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References: 1. Letter No. 102-03554, dated November 27, 1995, from W. L. Stewart, APS, to NRC, "Request for Exemption from 10 CFR 50.55a(f)(4)(i) and (ii) for Inservice Testing (IST) Frequency."

2. Letter No. 102-03573, dated December 20, 1995, "Request for Exemption from 10 CFR 50.55a(f)(4)(i) and (ii) for Inservice Testing (IST) Frequency, Supplement 1."

3. Letter dated March 15, 1996, from Charles R. Thomas, NRC, to W. L. Stewart, APS, "Request for Additional Information (RAI) on Risk-Informed Inservice Testing (RI-IST) Pilot Plant - Palo Verde Nuclear Station Units 1, 2, and 3."

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Response to NRC Request for Additional Information on Risk-Informed Inservice Testing Program

In Reference 1, as supplemented by Reference 2, Arizona Public Service Company (APS) submitted to the NRC a request for an exemption from the requirements of 10 CFR 50.55a(f)(4)(i) and (ii) to utilize a risk-informed inservice testing program to determine inservice test frequencies for valves that are identified as less safety significant, instead of testing those components at the frequencies specified in the ASME Code. This request was part of a pilot plant effort with Texas Utilities Electric Company (TU). In Reference 3, the NRC Staff provided to APS a request for additional information (RAI) related to the References 1 and 2 submittals. The NRC Staff also met with APS at the PVNGS site on April 22 and 23, 1996, to discuss the RAI. Enclosure 1 contains responses to the Reference 3 NRC RAI. Enclosure 2 contains additional PRA information and a revised proposed risk-informed IST program implementation schedule.

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During the April 22 and 23, 1996 meeting, the NRC Staff suggested that APS and TU request approval of the risk-informed IST programs as alternatives to the requirements of 10 CFR 50.55a(f) rather than exemptions to the regulations. APS expects to submit justification for NRC approval of the risk-informed IST program as an alternative to the 10 CFR 50.55a(f) requirements, pursuant to 10 CFR 50.55a(a)(3)(i), at a later date so as not to delay the submittal of this response to the NRC RAI. APS will also submit, at a later date, an updated risk-informed IST program incorporating changes resulting from the responses to the NRC RAI.

Should you have any questions, please contact Scott A. Bauer at (602) 393-5978.

Sincerely,

Jack A. Bailey

JAB/AKK/GAM/
Enclosure

cc: L. J. Callan
K. E. Perkins
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A. V. Godwin (ARRA)

ENCLOSURE 1

NRC Questions and APS Responses Related to

Risk-Informed IST

Question: G-1

The first ten-year interval of the Palo Verde Unit inservice testing (IST) program was scheduled to expire on January 28, 1996. Apparently, the submittal for the second ten-year interval has been delayed. Please give a status of this effort and provide a proposed implementation schedule. Will this effort proceed concurrent with the proposed exemption request for the Palo Verde IST program or is the second ten-year update dependent on the approval of the exemption request?

Response:

PVNGS recently adjusted the end of the first 10-year intervals (and the start dates for the second 10-year intervals) from January 28, 1996, September 22, 1996, and January 8, 1998 for units 1, 2, and 3 respectively to January 15, 1997 for all three units. This was done in accordance with paragraph IWA-2400(c) of Section XI of the ASME Boiler and Pressure Vessel Code (1980 Edition, through Winter 1981 Addenda), which allows the intervals to be decreased or extended by as much as one year without prior NRC approval. These changes were primarily due to dedication of IST resources to the risk-informed IST (RI-IST) project. APS plans to submit a request for an extension of the first 10-year intervals for all three units to January 1, 1998 in order to finish the RI-IST work.

Question: G-2

Were any check valves categorized as LSSCs that are currently disassembled and inspected in accordance with the guidance of GL 89-04, Position 2? If so, will there be any proposed changes to the inspection schedule?

Response:

PVNGS has two groups of valves that are disassembled and inspected in accordance with GL 89-04, Position 2. These are the containment recirculation sump check valves SIA-V206 and SIB-V205, which are ranked as MSSCs, and the containment spray header check valves SIA-V164 and SIB-V165, which are ranked as LSSCs. Currently one valve from each of these groups is disassembled and inspected each refueling outage. Under this schedule each valve is inspected every 3 years.

The proposed RI-IST program allows extension of LSSC test intervals if the performance history of the component supports the extension. Since the containment spray header check valves (the LSSC group) have not failed an inspection or test during the past 6 years, these valves would be candidates for extension under RI-IST. The inspection interval for each valve would be extended to 6 years since the performance histories of the valves support a 6-year interval.

The 6-year inspection cycle would most likely be implemented by inspecting one valve during one outage, the other valve during the next outage, and then skipping the next two outages before inspecting the first valve again. This would be done to accommodate the PVNGS refueling outages, which are planned so that predominantly A-train work is done one outage and B-train work the next. Inspecting one valve every other outage would schedule all the inspections during either A-train or B-train outages, and would interfere with train-related outage planning.

For a general explanation of the proposed LSSC testing scheme, see the response to Question E2-2.

Question: G-3

OM-1 establishes different test frequencies for different classes of safety/relief valves. Class 1 valves are tested once every 5 years. Class 2 and 3 valves are tested once every 10 years. It appears that all Class 1 relief valves in Palo Verde's IST program have been classified as MSSCs and Class 2 and 3 valves have been classified as LSSCs. What changes in the test frequency is the licensee proposing for the Class 2 and 3 valves?

Response:

Code classification was not a criterion used during risk ranking. The only Class 1 safety/relief valves (SRVs) in the PVNGS IST Program are the pressurizer safety valves . They are ranked as MSSCs. Two groups of Class 2 SRVs are ranked as MSSCs: The main steam safety valves and the LTOP relief valves.

