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LEVINE,J.M. Arizona Public Service Co. (formerly Arizona Nuclear Power
RECIP.NAME RECIPIENT AFFILIATION
MARTIN,J.B. Region 5 (Post 820201)

SUBJECT: RO:on 910619,inadvertent containment spray actuation occurred during performance of plant protection sys functional test.Incident investigation initiated.Verified proper ESF actuation & conducted physical insp.

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NOTES:Standardized plant. 05000530

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JAMES M. LEVINE
VICE PRESIDENT
NUCLEAR PRODUCTION

102-02047-JML/TRB/KR
June 28, 1991

Mr. J. B. Martin, Regional Administrator
U. S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Reference: Conversation between P. Johnson, NRC and J. M. Levine, APS on June 21, 1991

Dear Sir:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530 (License No. NPF-74)
Actions Following Inadvertent Containment Spray Actuation
File: 91-070-026

Pursuant to discussions between Arizona Public Service (APS) and NRC staff members, this letter is submitted to summarize actions taken by APS following an inadvertent actuation of the containment spray system.

EVENT SUMMARY

On June 19, 1991, Palo Verde Unit 3 experienced an inadvertent containment spray actuation during the performance of a plant protection system functional test required by the Technical Specifications. As a result, approximately 5000 gallons of borated water were discharged into containment during full power operation. In response to the event and in accordance with procedures, Control Room personnel secured the containment spray pumps terminating the containment spray flow, manually tripped the reactor, and secured all four reactor coolant pumps. The plant was stabilized in Mode 3 (HOT STANDBY). Reactor heat removal was accomplished by means of natural circulation in the reactor coolant system.

APS immediately initiated inspection and testing activities within containment to determine if the spray had adversely affected the operation of the reactor coolant pumps. Following visual inspection, satisfactory results from electrical meggar testing, and restart of one reactor coolant pump, forced circulation in the reactor coolant system was restored. An integrated investigation was initiated in accordance with the Incident Investigation Program to determine root cause(s) and necessary corrective actions.

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In order to facilitate subsequent troubleshooting, inspections and testing activities, APS initiated a cooldown to Mode 5 (COLD SHUTDOWN). These efforts demonstrated that no systems or components within containment were found to be adversely affected by the spray. Inspection and evaluation results of the consequences of the event on systems and components are summarized in Attachment 1. There have been no previous similar events at Palo Verde.

DISCUSSION

Based on an assessment of plant conditions, the duration of the containment spray, subsequent inspections and testing, and an evaluation of similar industry events, APS has determined that the borated water sprayed in containment did not have any immediate, adverse effects on safety-related systems or components within containment. Although long term adverse effects are not expected, APS will take continuing action to identify adverse conditions should any develop as a result of this event. A Licensee Event Report will be submitted within 30 days of the event in accordance with 10CFR50.73 which will provide further details concerning the cause of the event.

IMMEDIATE ACTIONS

Subsequent to stabilizing the plant in Mode 3, the following actions and evaluations were performed:

- Verification of proper Engineered Safety Feature actuation.
- Physical inspection of accessible areas inside containment to determine the wetted areas.
- Assessment of the plant conditions and development of an action plan to fully evaluate the consequences of the event on plant systems and components.

SUBSEQUENT ACTIONS

APS initiated an investigation in accordance with the PVNGS Incident Investigation Program to determine root cause(s) and necessary corrective actions. As part of that investigation, Engineering was requested to evaluate the consequences of the event on systems and components. The results are summarized in Attachment 1.

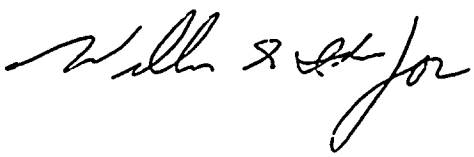
Additional follow-up actions identified as a result of this evaluation that will be performed by APS are included in Attachment 2.

CONCLUSION

Based on plant performance and inspections and testing activity results, APS concludes that there were no adverse effects of the containment spray on safety-related systems and components. The actions described in this letter complete our response to the event. Additional monitoring for long term effects will be performed.

If you have any questions or comments concerning this event and our follow-up activities, please contact me.

Very truly yours,



JML/TRB/KR

cc: W. F. Conway (all with attachments)
D. H. Coe
A. H. Gutterman
A. C. Gehr
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Attachment 1

APS has conducted an evaluation of the consequences of the inadvertent containment spray event on systems and components in containment. The evaluation results of the consequences of the event on systems and components are summarized in this attachment.

As a result of the inadvertent containment spray event that occurred at San Onofre Nuclear Generating Station, Unit 2, on November 20, 1990, the NRC staff performed a review (Safety Evaluation) of the inadvertent containment spray events at commercial nuclear power plants to determine the appropriate course of action for licensees to take following an event of this nature. The APS engineering evaluation incorporated the NRC's recommendations for an appropriate course of action and included, as a minimum, the elements and considerations listed in the NRC Safety Evaluation. A copy of the detailed engineering evaluation is available at APS for NRC review. The results of the evaluation are summarized below.

