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SUBJECT: Application for amend to License NPF-41,lowering min shutdown cooling flow specifications for Mode 5 loops.

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WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
NUCLEAR

161-03138-WFC/JST
April 30, 1990

Docket No. STN 50-528

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

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 1
Emergency Technical Specification Amendment Request-
Shutdown Cooling Flow
File: 90-056-026

This letter requests a one time only temporary emergency amendment to the PVNGS Unit 1 Technical Specification Surveillance Requirement 4.4.1.4.2. The proposed change would lower the minimum shutdown cooling flow specifications for Mode 5 loops not filled and require closing valve CHV183 (reactor makeup water pump outlet to charging pump suction isolation valve) to isolate the major source of non-borated make-up water from the reactor coolant system. The specification would remain in effect from approval until Unit 1 reaches Mode 2 of Cycle 3. The proposed specifications would meet the design requirements of the shutdown cooling system for decay heat removal with the present decay heat load, protect against a boron dilution event, and provide an increased operating margin between the minimum flow requirements and the onset of vortex formation and air entrainment in the shutdown cooling suction nozzles during reactor coolant system reduced inventory operation.

This amendment request is being submitted as an emergency request because of a steam generator tube leak which developed in Unit 1 during startup. Repair of this leak will require a reduction in reactor coolant system inventory to mid-loop. The RCS will be maintained in a mid-loop condition during installation of the steam generator nozzle dams. This work is anticipated to take 2 to 3 days. Following installation of the steam generator nozzle dams repair work on the steam generator tubes will commence and the RCS will be refilled to a greater than mid-loop condition. The RCS inventory would then again be reduced to mid-loop during removal of the nozzle dams and restoration of RCS integrity. The steam generator tube leak and consequent need to operate in a mid-loop condition could not be anticipated. During the outage every effort was made to ensure steam generator tube integrity including a one hundred percent eddy current examination of the tubes and leak check of the steam generator tubes by pressurizing the secondary side of the steam generators. The alternative to mid-loop operation would be to destack, detension and remove the reactor vessel head, and defuel the core prior to commencing repair of the steam generator tubes. This would result in at least a 35 day delay in startup over the time required to go to mid-loop and repair the tubes.

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To operate during mid-loop in the safest possible manner we are respectfully requesting a reduction in the minimum shutdown cooling flow requirements. Granting this request will enhance the safety of this evolution by increasing the margin between the minimum flow requirement and the onset of vortex formation. Vortex testing in Unit 1 has demonstrated that mid-loop operation can be performed with the existing Technical Specification but would require maintaining flow in a very small operating range and would have a small risk of air entrainment. To eliminate the possibility of air entrainment a minimum flow of 2000 gpm (actual) is proposed.

This request is also supported as one of the programmed enhancements of Generic Letter 88-17 "Loss of Shutdown Cooling." Arizona Public Service has been preparing an amendment for reduction in minimum flow requirements as part of our response to Generic Letter 88-17. However, the occurrence of a steam generator tube leak in Unit 1 requires an emergency amendment request to avoid a 35 day delay in the startup of Unit 1. Other actions taken by APS to ensure the safest possible operation during mid-loop conditions are:

- Operations personnel have been trained on mid-loop operation and the lessons learned at Palo Verde and other sites. Unit 1 Operations personnel will receive additional training on the procedures and evolutions required for mid-loop operation prior to reducing RCS inventory.

- Permanent wide and narrow range Refueling Water Level Indicators have been installed, tested, and calibrated in Unit 1. These indicators provide the control room with redundant channels of reactor vessel water level indication and alarms. The narrow range refueling water level indication provides level information from the bottom to the top of the hot leg. The wide range portion of the system provides water level indication from the bottom of the hot leg to greater than 50% pressurizer level. The system is equipped with "Lo" and "Lo-Lo" alarms which will alert the operator to decreasing RCS inventory and level perturbations.

- Control and accountability of containment penetrations and work activities allowed during mid-loop operation is accomplished by procedure 40AC-90P20 "Reduced Inventory Operation." This procedure ensures that containment integrity can be restored in a timely manner if shutdown cooling were lost. It also ensures that no unnecessary work which could impact shutdown cooling operation or reactor vessel level is allowed during reduced inventory operation.

- Procedure 4XOP-XZZ16 "RCS Drain Operations" requires that two core exit thermocouples be in operation and displayed on the Qualified Safety Parameter Display System (Class 1E system). The core exit thermocouples are closely monitored and the values logged every two hours during mid-loop operation. The core exit thermocouples and shutdown cooling heat exchanger inlet and outlet temperatures displayed on the main control board provide two independent means of determining core exit conditions.

