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See Proposed Changes to T.S.

SUBJECT: Application for amends to Licenses NPF-41,NPF-51 & NPF-74, changing Tech Spec 3/4.7.11, "Shutdown Cooling Sys" to delete auto-closure interlock surveillance of surveillance requirement 4.7.11b,per Generic Ltr 88-17.

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WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
NUCLEAR

161-04155-WFC/DAF

September 09, 1991

Docket Nos. STN 50-528/529/530

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
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References: 1) Letter from D. B. Karner (APS), to U. S. Nuclear Regulatory Commission, dated January 6, 1989

2) U. S. Nuclear Regulatory Commission, Office for Analysis & Evaluation of Operational Data, "Decay Heat Removal at U. S. Pressurized Water Reactors," Case Study Report AEOD/C503, December 1985

3) CE NPSD-550, Risk Evaluation of Removal of Shutdown Cooling System Auto-Closure Interlock, September 1989

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, & 3
Proposed Technical Specification Amendments to Specification 3/4.7.11, Shutdown Cooling System, to Delete the Auto-closure Interlock Surveillance of Surveillance Requirement 4.7.11b.
File: 91-004-419.05; 91-056-026

On October 17, 1988, the NRC issued Generic Letter 88-17, Loss of Decay Heat Removal, recommending further enhancements to procedures, programs, and Technical Specifications regarding loss of the shutdown cooling system. In response to the Generic Letter, Arizona Public Service Company (APS) stated in Reference 1 that Technical Specification changes concerning elimination of the automatic closure (auto-closure) interlocks for the shutdown cooling system (SDCS) would be pursued. Therefore, pursuant to 10 CFR 50.90, APS submits herewith a request to amend Facility Operating Licenses NPF-41, NPF-51, and NPF-74 for PVNGS Units 1, 2, and 3, respectively. The proposed amendments delete the surveillance requirement for the auto-closure interlock feature of the SDCS, and specify the open permissive interlock as the only interlock requiring surveillance.

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Provided in Attachment 1 to this letter are the following sections which support the proposed Technical Specification amendments:

A. Description of the Proposed Technical Specification Amendment Request
B. Purpose of the Technical Specifications
C. Need for Technical Specification Amendment
D. Safety Analysis for the Proposed Technical Specification Amendment Request
E. No Significant Hazards Consideration Determination
F. Environmental Impact Consideration Determination
G. Marked-up Technical Specification Change Pages

Provided in Attachment 2 to this letter is Reference 3, which supports this amendment request.

Pursuant to 10 CFR 50.91(b)(1), and by copy of this letter and attachment, the Arizona Radiation Regulatory Agency is being notified of this Technical Specification amendment request.

If you should have questions, please contact Michael E. Powell of my staff at (602) 340-4981.

Sincerely,

James M Levine for WFC

WFC/DAF/pmm

Attachments

cc: J. B. Martin
C. F. Tedford
D. H. Coe
A. C. Gehr
A. H. Gutterman

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I. J. M. Levine, represent that I am Vice President Nuclear Production, 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.

James M Levine
J. M. Levine

Sworn To Before Me This 9 Day Of September, 1991.

Nora E. Meador
Notary Public

My Commission Expires

My Commission Expires April 6, 1995

ATTACHMENT 1

A. DESCRIPTION OF THE PROPOSED TECHNICAL SPECIFICATION AMENDMENT REQUEST

The proposed changes would revise Surveillance Requirement 4.7.11b. of Specification 3/4.7.11 for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3. This specification requires verification of the shutdown cooling system (SDCS) auto-closure interlock (ACI) and open permissive interlock (OPI) action at least once per 18 months, during shutdown. This amendment request deletes the surveillance requirements for the ACI and revises the text to specify a surveillance for the OPI only. The proposed specification will read as follows:

4.7.11 Each shutdown cooling subsystem shall be demonstrated OPERABLE:

> b. At least once per 18 months, during shutdown, by testing the open permissive interlock action of the shutdown cooling system connections from the RCS. The shutdown cooling system suction valves shall not open when the RCS pressure is greater than 410 psia.

B. PURPOSE OF THE TECHNICAL SPECIFICATIONS

The SDCS is designed to achieve and maintain a cold shutdown condition by removing residual energy from the reactor coolant system (RCS) and decay heat from the reactor core.

