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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 91-008-01:on 910816,determined that design basis App R fire in control room could result in loss of RC pump seal cooling due to inadequate original App R evaluations. Continuous fire watch established.W/911023 ltr.

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Arizona Public Service Company
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JAMES M. LEVINE
VICE PRESIDENT
NUCLEAR PRODUCTION

192-00750-JML/TRB/RKR
October 23, 1991

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station P1-37
Washington, D.C. 20555

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 1
Docket No. STN 50-528 (License No. NPF-41)
Licensee Event Report 91-008-01
File: 91-020-404

Attached please find Supplement 1 to Licensee Event Report (LER) 91-008 prepared and submitted pursuant to Technical Specification 6.9.3 and 10CFR50.73. This supplement provides the results of the review to determine if a fire outside the Control Room could also result in the loss of Reactor Coolant Pump seal integrity. In accordance with 10CFR50.73(d), we are forwarding a copy of the LER to the Regional Administrator of the Region V office.

If you have any questions, please contact D. Alan Johnson, Compliance Supervisor, at (602) 393-3703.

Very truly yours,

James M Levine

JML/TRB/RKR/nk

Attachment

cc: W. F. Conway (all with attachment)
J. B. Martin
D. H. Coe
INPO Records Center

IE22
1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Palo Verde Unit 1	0 5 0 0 0 5 2 8	1 OF 0 7

TITLE (4)
RCS Leakage Possibly Exceeding Makeup Due To A Postulated Fire

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 NUMBER(S)
0 8	1 6	9 1	9 1	0 0 8	0 1	1 0	2 3	9 1	Palo Verde Unit 2	0 5 0 0 0 5 2 9
									Palo Verde Unit 3	0 5 0 0 0 5 3 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)	1 0 0	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)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	Technical Specification 6.9.3
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
D. Alan Johnson, Compliance Supervisor	AREA CODE 6 0 2 3 9 3 - 3 7 0 3

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	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)

On August 16, 1991, Palo Verde Units 1 and 3 were in Mode 1 at approximately 100 percent power and Unit 2 was in Mode 1 at approximately 64 percent power (until a reactor trip occurred at approximately 0839 MST: Reference LER 529/91-004) when APS engineering personnel determined that a design basis Appendix R fire in the Control Room could result in loss of Reactor Coolant Pump seal cooling. The loss of RCP seal cooling could result in RCP seal damage which may result in Reactor Coolant System leakage in excess of available charging. Upon discovery of this potential event, appropriate compensatory measures were established in accordance with the PVNGS Fire Protection Program. Subsequently, APS engineering determined that a fire outside the Control Room could also result in the loss of RCP seal integrity.

The cause of this postulated event was a failure of the original Appendix R evaluations to recognize the potential for RCP seal leakage greater than the makeup capacity of one charging pump (44 gallons per minute) due to a Control Room fire .

No previous similar events have been reported pursuant to Technical Specification 6.9.3 and 10CFR50.73.

I. DESCRIPTION OF WHAT OCCURRED:

A. Initial Conditions:

On August 16, 1991, Palo Verde Units 1 and 3 were in Mode 1 (POWER OPERATION) at approximately 100 percent power and Unit 2 was in Mode 1 at approximately 64 percent power (until a reactor trip occurred at approximately 0839 MST: Reference LER 529/91-004).

B. Reportable Event Description (Including Dates and Approximate Times of Major Occurrences):

Event Classification: Violation of the requirements of the Fire Protection Program which would have adversely affected the ability to achieve and maintain safe shutdown in the event of a fire (Technical Specification 6.9.3).

On August 16, 1991, APS engineering personnel (utility, non-licensed) determined that a design basis Appendix R fire in the Control Room (NA) could result in loss of Reactor Coolant Pump (RCP)(P)(AB) seal cooling. The loss of RCP seal cooling could result in RCP seal damage which may result in Reactor Coolant System (RCS)(SB) leakage in excess of assumed available charging capabilities. Upon discovery of this potential event, interim compensatory measures were established in accordance with the PVNGS Fire Protection Program. On September 27, 1991, APS engineering completed an evaluation of fires outside the Control Room and determined that fires outside the Control Room could also result in the loss of RCP seal integrity.

