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STN-50-530 Palo Verde Nuclear Station, Unit 3, Arizona Publi 05000530
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SUBJECT: Responds to Generic Ltr 88-17 re loss of DHR.Encl contains several programmed enhancement items.

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TITLE: OR/Licensing Submittal: Loss of Residual Heat Removal (RHR) GL-87-12

NOTES:Standardized plant. 05000528
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161-01597-DBK/BJA
January 6, 1989

Docket Nos. STN 50-528/529/530

Document Control Desk
U.S. Nuclear Regulatory Commission
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References: 1. Letter from Dennis M. Crutchfield, NRC, to All Holders of Operating Licenses or Construction Permits for PWRs dated October 17, 1988. Subject: Loss of Decay Heat Removal (Generic Letter No. 88-17).

2. Letter from J. G. Haynes, ANPP, to USNRC Document Control Desk dated September 21, 1987 (161-00517). Subject: Response to Generic Letter 87-12.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Response to Generic Letter 88-17 concerning Loss of Decay Heat Removal
File: 89-A-056-026

Pursuant to the requirements of 10CFR50.54(f), the NRC has requested a response to eight recommended expeditious actions and six programmed enhancement recommendations. The responses to the expeditious actions were requested within 60 days of receipt of Generic Letter 88-17 and responses to the programmed enhancements were requested within 90 days of receipt of the letter. The attachment to this letter provides the ANPP responses to the eight expeditious actions. Additionally, responses to several of the programmed enhancement items are provided in the attachment. The remainder of the programmed enhancement items will be addressed in a separate submittal.

If you have any additional questions on this matter, please contact Mr. A. C. Rogers at (602) 371-4041.

Very truly yours,

D. B. Karner
Executive Vice President

DBK/BJA/pvk
Attachment

A061
1/1

cc: G. W. Knighton (all w/a)
T. L. Chan
M. J. Davis
J. B. Martin
T. J. Polich
A. C. Gehr

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, Donald B. Karner, represent that I am Executive Vice President of Arizona Nuclear Power Project, that the foregoing document has been signed by me on behalf of Arizona Public Service Company with full authority to do so, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

Donald B. Karner

Sworn to before me this 6 day of January, 1988. 9 n.e.m. 1/6/89

Notary Public

My Commission Expires:

My Commission Expires April 6, 1991

ATTACHMENT 1

ANPP RESPONSES TO GENERIC LETTER 88-17
EXPEDITIOUS ACTIONS

The following sections provide the ANPP responses to the expeditious action items and two of the programmed enhancement items. Please note that the actions and commitments described in these responses do not apply when there is no fuel in the reactor vessel.

(1) NRC EXPEDITIOUS ACTION

Discuss the Diablo Canyon event, related events, lessons learned, and implications with appropriate plant personnel. Provide training shortly before entering a reduced inventory condition.

ANPP RESPONSE

Training will be provided to the following groups prior to entering the next reduced inventory condition for each Palo Verde unit:

- Licensed Operators
- Shift Technical Advisors (Mid-Loop Coordinators as discussed in the response to item #5)
- Auxiliary Operators*
- Containment Coordinators*
- LLRT Test Engineers*

* These groups will receive training commensurate with their job responsibilities during reduced inventory operations.

The training for the Licensed Operators and Shift Technical Advisors will include the following items:

1. INPO Case Study 88-018 - "Loss of Decay Heat Removal". This case study provides a description of the Diablo Canyon event as well as the Waterford and San Onofre events.

2. Causing factors and variables associated with decay heat load.

3. Heat-up rates, time to boil, and time to core uncovery if shutdown cooling is lost.

4. Concerns associated with operating in a reduced inventory condition.

5. Methods of preventing a loss of shutdown cooling and for mitigating a loss of shutdown cooling event.

6. Administrative and procedural controls associated with reduced inventory operations.

This training will be provided prior to the next reduced inventory operation for each of the Palo Verde units. In the longer term, the content and frequency of subsequent training courses will be determined by conducting a training needs analysis. This training needs analysis will be performed in accordance with approved methods for developing job related training using systematic training processes. The training needs analysis and any identified changes to the content and frequency of the training will be completed by December 31, 1989. This schedule will ensure that the changes are implemented prior to the next series of refueling outages for Palo Verde that occur after the upcoming ones.

