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January 18, 1996

Dr. Jason Jang
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475 Allendale Road
King of Prussia, PA 19406

Dear Dr. Jang:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket 50-219
Fish Kill Monitoring Report, December 1995

In accordance with the reporting requirements of Sections 1.1.1 A and 3.5.2 of Appendix B, Environmental Technical Specifications, enclosed is a report of Fish Kill Monitoring at OCNGS.

If you have any questions or require any additional information, please contact Mr. Malcolm Browne of our Environmental Affairs Department at (609) 971-4124.

Very truly yours,

Michael B. Roche
Vice President & Director
Oyster Creek

MEB/MBR/jdr

Enclosure

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FISH KILL MONITORING REPORT
FOR DECEMBER 1995

GPU Nuclear Corporation
Oyster Creek Nuclear Generating Station
Environmental Affairs Department
January, 1996

Executive Summary

An automatic and unplanned shutdown of the Oyster Creek Nuclear Generating Station (OCNGS) took place at 4:37 a.m. Monday, December 18, 1995 when a faulty temperature control valve resulted in higher than normal temperatures in the plant's main electrical generator. Following a 10-day outage during which repairs to the valve and other plant components were completed, OCNGS was restarted on Thursday, December 28.

As a result of the shutdown, the water temperature in the main condenser discharge decreased by approximately 20° F, from 56° F to 36° F, in less than 25 minutes. In order to document the effects of this thermal shock on the fish in Oyster Creek, a fish sampling program was conducted by GPU Nuclear beginning on December 18, immediately after the shutdown. The results of that monitoring effort indicated that 19 fish representing six different species died due to cold-shock shortly after the OCNGS shutdown. Bluefish (n=6) accounted for 32% of the mortalities, black drum (n=5) for 26%, spotted seatrout (n=3) and smooth dogfish (n=3) each accounted for 16%, and weakfish (n=1) and scup (n=1) each accounted for 10%.

In order to determine if any fish sank to the bottom subsequent to their death, bottom trawls were conducted at five locations between US Route 9 and the mouth of Oyster Creek. No additional dead fish were collected in any of these trawls. Small schools of live Atlantic menhaden and live Atlantic silversides, which appeared to have suffered no ill effects from the shutdown, were collected in trawls from residential lagoons adjacent to Oyster Creek. In addition, a school of striped bass was observed swimming normally in the main condenser discharge flow immediately following and during the 48 hour period subsequent to the shutdown.

A period of exceptionally cold subfreezing weather occurred during December 26th and 27th, over one week after the plant shutdown and prior to the restart of OCNGS on December 28th. Ambient water temperatures fell rapidly during this period from approximately 34° F on December 26th to less than 30°F on the morning of December 27th.

During the morning of December 27th, dead and stressed fish began appearing in the discharge canal and contiguous residential lagoons. It is believed that the exceptionally low ambient water temperatures (29.9°F) fell below the lower lethal temperature limits for these fish. A total of 855 fish were collected by environmental scientists on December 27th and during the following several days. Approximately 72% of the fish collected were striped bass (n=620), approximately 27% were white perch, and the remaining 1% consisted of American eel and gizzard shad.

All dead fish collected were found floating in Oyster Creek or adjacent residential lagoons, or lodged among rocks along the shoreline of the discharge canal or Oyster Creek. No dead fish were collected in trawls conducted along the bottom of Barnegat Bay immediately offshore of Oyster Creek, nor were any collected while bottom trawling in either the main channel of Oyster Creek or in the residential lagoons.

Introduction

This report documents the results of aquatic sampling conducted by GPU Nuclear Corporation following the shutdown of the Oyster Creek Nuclear Generating Station (OCNGS) on December 18, 1995 as well as prior to and subsequent to the restart of OCNGS on December 28th, 1995. The major objectives of the sampling program were:

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

2) To quantify the extent of any fish mortalities.

The monitoring effort took place on December 18, 19, 20, 27 and 28, 1995, as well as during the week of January 1, 1996.