The RI-IST program originally submitted was based on SRV testing at a 5-year frequency per IWV-3510. PVNGS has recently updated to OM-1 for SRV testing. OM-1 requires a test interval ranging from 24 months to 5 years for Class 1 valves and main steam safety valves, depending on the number of valves of the same type and manufacture. For Class 2 and 3 valves, the OM-1 test interval ranges from 48 months to 10 years.

Consistent with the philosophy of OM-1, PVNGS plans to test MSSC SRVs on a 5-year basis and LSSC SRVs on a 10-year basis. This will not affect current testing frequencies. The MSSCs will continue to be tested on a 5-year basis (pressurizer safety valves and main steam safety valves) or each refueling per their Technical Specification requirements (LTOP relief valves). All the other SRVs are ranked LSSC and will continue to be tested on a 10-year basis.

When ASME makes a risk-informed SRV Code Case available, APS will consider adopting this Code Case in place of the approach outlined above.

Question: G-4

What acceptance criteria are used for the full-stroke open test of the LPSI, HPSI and containment spray pump discharge check valves and the LPSI and containment spray pump suction check valves? If the acceptance criteria are based on achieving a specific flow rate during pump inservice testing, would the acceptance criteria change if the exemption request is implemented?

Response:

The current acceptance criteria for the full-stroke open test of the HPSI, LPSI, and containment spray pump check valves are passing the maximum required accident condition flow through the valves per Generic Letter 89-04, Position 1. These acceptance criteria will not be changed when the proposed alternative is initially implemented. Subsequent adoption of risk-informed check valve code cases may affect acceptance criteria in the future.

Question: G-5

[A] Are there any plans to perform any partial-stroke testing of any check valves classified as LSSCs during the deferred testing period? [B] Are other test methods, consistent with OM-22, being considered?

Response:

[A] APS foresees very little partial-stroke exercising once the LSSC testing strategy is implemented (see response to E1-3). LSSC valves will be full-stroke exercised during regular testing whenever practical. Partial-stroke testing will be performed only if the preferred test (full-stroke exercising) is not practical. The test intervals for good-performing LSSCs will soon exceed one fuel cycle, and full-stroke exercising is practical for most valves sometime during a fuel cycle. Therefore only those valves which are not practical to full-stroke at power and whose test interval is less than one fuel cycle will be part-stroke exercised. This is not expected to encompass very many valves.

[B] APS will continue to consider other test methods, such as non-intrusive testing and disassembly / inspection, where their use would be beneficial. It is anticipated that ASME will provide further guidance on using other test methods in future code cases.

Question: G-6

What is the testing schedule for LSSCs that can only be tested during cold shutdowns or refueling outages? How would you propose these components to be addressed in the deferred test justifications that are evaluated during the 10-year IST program intervals?

Response:

Under the RI-IST program, LSSCs will continue to be tested in the plant modes where testing is practical. Palo Verde will maintain deferred test justifications for those components where testing at power is not practical.

LSSCs that can only be tested during refueling outages will continue to be tested during refueling outages until their performance history justifies a test interval of two fuel cycles or longer. At that time one or more refueling outages may pass when the component is not required to be tested.

LSSCs that can only be tested during cold shutdowns will continue to be tested during cold shutdowns and refueling outages. When the performance history justifies interval extension, these components will naturally fall into a refueling outage cycle for testing. Again, as their performance history justifies, one or more refueling outages may pass when the component is not required to be tested.

Question: G-7

Some licensees have claimed in relief requests that stroke-time testing of solenoid valves provides no information because either the valve strokes or fails and therefore no determination of degradation can be made. It appears that virtually all solenoid valves in the Palo Verde IST program are classified as LSSCs. [1] Are all solenoid valves at Palo Verde exercised as a result of normal plant operations, whether it be at power, cold shutdowns or refueling outages? [2] If the exemption is implemented and testing of solenoid valves differed, would any of these valves be left in the energized position for the entire frequency? Is the licensee considering any more frequent exercising of solenoid valves that are not exercised during their deferred test interval? Please comment.

Response:

The understanding of the APS engineering staff is that any SOV left in one position for long periods without stroking it may be a concern. The APS Engineering staff agrees that stroke timing may be of little value where SOVs are concerned.

[1] There are 80 SOVs in the IST/PRA program. Fifteen are MSSCs and 65 are LSSCs. A preliminary review indicates most are exercised during normal plant operations. APS will provide an actual list of all components which are not exercised during the course of a cycle by July 31, 1996.

[2] The best information APS currently has suggests that it is beneficial to exercise all SOVs a minimum of once per cycle. It is anticipated that ASME will provide further guidance on testing of SOVs in future code cases. APS may modify this decision based on these code cases.

Question: G-8

The sensitivity studies described in section 4.2.5 do not appear to adequately explore whether components could easily change from one category to another as a function of: A) failure rates which could be age-dependent B) component unavailability assumptions which tend to vary with service condition C) small variations of the decision criteria [i.e., F-V and RAW thresholds].

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: G-9

Staff approval of an exemption from the requirements of 10 CFR 50.55a (f) does not relieve the licensee of its responsibility to comply with technical specifications (TS).

Response:

PVNGS Technical Specifications section 4.0.5 contains a provision that allows deviation from inservice testing requirements of ASME Code Class 1, 2, and 3 pumps and valves where written relief has been granted by the NRC. Since the proposed Risk-Informed IST program is expected to be approved by the NRC as an alternative to the ASME, no Technical Specification change to this section will be necessary to implement the NRC-approved program.

Implementation of the Risk Informed IST program, upon approval by NRC, will not conflict with full compliance with the valve and pump testing requirements specified in PVNGS Units 1, 2 or 3 Technical Specifications. APS will continue to fully comply with the Units' Technical Specifications, as required by the PVNGS Operating Licenses.