(2) NRC EXPEDITIOUS ACTION

Implement procedures and administrative controls that reasonably assure that containment closure will be achieved prior to the time at which a core uncovery could result from a loss of DHR coupled with an inability to initiate alternate cooling or addition of water to the RCS inventory. Containment closure procedures should include consideration of potential steam and radioactive material release from the RCS should closure activities extend into the time boiling takes place within the RCS. These procedures and administrative controls should be active and in use prior to entering a reduced RCS inventory condition for NSSSs supplied by Combustion Engineering or Westinghouse, and should apply whenever operating in those conditions. If such procedures and administrative controls are not operational, then either do not enter the applicable condition or maintain a closed containment.

ANPP RESPONSE

During the next refueling outages for the Palo Verde units, each unit will be operated in a reduced inventory condition. Additionally, cold leg openings in excess of one square inch are anticipated as a result of planned maintenance activities on the reactor coolant pumps. For this reason, a hot side vent will be established. This vent will be of sufficient capacity to prevent core uncovery due solely to pressurization of the hot side resulting from boiling of the core coolant. ANPP's preliminary analysis indicates that the removal of the pressurizer manway will satisfy this condition. Additional analyses may justify the use of other vent paths such as the removal

of the pressurizer safety valves.

The RCS configuration described above will place the Palo Verde units in the 2 hour category for containment closure. Prior to the next reduced inventory operation in each Palo Verde unit, ANPP will implement the appropriate administrative controls and procedures to reasonably assure containment closure within the 2 hour requirement or the containment will be maintained in a closed condition.

(3) NRC EXPEDITIOUS ACTION

Provide at least two independent, continuous temperature indications that are representative of the core exit conditions whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel. Temperature indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Temperature monitoring should be performed either:

(a) by an operator in the control room (CR), or

(b) from a location outside of the containment building with provision for providing immediate temperature values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes during normal conditions.

ANPP RESPONSE

In response to this NRC recommendation, ANPP will maintain at least two Core Exit Thermocouples (CETs) available whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel. The CETs are part of the fixed incore instrumentation. The CETs are located at the top of the active fuel and thus provide a good measure of the coolant conditions at the core exit.

During a typical refueling outage, the fixed incore instrumentation is disconnected in preparation for fuel movement. However, whenever the RCS is in a mid-loop condition and the reactor vessel head is

located on top of the reactor vessel, ANPP will use patch cords on two selected CETs to maintain their availability. The CETs provide temperature indication in the control room via a Plasma Display Unit (PDU). This provides the control room operators with continuous RCS temperature indication during mid-loop operations. In the event that the control room PDUs are not available, the temperature data can be obtained from a separate panel in the control room area.

(4) NRC EXPEDITIOUS ACTION

Provide at least two independent, continuous RCS water level indications whenever the RCS is in a reduced inventory condition. Water level indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Water level monitoring should be capable of being performed either:

(a) by an operator in the CR, or

(b) from a location other than the CR with provision for providing immediate water level values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes during normal conditions.

ANPP RESPONSE

ANPP plans to install a permanent RCS level monitoring system during the next refueling outage for each Palo Verde unit. In the interim, until such time as the permanent system is installed and operational, each of the Palo Verde units will be using a tygon tube level monitoring system to provide a means to monitor RCS level during reduced inventory operations.

Station procedures are in place to provide guidance on the installation and removal of the tygon tube level monitoring system. Station Manual procedure 31MT-9RC27 governs the installation and removal of the level monitoring system for RCS loop #1 and procedure 31MT-9RC28 provides the instructions for RCS loop #2. Both of these installation procedures include directions for the proper routing of

the tygon tubing and Quality Control verfications that no loop seals or kinks are present in the tygon tube level system.

Both tygon tube level systems are capable of being remotely monitored by a camera which is displayed in the control room on the communication console video monitor. Only the level system on the non-operating shutdown cooling loop is displayed in the control room due to a level correction factor for the level system associated with the operating shutdown cooling loop. This level correction factor is highly dependent upon flow rate in the operating shutdown cooling loop and varies from 0 to approximately 40 inches difference between actual and indicated level. Due to this inaccuracy, it is imprudent to use the level system associated with the operating shutdown cooling loop as the primary level indicator, but it remains valuable as a backup level indicator when the correction factors are used.