1. Personnel Hazards.

No personnel hazards have been identified as a result of this event. APS has concluded that PVNGS industrial and radiological safe work practices are sufficient to minimize the risk of injury. The levels of boric acid or hydrazine present in the containment atmosphere or the containment spray water pose no significant personnel health hazard.

2. Duration of the Event and the Amount of Water Sprayed.

The containment spray pumps operated for approximately 60 seconds. Two methods were used to determine the amount of borated water sprayed into containment: (1) calculation based on system design parameters and (2) estimation based on sump level increase. The calculation method assumed full design pump flow was achieved for 60 seconds and subsequent gravity feed flow from the refueling water tank for an additional five (5) minutes. The calculation method conservatively established an upper bound of 17,280 gallons of containment spray flow into containment. The estimation method accounted for a small amount of water accumulation on surfaces within containment, 340 gallons of water volume added to the containment atmosphere based on atmospheric data and psychrometric chart calculations, and 3900 gallons of water determined to be drained from the containment sumps. The estimation method establishes a lower bound of 5000 gallons of containment spray flow into containment. Based on the facts that 1) the estimated amount is bounded by the calculated upper limit, and 2) small variations in the system design based assumptions could greatly reduce the upper bound of the maximum spray flow, APS believes that the lower bound of 5000 gallons of containment spray flow into containment can be used with reasonable accuracy.

3. Containment Type and Configuration of Systems and Components Located Inside Containment.

Palo Verde uses a pre-stressed concrete containment structure with a 0.25 inch carbon steel welded liner plate attached to the inner walls of containment to minimize radioactive releases. The design of the PVNGS containment structure is such that no significant adverse consequences from a containment spray event would be anticipated. A full description of the containment structure is in the Updated Final Safety Analysis Report (UFSAR) 3.8.1 and 3.8.3.

A detailed listing of components located within containment has been developed. A description of the containment spray system, the containment heating, ventilation and air conditioning system, and the reactor coolant system leakage monitoring systems can be found in UFSAR 6.2.2 and 6.5.2, in UFSAR 9.4.6, and in UFSAR 1.8 and 5.2.5, respectively.

4. Appearance of Accessible Areas of Containment.

A detailed walkdown of containment was initiated approximately one hour and thirty (30) minutes after securing the containment spray pumps. No major equipment wetting was observed. Some standing water was found on the floor. A subsequent walkdown was performed to inspect electrical junction boxes and penetrations which may have been inadvertently wetted. The electrical boxes which had evidence of wetting were opened, however, no evidence of moisture intrusion was found. Electrical penetrations identified to have possible discrepancies (i.e., missing screws) were opened, however, no evidence of moisture intrusion was found.

5. Control Room Indication and Annunciation.

Control room indications and annunciations functioned as expected for an inadvertant containment spray actuation. No abnormal alarms or indications were received that were the result of wetted conditions. There were no indications of grounding.

6. Operability of Safety-Related Equipment and Compliance with Technical Specification Requirements.

The Unit 3 Technical Specifications (TS) do not specifically require the initiation of a shutdown following a containment spray event. No significant impact on Limiting Conditions of Operation (LCOs) that may be directly affected following a containment spray event were identified

by this review. The following TS systems, components and LCOs were included in the review:

Refueling water tank level, reactor cavity sump level, containment temperature and humidity, trisodium phosphate baskets, recirculation sumps level, reactor vessel water intrusion, boric acid walkdown components, polar crane, containment spray nozzles, low pressure safety injection and high pressure safety injection pumps, reactor coolant pumps, and thermo-lag fire-proofing applications.

The ability to satisfy operational reactor coolant system leakage surveillance requirements was impacted immediately following the event due to increasing radwaste sump levels.

Within approximately 60 seconds, Control Room personnel terminated the containment spray flow by securing the containment spray pumps in accordance with procedure. This action also results in both trains of containment spray being inoperable and entry into TS 3.0.3. Upon receipt of reactor coolant pump low nuclear cooling water flow alarms caused by the actuation of the containment spray system, the nuclear cooling containment isolation valves were overridden and opened in accordance with an abnormal operating procedure. This action results in both containment isolation valves located in the same containment penetration to be open and entry into TS 3.0.3.

Appropriate actions were taken to restore the components to the configurations required by the TS LCOs and TS 3.0.3 was exited within approximately twenty (20) minutes.

