AEOD TECHNICAL REVIEW REPORT

UNITS:	Multiple	TR REPORT NO.:	AEOD/T90-06
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LICENSEES:	Multiple	EVALUATOR/CONTACT:	L.Padovan
NSSS/AE:	Multiple		

SUBJECT: **AQUATIC LIFE IN EMERGENCY COOLING PONDS**

SUMMARY

A safety concern regarding aquatic life in emergency cooling ponds was raised in the December 1989, NRC Diagnostic Evaluation Team inspection at Arkansas Nuclear One (ANO), Units 1 and 2 (Ref. 1). The issue concerned the presence of fish and other aquatic life in emergency cooling ponds, which was not accounted for in the ANO plant design basis. The fish population in the emergency cooling pond at ANO was neither monitored nor controlled. During a postulated accident which would require use of the emergency cooling pond as the ultimate heat sink, the temperature of the pond could increase enough to kill fish and other aquatic life, potentially causing fouling of the pump intake screens and subsequent loss of emergency cooling capability.

The Reactor Operations Analysis Branch of AEOD assessed the design and operations of other plants that utilized cooling ponds similar to the pond at ANO-1. Ponds of interest were those with 1) no traveling screens at the intake structure of the emergency cooling pond, 2) no monitoring or chemical treatment for control of aquatic life, and 3) small acre-feet of water, where an increase in temperature during postulated accidents could kill the resident fish population and clog stationary intake screens.

38 candidate plant sites were identified where reservoirs, cooling towers, or canals are used for cooling. Of the 38 candidate plants, only 5 plant sites were found to utilize small emergency cooling ponds with no traveling screens on the intake structure. A detailed review of the cooling ponds at these plants determined periodic monitoring, fish eradication or water chemistry control was utilized at these facilities to prevent the existence of fish populations in the cooling ponds.

Additionally, Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment" has requested licensees to implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. Licensee actions in response to this letter should further reduce the likelihood of biofouling.

Accordingly, AEOD concludes no additional generic action in this regard is warranted.

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DISCUSSION

1. Description of the ANO Emergency Cooling Pond

The emergency cooling pond is a kidney shaped pond with an average water surface area of 14 acres (see Enclosure 1), and a normal depth of 6 feet for a total water inventory of 84 acre-feet. The pond serves as a heat sink for simultaneously shutting down both Unit 1 and Unit 2. The design basis for sizing the cooling pond is a LOCA in Unit 2 and a concurrent shutdown of Unit 1.

Suction and discharge water lines are routed from seismic Category 1 structures. Intake screens, consisting of 12 gauge wire with 3/8 inch openings, are provided in the intake structure. However, traveling screens are not utilized.

Cooling for Engineered Safeguards equipment is normally supplied by the service water system taking suction on the Dardanelle reservoir. During a loss of offsite power, the service water pumps are powered from the emergency diesel generators. In the event of a complete loss of water from the Dardanelle Reservoir, water is supplied by gravity flow from the emergency cooling pond through a supply line to the service water system. After being circulated through the service water system, the cooling water is returned to the emergency cooling pond.

Equipment cooled by the service water system includes:

reactor building cooling coils
decay heat removal pump room coolers
decay heat coolers
emergency diesel generator jacket heat exchanger
control room emergency air conditioning
reactor building spray pump lube oil coolers
Engineered Safeguards switchgear room chillers

2. Operational Data

All domestic nuclear power plant sites were examined to identify sites utilizing emergency cooling ponds similar to the pond at ANO-1. Ponds of interest were those with 1) no traveling screens at the intake structure of the emergency cooling pond, 2) no monitoring or chemical treatment for control of aquatic life, and 3) small acre-feet of water, where an increase in temperature during postulated accidents could kill the resident fish population, clogging stationary intake screens.

Plants with cooling systems utilizing large rivers, bays, lakes, or an ocean were eliminated from this study, as separate cooling ponds are most likely not incorporated into the design of these plants. This elimination process resulted in the following five plant sites being subjects of further detailed assessments:

WNP 2
Catawba
Limerick 1,2
Susquehanna 1,2
Palo Verde 1,2,3

For each of the above plants, information on the designs of the emergency cooling ponds, and the licensee's programs for monitoring and control of aquatic life in the ponds, was obtained from the utilities. Reviews of this information determined periodic monitoring, fish eradication or water chemistry control was utilized at these facilities to prevent the existence of fish populations in the cooling ponds, as follows:

WNP 2

The two spray ponds contain a total of 11.92 million gallons, minimum. No traveling screens are provided on the intake to the pumps, rather stationary 3/8" mesh screen is installed, instead.

