LICENSEE EVENT REPORT (LER)

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TITLE (4)
Spray Pond Pump Flow Greater than Design Basis Calculation

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBERS
									N/A	0 5 0 0 0
1 0	2 1	9 4	9 4	- 0 0 6	- 0 1	0 6	2 8	9 5	N/A	0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL(10)	9 8	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)		
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract		
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	below and in Text, NRC Form		
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	366A)		
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Burton A. Grabo, Supervisor, Nuclear Regulatory Affairs	AREA CODE 6 0 2 3 9 3 - 6 4 9 2

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

At approximately 1305 MST on October 21, 1994, Palo Verde Unit 1 was in Mode 1 (POWER OPERATIONS), when it was identified by Design Engineering personnel (utility, non-licensed) that the actual flow rates on the Unit 1 Spray Pond (SP) pumps may be exceeding design flow rates. This increased flow rate is due to oversized orifices in the Unit 1 SP return lines. The increased flow rate causes higher water losses from the spray ponds. Therefore, inventory may be depleted faster than the design analysis.

Unit 1 has established administrative controls to counter this condition until the correct orifices are installed. The work is being scheduled for the next refueling outage (1R5) in April, 1995. Also, pending Technical Specification (TS) and Updated Final Safety Analysis Report (UFSAR) amendments to reduce the SP inventory from 27 to 26 days may permit lifting some of the administrative controls or provide additional margin.

There have been no previously similar events reported pursuant to 10CFR50.73.

The purpose of this supplement is solely for the inclusion of EIIS codes, updating the status of corrective actions and correction of minor typographical errors

TEXT I. DESCRIPTION OF WHAT OCCURRED:

A. Initial Conditions:

At approximately 1305 MST on October 21, 1994, PVNGS Unit 1 was in Mode 1 (POWER OPERATION) at 98 percent power.

B. Reportable Event Description:

Event Classification: Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded; or that resulted in the nuclear power plant being: In a condition that was outside the design basis of the plant.

At approximately 1305 MST on October 21, 1994, Design Engineering personnel (utility, nonlicensed) identified that the actual flow rates on the Unit 1 Spray Pond (SP)(BS) pumps (P) may be exceeding design flow rates if instrument uncertainties are included. The increased flow rate causes higher water losses from the spray ponds. Therefore, inventory may be depleted faster than the design basis of 27 days. The increased flow rate is due to orifices (OR) in the SP return lines being oversized.

The Ultimate Heat Sink (UHS) at PVNGS is the two SPs. The Essential Spray Pond System (ESPS) consists of pumps, piping and heat exchangers (HX). Water taken from the SPs removes heat from various safety-related components via their heat exchangers and dissipates this heat load to the atmosphere via the spray nozzles. The UHS in conjunction with any one train of the ESPS provides for 100 percent of the heat removal from the reactor core (AC)(RCT), and other auxiliaries required for safe shutdown, during normal, forced, or design basis accident-related shutdowns. The combined inventory of both SPs is required for long term cooldown, that is, post Loss of Coolant Accident (LOCA).

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TEXT

Each return header of the ESPS (two per Unit) is provided with an orifice. The purpose of the orifices is to ensure that the SP pumps operate at their design pressure and flow rate.

To meet the Updated Final Safety Analysis Report's (UFSAR) requirement that the ESPS operate at a higher pressure than the Essential Cooling Water System (ECWS)(BI), the orifices were located downstream of the Essential Cooling Water (EW) heat exchangers. The orifice plates were fabricated, installed under a design change, and the system was tested in September 20, 1983.

Since September 20, 1983, potential opportunities were missed to identify that the wrong-sized orifices were installed in Unit 1. The close-out review of the initial Design Change Package (DCP) did not identify the oversized orifices. Also, Surveillance Testing (ST), performance monitoring and self-assessments on the Design Basis Project for Service Water did not identify the oversized orifices. It was not until October 28, 1993, while replacing leaking orifice gaskets that it was identified that the wrong sized orifices were installed in Unit 1. Based on surveillance test flow data, this condition does not exist in Units 2 and 3.

