improve the reliability and safety of the equipment to supply power to plant components, and to improve the reliability of the tie-in of OCGS to the offsite electrical grid.

AmerGen Energy Environmental Scientists were notified of the dilution pump shutdown and initiated a sampling program in the discharge canal. Dead and dying fish were collected from the discharge canal and the canal banks during the afternoon and evening of September 23, and on the following two days. The OCGS continued in operation during this period.

Fish Kill Monitoring Activities

Fish were collected from the discharge canal using dipnets by AmerGen personnel and environmental consutants. Dead fish were gathered from a small boat, as well as by personnel walking along the discharge canal banks between the OCGS discharge and the bayfront beaches near the mouth of Oyster Creek.

The results of the monitoring effort indicated that a total of 5876 fish and invertebrates representing 22 different fish species and two invertebrate species died during this fish kill event (Table 1). Most of the stressed or dead fish were striped bass, Atlantic menhaden and white perch which were collected from upstream portions of the discharge canal and shallow cove areas between the U. S. Route 9 bridge surface water and the mouth of Oyster Creek. The fish captured were identified, enumerated, and length ranges were determined for each species.

As detailed on Table 1, striped bass Morone saxatilis (n = 2720), Atlantic menhaden Brevoortia tyrannus (n = 999) and white perch Morone americanus (n = 664) together accounted for 74.6% of the mortalities. Spot Leiostomus xanthurus (n = 315) for 5.4%, and American eel Anguilla rostrata (n = 287) accounted for for 4.9%. Four additional species including oyster toadfish Opsanus tau (n = 254), Atlantic croaker Micropogonias undulatus (n = 230), gizzard shad Dorosoma cepedianum (n = 130) and bluefish Pomatomus saltatrix (n = 112) together accounted for about 12% of the total mortalities. Spider crab Libinia emarginata (n = 69) and blue crab Callinectes sapidus (n = 22) were the only invertebrates collected and together comprised about 1.5% of the total mortalities.

The striped bass collected ranged from 230 to 960 mm (9.1 to 37.8 in) forklength (FL). The Atlantic menhaden collected during the fish kill ranged in length from 110 to 165 mm (4.3 to 6.5 in) FL, and the white perch collected ranged in length from 130 to 285 mm (5.1 to 11.2 in) FL.

Discussion and Conclusions

The evidence indicates that the observed fish and invertebrate mortalities on September 23, 2002 and the days immediately thereafter were caused by heat shock. These fish, primarily temperate basses, herrings and drum species, were residing in the heated condenser discharge of the OCGS and the discharge canal at the time of the dilution pump shutdown. They were probably attracted to the elevated temperatures in the discharge canal during summer or early fall, and remained there. The death of these fish and invertebrates following a 5 °C (9 °F) rise in discharge water temperature at the Route 9 Bridge surface water over a period of about 1.5 hrs, up to a final water temperature of about 38.3 °C (101 °F), is consistent with what is known about their thermal tolerances, upper lethal temperature limits and past observations of heat-shock events.

The September 23, 2002 fish kill event resulted from the inability of many of the fish and invertebrate species inhabiting the OCGS discharge canal to tolerate the relatively high water temperatures they encountered in the discharge canal subsequent to shutdown of the dilution pumps. Intake canal temperatures were about 27.8 °C (82 °F), at the time of the dilution pump shutdown on September 23 (Figure 1). The Main Condenser discharge temperature at the time of the shutdown was approximately 38.9 °C (102 °F), resulting in a delta T of about 11.1 °C (20 °F). The rapid increase in discharge canal temperature as measured at the Route 9 Bridge surface water (from about 32.7 °C / 90.9 °F to over 37.7 °C / 100 °F in 95 minutes), which occurred following the dilution pump shutdown (Figure 1), appears to have induced heat shock relatively rapidly. The discharge canal temperature increased to about 38.3 °C (101 °F) at the Route 9 Bridge surface water about three hours after the dilution pump shutdown, then remained between 37.2 °C and 38.3 °C (99 °F to 101 °F) until after the first dilution pump was restarted at 8:37 PM (Figure 2).

At OCGS, several fish species collected during this fish kill event (including striped bass, Atlantic menhaden, white perch, American eel, oyster toadfish, Northern puffer, bluefish and summer flounder) have been involved in heat shock fish kills on previous occasions between 1973 and 1995. For example, a June 1995 fish kill involving striped bass and Northern puffer occurred when intake temperatures were 22.9 °C (73.2 °F), discharge temperatures were 34.4 °C (94 °F), and both operating dilution pumps were taken out of service.