OCNGS, which had operated continuously for the previous 367 days, was operating at full power with four circulating water and two dilution pumps in operation on December 18. Immediately prior to the shutdown at 0430 hrs that day, the intake temperature was approximately 36° F and the discharge temperature was approximately 56° F (Figures 1 and 2). A faulty temperature control valve resulted in higher than normal temperatures in the plant's main electrical generator, which led to the automatic reactor shutdown. As a result of the shutdown, the water temperature in the main condenser discharge decreased by approximately 20° F, from 56° F to 36° F, in less than 25 minutes (Figure 2).

During the outage following the shutdown, the faulty valve was repaired and additional required maintenance was performed on systems and components which can only be worked on when the reactor is shut down. OCNGS went back on line producing electricity on December 28th following a 10-day outage.

Post-Shutdown Surveys

Post-Shutdown Dipnetting -

Following the plant shutdown in the early morning hours of December 18th, a few fish became thermally stressed and moved downstream of the OCNGS condenser discharge. These fish were collected by environmental scientists from the discharge canal using dipnets. Dead and severely stressed fish were collected from a small boat and by personnel walking along the discharge canal streambanks, between the OCNGS discharge and the mouth of Oyster Creek. All fish were identified and enumerated; length ranges were obtained.

A total of 19 dead or stressed fish, representing six species, was collected (Table 1). Bluefish (Pomatomus saltatrix) and black drum (Pogonias cromis)accounted for 58 percent of the total; the remaining species were represented by no more than 3 individuals.

Post-Shutdown Trawling -

Bottom trawls were conducted at each of three stations in the discharge canal and Barnegat Bay east of the Route 9 bridge as well as within two of the residential lagoons during the afternoon of December 18 (Figure 3).

Trawling was done for a minimum duration of three minutes with a 4.8 m semiballoon otter trawl with a 3.9 cm stretch mesh body, a 3.2 cm stretch mesh cod end and a 1.3 cm stretch mesh liner. All fish captured were identified and enumerated, length ranges were obtained, and the specimens were released. The surface and bottom water temperature were recorded at each trawl station.

All fish collected in the trawls were alive, exhibited no signs of thermal stress, and were immediately released. No fish were captured at Stations T1, T2, and T7 (Table 2). Fifty-two live Atlantic silversides (Menidia menidia) and one live Atlantic menhaden (Brevoortia tyrannus) were captured at Station T3 (the fourth residential lagoon east of Route 9). At Station T5 (the second residential lagoon east of Route 9) sixty live Atlantic menhaden approximately 70 mm fork length (FL), and forty-five live Atlantic silversides approximately 50 mm FL were captured.

Other Post-Shutdown Observations -

A school of striped bass (Monrone saxatilis) was observed swimming normally in the condenser discharge of the OCNGS immediately after the shutdown. Periodic observations during the 48-hour period following the shutdown indicated that these fish survived the thermal shock that occurred on December 18th and remained in the vicinity of the condenser discharge flow.

Post-Fish Kill Monitoring of December 27-28, 1995 and the week of January 1, 1996

Following the collection of dead and stressed fish on December 18th which was described above, there was no further evidence of stressed or dead fish for over a week as continuing maintenance to OCNGS kept the plant shut down. However, a period of exceptionally cold weather occurred after Christmas Day and ambient water temperatures dropped rapidly from approximately 34° F on December 26 to 29.9° F at 8:00 a.m. on December 27 (Figures 1 and 4). During the morning of December 27th, large numbers of stressed and dead fish began appearing in Oyster Creek downstream of OCNGS.

Post-Fish Kill Dipnetting -

Responding to reports that dead and severely stressed fish were appearing in Oyster Creek and adjacent residential lagoons, plant personnel began collecting the fish as soon as possible. The dead and stressed fish were collected with dipnets by environmental scientists operating a small boat as well as walking along the discharge canal streambanks between the OCNGS discharge and the mouth of Oyster Creek. All fish were identified to species and enumerated; length ranges were obtained (Table 3).