The pond is not chemically treated to control the fish population. However, annual dives in the ponds are made to inspect the spray "trees" (headers) and screens. The last dive took four days. During that period of time, the divers observed no fish in the ponds.

Catawba

The standby nuclear service water pond contains 390 acre-feet of water at maximum allowable drawdown. No traveling screens are provided, even though the pond was constructed by placing a dam across a small cove of Lake Wylie, and is consistently inhabited by fish. Metal bars, spaced three inches apart, are in place outside the pump house, and one inch screens are installed in the pump suction inside the pump house.

No measures to control the growth of aquatic life are taken by the utility. However, the utility indicated that the intake from the pond is located 32 feet below the surface of the water, and in the event of a fish kill, the fish would float and not obstruct the intake. The large acre-feet capacity of the pond also reduces the likelihood of a fish kill due to an unanticipated rise in water temperature.

Limerick 1,2

The spray pond is 10 acres in surface area, with a capacity of 27 million gallons at normal water level. No traveling screens are provided, and a removable screen is installed at the entrance to the pump bays.

Fish eradications were required in the Fall of 1986, and in 1988. In both instances, about 200,000 1"-3" long "blue gill sunnys" were killed utilizing "Nusyn-Noxfish" (Rotenone).

During warm weather months, hypochlorite is now added to the pond, creating a residual concentration of about one ppm chlorine, which destroys the fish habitat at the outer edge of the pond.

Calculations performed by the licensee determined the flow rate at a distance of ten feet from the intake was minimal (about 1/10 feet per second). Accordingly, the licensee does not expect entrainment of dead fish on the removable screen.

Additionally, in licensee's response to the GL on service water, they proposed to survey the spray pond structure and bottom each refueling cycle.

Susquehanna 1,2

The ultimate heat sink is a spray pond of 8 surface acres, containing 25 million gallons. It is common to both units. Make-up to the pond can be supplied from the river, creating the possibility of fish introduction into the pond.

No traveling screens are provided on the pond. A mesh screen is installed in the pump structure, instead.

Fish (stickleback) were observed last year, and about a dozen 10" long fish were killed through chlorination. Subsequent chlorinations yielded no dead fish.

Every fall, the pond is monitored as follows:

1) A trout line with bait hooks in placed in the pond to determine the presence of fish.

2) Monthly chlorinations at outer edge (fish habitat) are performed. A few days later, dead fish are looked for, and the effects on the algae, and weed populations are observed.

During 1990, the licensee expects to treat the pond with "Nusyn-Noxfish".

Palo Verde 1,2,3

Two spray ponds are provided for each unit. Each pond contains 16.3 acre-feet of water, at a minimum depth of 12 feet. Only fixed screens are installed, but they are provided with delta P monitoring, which alarms in the control room. The screens are also automatically backwashed on high delta P.

Well water is utilized for makeup, reducing the likelihood of fish habitation.

Water from the spray pond is sampled for microbiological activity three times a week. Weekly bulk water samples are also checked for microbiological activity. Pond water is treated with chlorine and acids to maintain pH, and a biocide is used to control algae and bacteria.

During annual dives to inspect intake screens and sump, no fish or aquatic life were detected, either.

Based on the above, AEOD concludes no additional generic action in this regard is warranted.

FINDINGS AND CONCLUSIONS

38 candidate plant sites were identified that utilized reservoirs, cooling towers, or canals for emergency cooling. Of the 38 candidate plants, only five plant sites were found to utilize small emergency cooling ponds with no traveling screens on the intake structure. These plants required detailed assessments.

For these five plants, provisions to monitor or control fish populations were found to be utilized. Additionally, Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment" has requested licensees to implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. Licensee actions in response to this letter should further reduce the likelihood of biofouling.
Accordingly, no further AEOD action in this regard is recommended at this time.

REFERENCE

1. USNRC, "Diagnostic Evaluation Team Report for the Arkansas Nuclear One Units 1 and 2," Docket Nos. 50-313 and 50-368, December 1989.

ENCLOSURE 1

EMERGENCY COOLING POND