7. <u>Operability of Nonsafety-Related Equipment and Electrical Interaction Considerations.</u>

The operability of nonsafety-related and safety-related equipment not included in the 10CFR50.49 Qualification Program has been reviewed and found to be acceptable. Equipment in containment was reviewed for adverse impact resulting from the containment spray. The determination was based on the amount of water sprayed, duration of the spray, the area sprayed, equipment walkdown reports, consequences of equipment failures, and the equipment design basis features and functions. Selected equipment located in the sprayed areas was examined to determine the extent of wetting. Based on observations, selected equipment was opened because of wetting and possible water entry. No water damage was observed. The following equipment walkdowns were performed to support the operability determination:

- Mechanical equipment (i.e., air and motor operated valves, pressure valves, pumps, cooling and ventilation systems, tanks, insulation, etc.),

- electrical equipment (i.e., cables, junction and terminal boxes, molded case circuit breakers, motors, pressurizer heaters, etc.),
- fire detection equipment, and
- instrument and control equipment (i.e., radiation detectors, transmitters, switches, pressure regulators, indicators, etc.).

8. Containment Spray System Status and Boron Precipitation Considerations.

The containment spray system was restored to its pre-actuation status. The system piping and component materials are compatible with the chemical solutions (boric acid and hydrazine) present, therefore no equipment degradation resulting from the event is expected. In addition, the containment spray nozzles are of the nonclogging type and are not adversely impacted by boric acid residue. No adverse effects on the containment spray system were identified or expected due to the spray initiation.

9. Status of Snubbers and Long Term Effects.

Following the event, approximately 95 percent of the snubbers located in the wetted areas were visually inspected for signs of degradation. Trace amounts of boric acid residue was present on the external surfaces. Indications were that the snubbers had been subjected to a short spray duration and therefore no long term adverse operational effects are anticipated from this event. However, a long term action identified as a result of this evaluation is included in Attachment 2.

10. Status of Equipment Qualification and Long Term Effects.

A list of electrical and mechanical equipment in containment and within the scope of the Equipment Qualification program was reviewed to assess whether qualification may have been adversely affected by the containment spray event. A review was performed to determine whether the type-test included containment spray exposure. A few electrical items, such as the reactor coolant pump shaft speed sensing system, the excore detector assembly, including preamplifier and filter, and certain Rosemount transmitters had not been previously type-tested for containment spray conditions. Subsequent inspections revealed that none of this electrical equipment was sprayed. In addition, internal inspection of a random sample of junction boxes in the wetted areas was performed to ensure that water had not entered the unsealed conduit system and collected above qualified environmental equipment seals. No moisture intrusion in the junction boxes was found. Mechanical equipment is not subject to the same failure modes (e.g., grounds) as electrical, when subject to containment spray. The likelihood of significant water intrusion during this event is considered small, since

the duration of the spray was short, and the containment pressure did not increase to provide a driving force for moisture intrusion.

11. Status of Materials and Long Term Effects (i.e., accelerated corrosion of carbon steel, thermal shock, etc.).

An inspection of the plant materials or components susceptible to accelerated corrosion revealed the following conditions within containment:

1. The hydrazine concentration in containment was too diluted to significantly impact the corrosion rate and, considering the compatibility of hydrazine with plant components, the amount of hydrazine introduced into containment would not adversely impact these components.

2. Boric acid did not concentrate in sufficient quantities to cause accelerated corrosion on carbon steel components.

Based on the above, long term adverse effects of the containment spray on materials or components are not expected. As discussed in Attachment 2, APS will take continuing action to identify adverse conditions should any develop as a result of this event.

12. Development of Short Term and Long Term Inspection, Testing, and Surveillance Programs.

The short term inspection, testing, and surveillance programs have been described in this attachment. Long term actions identified as a result of this evaluation are included in Attachment 2. In addition, the systems and components which may have been affected by the containment spray are continuously or periodically monitored under existing PVNGS maintenance and surveillance programs.

13. Previous Industry Experience.

A review of industry experience related to containment spray events was performed to ensure that appropriate inspections, testing, and corrective actions recommended by other licensees, INPO, or the NRC were incorporated into APS's action plan. As a result of the recent inadvertent containment spray event that occurred at San Onofre Nuclear Generating Station, Unit 2, on November 20, 1990, information was readily available from several sources and was expeditiously reviewed for applicability to the PVNGS event.

Attachment 2

The following actions to be performed by APS have been identified as a result of the engineering evaluation of the consequences of the inadvertent containment spray event on systems and components in containment:

1. During the next refueling outage, following removal of the reactor head and associated insulation, the reactor head will be inspected for evidence of boric acid residue to determine if any water seeped under the insulation, and to determine if insulation removal is warranted.

2. Prior to use of the polar crane during the next refueling outage, the cables and drums will be wiped free of boric acid residue.

3. As a long term action, the physical orientation of mechanical snubbers in the identified wetted areas will be reviewed. Based upon the results of this review, snubbers found susceptible to internal condensation will be tested and an independent assessment will be made.

Although long term adverse effects are not expected, APS will continue to be active in identifying adverse conditions should any develop as a result of this event, in particular, any indications of systems or components that may become grounded.