- Procedure 4XOP-XZZ16 "RCS Drain Operations" requires the Shift Supervisor to designate two borated RCS make-up supply paths whose individual make-up flow rates exceed the core boil off rate. In the event shutdown cooling is lost either of these supply paths would supply sufficient make-up to maintain reactor vessel level. These make-up paths are required to be lined up for operation prior to entering mid-loop operation.

- Procedure 40AC-90P20 "Reduced Inventory Operation" requires removal of either the pressurizer safety valves or pressurizer manway to establish a hot leg vent path large enough to prevent pressurization of the upper plenum of the reactor vessel. It is currently intended to remove the pressurizer safety valves to provide a hot leg vent path. This action prevents water from being forced out of the vessel by a pressure buildup in the upper plenum.

- APS has analyzed the effects of a loss of shutdown cooling. The results of this analysis are contained in the core data book located in each units control room. The results provide operators the decay heat load expected, heatup rate of the core, time to initiation of core boiling, required makeup flow rate to match core boil off, and time to core uncovery following a total loss of shutdown cooling during mid-loop operation. The results of these analysis for Unit 1 show that should a loss of shutdown cooling occur and the loss sustained there would be more than 2 1/2 hours available for operator action prior to boiling occurring in the core. Core uncovery would not occur for more than 18 hours after a loss of shutdown cooling.

The above actions combined with this Technical Specification amendment request will assure the safest possible operation of Palo Verde Unit 1 consistent with protection of the health and safety of the public.

Attached with this amendment request are:

A. Description of Amendment Request

B. Purpose of the Technical Specification

C. Need for the Technical Specification Change

D. Basis for No Significant Hazards Consideration

E. Safety Analysis of the Proposed Change Request

F. Environmental Impact Consideration Determination

G. Revised Technical Specification Change Pages

Pursuant to 10 CFR 50.91(b)(1) a copy of this request has been forwarded to the Arizona Radiation Regulatory Agency.

If there are any questions concerning this request, please contact Mr. R. A. Bernier at (602) 340-4295.

Sincerely,

WFConway

WFC/JST/jle

Attachment

cc: J. B. Martin (all w/a)
T. L. Chan
D. H. Coe
A. H. Gutterman
S. R. Peterson
C. F. Tedford

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, W. F. Conway, represent that I am Executive Vice President - Nuclear, 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 and correct.

W F Conway
W. F. Conway

Sworn To Before Me This 30 Day Of april, 1990.

Dora E. Meador
Notary Public

My Commission Expires

My Commission Expires April 6, 1991

ATTACHMENT

A. Description of Amendment Request

This amendment request proposes changes to Surveillance Requirement 4.4.1.4.2 for minimum shutdown cooling flow in Mode 5 loops not filled. The current Surveillance Requirement verifies, at least once per 12 hours, that at least one shutdown cooling loop is in operation with a flow rate of greater than or equal to 4000 gallons per minute (gpm). The proposed change would require this minimum flow rate to be greater than or equal to 2000 gpm (actual). The proposed amendment would also require closing valve CHV183 (reactor makeup water pump outlet to charging pump suction isolation valve) per the "Station Clearance and Tagging Procedure" (40AC-90P15) so that the normal source of non-borated make-up water to the RCS will be isolated. This action prevents the possibility of a boron dilution event occurring during mid-loop operation.

Attachment G contains the revised Technical Specification change page.

B. Purpose of the Technical Specification

The purpose of Surveillance Requirement 4.4.1.4.2 (applicable in Mode 5 without reactor coolant loops filled) is to ensure adequate shutdown cooling loop flow while on shutdown cooling for decay heat removal. This minimum flow requirement also provides adequate flow to ensure mixing, prevent stratification, and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System.

C. Need for the Technical Specification Change

PVNGS is proposing this amendment to ensure the safest possible operation during mid-loop operation in Unit 1 during the current steam generator tube repair. This amendment will provide additional margin between the minimum flow requirements for shutdown cooling and the onset of vortex formation in the shutdown cooling suction nozzles during reduced reactor coolant system inventory operation. The formation of vortexes in the shutdown cooling nozzles has the potential to air bind the shutdown cooling pump and heat exchanger thus rendering the system inoperable. The reactor coolant system is drained to mid-loop during the installation of Steam Generator nozzle dams. The installation of these dams permits work and inspections to be performed on the Steam Generators without defueling. Vortex formation, has been observed, with flows above 4100 gpm. The current minimum flow of 4000 gpm allows only a 100 gpm band in which to operate the shutdown cooling system between the onset of vortex formation and the Technical Specification minimum flow. The minimum flow proposed by this amendment (2000 gpm) would greatly increase this margin and continue to provide adequate mixing of boron in the RCS. This change would improve the safety of the shutdown cooling system by allowing operation substantially below the vortex formation flowrate, which minimizes the possibility of air binding the shutdown cooling system (SDCS), while providing adequate flow for decay heat removal and mixing of boron.