Each of the four (4) RCPs in each unit has a shaft seal assembly which acts as a pressure boundary between the RCS and Containment (NH) while minimizing leakage along the pump shaft. The seal assembly consists of three (3) tandem mechanical pressure reduction seals and an auxiliary impeller. Each of the mechanical seals consists of a rotating carbon ring and a stationary Tungsten carbide ring. Seal integrity is maintained using seal injection and seal cooling. Seal injection water is supplied at a controlled temperature from the charging pumps (P)(CB). RCP seal cooling water is circulated by the auxiliary impeller through an external heat exchanger (HX)(CC) which is cooled by the Nuclear Cooling Water System (CC). Seal injection bleedoff is returned to the Chemical and Volume Control System (CB) via a fail closed isolation valve (ISV)(CB). A relief valve with a normally open, fail open isolation valve on the seal injection bleedoff header

inside containment provides an alternate bleedoff path to the Reactor Drain Tank (TK)(CA).

Prior to the discovery of this postulated event, an Engineering Evaluation Request (EER) was initiated on August 30, 1990, requesting a reevaluation of the existing Appendix R fire analysis on the need to have RCP seal bleedoff isolated assuming that seal injection and the Nuclear Cooling Water System were unavailable during a fire (RCP seal bleedoff isolation would minimize the amount of high temperature RCS leaking through the seals and consequent thermal transient). The initial engineering assessment concluded that the EER did not require an expedited disposition because:

1. The original Appendix R evaluation performed by Combustion Engineering (CE), Bechtel, and APS included an evaluation of spurious actuations of components in the seal bleedoff flowpath if a fire were to occur.

2. Plant transients at PVNGS have exposed the RCP seals to the conditions similar to that postulated in the EER for significant periods of time without significant loss of seal integrity.

Based upon this evaluation, the EER received a "normal" priority and other higher priority emergent work was performed.

A contract was executed with CE in July 1991, to perform the evaluation of this EER. CE evaluated the EER concurrent with the draft resolution of NRC Generic Issue 23, "RCP Seal Failure" being issued and determined that a design basis Appendix R fire in the Control Room could result in the loss of RCP seal injection, the inability to secure seal bleedoff, and the loss of Nuclear Cooling Water (as a result of a loss of off-site power). If this situation were to occur seal degradation could potentially result in RCS leakage greater than the capacity of the available charging pump. APS engineering confirmed CE's findings and notified appropriate plant management on August 16, 1991. Interim compensatory measures have been established and will continue until long term compensatory measures can be developed and implemented.

C. Status of structures, systems, or components that were inoperable at the start of the event that contributed to the event:

Not applicable - no structures, systems, or components were inoperable at the start of the event which contributed to this event.

D. Cause of each component or system failure, if known:

Not applicable - no component or system failures were involved.

E. Failure mode, mechanism, and effect of each failed component, if known:

Not applicable - no component failures were involved.

F. For failures of components with multiple functions, list of systems or secondary functions that were also affected:

Not applicable - no component failures were involved.

G. For a failure that rendered a train of a safety system inoperable, estimated time elapsed from the discovery of the failure until the train was returned to service:

Not applicable - no failures were involved which rendered a train of a safety system inoperable.

H. Method of discovery of each component or system failure or procedural error:

Not applicable - there have been no component or system failures or procedural errors identified.

I. Cause of event:

The cause of this postulated event was a failure of the original Appendix R evaluations to recognize the potential for RCP seal leakage greater than the makeup capacity of available charging [44 gallons per minute (gpm)] due to a fire (SALP Cause Code B: Design Error). Prior to licensing of Unit 1 during mid 1984, CE, Bechtel, and APS evaluated and identified equipment necessary to safely shutdown the plant during postulated fires. This evaluation did not include provisions for establishing seal injection or isolating seal bleedoff in the event of a fire. CE, Bechtel, and APS did not recognize the potential for RCP seal

leakage greater than the make-up capacity of available charging. Subsequent to this evaluation, the possibility of significant RCP seal leakage resulting from off-normal conditions has been identified as an industry concern and is being addressed by NRC Generic Issue 23.

J. Safety System Response:

Not applicable - there were no safety system responses and none were required.

K. Failed Component Information:

Not applicable - there were no component failures involved.