On October 28, 1993, a 10CFR50.59 evaluation was performed for the identified condition. The evaluation was based on a SP flow rate of 17,950 gallons per minute.(gpm). The evaluation determined that the TS-required volume in the SPs will provide an inventory for 26.2 days versus 27 days as currently stated in the UFSAR. Also, the calculation showed that the large-bore-sized orifices and the reduction of a nominal one day in water inventory will have no significant impact on the originally defined design criteria and safety analysis.

Unit 1 indicated flow rates, plus an allowance for the appropriate instrument uncertainty, may result in an actual flow rate greater than the 17,950 gpm previously used.

TEXT

On October 21, 1994, another 10CFR50.59 evaluation (considering instrument uncertainties) was performed on the Unit 1 SP orifices based on the revised calculation. In this evaluation it was determined that certain administrative controls needed to be put in placed for Unit 1 until that time when the orifices are replaced to conform to the original design. With these administrative controls in place the analysis has shown that the water inventory requirement of 27 days will be satisfied.

There were no component or system failures, nor any structures, systems or components were inoperable at the start of the event that contributed to the event. No safety system activation occurred and none were necessary.

II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

The primary purpose of the orifice plates is to (1) provide adequate backpressure to ensure that the ESPS operates at a higher pressure than the ECWS, (2) ensure that the ESPS flow is adequate from a thermal performance standpoint and (3) limit the ESPS flow to a value such that the water inventory of the UHS is adequate. Per the UFSAR a 27 day water inventory is available for post LOCA cooldown. Currently, License Document Change Requests are in the review cycle to change the 27 days to 26 days in the UFSAR and TS Bases due to the as built ESPS having a higher flow rate than originally assumed in the water supply calculation.

The impact of a larger bore in the orifice on the system function as it pertains to its to date operation is as follows:

(1) A hydraulic analysis of the SP system concluded that, the maximum predicted flow for the ESPS is 16,954 gpm.

The calculation demonstrates that for flows up to this value, the predicted pressures in the ESPS will be higher than the predicted pressures in the ECWS at the EW heat exchanger (this is consistent with the UFSAR). For flows greater than 16,954 gpm the calculation indicates that this criterion (of ESPS operating at a higher pressure than ECWS) should be verified by field measurements. An Engineering Evaluation Request (EER) performed on January 1, 1988, documented (from data collected in the field) that an ESPS to ECWS differential of 12 psi for the A Train and 12.5 psi for the B Train at the EW heat exchanger existed. Therefore, the criterion of maintaining the ESPS at a higher pressure than ECWS has been met even with the larger-bore-sized orifices.

(2) The SP/EW system thermal performance Design Bases Analysis concludes that an ESPS flow of 16,000 gpm is required for safe shutdown after a design basis LOCA. The system hydraulic calculation demonstrates that the minimum predicted flow of any ESPS train will exceed the 16,000 gpm requirement. A larger bore size orifice results in higher flows. Therefore, the minimum flow requirement from a thermal standpoint has been met.

(3) Per Regulatory Guide (RG) 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants", Regulatory Position C.1, The ultimate heat sink should be capable of providing sufficient cooling for at least 30 days.

Furthermore it also states that, "A cooling capacity of less than 30 days may be acceptable if it can be demonstrated that replenishment or use of an alternate water supply can be effected to assure the continuous capability of the sink to perform it's safety functions, taking into account the availability of replenishment equipment and limitations that may be imposed on `freedom of movement' following an accident or the occurrence of severe natural phenomena."

