



A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

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102-05567-CE/SAB/JAP/DJS
September 20, 2006

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
License No. NPF 51
Licensee Event Report 2006-003-00**

Attached please find Licensee Event Report (LER) 50-529/2006-003-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports an automatic reactor trip on variable overpower during restoration of an out of service main turbine control valve.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the NRC Regional Office, NRC Region IV and the Senior Resident Inspector. If you have questions regarding this submittal, please contact James A. Proctor, Section Leader, Regulatory Affairs, at (623) 393-5730.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

CE/SAB/JAP/DJS/gt

Attachment

cc: B. S. Mallett NRC Region IV Regional Administrator
M. B. Fields NRC NRR Project Manager - (send electronic and paper)
G. G. Warnick NRC Senior Resident Inspector for PVNGS

JE22

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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4. TITLE
Unit 2 Variable Overpower Reactor Trip During Main Turbine Control Valve Restoration

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	26	2006	2006	- 003 -	00	09	20	2006	None	05000
									FACILITY NAME	DOCKET NUMBER
									None	05000

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)										
	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)							
10. POWER LEVEL 90	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(vii)(A)							
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)							
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)							
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)							
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)							
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)							
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER								
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A								

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME James A. Proctor, Section Leader, Regulatory Affairs - Compliance	TELEPHONE NUMBER (Include Area Code) 623 393 5730
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED <input checked="" type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE MONTH: 11, DAY: 22, YEAR: 2006
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 26, 2006 at approximately 07:33 Mountain Standard Time (MST), Unit 2 was in Mode 1, Power Operation, at approximately 90 percent rated thermal power with main turbine control valve #2 (CV#2) closed to complete maintenance on its position transducer and linkage arm. A jumper installed in the test button circuit kept CV#2 closed during the maintenance. After removal of the jumper and CV#2 from "test", the valve was allowed to re-open resulting in a series of control system responses causing reactor power to increase rapidly. The reactor tripped on core protection calculator high variable overpower at approximately 98 percent power, approximately 18 seconds after removing CV#2 from "test". No other safety system actuations occurred and none were required.

The preliminary root cause of the event was implementation of an inadequate action plan for corrective maintenance which did not accommodate for the build up of condensate in the isolated main turbine piping associated with CV#2. This occurred due to a belief that the maintenance evolution was equivalent to control valve testing. Development of corrective actions is pending.

A similar trip event caused by a main turbine upset occurred on June 7, 2004 in Unit 3, when a main turbine electro-hydraulic system malfunction caused main turbine control and intercept valves to close, resulting in a reactor trip.

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

All times in this report are approximate and Mountain Standard Time (MST) unless otherwise noted.

1. REPORTING REQUIREMENT(S):

This LER (50-529/2006-003-00) is being submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A), to report a reactor protection system (RPS) (EIS: JC) initiated reactor trip, while critical on July 26, 2006 at 07:33.

On July 26, 2006 at 11:20, APS made notification of the event to the Nuclear Regulatory Commission (NRC) via the emergency notification system (ENS# 42730).

2. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The main turbine (EIS: TA) is equipped with an electro-hydraulic control (EHC) system that combines electronics and high-pressure hydraulics (EIS: TG) to control steam flow through the turbine via main turbine stop and control valves. The flow of the main steam entering the high-pressure turbine is controlled by four stop valves and four governing control valves. The function of the stop valves is to shut off the flow of steam to the turbine when required, so they are either fully open or fully closed. The function of the control valves is to regulate steam flow as directed by the EHC load control unit. The control valves are operated in full arc emission mode, with each of the four valves throttled an equal amount to achieve load control. The control valves each have a control loop consisting of electronic circuitry, an electro-hydraulic servo valve, a hydraulic actuator and a linear position transducer. By use of valve position feedback control, the control valves are positioned according to the flow demand signal from the EHC load control unit, the standby control unit, or directly from the control panel during monthly valve testing.