Question: E1-1

The test frequencies referenced in the Enclosure 1 table are based on the 1980 edition of ASME Section XI. The licensee's second ten-year IST interval will be based on OM-1 for relief valves, OM-6 for pumps, and OM-10 for valves other than relief valves. This table should be revised to reflect the applicable code references.

Response:

The current PVNGS IST Program is based on the 1980 Edition / Winter 1981 Addenda of Section XI, although APS recently updated to OM-1 for safety/relief valve testing (see response to Question G-3). Since approval of the RI-IST Program during the first 10-year interval (see response to Question G-1) is anticipated, the references to IWP and IWV remain valid.

Question: E1-2

Under Item 1, it is stated that two SSC groups were used, the MSSC and the LSSC groups. Later in the submittal (such as in the table on page 11 in Enclosure 3) a 3rd "Medium" grouping for intermediate safety significant SSCs is used. We found this apparent inconsistency confusing although the use of the Medium group was identified later. A broad question during this program is going to be the concerns associated with how to deal with SSCs that are borderline, those that, considering uncertainty, fall so close to whatever cutoff criteria are used, might well belong in either group. See Figure 1 which is a plot of RAW vs. F-V importance (at the end of this question list). This plot is a fairly typical example of the relatively large number of plant components that can fall in the borderline mid-range of the cutoff criteria. This issue is connected with later questions that we have identified about the details of how the Expert Panel carried out its decision process. For this specific area, please provide a more detailed discussion of how the medium group was resolved into the higher or lower safety significant groups.

Response:

Written criteria for ranking IST components by the Expert Panel were not established prior to the final ranking of components by the Expert Panel as MSSCs and LSSCs. Criteria were established through the Expert Panel deliberations during the ranking process. These criteria were described in general terms in Enclosure 3 of APS letter 102-03554 dated November 27, 1995 and in more detail in the enclosure to letter 102-03573 dated December 20, 1995. However, neither description provided specific information that described how the decision criteria were applied to each IST component.

Decision criteria will be documented for the initial ranking of IST components for the following deterministic considerations not currently quantified by a PRA:

- Ranking of IST components for containment isolation,
- Ranking of IST components that are not modeled by PVNGS at power PRA,
- Ranking of IST components for Shutdown operation,
- Ranking of IST components from an Initiating Event perspective,
- Ranking of IST components from an External Events perspective including
    - Seismic events
    - Fire events
    - Flooding Events.

The results of the above initial deterministic evaluations will then be considered by the Expert Panel, along with the input from the PRA ranking of IST components, to determine the final ranking of the components. The decision criteria used by the Expert Panel to perform the final ranking will also be documented.

APS will then re-perform the ranking by the Expert Panel and provide the decision criteria and results to the NRC by September 30, 1996.

Question: E1-3

Under Item 1, it is stated that all pumps and valves whose function is required for safety will continue to be tested in accordance with the ASME Code. To be consistent with later statements in your proposed program, shouldn't this statement be revised to indicate that improved test methods may be identified for the MSSCs through the ASME O&M Committee work described on page 4 of Enclosure 3 of your submittal?

Response:

Yes. The ASME O&M Committee is developing Code Cases with recommendations for enhancing the testing of MSSCs.

Palo Verde is currently evaluating OMN-1 and attempting to integrate it with the current MOV testing program and the RI IST program. The issue of incorporation of OMN-1 into this submittal remains undecided. Specifically, the issue of whether the current PRA Analysis bounds the use of OMN-1 by itself remains open; the quantification of test effectiveness for enhanced testing methodologies needs to be addressed.

APS's goal is to have this issue addressed by September 30, 1996.

Question: E1-4

Under Item 3, it is stated that the RB-IST Program Description may be changed without prior NRC approval provided the changes do not have an adverse impact on plant safety. Please describe what criteria will be used to make that determination.

Response:

The following criteria is proposed:

APS may make changes to the Risk-Informed IST program process without prior NRC approval provided the changes do not involve an unreviewed safety question as defined in 10 CFR 50.59. APS may make changes to the component classifications (LSSC vs. MSSC) and testing schedules in the RI-IST program without prior NRC approval provided the guidance of the RI-IST program is utilized. Changes made to the RI-IST program process or to the component classifications or testing schedule made without prior NRC approval will be reported to the NRC within 90 days of implementation of the changes during the first two years after approval of the RI-IST program. After the first two years following approval of the RI-IST program, IST program documents will be submitted to the NRC to reflect major changes and at least once every other operating cycle for PVNGS Unit 1, as recommended in Appendix A, Question Group 61, to NUREG-1482.

Question: E1-5

The next to last paragraph of this page states that one MSSC that was not originally in the IST program and that, although it is outside of the ASME Code class boundary, it is planned to test that component because it has safety significance. It is important that the details concerning such cases be well documented so that an improved understanding can be achieved of this whole process of using risk information. Accordingly, please provide more detailed information about this component (and any other such components) including the information used to [1] determine its risk significance, [2] the proposed test strategy, [3] and information on its associated Code class boundary, etc.

Response:

AFNV012 is the discharge check valve for the Non-essential auxiliary feedwater pump (AFN-P01). From a PRA perspective the entire auxiliary feedwater system is important primarily because Palo Verde lacks the ability for once through cooling, because Palo Verde has no power operated relief valves (PORVs). AFN-P01 is important because it can be used as a backup to the Essential Aux Feedwater system even though it is NOT credited in the Safety Analysis. It is used primarily for supplying makeup water to the steam generators during startup and shutdown. AFN-P01does not receive an Auxiliary Feedwater Actuation Signal (AFAS). The pump is included in the IST program as an augmented component because it has Technical Specification requirements.

[1] AFNV012 was determined to be a MSSC because there is a potential for vapor binding/failure of the pump if it were to leak.

