AEOD TECHNICAL REVIEW REPORT

UNITS: Beaver Valley 2
DOCKET NO.: 5000412
LICENSEE: Duquesne Light Co.
NSSS/AE: Westinghouse/Sargent and Lundy

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SUBJECT: EVALUATION OF TWO BEAVER VALLEY 2 NUCLEAR PLANT EQUIPMENT DEGRADATION EVENTS FOR THEIR COMBINED SIGNIFICANCE

SUMMARY

This report evaluates two separately reported Beaver Valley 2 licensee event reports (LERs) to assess their combined safety importance. These LERs involve degradations of the recirculation spray system. The recirculation spray system is an engineered safeguards system that is tested at approximately 18-month (refueling) intervals.

The first LER concerns reduction of the emergency service water (ESW) flow through the heat exchangers of train B of the containment recirculation spray system (Figure 1). The ESW flow reduction was caused by partial blockage of the heat exchangers due to Asiatic clams. The Beaver Valley 2 plant design provides dual function use of the recirculation spray pump trains. Given a loss of coolant accident (LOCA), the containment recirculation system pumps are used for both reactor inventory makeup, and for containment heat removal. The reduced ESW flow could affect the performance of both functions given an accident. The second LER evaluated in this report concerns incorrect operation of the containment recirculation pump start timers. These described problems would degrade the redundancy of the systems available to respond to and mitigate a LOCA.

INTRODUCTION

The events evaluated in this report concern degradation of ESF functions. They specifically concern reduced ESW flow through the recirculation spray pump heat exchangers and incorrect start times for the recirculation spray pumps. The degradations are not revealed during normal plant operations. The recirculation spray system is flow tested at refueling, therefore the problems could have existed for up to 18 months.

DISCUSSION

Event Descriptions

The events of concern in this report are summarized below:

Event 1. LER 412/89-013, event date 04/27/89, "Degraded Recirculation Spray System Heat Exchanger Service Water Flow". A problem was uncovered while performing the "Recirculation Spray Heat Exchanger Flow Test," OST 2.30.13. This test is performed at least once every eighteen months during shutdown as required by technical specification (TS) paragraph 4.6.2.2. The problem reported concerned the partial blockage of service water to the "B" and "D" heat exchangers due to Asiatic clams (See the attached Figure 1). These "B" & "D" heat exchangers are part of the "B" train and were found to have a flow rate of about 8,500 to 9,200 gpm versus the expected 12,000 gpm. The "A" train service water flow through heat exchangers "A" and "C" was found adequate. A factor partially contributing to flow reduction was that the flow orifices in the heat exchangers were sized for 4,995 gpm versus the required 6,000 gpm. The LER also notes that during heat exchanger flushing and retest, the "B" train safeguards air conditioning unit (ACU) indicated less than the 200 gpm specified in the Updated Final Safety Analysis Report.

Event 2. LER 412/89-011, event date 04/22/89, "Recirculation Spray Pumps' Timer Failures". This LER concerns the settings for the recirculation pump start timers. The recirculation pump start timers are checked by the Recirculation Spray Pump Test (2BVT 1.13.5) at least once every 18 months as required by TS paragraph 4.6.2.2. The "B" timer was found out of adjustment due to setpoint drift. The "C" and "D" timers had failed because of excessive motor operating current, defeating the regulating action of the timers' control circuits. The "as-found" versus TS required times follow:

Recirculation spray pump	"As-found" start delay	TS-required spray pump start delay
A	624.5 seconds	623 to 633 seconds
B	644.9 seconds	" "
C	677.5 seconds	" "
D	619.0 seconds	" "

Effect of Degradations on System Operation

The first LER describes a degradation found during refueling outage tests of the Train B recirculation spray system. The degradation involved partial blockage of ESW heat exchangers in the B train due to ingress and growth of Asiatic clams. The clams restricted the ESW cooling water flow through the tube side of the heat exchangers for recirculation pump B and D (see attached simplified sketch).

The Beaver Valley Power Station unit 2 differs somewhat from other pressurized water reactors in that, at some point after LOCA initiation, it utilizes two of the four recirculation spray system pumps to inject recirculated containment sump water into the reactor. The changeover of 2 of the 4 pumps from containment spray recirculation to reactor vessel recirculation is accomplished by reconfiguring valves to redirect the cooling water flow. This dual function of equipment makes the degradations pertinent to both the reactor inventory and containment heat removal functions. The Beaver Valley 2 plant design does not have containment fan coolers to serve as a backup or redundant means of containment heat removal given a LOCA.

The second LER describes recirculation pump train start timer problems. The B pump start timer started 12 seconds later than allowable because of drift. The C and D pump timers could not be adjusted because of timer internal failures and the timers had to be replaced. The LER notes that existing analysis could not verify the operability of the "D" pump for recirculation mode because 619 seconds is currently the minimum time for which NPSH concerns are analyzed.

The plant has four pumps for containment recirculation heat removal. However, only pumps D and C can be configured (through valve positioning changes) to feed sump recirculation water to the reactor vessel either directly or via the charging pumps. As stated above, LER 412/89-011 notes that successful D pump operability could not be assured in the recirculation mode because of NPSH concerns. Therefore successful LOCA mitigation depends on recirculation pump C replenishing reactor vessel water inventory during the recirculation phase of the LOCA.

After the plant has drained the RWST and gone into recirculation mode during the course of a LOCA, the containment sump water is the source of rector makeup and cooling. The sump water is fed by recirculation pump D or C directly to the reactor or to the charging pump inlets for high pressure injection. As noted above, pump D is not available due to NPSH considerations and therefore the reactor vessel inventory function must be provided by pump C which would start 45 seconds late. A primary concern is that the reactor vessel inventory maintenance function was dependant upon a single pump (pump C) for some fraction of the 18 month period between the recirculation system tests. The reliability of this function was accordingly somewhat decreased

due to the reduced redundancy.

Another concern of this analysis related to clams entering in the room cooler of the north safeguards area. LER 412/89-013 notes that the ESW flow to the Air Conditioner Unit (ACU) in the north safeguards area was degraded by Asiatic clam ingression. The north safeguards area contains "B" train safeguards equipment and requires room cooling during equipment operation. A discussion with the licensee indicated that the as found ACU flow rate was 108 gpm vs the 200 gpm specified in the UFSAR. The licensee indicated that an engineering analysis was subsequently performed and showed that room temperature requirement could be met with flow as low as 100 gpm. The licensee indicated that a technical specification change will be initiated to reflect the 100 gpm flow requirement.

CONCLUSIONS

Each of the two LERs separately noted that the system design is such that the degradations described within each LER could be tolerated and the affected system or systems still perform their intended function. However, these events concurrently existed for some period and the degradations are of greater impact when considered together. The LER events analyzed herein could have an adverse impact on the reactor cooling function given a LOCA and on the mitigation of a LOCA by the containment systems.

The corrective actions taken by the licensee appear to have been adequate. These actions included replacing or readjusting recirculation pump start timers as needed, and increasing the monitoring and preventative maintenance on the affected heat exchangers. No further action by AEOD other than monitoring these types of events is required.

Figure 1 - Simplified sketch of Selected Beaver Valley 2 ESF systems