The operability of two separate and independent shutdown cooling subsystems ensures that the capability of initiating shutdown cooling in the event of an accident exists, even assuming the most limiting single failure occurs. The safety analysis assumes that shutdown cooling can be initiated when conditions permit.

The limits of operation with one shutdown cooling loop inoperable for any reason minimize the time exposure of the plant to an accident occurring simultaneous with the failure of a component on the other shutdown cooling loop.

C. NEED FOR THE TECHNICAL SPECIFICATION AMENDMENT

While the RCS has a design pressure of 2500 psia, the shutdown cooling pumps, piping and heat exchangers have a design pressure of 650 psia or less. Since two piping systems of different design pressures are connected, suitable isolation capability must be provided when the RCS is being operated at high pressure. To ensure that isolation of the SDCS will remain in effect after any single credible failure has occurred, two isolation devices in series are

provided, each capable of maintaining the RCS pressure boundary with the other device failed. General Design Criteria 55 also requires that, when these lines penetrate the reactor containment, there must be at least one isolation device on each side of the containment boundary. Figure 1 on page 11 shows the SDCS suction line arrangement for PVNGS.

When the SDCS is in use, the system becomes an extension of the reactor coolant pressure boundary. Since a number of pressurization sources exist within or are connected to the high pressure RCS, the low pressure SDCS must be protected against postulated pressurization transients when the systems are connected. To accomplish this, a relief valve is provided on each SDCS suction line.

This relief valve provides protection for the reactor coolant pressure boundary against brittle fracture due to pressurization at low temperature. This feature is called Low Temperature Overpressure Protection (LTOP). At PVNGS, the SDCS relief valves are used for LTOP. Due to the high flowrates required to mitigate the postulated LTOP transients, the relief valves are located within the containment building and discharge to the containment sump.

The overpressure protection of the SDCS which is provided by the SDCS relief valves is based on those transients postulated to occur during normal SDCS operation. These relief valves are not intended to protect the SDCS against overpressurization as a result of being inadvertently exposed to full RCS pressure during power operation. A relief device with the capacity to protect against this event would not be practical. Should the SDCS be exposed to RCS pressure during power operation, the SDCS could rupture at a point outside the containment, causing a LOCA outside containment.

To guard against this, appropriate alarms and two instrumentation interlocks are used to reduce the probability of the inadvertent connection of the RCS to the SDCS when the RCS is pressurized. These interlocks are required by, and described in, NRC Branch Technical Position (BTP) 5-1. The first interlock is to prevent opening of the SDCS isolation valves when RCS pressure is above the SDCS design pressure. This feature is the OPI. It protects against the spectrum of events which result from the SDCS suction isolation valves being opened when the RCS is already pressurized. The proposed Technical Specification amendments do not change this interlock.

The second interlock automatically provides a close signal to the SDCS suction valves outside containment when RCS pressure exceeds 500 psia, while the SDCS suction valves located inside containment receive an automatic close signal when the RCS pressure is greater than 700 psia. Therefore, should these valves be inadvertently left open during RCS heatup and pressurization, the SDCS isolation valves would automatically close upon reaching a predetermined pressure

setpoint. This feature is the ACI. Removal of the ACI feature is being proposed as a way to decrease the probability of loss of shutdown cooling events.

As previously described, it is necessary to have two valves in series to form a reactor coolant pressure boundary, so that no single failure can result in a complete loss of this barrier. The double barrier is established by the operator closing both valves when going from SDCS operation to steam generator cooling during plant heatup. Failure to establish this double barrier is possible due to a failure of the valve, valve operator, valve controls, or by operator error. A potential operator error is the closure of only one valve followed by RCS pressurization. It is this operator error that ACI is intended to guard against.

The design of ACI presents a problem of competition between two safety functions. When the SDCS is needed, the suction valves must be open. Failures resulting in valve closure are a safety concern due to the loss of decay heat removal. Conversely, when ACI action is required, failures which leave the valves open adversely impact safety by overpressurizing the SDCS.