[2] Current Testing: AFNV012 is periodically disassembled per 73AC-0XI03, Check Valve Predictive Maintenance and Monitoring Program. This valve is also monitored on a shiftly basis by an Auxiliary Operator. The piping upstream of the check valve is monitored for temperature to ensure there is no reverse flow of steam, which could potentially bind the pump.
While this component will be tested using ASME methodology insofar as practical, it will not be subject to ASME administrative requirements (i.e. relief requirements).

[3] This valve is Quality Augmented (QAG). It and the line it is in were originally constructed in accordance with ANSI B31.1. It is non-seismic and non-ASME. This valve is located at Coordinates H,5 on plant drawing 01-M-AFP-001.

Question: E1-6

In the 5th paragraph on this page, it is stated that Item 3 of the exemption request will allow certain changes to be made to the methodology without NRC approval. Please describe the criteria that will be used to distinguish when changes will be approved through the NRC and when they will not. If there is a single set of criteria that applies to the statement made on this page and the similar issue addressed as E1-4 above, a single answer is fine.

Response:

See the response to Question E1-4.

Question: E1-7

Paragraph 6 of this page discusses that changes in IST test frequencies will be provided to the NRC in regular program updates. How frequently are these updates envisioned? [See also E1-4]

Response:

See the response to Question E1-4.

Question: E1-8

The next to last paragraph of this page discusses the negative aspects of overly extensive testing of components, from component wearout and system unavailability to personnel radiation exposure. We agree that all of these negative aspects exist and wish to develop a better understanding of the potential impact on your plant. Accordingly, please provide a summary of any analyses that you have performed to assess these important factors.

Response:

APS has discussed several evaluations with the staff which consider some of these elements. This should give the NRC a better understanding of how these issues impact PVNGS.

Question: E1-9

The exemption request (page 3 of 5) states that:
Components in the current ASME Section XI IST Program which are MSSCs will continue to be tested in accordance with the current IST Program, which meets the requirements of Section XI of the ASME Boiler and Pressure Vessel Code, except where specific written relief has been granted.

The licensee should describe its method for determining the test frequencies of both the LSSCs and MSSCs. If the test frequency for the MSSCs was based solely on the Code test frequency, and not through a risk analysis, discuss why this is acceptable.

Response:

The method for determining the test frequencies of the LSSCs was described in Enclosure 5, section 5.5.1, Analysis Results, of APS letter 102-03554 dated November 27, 1996.

In brief summary, a base case was established using the current frequencies. (Frequencies are the code frequency except where relief has been granted). The test intervals were extended to 3, 6, 9, 12, and 15 years for LSSCs while the intervals for the MSSCs were left at their current frequency. The percent increase in CDF, LERF, and 90-mile Dose were recalculated for the aggregate. The choice of six years for the LSSCs was an attempt to 'optimize' risk, schedule and cost. The results of this analysis were compared to the acceptance criteria calculated in accordance with the EPRI PSA Applications Guide (Table 4-1, Quantitative Screening Criteria) and found to be acceptable, as shown in Table 5 (of Enclosure 5). It was concluded that the proposed changes to LSSC test intervals would maintain an acceptable level of public safety. This recalculation included leaving the MSSCs at the current frequency.

While the resulting analysis did show that there was an acceptable increase in risk, APS sees the value of optimizing MSSC components on an individual basis with available plant data. It is APS' intention to do that with the ASME code case(s) as they become available however, the issues of enhanced test effectiveness remain open as discussed in E1-3.

Question: E2-1

In the 1st bullet on this page it is stated that candidate components for extended frequencies were placed in the LSSC category by a blending of probabilistic and deterministic methods. Please describe the criteria used for accomplishing this blending.

Response:

See response to E1-2.

Question: E2-2

Section 2 states that testing of an LSSC can be deferred to once every 6 years after two successful tests. Valves would be arranged into groups similar to those described in GL 89-04, Position 2, and tested on a staggered basis. However, for valves that are tested quarterly, a large number of valves would become eligible for deferred testing six months after approval of the exemption request. The NRC will need to review the [1] actual component groupings, the detailed grouping criteria, and [2] sample expansion criteria in order to evaluate the adequacy of this phased-in approach. [3] Also, please describe the implementation schedule to achieve deferred testing on a staggered basis.

Response:

[1] Groups will have to be established for two purposes. Groups for ease of scheduling tests, and groups that would need to be established if a component were to experience a transportable failure. In general, groups established for ease of scheduling would be by service condition, orientation, and manufacturer. An example of a group might be all the Safety Injection Tank (SIT) isolation MOVs. For Palo Verde there are four of these valves; 1JSIBUV0614, 1JSIBUV0624, 1JSIAUV0634 and 1JSIAUV0644. It is not possible to foresee all the different groupings that may arise during the course of a failure evaluation.

[2] APS has been exploring two options for extending LSSC test intervals from their current periodicity to the analyzed limit of six years.

The first option ('doubling') tracks components individually. At least two good tests are verified and then the interval is doubled. If the component was on a quarterly test, then, assuming good tests, its interval would double from quarterly to six months to a year to two years to four years. Then because eight years would be beyond the analyzed limit, the frequency would increase to six years, provided there are no failures. Graphic and narrative examples are provided in Attachment 1.

The second option ('staggering') tracks components by groups. The above mentioned SIT valves have been used to illustrate how like components may be staggered. Again, at least two good tests would be verified for each individual component. Then the components would be staggered over their respective train outages. Graphic and narrative examples are provided in Attachment 2.

[3] The schedule of achieving the deferred testing on a staggered basis will be provided to you by September 30, 1996.