Gift and Westman (1971) found that striped bass acclimated to a temperature of 25 °C (77.2 °F) had an Upper Thermal Tolerance Limit (UTTL) of 37.3 °C (99.13 °F). Similarly, Gift and Westman estimated the UTTL's of white perch, Northern kingfish and bluefish acclimated to 25 °C to be 37.7 °C, 36.6 °C and 36.4 °C, respectively. Heat shock experiments conducted by Terpin, Wyllie and Holmstrom (1977) reported that bluefish acclimated to 24 °C and exposed to a heat shock temperature of 34 °C died within seven hours of exposure. Similarly, Terpin et.al. (1977) reported that Atlantic menhaden acclimated to 25 °C and exposed to a heat shock temperature of 35 °C died within one hour of exposure. Therefore, it appears that the upper lethal temperature for the species involved in the September 2002 fish kill is likely to be between 35 °C and 38 °C. The relatively rapid increase of discharge canal temperatures which resulted from the simultaneous shutdown of the two operating dilution pumps, as well as the sustained discharge canal temperatures above 37.8 °C (100 °F) during the dilution pump shutdown, may have contributed to the severity of this fish kill.

The only species collected during the September 2002 fish kill species which has not been involved in previous OCGS fish kills was the hogchoker Trinectes maculatus. Hogchoker may have avoided involvement in previous fish kills because of either wide temperature tolerances or an ability to find a thermal refuge in their demersal (near-bottom) habitat.

Event Cause and Corrective Actions

The cause of the permit violation was determined to be the lack of integration of applicable environmental requirements into the planning, scheduling, and work processes.

Immediate corrective actions taken included restoring the Bank 5 transformers to service and restarting the Dilution Plant. This restored Oyster Creek to full compliance with the NJPDES permit. Compliance was achieved on September 23, 2002.

Interim corrective actions were taken to schedule a review of the NJPDES permit with Senior Site Management (Managers and Directors) and Licensed Senior Reactor Operator personnel to increase environmental awareness.

Long term corrective actions to prevent occurrence include creating a site policy to formalize interactions with the State of New Jersey and provide more effective communications for activities which could potentially challenge the NJPDES permit. Internal communication sessions will be held, and procedure revisions will be issued to ensure future compliance with the permit. The process for scheduling work will be modified to emphasize the months when the dilution plant cannot be removed from service.

References

Gift, J. J. and J. R. Westman, 1971. Responses of some estuarine fish to increasing thermal gradients. Unpublished monograph. 154 pp.

Jersey Central Power & Light Company, 1978. Oyster Creek and Forked River Nuclear Generating Stations 316 (a) and (b) Demonstration. Jersey Central Power & Light Company, Morristown, New Jersey.

Terpin, K.M., M.C. Wyllie and E.R Holmstrom, 1977. Temperature preference, avoidance, shock, and swim speed studies with marine and estuarine organisms from New Jersey. Report for the period January-December 1976. Bulletin No. 17. Ichthyological Associates, Inc., Brigantine, New Jersey.

Table 1.

Number and size of dead and stressed fish and invertebrates collected from Oyster Creek following the OCGS dilution pump shutdown on September 23, 2002.

Species of Dead/Stressed Fish and Invertebrates Collected	Species Common Name	Total Count Per Species	Percentage of Total (%)	Minimum Length (mm)	Maximum Length (mm)
Morone saxatilis	Striped bass	2720	46.29%	230	960
Brevoortia tyrannus	Atlantic menhaden	999	17.00%	110	165
Morone americanus	White perch	664	11.30%	130	285
Leiostomus xanthurus	Spot	315	5.36%	unknown	162
Anguilla rostrata	American eel	287	4.88%	232	720
Opsanus tau	Oyster toadfish	254	4.32%	162	246
Micropogonias undulatus	Atlantic croaker	230	3.91%	191	195
Dorosoma cepedianum	Gizzard shad	130	2.21%	350	424
Pomatomus saltatrix	Bluefish	112	1.91%	412	895
Libinia emarginata	Spider crab	69	1.17%	unknown	unknown
Pogonias cromis	Black drum	30	0.51%	unknown	520
Callinectes sapidus	Blue crab	22	0.37%	unknown	unknown
N/A	Unidentified	16	0.27%	unknown	unknown
Cynoscion regalis	Weakfish	9	0.15%	unknown	603
Fundulus heteroclitus	Mummichog	4	0.07%	33	56
Trinectes maculatus	Hogchoker	4	0.07%	109	179
Scaridae (?)	Parrotfish (?)	2	0.03%	unknown	unknown
Scaienops ocellatus	Red drum	2	0.03%	481	1150
Dasyatis sabina	Atlantic stingray	2	0.03%	unknown	446
Strongylura marina	Atlantic needlefish	1	0.02%	293	293
Menidia menidia	Atlantic silverside	1	0.02%	87	87
Sphoeroides maculatus	Northern puffer	1	0.02%	238	238
Mugil cephalus	Striped mullet	1	0.02%	450	450
Paralichthys dentatus	Summer flounder	1	0.02%	300	300
	Total	5876	100.00%		