The dead and stressed fish were all observed floating at or near the waters surface and did not accumulate on the bottom. Even when inadvertently pushed below the surface during the dipnetting effort, the bodies quickly rose back to the surface. The trawl samples collected on December 28th confirmed that dead fish did not accumulate on the bottom.

The results of the monitoring effort indicated that a total of 855 fish representing four different species died during this fish kill event. Striped bass (n=620) accounted for over 72% of the mortalities, white perch (Morone americana) (n=229) for nearly 27%, while American eel (Anguilla rostrata) (n=5) plus gizzard shad (Dorosoma cepedianum) (n=1) together accounted for about 1% (Table 3).

The striped bass ranged in length from 296 mm to 758 mm (11.6 to 29.8 in) forklength (FL). Mean length of the striped bass based on a random subsample was 524 mm (20.6 in) FL. The white perch collected during the fish kill ranged from 228 to 361 mm (9.0 to 14.2 in) FL. The mean length of a representative subsample of the white perch was 292 mm (11.5 in) FL. The American eels ranged in total length (TL) from 640 mm to 714 mm (25.2 to 28.1 in). The mean length of all eels collected was 674 mm (26.5 in) TL. The single specimen of gizzard shad measured 365 mm (14.4 in) FL.

Post-Fish Kill Trawling -

Bottom trawls were conducted at each of the three stations in the discharge canal east of Route 9, as well as within three of the residential lagoons (Figure 3), during the afternoon of December 28. Trawling was done for a minimum duration of three minutes per station with the same 4.8m semiballoon otter trawl used during the December 18, 1995 post-shutdown surveys.

No fish, alive or dead were captured in any of the six trawl samples (Table 4) confirming the observation that the dead fish were floating, not accumulating on the bottom.

Discussion and Conclusions

The December 18, 1995 unplanned, automatic shutdown of the OCNGS resulted in the cold-shock mortality of 19 fish representing six different species. These fish, primarily bluefish and black drum, were residing in the heated condenser discharge of the OCNGS. The death of these fish following a 20° F drop in discharge water temperature in less than 25 minutes is consistent with what is known about their thermal tolerances and past observations of cold-shock events.

The ability of the striped bass and white perch to survive the December 18 cold-shock event is also consistent with the available information on their thermal tolerances. Cold-shock experiments conducted by Ichthyological Associates, Inc. (Jersey Central Power & Light Company, 1978) demonstrated that striped bass are able to tolerate extreme temperature shocks. Striped bass acclimated to temperatures ranging from 44 to 82° F exhibited 100 percent survival 96 hours after exposure to sudden temperature reductions of 9 to 28° F, down to levels as low as 35°F. Similarly, Texas Instruments (1976) found that adult white perch were able to survive a sudden temperature reduction of 23.4° F, from 59° F to 35.6° F. The temperature conditions in the discharge canal following the December 18 shutdown fell within the range of these experimental conditions and so it is not surprising that these species survived the cold-shock event.

The mortality of the striped bass and white perch, 10 days after the December 18 shutdown was apparently caused by the ambient water temperatures dropping below the lower lethal limit for those species.

The relatively high salinity of the water in the OCNGS intake and discharge canals allows the water temperature to fall below the freezing point during periods of extremely cold weather. Air temperatures dropped into the low twenties on December 26 and 27, depressing ambient water temperatures to extremely low levels. The discharge canal temperature dropped from just above freezing (32.2° F), at midnight on December 26, to 29.9° F at 8:00 a.m. on December 27. These extremely low ambient water temperatures immediately preceded the appearance of stressed and dead striped bass and white perch on the morning of December 27.

Cold-shock experiments have demonstrated that striped bass can tolerate exposure to water temperatures as low as 32° F for at least a few days but death occurs in a few hours at temperatures of 30.2° F or less (Gift and Westman, 1971; Public Service Electric and Gas Company, 1978). These results indicate that the ambient water temperature in the discharge canal fell below the lower lethal limit for the striped bass on the morning of December 27, resulting in their death. The lower lethal temperature limit for the white perch has not been determined. However, given their close taxonomic relationship to the striped bass and the similarity of their responses in cold-shock experiments, it is likely that the white perch mortality was also caused by ambient water temperatures falling below their lower lethal limit.