Question: E2-3

Section 2 of Enclosure 2 states that "[t]he test frequency of certain LSSCs in the IST Program shall initially be extended to once every 6 years." [a] "[t]he test interval for LSSC must be supported by performance data such that the licensee can reasonably expect to find that the component is functional when the inservice test is performed. Therefore, the risk analysis should be supported by performance data for the proposed test interval i.e., the PRA should be supplemented by deterministic methods, such as performance history, to evaluate the acceptability of the proposed test frequency. [b] Furthermore, there should be a performance based feedback mechanism in place to ensure that any adverse or ineffective test strategies are promptly detected and revised.

Response:

[a] The performance history of each LSSC will be reviewed prior to its tests interval being expanded. The "doubling" and "staggering" approaches have been described in question E2-2.

[b] The performance feedback mechanism, which will address test frequency changes, has been described in question [E2-4]. Test methodologies which are determined to be adverse or ineffective will be addressed as they are under the current program: Although licensees are obligated to continue performing the code-required test until a revised code becomes effective or relief is granted, PVNGS performs supplementary testing as necessary to demonstrate that all pumps and valves necessary for safe operation will perform satisfactorily in service.

Question: E2-4

Describe the PVNGS corrective action program that is referenced in Section 2 and exercised in the event that an LSSC fails its inservice test. What criteria would be used to initiate testing of the remaining valves in that group? The corrective action should explicitly include consideration of the need for revising the test frequency. The staff would like to review, during a site visit, any PVNGS procedures or program documents that provide assurance that failures of IST components will be promptly identified and addressed and modifications to the inservice testing program (e.g., changes to the surveillance intervals) are made in a timely manner.

Response:

In general, there are two circumstances when a failure of an IST component warrants review:

1. When a component is operated for the purposes of performing the periodic In Service Test (IST) and it fails;
2. When a component is operated during routine evolutions and it is recognized by the operator that it has failed to perform its function.

There are several mechanisms in place to assure that these failures are captured. The accompanying flowchart provided in Attachment 3 describes the process which is currently in place. Several others are being evaluated by Palo Verde (These appear as grey boxes on the flow chart).

Once the failures are identified, there are two specific issues to be addressed. These issues are:

1. "Transportability," which is identifying other components susceptible to the same failure mechanism and the corrective actions needed to address them; and
2. The need to adjust test intervals.

1. Transportability: A Condition Report / Disposition Request (CRDR) is initiated when a CRDR condition exists. CRDR conditions include premature, repetitive, or unexpected component failures which require additional evaluation. Therefore a CRDR would be initiated whenever a failure occurs. CRDRs are classified as Significant, Adverse, or Review. Failure of a RI-IST component would be classified as Significant or Adverse using the guidelines in the CRDR procedure. It is expected that failure of MSSCs would be classified as significant and failures of LSSCs would be classified as adverse. Significant CRDRs receive a transportability evaluation as part of the root cause investigation to identify other equipment that may experience failures from similar root cause(s) and to ensure that specified corrective actions will be broad enough to prevent this specific failure as well as other susceptible component failures. Adverse CRDR evaluations also address the transportability of the condition, although less rigorously than in a formal root cause investigation. Therefore the CRDR process ensures that failures of components in the RI-IST Program will be evaluated to address the susceptibility of other components to the same failure mechanism and the need for corrective action on other components. Palo Verde is currently evaluating the need to identify any work document generated on the equipment within the scope of the RI-IST program. This may involve the IST engineer screening all work

documents for conditions which may need further evaluation. Further details on this will be provided to the staff by September 30, 1996.

2. The need to adjust test intervals: Because fixed IST test intervals are specified by the Code, the current corrective action program does not address the need to evaluate test intervals after a failure. A new process will be added to the IST Program procedure to evaluate functional failures of IST components for the need to adjust the test intervals. It may use the functional failure reporting mechanism developed for the Maintenance Rule. The evaluations will be done by IST Engineering, which will also initiate any necessary test interval changes. The procedure content to put this process in place will be provided to the staff by September 30, 1996.

Question: E2-5

Item 4 states that the aggregate impact of multiple changes to test frequencies will be evaluated by one or both of (1) Expert Panel review, and (2) updates to the PRA models and analyses. Please provide the rationale (criteria) to decide when and when not to use both of these approaches. Also describe how the aggregate impact will be evaluated including any "cutoff" criteria beyond which further changes may not be allowed. (see PRA-6)

Response:

It is intended that the aggregate impact of all changes will be evaluated by analysis and the results reviewed by the Expert Panel. The "cutoff" criteria that will be used will be the permanent change criteria contained in the EPRI PSA Applications Guide. The Expert Panel will review the analysis to determine if changes to the risk ranking results are appropriate due to changes in relative importance, even if the change criteria are met.

Question: E2-6

Item 5 on this page states that the need to update the PRA will be evaluated every 18 months. Please expand on why this particular interval is planned for maintaining your living PRA. For example, presumably there will be some criteria that the licensee will use at the end of each 18 months to determine if there has been sufficient and significant changes in the plant systems or in PRA analysis areas that a PRA update would be justified. Please describe such criteria. Also, does the licensee envision that an update would be made sooner in certain instances, e.g., if new data became available that was judged to potentially have a significant impact on the ranking of the SSCs?

Response:

The 18-month period designated for PRA model evaluation/update is based upon the PVNGS 18-month operating cycle. Because plant changes are typically implemented during shutdown, the PRA update is intended to coincide with this cycle. As part of each PRA model update, bayesian update of certian plant specific data is performed. Such updates provide for inclusion of new data related to component performance.

In order to maintain an awareness of plant design changes, members of the PRA group are designated as "system engineers" for particular plant systems. Each is responsible for performing pre-installation review of design changes to his/her assigned systems. Through such review, as well as direct interaction with PVNGS Design Engineering, the PRA team is able to provide feedback on the overall risk effect of proposed plant modifications. In addition, the PRA engineer is able to assess the need for changes to the PRA model as a result of such plant changes.