The industry has experienced a number of spurious valve closure events caused at least in part by the presence of the ACI. A frequent cause of spurious ACI action is the accidental or intentional de-energization of a power supply during refueling. This event frequently results from maintenance work performed during refueling outages. While redesign of the pressure loops and ACI circuit could eliminate the loss of power supply problems, it would not protect against invalid pressure signals.

Resolution of issues related to loss of shutdown cooling events has been a topic of increasing concern to both the NRC and the industry for several years. Studies have identified spurious operation of ACI as the most frequent cause of reported loss of SDCS events between 1976 and 1983 (Reference 2).

Spurious operation of ACI results in the closure of the SDCS pump suction valves. This has three potential impacts. The most immediate impact of valve closure is the loss of SDCS flow and the corresponding loss of decay heat removal from the core. The resultant RCS temperature rise can result in pressurization of a closed system or loss of fluid through boiling if the reactor vessel head is removed for refueling. The second impact of valve closure may be significant damage to the SDCS pumps due to loss of suction. This event is serious due to the potential for complicating the short term recovery of core cooling and the long repair time and associated high cost. Finally, because PVNGS uses the SDCS relief valves to perform LTOP, the loss of SDCS by closure of the suction valves isolates the RCS from these relief valves thereby increasing the potential for a brittle fracture of the reactor coolant pressure boundary if a pressure transient occurs.

Since ACI is a major cause of loss of SDCS events, Arizona Public Service (APS) is proposing removal of this feature from PVNGS. The NRC has encouraged removal of ACI, most recently in Generic Letter 88-17. From the discussion presented above, therefore, the subject Technical Specification amendments are needed.

D. SAFETY ANALYSIS FOR THE PROPOSED TECHNICAL AMENDMENT REQUEST

Combustion Engineering (CE) has evaluated removal of the ACI as a means to improve SDCS reliability (Reference 3, Attachment 2). This evaluation addresses seven guidelines for ACI removal recommended by the NRC in a memorandum from B.W. Sheron (Chief, Reactor Systems Branch), dated January 28, 1985. These guidelines have been addressed in similar Technical Specification requests by other utilities. The summary below describes how each of the seven items will be met at PVNGS.

1. Means Available to Prevent a LOCA Outside Containment:

   The PVNGS design provides for a double barrier between the RCS and the SDCS. The design provides a very high probability that at least one barrier can be established and maintained under postulated conditions. Procedural controls, training, alarms, and the OPI function minimize the potential that the operator will fail to achieve double isolation during RCS heatup and pressurization, or defeat it once established. Additionally, the SDCS is protected against rupture during normal heatup and pressurization of the RCS (whenever the SDCS suction valves are open) by the SDCS suction relief valves. Furthermore, there is a third isolation valve in each SDCS line, located just outside the containment. These valves provide an additional measure of protection against a LOCA outside containment.

   The CE risk evaluation has shown that, for the PVNGS design, removal of the ACI results in a negligible increase (0.09%) in the frequency of an Interfacing System LOCA (ISLOCA).

2. Alarms to Notify the Operator that SDCS Suction Valves are Mispositioned:

   Visual and audible alarms are provided in the main control room to inform the operator that the SDCS suction valves are not fully closed when the RCS pressure is above the SDCS operating pressure. These alarms, located on the main control boards, are an annunciator type which provide operators with both flashing light and audible bell signals. This alarm setpoint is at 410 psia as described in Section 7.6.1.1.1 of the UFSAR. The alarms are tested at each refueling to ensure reliability, and are designed to alert the operator upon alarm circuit failure.

3. Verification of the Adequacy of Relief Valve Capacity:

   As a part of the original system design, calculations were performed by CE to ensure that relief devices in the SDCS suction lines had adequate capacity to prevent overpressurization of the SDCS. These calculations have been reviewed to confirm that ACI was not credited in the selection of limiting events or mitigation of the resulting transients. Therefore, the calculations remain applicable with the ACI removed.

4. Means other than ACI to Ensure that Both Isolation Valves are Closed:

   As described under Items 1 and 2 above, the current PVNGS design uses alarms, position indication, and procedures to ensure that the double barrier is established upon heatup.

5. Assurance that the OPI is not Affected by ACI Removal:

   The OPI function will be maintained in its present form.