During monthly control valve testing, each control valve is stroked from its normal approximate 40 percent open position to full closed by depressing the test button. The valve is then immediately restored to its original position as dictated by turbine load by releasing the test button. During the test, a control signal modulates the remaining three control valves as necessary to regulate main turbine first stage pressure (MTFSP). By minimizing changes in MTFSP, any turbine load swings are minimized. The resulting plant transient during the test is minimal.

The steam bypass control system (SBCS) (EIS: JI) controls the positioning of the turbine bypass valves, through which steam is bypassed around the turbine into the unit condenser, with exception of two valves which dump steam to atmosphere. These two valves are the last to open and first to close during steam bypass operation. The system is designed to accommodate large load

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rejections by sensing rapid decreases in steam flow and turbine first stage pressure (turbine load index) to quickly open steam bypass control valves, based on the magnitude of the load rejection.

The core protection calculator (CPC) (EISS Code: JC) consists of four independent channels which generate low departure from nuclear boiling ratio (DNBR) and high local power density (LPD) reactor trip signals using two out of four coincidence logic, or two out of three, if one channel is bypassed. The CPC also provides auxiliary trips; among them, a variable overpower trip (VOPT) signal to trip the reactor when reactor power either increases at a great enough rate, or reaches a preset value. Under steady state conditions the trip setpoint will stay above the neutron power level signal by a preset value of \leq 8.0 percent rated thermal power (RTP). When power increases or decreases the setpoint will track power by a fixed amount defined by a band function. The band function automatically adjusts the trip setpoint with increasing reactor power at maximum increasing tracking rate of less than or equal to 1 percent RTP per minute. Should reactor power increase at too rapid a rate, it will catch up with the more slowly increasing trip setpoint and cause a trip. The setpoint will also track during power reductions with a rate of decrease of \leq 16.67 percent RTP per second. The VOPT circuit also includes a maximum trip setpoint that causes a trip if power reaches an allowable value of 110 percent RTP.

3. INITIAL PLANT CONDITIONS:

On June 26, 2006, at approximately 07:33, Palo Verde Unit 2 was in Mode 1 (POWER OPERATION), operating at approximately 90 percent power. Main Turbine control valve #2 (CV #2) (EISS – TG) was closed to perform corrective maintenance on its failed position transducer and linkage arm. A jumper was installed on the test push button circuitry to keep CV#2 closed during the maintenance. No major structures, systems, or components were inoperable at the start of the event that contributed to the event.

Condensate accumulated in the isolated steam line of CV#2 because no condensate drain path was provided during the four hours CV#2 was closed for maintenance.

4. EVENT DESCRIPTION:

On June 26, 2006 at 07:33, following completion of maintenance, the reactor operator (RO) (utility – licensed) depressed the CV#2 test button to hold the valve closed to allow removal of the jumper. An instrumentation and control technician (utility – non-licensed) removed the jumper after which the RO released the CV#2 test button to allow the valve to open. CV#2 opened and then modulated closed along with control valves #1, #3, and #4 as directed by the turbine controls. When CV#2 opened, indicated MTFSP increased rapidly from 625 psig to 695 psig. This spike was

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the result of the wet steam passing through the turbine and was not indicative of an actual turbine load increase. Turbine load actually decreased, as evidenced by a generator megawatt output decrease as all four valves modulated closed. All four control valves stabilized at approximately 30 percent open within approximately 5 seconds.

The passing of the volume of wet steam combined with the control valves modulating closed then caused MTFSP to drop fast enough to cause the rate of change of turbine load index to initiate a Steam Bypass Control System (SBCS) Quick Open X2 relay actuation. The closure of the control valves resulted in a large drop in steam flow (~44 percent decrease). This rapid reduction in steam flow was large enough to actuate the SBCS Quick Open X1 relay. With both Quick Open X1 and X2 relays actuated, a Quick Open Group X was briefly generated and SBCS Valves 1, 4, and 6 responded by opening quickly then modulating closed. The quick opening of the Group X SBCS valves resulted in a large increase in steam flow that caused a drop in RCS temperature of 5 degrees. Indicated power had initially dropped from 90 percent to 88 percent, then due to negative Moderator Temperature Coefficient (MTC) it quickly increased to 98 percent. This power, as measured by excore neutron instruments, (EIS - IG) increased faster than the CPC VOPT band setpoint, and caused the VOPT trip at 98 percent on the CPC. This resulted in an automatic reactor trip (RPS actuation) and insertion of all control element assemblies (CEA's) (EIS - AA). No engineered safety feature (ESF) actuations occurred nor were any required. All safety systems functioned as required.