Question: E2-7

If it is to be used, describe how the ASME Code Case OMN-1 may be used in conjunction with the risk-informed IST program.

Response:

The OMN-1 Code Case may not be bounded by the current PRA analysis (i.e. test frequency would be extended). APS believes the enhanced testing of OMN-1 would be beneficial. APS is currently in the process of evaluating OMN-1 to assure the safety benefits of the Code Case can be incorporated into the Risk Informed Inservice Testing Program. (Also see E1-3)

Question: E3-1

Section 1.0 states that there are possible savings from risk informed testing including reduced costs for developing test criteria at design basis conditions. Yet, testing MSSCs in this manner is not required by the current Code (but could be a more effective means for detecting important failure modes and causes). Please comment.

Response:

The submittal was written based on the assumption that the requirement for design basis testing was imminent. [Case in point, the MOV Code case is considered design basis testing]. If design basis testing were to be required for IST components under the RI-IST, it would be appropriate to apply design basis testing to MSSCs but not LSSCs and hence the savings. If design basis testing does not become a requirement, then savings would not be credited.

Question: E3-2

In the first paragraph on this page it is stated that the ASME O&M Committee is to make recommendations about possible improvements for the MSSCs. The licensee should clarify the relevance of this activity to their exemption request (i.e., does the licensee anticipate incorporating revised ASME Code test strategies into their risk-informed IST program?). Please give us any updated information about the schedule for this activity and how the licensee plans to evaluate the potential value of utilizing this information in its IST program.

Response:

Since the November 27, 1995 submittal, ASME has published the OMN-1 Code Case for MOVs. The NRC has stated that it is acceptable to use this as a long term implementation of the MOV program, and that a licensee could use this long term program as an alternative to the typical stroke time testing done under most IST programs.

There is still a PRA issue associated with test effectiveness to resolve prior to implementing OMN-1. (See answer to E1-3)

The ASME is publishing rules for check valve condition monitoring in an appendix to the 1996 addenda of the OM Code. If check valve condition monitoring is positively received by the NRC (as the MOV code case was) Palo Verde will consider using it as well.

The ASME main committee has directed all subcommittees and working groups to put all other work on hold and to focus their energies on publishing Risk Based Code Cases for the rest of the valve types. As these become available, and endorsed by the NRC they will be considered for implementation at Palo Verde.

Question: E3-3

Starting at the bottom of page 4 under the section titled "Direct Safety Enhancements," the first and last bullets appear to contradict each other as written and may be misleading. Some revised wording is suggested here to clarify the greater attention that will be given to the MSSCs (e.g., the thought that the revised IST program could result in some MSSCs being tested with higher frequencies and others with lower frequencies with the overall intent of enhancing safety). (This comment also applies to discussion in Section 2.1 of Enclosure 4.)

Response:

APS agrees with the NRC comment and will change the sections to reflect the concern in the revised program to be submitted at a later time. (Note: the whole section will be changed to remove the reference to direct and indirect safety enhancements. The way the sections are written now, there is mixing of indirect and direct, MSSC and LSSC.)

Question: E3-4

In the second bullet on this page, describing the three phases of the IST project, it indicates that component performance was used with risk insights to make decisions about what components should be deferred. Please describe what role component performance played in making such decisions together with risk information.

Response:

Component performance is inherently considered in the PRA by using generic and/or plant specific failure rate data. The Expert Panel did not specifically consider individual component performance. The Expert Panel only considered generic performance of components during the ranking process. As an example, check valves are known to open very reliably. In contrast, SOVs are generically known to fail if not cycled periodically.

LSSCs will be evaluated individually by the IST Engineer to determine whether their performance warrants extension. This evaluation and the methods to phase in the interval extension is explained in the response to question E2-2.

Question: E3-5

In the second paragraph of this page, it is stated that the methodology described in this document is consistent with the EPRI/NEI PSA Applications Guide generally. Please identify any areas that you consider significant where you deviated from the guidance in the PSA Guide and your reasons for doing so.

Response:

Noted deviations from the PSA Guide include the application of more stringent criteria for component categorization than suggested in the PSA Guide. For example, the PSA Guide, (page 4-12) recommends a component-level Fussell-Vesely (F-V) importance criteria of >0.005 for overall risk significance determination. Palo Verde used a F-V risk significance cutoff of >0.001 for Low, and a cutoff of 0.01 for High risk significance. In the subsequent ranking, components initially ranked as Medium were ranked as MSSCs, unless the Expert Panel provided adequate justification for their being removed to the LSSC category. In addition, the PSA Guide suggests a Risk Achievment Worth (RAW) importance criteria cutoff of >2 for overall risk significance determination. Palo Verde used a RAW cutoff of >2 for the Medium category, and a RAW of 10 for the High category. Because the Risk Reduction Worth (RRW) computation is simply a function of the F-V importance measure, Palo Verde did not directly evaluate using RRW criteria. In addition, Palo Verde did not perform system/train level risk significance determination.

Question: E3-6

The second bullet states that sensitivity studies were used to compensate for limitations in the quantitative PRA models. Please describe how each sensitivity study was carried out and the results.

Response:

The following sensitivity studies will be performed using the 1994 PVNGS PRA model solution cutsets. Analysis results will be provided to the Expert Panel upon completion. The Expert Panel will review results of each analysis to determine whether changes to the risk ranking are warranted. Analysis results will be provided to the NRC upon completion of each study. All analyses are scheduled for completion in August 1996.

Unavailability sensitivity
This analysis will assess whether components could change risk importance categories as a result of component unavailability assumed in the PRA model. For unavailability calculations, the PVNGS PRA model uses predominantly the mean value. In order to assess the potential effect of sensitivity to assumed component unavailabilities, specific valve groupings will be re-ranked based on both the 5th and 95th percentile unavailability. The study will include separate analyses for groupings of valves in each of the following categories: MOV, AOV, SOV, PSV and CKV. Failure modes to be analyzed will be determined as analysis is performed.