References

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

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

Public Service Electric and Gas Company, 1978. Annual environmental operating report (non-radiological). Salem Nuclear Generating Station. Unit 1. Vol.3. Special surveillance and study activities. Public Service Electric and Gas Company, Newark, New Jersey.

Texas Instruments, Inc., 1976. Hudson River ecological study in the area of Indian Point, thermal effects report. Prepared for Consolidated Edison Company of New York, Inc..

Table 1. Number and size of dead and stressed fish dipnetted from Oyster Creek on December 18, 1995 following OCNGS shutdown.

SPECIES	NUMBER	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Pogonias cromis black drum	5	210 - 290	254
Cynoscion nebulosus spotted sea trout	3	435 - 560	492
Cynoscion regalis weakfish	1	430	430
Mustelus canis smooth dogfish	3	600 - 668	629
Pomatomus saltatrix bluefish	6	308 - 457	401
Stenotomus chrysops scup	1	210	210
TOTAL	19		

Table 2. Results of trawl sampling on December 18,1995 following OCNGS shutdown. Numbers of individuals captured with typical lengths (millimeters in parentheses) indicated for each species.

STATION	START TIME	STOP TIME	TEMP (deg. F)	Brevoortia tyrannus Atlantic menhaden	Menidia menidia Atlantic silversides
T1 SURFACE			39.2		
BOTTOM	1345	1350	39.2	0	0
T2 SURFACE			39.2		
BOTTOM	1354	1403	39.2	0	0
T3 SURFACE			38.3		
BOTTOM	1422	1425	46.0	1 (45)	52 (50)
T5 SURFACE			41.0		
BOTTOM	1409	1412	44.9	60 (70)	45 (50)
T7 SURFACE			36.1		
BOTTOM	1444	1450	36.0	0	0

NOTE: All fish were alive and exhibited no signs of stress when collected.

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BOTTOM	1354	1403	39.2	0	0
T3 SURFACE			38.3		
BOTTOM	1422	1425	46.0	1 (45)	52 (50)
T5 SURFACE			41.0		
BOTTOM	1409	1412	44.9	60 (70)	45 (50)
T7 SURFACE			36.1		
BOTTOM	1444	1450	36.0	0	0

NOTE: All fish were alive and exhibited no signs of stress when collected.

Table 3. Number of dead and stressed fish dipnetted from Oyster Creek on December 27-28, 1995 and the week of January 1, 1996.

SPECIES	NUMBER	PERCENT OF CATCH	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Anguilla rostrata American eel	5	0.6	640 - 714	674
Dorosoma cepedianum gizzard shad	1	0.1	365	365
Morone americana white perch	229	26.8	228 - 361	292
Morone saxatilis striped bass	620	72.5	296 - 758	524
TOTAL	855	100		

Table 4. Oyster Creek discharge canal and residential lagoon trawl locations and depths at trawl stations, December 28, 1995.

STATION	START TIME	STOP TIME	DEPTH (ft)
T1	1404	1410	6.5
T2	1415	1421	13.0
T3	1433	1436	8.8
T4	1426	1429	7.5
T6	1453	1456	6.7
T7	1500	1505	8.7

NOTE: No fish, alive or dead, were captured in the six trawl samples.