During steady state operations, the RCS level is periodically monitored by the reactor operators and the Shift Technical Advisors (Mid-Loop Coordinators) in the control room. When RCS level is intentionally changed, an Auxiliary Operator is stationed at the level monitoring system and is in continuous radio communication with the control room personnel. In the event that the control room level display is not available, an Auxiliary Operator will be dispatched to the level monitoring system to verify the RCS level every 15 minutes.

In conclusion, each Palo Verde unit will be equipped with two, independent tygon tube level monitoring systems during reduced

inventory operations. The level monitoring system provides for control room display which allows the control room personnel to periodically monitor and record the level information. ANPP believes that this level monitoring system adequately addresses the NRC requirements and will provide an acceptable alternative until such time as the permanent level monitoring system can be installed in each of the Palo Verde units.

(5) NRC EXPEDITIOUS ACTION

Implement procedures and administrative controls that generally avoid operations that deliberately or knowingly lead to perturbations to the RCS and/or to systems that are necessary to maintain the RCS in a stable and controlled condition while the RCS is in a reduced inventory condition.

If operations that could perturb the RCS or systems supporting the RCS must be conducted while in a reduced inventory condition, then additional measures should be taken to assure that the RCS will remain in a stable and controlled condition. Such additional measures include both prevention of a loss of DHR and enhanced monitoring requirements to ensure timely response to a loss of DHR should such a loss occur.

ANPP RESPONSE

To address this NRC recommendation, ANPP will develop an administrative control procedure which will define the responsibilities, interfaces, and accountabilities of the Operations Shift Supervisor, the Unit Work Control Manager, the Work Control Containment Coordinator, and the Mid-Loop Coordinator (MLOC). This procedure will be implemented prior to the next reduced inventory operation in each Palo Verde unit. The procedure will formalize the requirements of the Shift Technical Advisor's (STA's) mid-loop program which was initiated in response to Generic Letter 87-12.

This procedure will include the use of the STA as the MLOC. The MLOC

will be available to the control room staff for technical support during reduced inventory operations. The MLOC will maintain an up to date status of ongoing activities and assist in the timely closure of containment should a loss of SDCS occur. The procedure will also delineate the Unit Work Control Manager's responsibilities in relation to scheduling work activities so as to minimize the potential for RCS perturbations during reduced inventory operations and the use of the Work Control Containment Coordinator.

In addition to this administrative control procedure, ANPP is currently evaluating the need for a general operating procedure for reduced inventory operations. This procedure will include prerequisites, limitations/precautions, and operating instructions for reduced inventory operations. Currently, these procedural instructions are provided in the Mode 5 operations procedure.

(6) NRC EXPEDITIOUS ACTION

Provide at least two available or operable means of adding inventory to the RCS that are in addition to pumps that are a part of the normal DHR systems. These should include at least one high pressure injection pump. The water addition rate capable of being provided by each of the means should be at least sufficient to keep the core covered. Procedures for use of these systems during loss of DHR events should be provided. The path of water addition must be specified to assure the flow does not bypass the reactor vessel before exiting any opening in the RCS.

ANPP RESPONSE

For each Palo Verde unit, at least two available means for adding inventory to the RCS will be provided whenever the RCS is in a reduced inventory condition. Operating procedures will be revised to specify that at least two means of providing makeup to the RCS be available when in a reduced inventory condition. The procedures will also require available makeup paths that ensure that the makeup water will not bypass the reactor vessel for the existing RCS configuration.

Note that ANPP is currently performing analyses to quantify the required makeup rates and to determine other RCS parameters such as pressure response during a loss of shutdown cooling event. The acceptability of various other means of providing RCS makeup (besides HPSI pumps) during loss of shutdown cooling events can be determined based on the results of the analyses. ANPP does not

believe that it is necessary to constrain outage related activities by requiring that one of the means of providing RCS makeup be a HPSI pump. Therefore, ANPP proposes to use the following criteria to specify available makeup methods:

1. Provide at least two available means of adding inventory to the RCS.

2. Each means of providing makeup must be in addition to pumps that are a part of the normal shutdown cooling systems.

3. Each means of providing makeup must provide a water addition path that assures that flow does not bypass the reactor vessel for the existing RCS configuration.