Human Errors
In performing component risk ranking, the potential exists for masking the importance of components as a result of optimistic values for human recovery actions. In order to assess the potential effect of human recovery assumptions, cutset analysis and component re-ranking will be performed on minimal core damage cutsets with human errors eliminated. This elimination will include all modeled human action events except for "operator failure to restore after maintenance" events.

Common Cause
The potential was noted for overly-conservative common cause values to mask component importance during the SSC risk ranking. In order to assess this potential effect, cutsets containing common cause events will be eliminated from the PRA Model solution. Elimination of such cutsets will result in the retention of only valid, minimal core damage cutsets.

Human Error/Common Cause
The combined effect of human error and common cause events may result in component risk importance masking. In order to assess this possibility, a further analysis will combine the techniques described in the above Human Error and Common Cause categories.

Truncation limit
In performing the PRA quantification, the potential exists for certain components to be eliminated from the core damage cutsets as a result of the truncation level applied. Quantification at lower truncation levels may result in components shifting between risk importance categories.
In order to assess the potential for components shifting between categories, core damage cutset analysis and component ranking will be performed at various truncation limits.

Dynamic risk ranking
The structure of the PRA model is such that it does not directly account for variations in plant equipment status due to regularly scheduled maintenance activities. Because of this, the potential exists for variation in SSC ranking for different plant configurations. In order to assess the potential for operational configurations affecting SSC ranking, component re-ranking will be performed to include such variations. The analysis will include various component configurations identified in Palo Verde's 12-wk. site maintenance schedule (APS procedure 51DP-9OM03). Initially, this study will analyze the individual weeks which have the highest risk levels. Additional analysis may be performed, as deemed appropriate.

Age-dependent failure rates
The potential exists for variation in component importance ranking based on component age and service condition considerations. Review of industry documentation (i.e. NUREG/CR-5944) will be performed to ensure that these effects are bounded by the analysis for component unavailability sensitivity, described above. If age-dependency and service condition effects are determined to be outside the bounds of the unavailability analysis, they will be addressed explicitly.

Dual components OOS
During the course of plant operations, it is possible for multiple plant components to be simultaneously out of service. During these periods, the risk importance of in-service components providing similar functions may be increased. In order to assess the potential for increased component importance as a result of plant configurations, analysis will be performed to evaluate combinations of two valves removed from service. Component re-ranking (in terms of RAW) will be performed on minimal core damage cutsets with various sets of two valves simultaneously removed from service. Specific valve combinations to be analyzed will be determined as analysis is performed. Further analysis may be performed, as deemed appropriate.

Decision Criteria
The potential exists for components changing risk importance category as a result of variations in decision criteria. In order to assess this possibility, components will be ranked at various F-V and RAW threshold values.

Question: E3-7

The fourth bullet on this page states that IST engineers will review past performance and service conditions of LSSCs to determine if they warrant extended test intervals. Will the Expert Panel review such cases and what criteria will be used by both the IST engineers and the panel (if the panel is involved)?

Response:

EP will not be involved. See the response to question E2-2 for details on performance evaluation by the IST engineers.

Question: E3-8

At the end of page 7 and top of page 8 it is stated that, while core damage prevention has been found to be a good measure of the spectrum of releases that can result from severe accidents, several components have been identified that do not impact core damage frequency yet they do have a large impact on fission product release potential. Please identify such components.

Response:

Such components would include those having a LERF-RAW of >=2, and a F-V rank of <1E-3. The following is a listing of such components (taken from Enclosure 4, Appendix C). It should be noted that the results reported in Enclosure 4 will be revised prior to implementation of the RI-IST program, after completion of the 1996 PRA quantification. Final results may vary from those reported in Enclosure 4 with APS letter 102-03573 dated December 20, 1995.

AFA-V015	AFW pump AFA-P01 disch check valve
AFA-V137	AFW pump AFA-P01 disch check valve
AFB-HV30	AFW pump AFB-P01 flow control valve to SG-1
AFB-HV31	AFW pump AFB-P01 flow control valve to SG-2
AFB-UV34	AFW pump AFB-P01 isolation to SG-1
AFB-UV35	AFW pump AFB-P01 isolation to SG-2
AFA-UV37	AFW pump AFA-P01 isolation to SG-2
AFC-UV36	AFW pump AFA-P01 isolation to SG-1
AFA-V016	AFA-P01 disch isolation
AFN-V012	AFW pump AFN-P01 disch check valve
AFN-V013	AFW pump AFN-P01 disch isolation valve
SIA-HV687	Ctmt Spray isolation valve
SIB-HV695	Ctmt Spray isolation valve
SIA-UV660	RWT recirc isolation valve
SIB-UV659	RWT recirc isolation valve
CHB-HV530	RWT isolation valve
CHA-HV531	RWT isolation valve

Question: E3-9

Item 3.3 titled "Completeness Issues" starting on page 8 describes what was done to compensate for the limitations in the PRA quantitative risk models. The five bulleted items briefly describe evaluations aimed at: truncation limits, masked components, common cause, operational concerns and sensitivity studies. We believe that these are extremely important issues concerning the adequacy of the PRA models used, and the description is not sufficient for us to understand how each of these issues was evaluated and the results. Please expand this area to more fully explain what was done and what was learned.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: E3-10

Item 3.4 on "Cumulative Effects of Test Interval Changes" is, similarly to Item 3.3 (E3-9), too brief for us to fully understand what was done. This is another area that we have been very interested in learning more about its ramifications and possible approaches for avoiding unacceptable risk levels. Please provide an expanded discussion of how this issue was evaluated and what the results were.