6. Assurance that Valve Position Indication will Remain Available in the Control Room After ACI Removal:

   The current design provides for continuous valve position indication in the main control room. This indication will be present even when valve operation is locked out during power operation. Additional indication that the valve is closed is provided by the lack of an alarm at any pressure above the alarm setpoint.

7. Assessment of the Effect of ACI Removal on SDCS Availability and LTOP:

   CE conducted a risk evaluation (Reference 3) of the impact of removing the ACI from the SDCS. The analysis was performed to determine the change in ISLOCA frequency, the change in SDCS unavailability, and the impact on mitigating LTOP events due to removal of the ACI. This analysis bounds the PVNGS design by modeling the present SDCS configuration and that proposed in this amendment request.

   The CE evaluation analyzed three configurations of the SDCS. The first configuration considers SDCS suction valves with ACI and valve position alarm (the present PVNGS configuration). The second configuration considers SDCS suction valves with a valve position alarm and the ACI removed. This configuration is the proposed configuration for PVNGS. The third configuration considers the SDCS suction valves with ACI only. Since this configuration is not the present or proposed design for PVNGS, it is not relevant for discussion in this amendment

request.

Although the CE report is attached for information, a synopsis of the results applicable to PVNGS is presented below:

ISLOCA Frequency Results:

SDCS Configuration	ISLOCA Frequency
1. SDCS suction valves with ACI and alarm	1.12E-07/year
2. SDCS suction valves with alarm only	1.12E-07/year

Because the ISLOCA frequency is governed by the combined catastrophic failure of both suction valves (gross leakage without position indication), there is only a negligible increase (0.09%) in ISLOCA frequency due to removal of the ACI.

Based on earlier NRC guidance (which is discussed below), sensitivity analyses were performed to determine the impact of operator error assumptions on ISLOCA frequency based upon a) the operator failing to close a valve after previous use, b) the operator failing to detect a valve in the wrong position, or c) the operator failing to respond to an alarm. Since the ISLOCA frequency is governed by the catastrophic failure of both valves (rather than the operator failing to close a valve), the change in frequency was found to be insensitive to the variations of operator error probabilities.

In performing the ISLOCA analyses it was assumed that the existing alarm was tested at each refueling. A sensitivity analysis was performed to determine the potential impact of this assumption on ISLOCA frequency. Test intervals ranging from 30 days to 20 years were used for the sensitivity analysis. The frequency of ISLOCA was found to be relatively insensitive to how often the alarm was tested. A small increase in the ISLOCA frequency is observed when the test interval is five years or more. The proposed change maintains a refueling outage test schedule for the alarms.

SDCS Unavailability Results:

For the SDCS unavailability analysis, the presence or absence of a valve position alarm is immaterial. For the two configurations of concern, SDCS unavailability was evaluated for failure to provide shutdown cooling during refueling operations. The evaluation includes failure of the SDCS to actuate and failure to operate given that the system has actuated. The results are presented below:

SDCS Configuration	SDCS Unavailability
1. SDCS suction valves with ACI	5.05E-02
2. SDCS suction valves with ACI removed	3.08E-02

The change in SDCS unavailability represents a 39% decrease in unavailability during refueling outages.

Mitigating LTOP Events:

PVNGS employs six inch relief valves in the SDCS (one in each SDCS line) with sufficient capacity to mitigate LTOP events that may occur during shutdown cooling operations. These valves are located downstream of the SDCS suction valves inside containment. Because of their locations, inadvertent closure of the SDCS suction valves by ACI will isolate the relief valves and eliminate protection of the RCS piping if an LTOP event occurs.

As discussed above, removal of the ACI from the SDCS suction valves markedly decreases the unavailability of the SDCS. The number of inadvertent closures of the SDCS suction valves also decreases. By removing the ACI from the SDCS suction valves the availability of the relief valves (i.e., the availability of LTOP protection) increases.

NRC Guidance:

In January 1989, the CE Owners Group held its annual meeting with NRC management and technical staff. At that meeting, removal of the ACI was discussed in some detail. The NRC has requested that submittals for ACI removal specifically address two issues related to ISLOCA: 1) the sensitivity of the analyses to assumptions about operator error rates, and 2) a review of the significance of the December 1987 Biblis-A ISLOCA precursor event.