The 2000 gpm minimum flow value was determined after consultation between APS Engineering and the pump vendor (Ingersol-Rand). The low pressure safety injection pumps have experienced two phenomena which makes operation in two flow ranges undesirable. The first phenomenon is a system flow instability which occurs in the 2800 to 3400 gpm range. The observed phenomenon is an acoustic rumble which results from recirculation flow in the pump inlet piping. The effects of this are increased pump vibration which if allowed to occur long enough would reduce the life of pump and motor. APS does not intend to operate in this region. The second restriction on pump operation is the minimum continuous flow of 2400 gpm supplied by the vendor. This value is the minimum flow at which the pump will operate with vibration levels that are not detrimental to seal life. Engineering and the vendor have discussed operation below this minimum flow and determined that pump operation below 2400 gpm is acceptable provided the hours of operation below 2400 gpm are accounted for and factored into the next planned preventative maintenance. Thus operation of the pump will be controlled to flow ranges where stable operation can be achieved and no degradation of equipment will occur.

The addition of a statement which requires closing valve CHV183 isolates the normal source of non-borated makeup water to the RCS and provides assurance that a boron dilution event will not occur while the Unit is in a reduced flow condition.

D. Basis for No Significant Hazards Consideration

The commission has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) Involve a significant increase in the probability or consequences of an accident previously evaluated: or (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involve a significant reduction in a margin of safety.

A discussion of these standards, as they relate to the amendment, follows:

Standard 1 - Involves a significant increase in the probability or consequences of an accident previously evaluated.

The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated but actually enhances the safety of operation of the shutdown cooling system. Lowering the shutdown cooling flow during reduced reactor coolant system inventory operation improves the margin between the required minimum flow and the formation of vortexes in the shutdown cooling suction nozzles. The formation of these vortexes has the potential of air binding the shutdown cooling heat exchanger and pumps of the operating shutdown cooling train. The low decay heat load in Unit 1 at this time makes it possible to significantly reduce the flow without affecting the ability of the shutdown cooling system to remove decay heat. Unit 1 has been shutdown greater than one year and has less than 1 Mwt of decay heat.

The boron dilution event was analyzed by APS to determine if the new flowrates would provide adequate time for operator recognition and correction prior to criticality. The limiting (most rapid) case which was analyzed for PVNGS was the case of a dilution during Beginning of Core (BOC), Mode 5 drained conditions, at the maximum charging flow rate. Based upon the RCS volume at this condition, and the time associated with circulation of the RCS at an actual flow of 2000 gpm, the analysis shows that the mixing time is short relative to the time to criticality therefore the dilution would proceed smoothly. It is concluded that there will be sufficient time to recognize and control the dilution before the core reached criticality. Therefore a shutdown cooling system flowrate of 2000 gpm is acceptable in Mode 5 with respect to a postulated boron dilution event.

The administrative control on the normal source of non-borated make-up water to the RCS minimizes the potential for a boron dilution event while in mid-loop operation. Thus the probability of either a loss of shutdown cooling due to vortexing or a boron dilution event are reduced by this change.

Standard 2 - Create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed reduced shutdown cooling flow only changes the allowable flow to a value which does not affect the capability to mitigate a boron dilution incident while on shutdown cooling. The ability of the shutdown cooling system to remove decay heat and maintain RCS temperature will still be controlled by operators who will vary flow through the shutdown cooling heat exchanger to maintain the specified mode temperature requirements. The proposed minimum flow decreases the possibility of air binding the shutdown cooling system when at mid-loop by minimizing operation with flowrates which could induce vortex formation in the shutdown cooling suction nozzles. The reduced flow does not affect operation of the shutdown cooling system nor involve any system configuration changes. Thus no possibility of a new or different kind of accident from any accident previously evaluated is created.

The administrative requirement to isolate sources of non-borated make-up water from the RCS minimizes the possibility of a boron dilution event.

Standard 3 - Involve a significant reduction in a margin of safety.