4. Each makeup method must provide a flowrate that is sufficient to compensate for the expected RCS inventory loss during a loss of shutdown cooling event and be capable of adding inventory to the RCS under the expected RCS conditions.

5. Each makeup method must be addressed in the appropriate procedures for loss of shutdown cooling events.

ANPP believes that these criteria will ensure an adequate degree of protection during loss of shutdown cooling events and will be consistent with the intent of the NRC requirements. The procedural and administrative changes necessary to implement these requirements will be completed prior to the next reduced inventory operation for each of the Palo Verde units.

(7) NRC EXPEDITIOUS ACTION

Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by nozzle dams unless a vent path is provided that is large enough to prevent pressurization of the upper plenum of the RV.

ANPP RESPONSE

ANPP is in the process of proceduralizing the proper installation sequence for nozzle dams. The procedure will require that a hot side vent be established prior to blocking both RCS hot legs with nozzle dams. This vent will be of sufficient capacity to prevent core uncovery due solely to pressurization of the hot side resulting from boiling of the core coolant. ANPP's preliminary analysis indicates that the removal of the pressurizer manway will satisfy this condition. Additional analyses may justify the use of other vent paths such as the removal of the pressurizer safety valves. These procedural controls will be implemented prior to the next installation of nozzle dams in each of the Palo Verde units.

(8) NRC EXPEDITIOUS ACTION

Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by closed stop valves unless a vent path is provided that is large enough to prevent pressurization of the RV upper plenum or unless the RCS configuration prevents RV water loss if RV pressurization should occur. Closing cold legs by nozzle dams does not meet this condition.

ANPP RESPONSE

This question is not applicable to Palo Verde. The RCS is not equipped with loop stop valves in any of the Palo Verde units.

ATTACHMENT 2

ANPP RESPONSES TO GENERIC LETTER 88-17

PROGRAMMED ENHANCEMENTS

(4) NRC PROGRAMMED ENHANCEMENT

Conduct analyses to supplement existing information and develop a basis for procedures, instrumentation installation and response, and equipment/NSSS interactions and response. The analyses should encompass thermodynamic and physical (configuration) states to which the hardware can be subjected and should provide sufficient depth that the basis is developed. Emphasis should be placed upon obtaining a complete understanding of NSSS behavior under nonpower operation.

ANPP RESPONSE

ANPP has initiated an analysis effort to examine the NSSS response to loss of shutdown cooling events. The analysis is being performed by ANPP safety analysis engineers using the RETRAN computer code. Important analysis results that will be obtained for loss of shutdown cooling events include: heatup rates, time to reach saturation conditions, time to core uncovery, steam venting, liquid loss through cold leg openings, and the use of SGs as a heat sink. The analysis will also investigate various RCS configurations that are likely to occur during outage situations.

ANPP will complete as much of the analysis effort as necessary prior to the next reduced inventory operation in any of the Palo Verde units (the next planned outage with reduced inventory operations is tentatively scheduled to occur in early March, 1989). The use of ANPP safety analysis engineers to perform the analysis benefits ANPP by helping to develop in-house expertise and understanding of the NSSS

behavior during reduced inventory operations.

(5) NRC PROGRAMMED ENHANCEMENT

Technical Specifications (TSs) that restrict or limit the safety benefit of the actions identified in this letter should be identified and appropriate changes should be submitted.

ANPP RESPONSE

ANPP has identified two Technical Specification items that, when revised, would result in a safety benefit. These two items are described in further detail below. ANPP intends to pursue Technical Specification changes on these items with the goal of obtaining approved changes from the NRC prior to the scheduled Unit 2 refueling outage in the fall of 1989.

i) Elimination of the automatic closure interlocks for the SDCS suction valves. ANPP is currently participating in a generic CE Owner's Group task on this item. Elimination of the requirement for automatic closure interlocks will improve plant safety by eliminating a significant contributor to loss of SDCS events.

ii) Reduction of the shutdown cooling flow rate requirement. The current Palo Verde Technical Specifications require a minimum flow rate of 4000 gpm. It is expected that this minimum flow rate could be reduced which would enhance plant safety by reducing the potential for vortexing and air entrainment at the SDCS suction connections.