GPU Nuclear

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September 22, 1982

Mr. Ronald C. Haynes, Administrator
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Haynes:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Item of Interest
Biofouling of Containment Spray Heat Exchangers

On Saturday, August 14, 1982, a normal reactor shutdown commenced at the Oyster Creek Station. The shutdown was initiated to investigate higher than normal differential pressure readings in the Emergency Service Water System (ESW) which provides cooling water to the Containment Spray Heat Exchangers. Upon removal of the Containment Spray Heat Exchanger waterbox heads, blockage of the tube sheet inlets was discovered. The debris comprising the blockage was primarily composed of live and dead animal matter.

The first indications of a problem were higher than normal differential pressure measured across the ESW pumps and a decrease in ESW flow rates found during performance of a monthly surveillance test on Friday, August 13, 1982. The ESW pumps provide cooling water, via the intake canal from Barnegat Bay, to the Containment Spray Heat Exchangers. Since all four ESW pumps showed high differential pressure, it was surmised that the reason for this was increased system resistance, which resulted in decreased flow rates, caused by piping or heat exchanger flow blockage. A retest of the ESW pumps indicated a decrease in differential pressure initially measured. The results, however, had not returned to values considered to be normal; and, based upon available data, the decision was made to shutdown.

All Containment Spray Heat Exchanger waterbox heads were removed and the tube sheets inspected. Samples of the fouling organisms were obtained and analyzed. The fouling organisms were concentrated on tube sheet inlets, rather than on the surfaces of the tubes or the tubesheet outlets.

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The types of organisms found, their relative abundance, and condition are indicated on Attachment 1. Plants accounted for only two (2) percent of the sample and consisted primarily of small fragments. The remainder of the organisms have four characteristics in common which enable them to become established and thrive in the heat exchanger:

1. Their larval stages are extremely small allowing them to disperse into any area where Barnegat Bay water flows.

2. They possess some means of attaching to substrates such as adhesive threads or glue-like substances. This allows them to remain in place during high flow rate conditions.

3. They feed by removing food particles from the water. High flow rates, therefore, provide good feeding conditions.

4. They are able to "close up" under adverse conditions and can therefore avoid biocides in the surrounding water for considerable periods of time.

It can be concluded that most, if not all of these organisms, entered the heat exchangers as larvae, settled on the exchanger surfaces, and grew in place. They did not enter the system as adults. This conclusion is supported by the fact that most of the mussel shells, barnacles and tunicates were too large to pass through the three-eighths (3/8) inch mesh of the intake structure traveling screens. Furthermore, the adult forms of most of these animals are unable to reattach once dislodged from the substrate they settled upon as larvae.

The colonial Bryozoans and Hydroids (grass-like organisms) and Hydroides (worms in white calcereous tubes) appear to be the major problem organisms. These animals were found attached directly to the tube sheets indicating that they were the first to become established. They provide a large amount of surface area which acts as a filter for any debris in the water and serve as a point of attachment for additional organisms.

The Containment Spray Heat Exchangers are the straight-tube, four-pass type with two top end (inlet/outlet side) baffles and one bottom end baffle. Increased differential pressure across the top end baffles resulted in top end baffle deformation in all heat exchangers. Braces were installed to inhibit further deformation until a permanent repair can be made during the next refueling outage, now scheduled for January 1983.

Analysis of measured flow rates and the extent of the biofouling and baffle deformation determined that the heat exchangers' performance had been reduced, but the ability to perform their intended function, if called upon, was not compromised; however, it is not known how long this condition would have prevailed.

The fibrous-like mat of fouling organisms was removed from the tube sheets. The tubes were cleaned by means of a water-jetting process. Also, additional local pressure gauges were installed to determine baffle plate differential pressures. Prior to restart, a satisfactory surveillance was performed on the Emergency Service Water System.

In order to avoid the biofouling problem in the future, a chlorination system will be put into operation. An optimized schedule for chlorination will be developed dependent upon the seasonal abundance patterns of these fouling organisms.

The ability of the Inservice Test (IST) program to detect degrading performance of the heat exchangers will be enhanced by the installation of additional local pressure indication to measure baffle differential pressures, to ensure that an instance of this type can be detected before major fouling occurs which might render a heat exchanger inoperable.

Very truly yours,

Peter B. Fiedler
Vice President and Director
Oyster Creek

PBF:lse

Attachment

cc: Mr. Leo Modenos
Institute of Nuclear Power Operations
1820 Water Place
Atlanta, Georgia 30339

NRC Resident Inspector
Oyster Creek Nuclear Generating Station
Forked River, NJ 08731

ATTACHMENT I

Results of Analysis of Biofouling Sample
Obtained from Containment Spray Heat Exchanger 1-2

Type of Organism	Relative Abundance (By Volume)	Condition
Colonial Hydroids and Bryozoans ("Grass like" organisms)	56%	Live
Blue Mussels*	21%	Dead
Amphipod Tubes ("Shrimp like" organisms)	7%	Dead
Hydroides (Worms in white calcereous tubes)	7%	Live
Barnacles	5%	Dead
Tunicates	3%	Live
Plant Fragments	2%	Dead

*Shell lengths ranged from 1.2-2.6 cm.