As noted above, sensitivity studies of operator error rate assumptions were performed as part of the ISLOCA frequency determinations. It was found that the change in ISLOCA frequency was insensitive to operator error rate assumptions. The insensitivity is attributed to the dominant failure mechanism being catastrophic failure of both suction valves.

A review of the Biblis-A PWR event shows that the operator tried to close a mispositioned pressure isolation valve that should have been closed prior to startup. The operator tried to manipulate the pressure on the mispositioned valve by

opening a second valve. In doing so, a path from the RCS to the atmosphere was established resulting in a short duration release.

For the PVNGS SDCS, the pressure isolation valves (SDCS suction valves) cannot be opened by the operator while RCS pressure is above shutdown cooling entry conditions. The OPI will prevent such actions by the operator. These interlocks will remain as an integral part of the SDCS suction valves. As such, the sequence of events involving operator actions that occurred at Biblis-A is not expected to occur in the SDCS at PVNGS.

Therefore, ACI removal is consistent with the guidelines previously endorsed by the NRC, and will result in a net increase in reactor safety. Although there is a negligible (0.09%) increase in the calculated probability of an ISLOCA event associated with ACI removal, this increase is in contrast to a 39% increase in SDCS and LTOP availability and a corresponding decrease in risk associated with loss of SDCS and LTOP events.

The analytical methods used to determine ISLOCA frequency and SDCS unavailability involve fault tree analysis along with mechanical and human error probabilities. The NRC has previously approved ACI removal for several plants utilizing this approach, including Waterford, San Onofre, and Diablo Canyon.

The discussion presented above demonstrates an adequate level of safety to support the requested amendments.

E. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission has provided standards for determining whether a no significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility involves a 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 request follows:

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

The ACI is intended to ensure that the low pressure piping of the SDCS is properly isolated from the RCS pressure during startup

operations. The reason for removing the ACI is to minimize potential loss of the SDCS due to inadvertent actuation.

Protection of the SDCS from an overpressure condition will still be provided by the OPI, which is designed to prevent opening of its associated isolation valve whenever system pressure is greater than 410 psia. Other protective features are the LTOP provided by the SDCS relief valves, individual valve position indication, and alarms to notify operators of valve misposition.

As shown from the CE Owners Group Report (CE NPSD-550, Risk Evaluation of Removal of Shutdown Cooling System Auto-Closure Interlock), removal of the ACI results in only a negligible increase (0.09%) in the calculated probability of an ISLOCA event in contrast to a 39% increase in the SDCS and LTOP availability with a corresponding decrease in risk associated with loss of SDCS and LTOP events. Therefore, the proposed amendments will not increase the probability or consequences of an accident previously evaluated.

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

SDCS overpressure and loss of decay heat removal are the only accidents that removal of the ACI impacts. The ACI is intended to ensure that the low pressure piping of the SDCS is properly isolated from the RCS pressure during startup operations; it does not protect against hardware failure. The valve position alarms will warn against both operator error and hardware failure.

The ACI does not protect against a rapid overpressure transient since the stroke times of these large motor operated valves are too long compared to a pressure transient event.

The possibility of a loss of decay heat removal is reduced by this change because the potential of the SDCS isolation valves being closed by a spurious signal will be eliminated. No other failure modes are introduced by ACI removal.

Therefore, the proposed amendments will not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

Protection of the SDCS from an overpressure condition will still be provided by the OPI, which is designed to prevent opening of its associated isolation valve whenever system pressure is greater than 410 psia. Other protective features are the LTOP provided by the SDCS relief valves, individual valve position indication, and alarms to notify operators of valve misposition.

Based on the above discussion, the proposed amendments will not

involve a significant reduction in a margin of safety.