FIGURE 1
AIR AND WATER TEMPERATURES DURING FISH KILL EVENT
17DEC95 THROUGH 28DEC95
TEMPERATURE IN DEGREES FAHRENHEIT

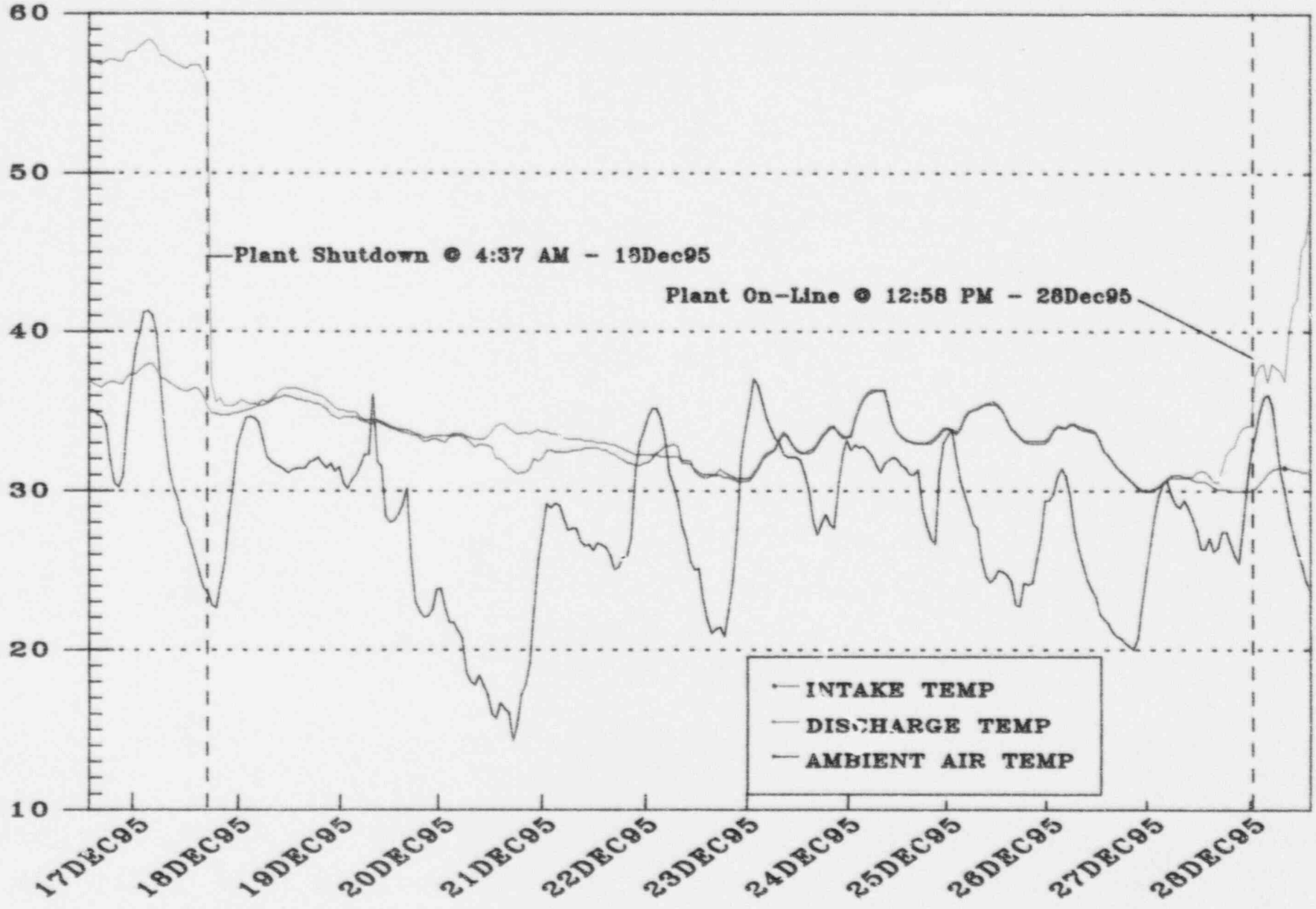
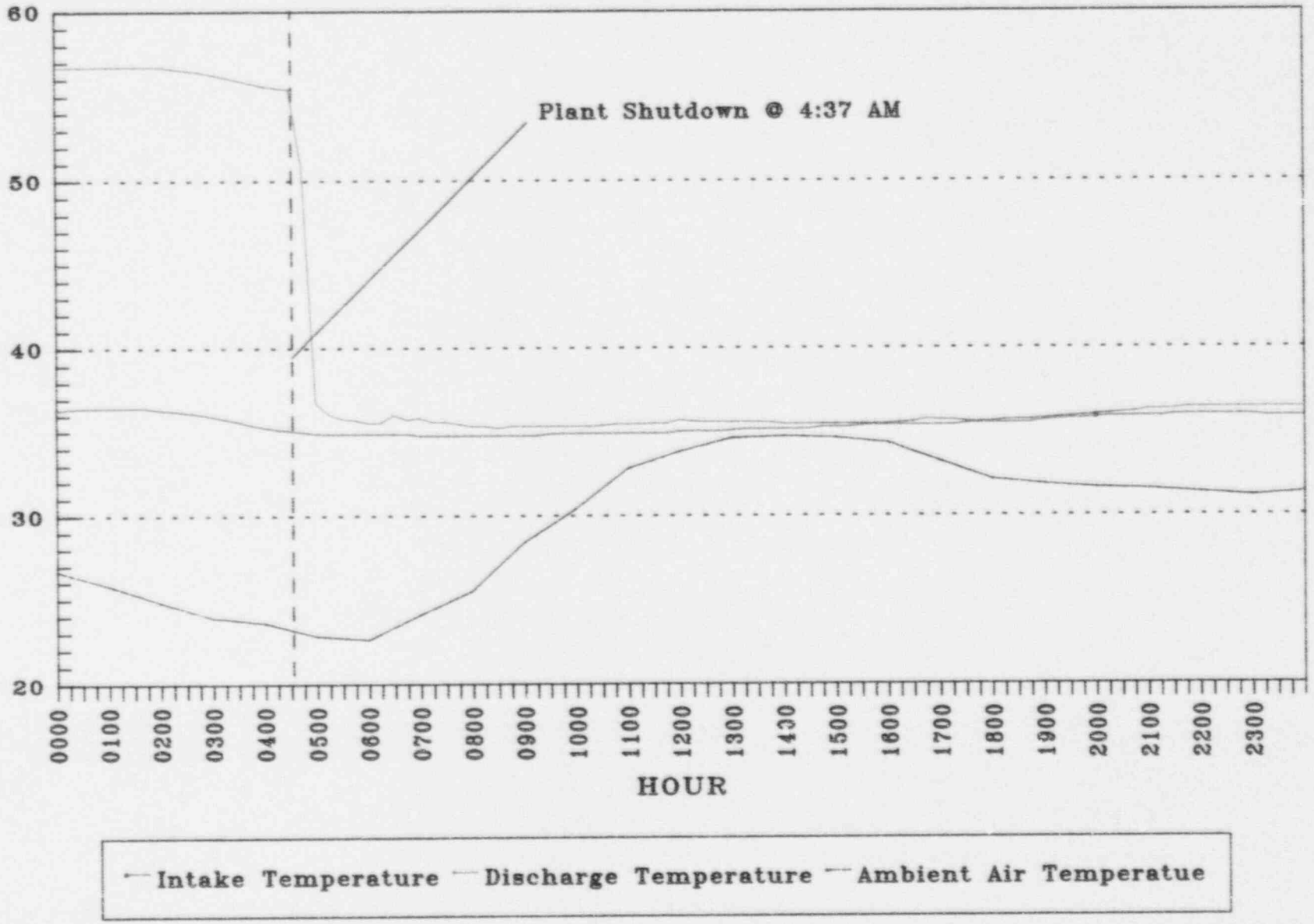