The SBCS system operated to maintain steam generator and reactor coolant system (RCS) heat removal. Pressurizer level and pressure control systems (EIS: AB) operated to maintain level and pressure. The main turbine EHC and SBCS responded per design during the event.

The control room supervisor (CRS) (utility - licensed) and ROs completed standard post trip actions and entered emergency operating procedure 40EP-9EO02, Reactor Trip. The CRS determined no emergency classification was required and diagnosed the event as an uncomplicated reactor trip.

Off site power remained available throughout the event as did normal heat removal through the condenser. The NRC operations center was called and notified of the event at 11:20 (reference ENS 42730).

Operators stabilized the plant in Mode 3, Hot Standby, at normal operating temperature and pressure.

The event did not occur as the result of a failed or degraded system, structure, or component. The restored control valve (CV#2) and its related systems responded as designed during the event.

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5. ASSESSMENT OF SAFETY CONSEQUENCES:

The plant remained within safety limits throughout the event. The primary system and secondary pressure boundary limits were not approached and no violations of the specified acceptable fuel design limits (SAFDL) occurred. No ESF actuations occurred and none were required. There were no inoperable structures, systems, or components at the time of the event that contributed to the event.

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

The condition would not have prevented the fulfillment of any safety function and did not result in a safety system functional failure as defined by 10CFR50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

The event causes are preliminary. If substantial changes occur, they will be provided in a supplement to this LER.

The direct cause of the reactor trip was a secondary plant transient resulting from a rapid increase of indicated turbine first stage pressure upon admission of a volume of wet steam as CV#2 opened. The condensate in the steam accumulated in the main turbine piping associated with CV#2 during the maintenance because no drain path was provided.

The root cause of the event was implementation of an inadequate action plan for corrective maintenance which did not accommodate for the build up of condensate in the isolated main turbine piping. This occurred due to a belief that the maintenance evolution was equivalent to control valve testing.

Previous success in completing on-line repairs to control valves led to a belief that use of the control valve test function would be successful in returning the valve to service. However, there were significant differences between the two prior repairs and the July 2006 Unit 2 repair as indicated below:

In 1993, a Unit 3 main turbine CV#4 on-line repair was accomplished using the test function and jumper installation to close, hold, and restore the control valve for similar repairs. However, the Unit 3 turbine at that time operated in the partial arc admission with drain valves (EISS – TF) that

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opened automatically when ever the control valves closed. Since then, turbine controls were changed to full arc admission and the respective drain valves automatically open only upon turbine trip.

A 1993 on-line repair was made to Unit 1 CV#1 which would not fully close during a CV test. Because the on-line repair was completed with CV#1 in the open position, steam flow through the pipe prevented moisture accumulation.

7. CORRECTIVE ACTIONS:

Development of corrective actions is pending. A supplement to this LER will be provided when these are determined.

8. PREVIOUS SIMILAR EVENTS:

Arizona Public Service reported a previous event caused by a main turbine control system upset which occurred on June 7, 2004 in Unit 3. A main turbine EHC system malfunction caused main turbine control and intercept valves to close, resulting in a reactor trip on LO DNBR, LER 50-530/2004-002-01. The event was similar because the event started with a main turbine control system response. The causes were dissimilar because the prior event was the result of EHC component failure and overly conservative factors applied to the CPC which have been corrected. No other similar event has been reported to the NRC within the last three years caused by main turbine control system response.