The reduction in the minimum flow requirements does not reduce the margin of safety in the shutdown cooling system. The one time reduction in cooling flow acknowledges the low decay heat load currently present in Unit 1. The current decay heat load is approximately one tenth that of the design heat load for the 4000 gpm minimum. The system will still perform within its design bases. The proposed flow will increase the margin of safety of the system by allowing operation further away from the flowrates which produce vortexes in the shutdown cooling suction nozzles. This minimizes the possibility of rendering one train of shutdown cooling inoperable due to air binding of the pumps or heat exchanger. The proposed flow rate of 2000 gpm actual will circulate the RCS inventory at mid-loop in approximately 17 minutes. This is much shorter than the 52 minute time to criticality calculated in UFSAR Section 15.4.6 and provides assurance that deboration will occur uniformly giving the operator adequate time to recognize and stop the inadvertent deboration.

E. Safety Analysis of the Proposed Change Request

The proposed Technical Specification change will not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the Final Safety Analysis Report (FSAR). The change does not make changes to the facility. The effects of the change are lower minimum flow requirements for shutdown cooling operation.

The proposed Technical Specification change will not create the possibility of an accident or malfunction of equipment of a different type than any evaluated previously in the FSAR. This change will minimize the possibility of a loss of shutdown cooling event by increasing the margin between the onset of vortex formation and the minimum required flow for shutdown cooling. There are no equipment changes proposed in this amendment nor any change in the operation of shutdown cooling system other than a change to the Technical Specification minimum flowrate in Mode 5 loops not filled. The design bases of the shutdown cooling system are not affected by this change.

The proposed Technical Specification change will not reduce the margin of safety as defined in the basis for any Technical Specification. The bases for Surveillance Requirement 4.4.1.4.2 have been reviewed. The requirements stated in the bases section are still met with the proposed minimum flowrate. The requirement for removal of decay heat is still a function of the operators who control RCS temperature by varying the amount of flow bypassing the shutdown cooling heat exchanger. The requirements for boron mixing are satisfied with the proposed flowrate. Thus the proposed minimum flowrates do not reduce the margin of safety as defined in the bases for these Technical Specifications.

The proposed amendment to reduce the minimum flow for this Surveillance Requirement has been evaluated to ensure adequate circulation is maintained to minimize the effects of a boron dilution event incident and prevent boron stratification. The basis for the 23 minute loop circulation time criteria in the Technical Specification Bases is derived from a concern for avoiding a boron dilution event. The available information indicates that a calculation was performed which developed acceptable accident mitigation under the following assumptions:

- The SDCS operates in one RCS loop while the other RCS loop is static (i.e., only one train of SDCS is in operation);
- The SDCS is in operation at 4000 gpm;
- The RCS is full;
- The fuel in the core is at beginning of core life.

Also, inherent to the calculation are assumptions regarding fluid mixing of the RCS. At 4000 gpm a full RCS (90,000 gal) will be completely circulated within 23 minutes. This time interval was evaluated to be acceptable relative to the assumed time to criticality during a boron dilution event under these conditions (approximately one hour). The flowrate proposed in this amendment actually reduces the loop circulation time in mid loop operation (33,660 gal) to 17 minutes which meets the original criteria of being significantly less than the time to criticality. Therefore, in mid-loop, with the associated reduced volume

the reduced flow rate will still ensure adequate mixing of boron for operator recognition and correction of a boron dilution event.

The requirements to remove decay heat are controlled by the operators who must ensure sufficient flow to maintain the temperature requirements of the applicable mode. The proposed flow of 2000 gpm and the current level of decay heat in Unit 1 will result in only a 2 degree cooling water temperature rise across the core. Analysis has also shown that upon a loss of shutdown cooling there would be more than 2 1/2 hours available for operator action prior to boiling occurring in the core. Core uncovery would not occur for more than 18 hours after a loss of shutdown cooling. The control of RCS temperature while on shutdown cooling at Palo Verde is accomplished by controlling the amount of flow bypassing the shutdown cooling heat exchanger and not by maintaining a minimum system flowrate. Thus the requirement to maintain a minimum system flow is only for prevention of a boron dilution event and does not directly relate to decay heat removal.

F. Environmental Impact Consideration Determination

The proposed change request does not involve an unreviewed environmental question because operation of PVNGS Unit 1 in accordance with this change would not:

1. Result in a significant increase in any adverse environmental impact previously evaluated in the Final Environmental Statement (FES) as modified by the staff's testimony to the Atomic Safety and Licensing Board, Supplements to the FES, Environmental Impact Appraisals, or in any decisions of the Atomic Safety Licensing Board: or

2. Result in a significant change in effluents or power levels; or

3. Result in matters not previously reviewed in the licensing basis for PVNGS which may have a significant environmental impact.

Operation at a lower shutdown cooling flow does not affect power level, or any plant effluents.

G. Revised Technical Specification Change Pages

See attached page 3/4 4-6. Deletions are noted by strikeout and additions are highlighted and in bold italic print.