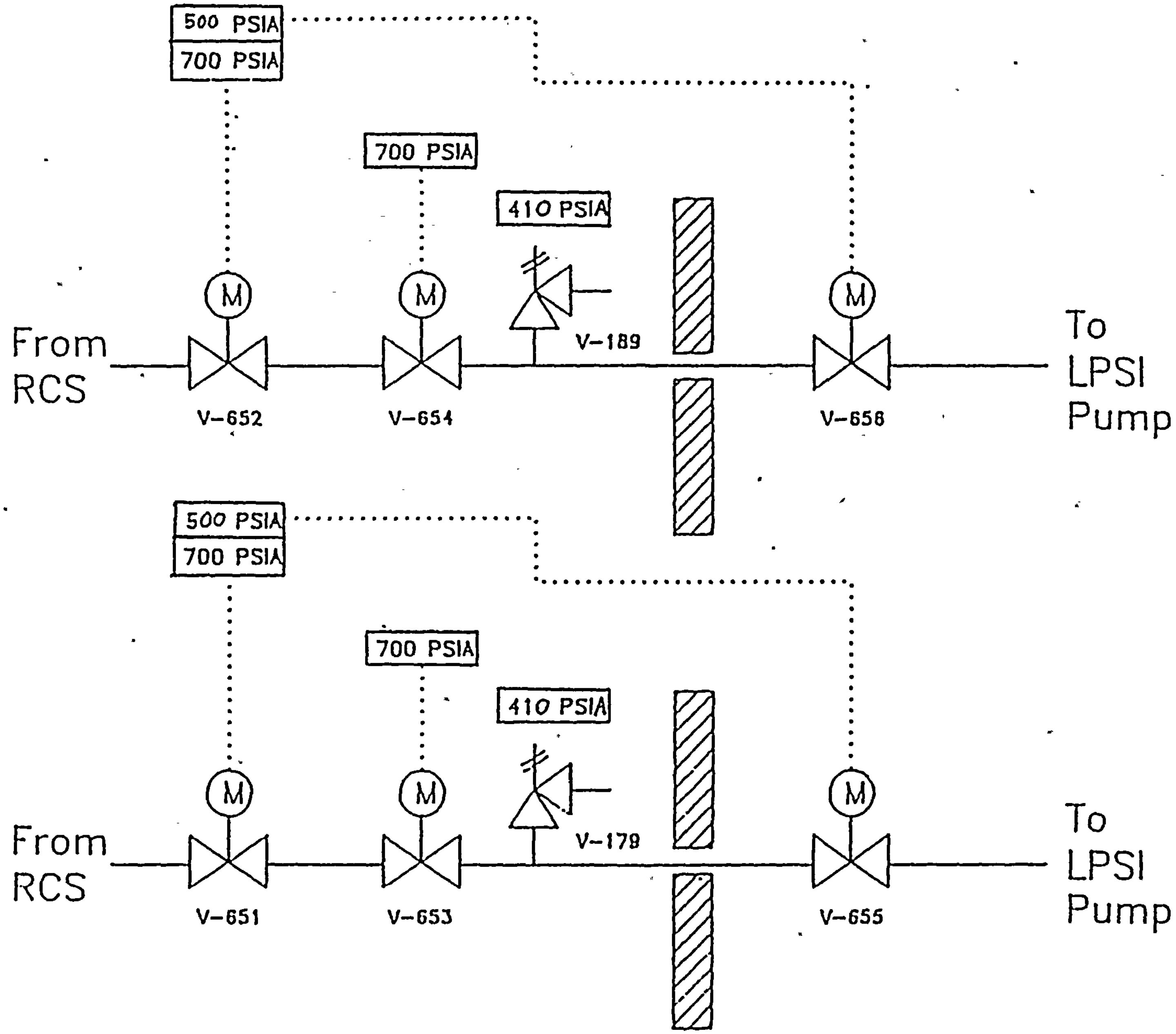
F. ENVIRONMENTAL IMPACT CONSIDERATION DETERMINATION

The proposed amendments delete the surveillance requirement for the ACI feature of the SDCS and specify the OPI as the only interlock action requiring surveillance.

APS has determined that the proposed amendments involve no change in the amount or type of any effluent that may be released offsite, and that there is no increase in individual or cumulative occupational radiation exposure. As such, operation of PVNGS Units 1, 2, and 3, in accordance with the proposed amendments, does not involve an unreviewed safety question.

G. MARKED-UP TECHNICAL SPECIFICATION CHANGE PAGES

See attached page 3/4 7-29 for Units 1, 2, and 3, respectively.



Palo Verde Units 1, 2 & 3
Figure 1