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

The PVNGS Fire Protection Program assures that safe shutdown can be achieved and maintained in the event of a fire. To assure that safe shutdown conditions can be achieved and maintained for a fire in the Control Room, procedures are in place and fire protection features are designed to use selected Train "B" components for safe shutdown activities. To assure that safe shutdown conditions can be achieved and maintained for a fire outside the Control Room, the Pre-fire Strategies Manual has been developed to provide recommended actions necessary for safe shutdown activities.

In general, to maintain RCP seal integrity it is necessary to: maintain seal injection, or isolate seal bleedoff and maintain seal cooling. If a fire were to occur in the Control Room, the Train "B" charging pump should be available for seal injection. Depending on the location of the fire outside the Control Room, one (1) or more charging pumps should be available for seal injection. However, spurious isolation of one or more valves in the seal injection flowpath could isolate seal injection. Control Room personnel would isolate seal bleedoff if conditions permit. However, spurious actuations may result in the bleedoff valves reopening. The assumed loss of off-site power concurrent with the fire would cause a loss of power to the non-safety related Nuclear Cooling Water System and the resultant loss of seal cooling. Depending on plant conditions, one or more of these three functions should be maintained to ensure no RCP seal degradation occurs.

If an event were to occur resulting in the degraded conditions described above, it is postulated that RCP seal degradation could occur which would exceed the makeup capacity of the charging pump. No testing has been performed to determine the approximate length of time the RCP seals can withstand these degraded conditions without exceeding available charging capability (44 gpm).

However, APS experience indicates that sufficient time is available to restore seal cooling without significant seal degradation. For example on March 3, 1989, an event occurred in Unit 3 where seal injection and nuclear cooling water were secured and seal bleedoff was not isolated on the four (4) RCPs for approximately one hour and nine minutes. The seals were exposed to normal operating temperature and pressure and seal leakage increased on the 1B RCP only and by approximately 1.2 gpm. Subsequent seal inspection revealed that one of the three seal stages was significantly damaged; however, the damage to the other two stages was minor. The other three RCPs experienced no apparent increase in seal leakage.

III. CORRECTIVE ACTION:

A. Immediate:

A continuous fire watch was established in the Control Room as an interim compensatory measure after APS engineering confirmed the results of CE's analysis. The continuous fire watch was discontinued on October 11, 1991, after long term actions for a Control Room fire had been developed and implemented in accordance with the APS Incident Investigation Program.

An hourly fire watch has been established for the affected areas outside the Control Room as an interim compensatory measure after APS engineering determined that fires outside the Control Room could also result in loss of RCP seal integrity. The hourly fire watch will remain in effect until the actions described in Section III.B.3 are implemented.

B. Action to Prevent Recurrence:

Prior to the discovery of the event postulated in this LER, APS Engineering initiated an Appendix R Revalidation Project which consists of an in-depth review of the existing safe shutdown analysis. The project involves validating the existing shutdown logic, verifying that the appropriate components are on the safe shutdown equipment list, verifying safe shutdown component circuits, reviewing spurious actuation concerns, verifying

separation compliance, verifying access/egress paths for operator actions (which includes verification of adequate manpower), making design basis document changes, and initiating plant changes where necessary. This is a full scope revalidation effort which is expected to be completed by the end of 1992. The revalidation effort will identify if other situations exist where errors were made in original assumptions.

APS engineering has also determined that a fire outside the Control Room could result in loss of RCP seal integrity as described above. APS engineering and Plant Management have reviewed the effects of a fire inside or outside the Control Room. Based on this review, the following actions have been developed to ensure that a fire, whether inside or outside the Control Room, will not cause a significant loss of RCP seal integrity as described in Section I.B.

1. The procedures for shutdown outside the Control Room due to a fire inside the Control Room have been revised to ensure RCP seal integrity is maintained as described in Section II.

2. The breakers supplying power to specific non-safety related motor operated valves in containment which could spuriously close due to a Control Room fire and isolate seal injection have been locked open to prevent spurious closure.

3. The Pre-fire Strategies Manual is being revised to include the actions necessary to ensure RCP seal integrity is maintained during a fire outside the Control Room. This revision is expected to be issued by December 31, 1991.

IV. PREVIOUS SIMILAR EVENTS:

No previous similar events have been reported pursuant to Technical Specification 6.9.3 and 10CFR50.73.