FIGURE 2
AIR AND WATER TEMPERATURES DURING FISH KILL EVENT
QUARTER-HOUR DATA - DECEMBER 18, 1995
TEMPERATURE IN DEGREES FAHRENHEIT



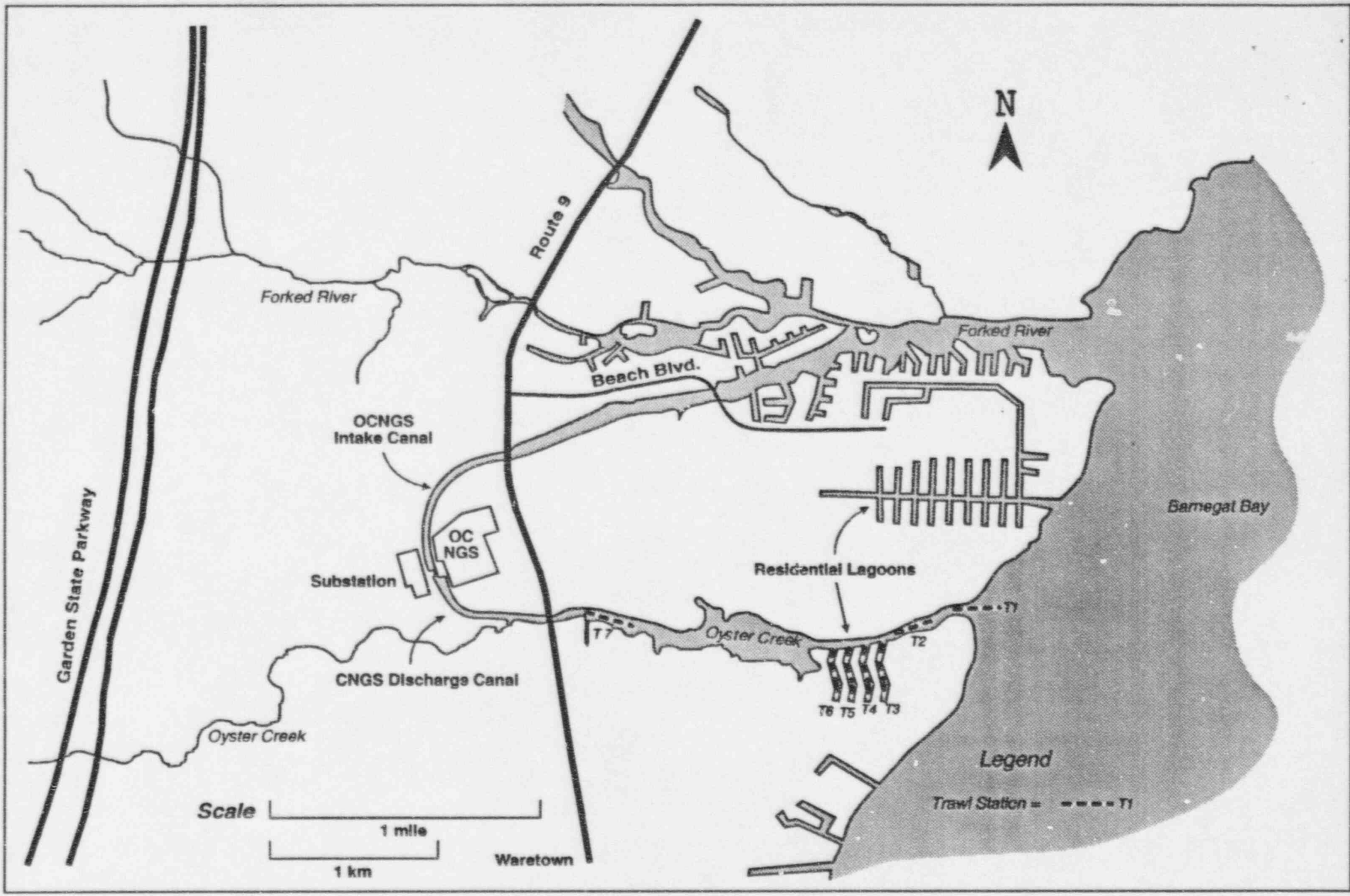


Figure 3. Location map of OCNGS and trawl stations.

FIGURE 4
AIR AND WATER TEMPERATURES DURING FISH KILL EVENT
QUARTER-HOUR DATA - MIDDAY 26DEC95 THROUGH 27DEC95
TEMPERATURE IN DEGREES FAHRENHEIT