Figure 1
Oyster Creek Generating Station
Water and Air Temperatures - 23Sep2002

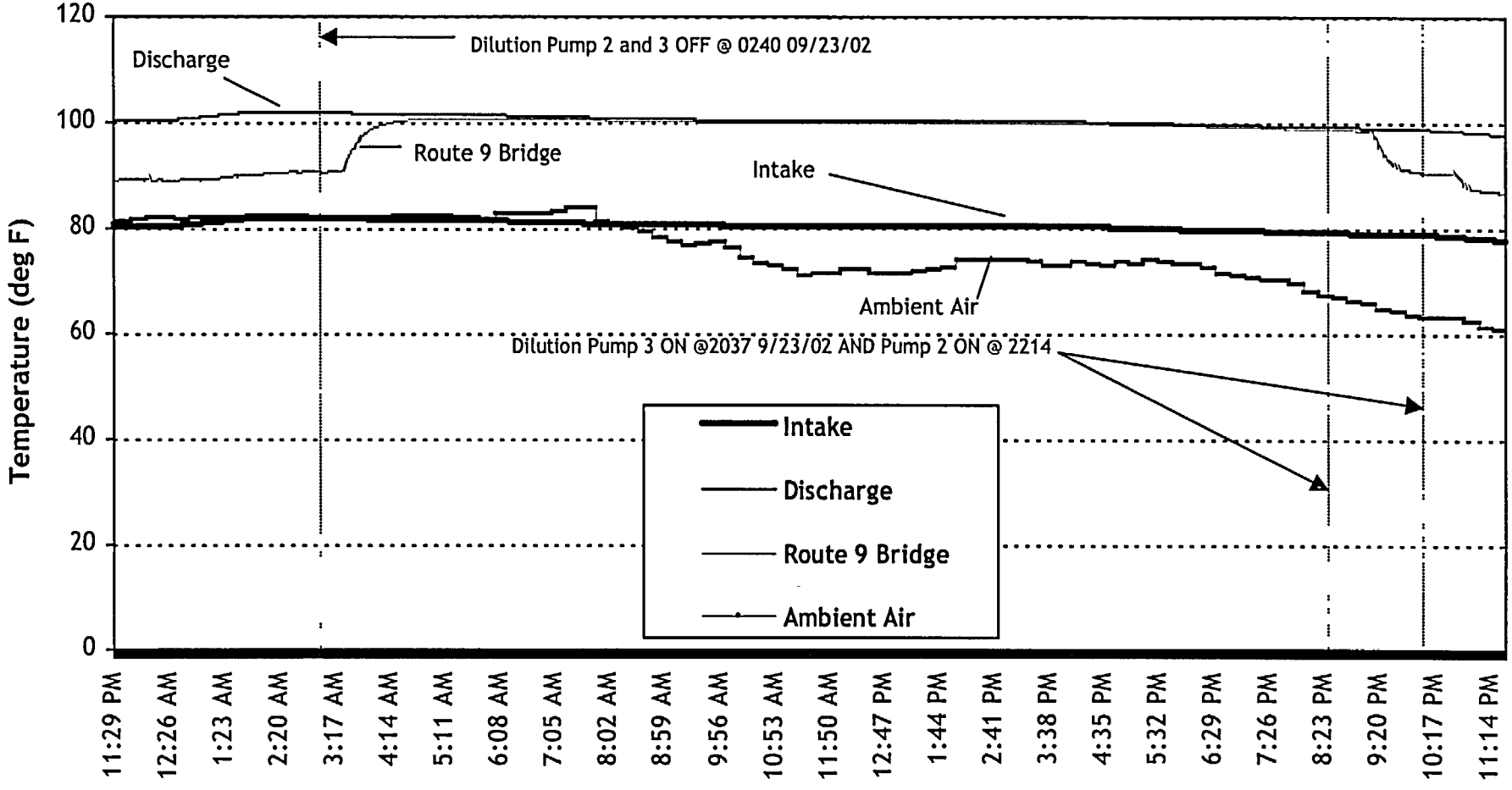

Figure 2
Oyster Creek Generating Station
Water and Air Temperatures
22Sep2002 Through 26Sep2002