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TEXT

Per earlier UFSAR submittals to the NRC, procedures have been put in place and actions taken to ensure makeup is made available to the UHS prior to the depletion of the available inventory of 27 days to meet the RG 1.27 requirements. These actions/provisions are discussed in Emergency Plan Implementing Procedure (EPIP)-56, Ultimate Heat Sink Emergency Water Supply. One of the provisions is to have a well functional within 15 days from the start of an accident. The NRC in their review (as documented in SER Supplement 3, dated September 1982, Sec. 2.4.4.2) found the actions/provisions acceptable and concluded that Units 1, 2, and 3 meet the guidelines of RG 1.27 and the requirements of General Design Criteria (GDC) 44.

The water losses from an operating spray pond are comprised of four components: (i) evaporation losses (because of the spray action), (ii) drift losses (because of the wind), (iii) surface evaporation losses (losses from the unsprayed area of the pond), and (iv) air to water heat transfer losses (occurring when the air temperature is higher than the water temperature) with (i) and (ii) being the major components. Since the system is operated normally with all valves wide open, a larger-bore-sized orifice results in a higher total system flow. The larger flow in turn results in a higher spray height which results in greater water losses through drift and evaporation depleting the available inventory sooner.

Thus the only system function that has been affected by the incorrect orifices is the available water inventory in the UHS. An evaluation has been conducted using the same methodology previously used in calculations with the following three input exceptions: (i) a Spent Fuel Pool (SFP)(ND) heat load of 9.0 E6 BTU/Hr, which is less than the bounding heat load, but greater than the current heat load, based on the actual SFP inventory, (ii) a SP pump flow of 18,400 gpm versus the original 17,950 gpm and (iii) an initial SP temperature of 89 degrees Fahrenheit (F) versus the previous 97 degrees F have been used in this analysis.

The input exceptions used bound Unit 1 operations to date. As stated earlier, all other inputs to this evaluation are identical to the current design bases analysis and would be collectively more conservative than any maximum actuals experienced.

The results of this evaluation indicate that even with the higher flow rate, the water inventory in the UHS would have always been in excess of 25 days. This inventory would have thus still provided adequate margin between the time that a makeup source would have been made available and the depletion of the SP inventory. The continuous cooling capability as required by RG 1.27 and the safety design bases of the system would have still been met (albeit with a slightly reduced margin) with the higher flows.

The event did not result in any challenges to the fission product barriers or result in any releases of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or the health and safety of the public.

III. CORRECTIVE ACTION:

A. Immediate:

On October 21, 1994, a 10CFR50.59 evaluation was completed and presented to the Plant Review Board (PRB) for review. The 50.59 evaluation placed three administrative restrictions on Unit 1 SP operations. The restrictions are as follows:

- A maximum actual spray pond temperature of 89 degrees F.
- An actual minimum spray pond usable level of 12 feet 5 inches of water in each of the ponds.
- A SFP heat load less than or equal to 9.0 E06 BTU/HR.

With these restrictions in place the calculation has shown that the water inventory requirement of 27 days will be satisfied. Instrument loop uncertainties have been factored into the implementation of these restrictions.

B. Action to Prevent Recurrence:

APS has replaced the SP return line orifice for both Trains A and B, during the fifth refueling outage (1R5) of Unit 1. The fifth refueling outage began on April 1, 1995.

IV. PREVIOUS SIMILAR EVENTS:

There have been no similar events of this type of failure reported pursuant to 10CFR50.73.

V. ADDITIONAL INFORMATION:

Further evaluation indicated that, although the specified maximum flow rate will ensure that the water inventory requirement is satisfied, it will be necessary to impose an additional control of throttling the SP flow rate back to a lower value post LOCA during long-term cooldown to ensure that when the usable inventory in the ponds is depleted, the SP pump Net Positive Suction Head (NPSH) requirements will still be met.

An action to reduce SP system flow to an indicated value of 17,000 gpm has been added to the LOCA emergency operating procedures (EOPs) to ensure that the SP pump NPSH requirements would be met. This action will further ensure the 27 day requirement is maintained.

The above change to the LOCA EOPs will stay in effect for Unit 1 until the new EOP procedures are implemented. The new EOPs are expected to be implemented on June 28, 1995.