Response:

A risk-ranking approach based on importance measures for individual valves does not guarantee that acceptable levels of risk will result when changes are made to the testing strategies for multiple components. Individual risk importance measures are based on changes to components one at a time. Simultaneous changes to many components may cause unintended increases in risk, despite meeting the risk-ranking measures. To address this issue, analysis was performed to evaluate the aggregate risk impact of simultaneously increasing test intervals for all the candidates for test interval extension. This was done to ensure an acceptable change in plant safety. Consideration was given to available information on how component unavailability is affected by changes in test intervals. Uncertainty in this information, together with the complexity required to model such an approach, dictated the use of a simplified but conservative approach. That is, risk impact was measured assuming that the increase in component unavailability was proportional to the associated test interval.

The impact of the changes to the IST program was evaluated by increasing the failure probability of the 85 PRA-modeled LSSCs in the IST Program. The individual failure frequencies were modified to reflect the new test frequency. The associated changes in CDF, LERF, and public consequences were then calculated by updating the basic event probabilities in a copy of the basecase cutset file from the 1994 PVNGS PRA model. This entailed the following assumptions:

1. The failure probability for all valves is considered to be completely time-dependent.
2. Changes to the IST Program will not change the failure rate.
3. All 85 LSSC test periods were uniformly extended to 3, 6, 9, 12, and 15 years.
4. Reduction in risk due to reduced opportunities for failing to restore components or test-induced failures were not considered.

The first analysis using the 6-year interval resulted in a CDF increase of greater than 300%. This increase was dominated by the changes made to 8 motor-operated valves in the Auxiliary Feedwater (AF) system. These valves were re-reviewed by the Expert Panel and reclassified as MSSCs. A subsequent analysis was performed with the 8 AF valves restored to their original test frequency. The results of this analysis is shown in Table 4.

In order to evaluate the sensitivity of risk measures on test interval, additional analyses were performed for test intervals of 3, 9, 12, and 15 years. The results of these analyses are also shown in Table 4 of Enclosure 4 to letter 102-03573 dated December 20, 1995.

Table 4. Aggregate impact on plant safety due to IST interval extension.

Test Interval (years)	**CDF (per year)**	**LERF (per year)**	**90-mile Dose (man-rem/year)**
Base Case	4.74E-5	2.13E-6	40.2
3	4.92E-5 (+4%)	2.44E-6 (+14%)	46.9 (+17%)
6	5.12E-5 (+8%)	2.51E-6 (+18%)	47.9 (+19%)
9	5.33E-5 (+12%)	2.57E-6 (+21%)	49.3 (+23%)
12	5.55E-5 (+17%)	2.64E-6 (+24%)	51.2 (+27%)
15	5.80E-5 (+22%)	2.71E-6 (+27%)	53.8 (+34%)

The results of this analysis were compared with acceptance criteria calculated in accordance with the EPRI PSA Applications Guide (Table 4-1, Quantitative Screening Criteria) and found to be acceptable, as indicated in table 5. It is, therefore, concluded that the proposed changes to LSSC test intervals will maintain an acceptable level of public safety.

Table 5 - Evaluation of Aggregate Impact

Risk Measure	CDF	LERF	90-Mile Dose
Aggregate Impact of extending LSSC Test Intervals to 6 Years	+8%	+18%	+19%
Acceptance Criteria from the PSA Applications Guide	<= +14.5%	<= +21.7%	(None Provided)
Evaluation	Acceptable	Acceptable	(N/A)

The above analysis does not consider the impact of extending the 265 LSSC valves which are included in the IST program, but are not modeled in the PRA. Since the PRA is intended to be a comprehensive evaluation of all combinations of failures that could lead to either core damage or large early release, it is unlikely that extending the test intervals of these valves would significantly impact the results presented above. Nevertheless, PVNGS plans to evaluate each of these valves for potential addition to the PRA model. Once appropriate inclusions are made, the aggregate risk impact of extended test intervals will be re-quantified. This requantification will be completed prior to final categorization of IST components.

Question: E3-11

In Section 3.5, areas of expertise are identified for the Expert Panel. Do one or more of these areas include experience in inservice testing?

Response:

During the initial ranking of components an IST engineer was present, however, he was not an official member of the Expert Panel. PVNGS has reevaluated its position and will officially add an IST engineer to the expert panel when considering IST related issues.

Question: E3-12

In Section 3.5.1, the first paragraph discusses the emphasis on using core damage frequency as the primary figure of merit. Please provide a discussion of your views on how to maintain a prudent balance between the emphasized use of CDF and challenges to the containment (defense in depth).

Response:

The risk-based prioritization of components relates component performance to overall public safety. Public safety is maintained through control of multiple barriers including fuel cladding, primary system pressure boundaries, and containment. For risk ranking, CDF was chosen as the primary figure of merit. This was based on the fact that most of the components considered are used to prevent or mitigate core damage. Additional figures of merit, including LERF, were used to provide additional risk insights with regard to risk significance, as well as to address those components which do not impact core damage frequency. Components were ranked high based on either high CDF or high LERF. This methodology provides for preservation of both barriers.

Question: E3-13

The paragraph directly under the table discusses how components were initially categorized. The explanation of this process is not clear. Please provide an example of how this was done (referring to specific components).

Response:

There were four risk indicators used to initially rank each component modeled in the PRA; CDF F-V, CDF RAW, LERF RAW and Common Cause RAW. The criteria for each risk indicator is listed in the table referenced in the question. The final PRA ranking is then the highest of the four rankings from each risk indicator. Two examples may be found on page 83 of Appendix C to Enclosure 4 provided in APS letter 102-03573 dated December 20, 1995, and are repeated below.

	CDF F-V	CDF RAW	LERF RAW	CC RAW	Final PRA Ranking
SIE-V113	2E-4	1.79	0	6	
Ranking	Low	Low	Low	Medium	Medium

In this case, the final PRA ranking of Medium is the highest of the four rankings based on the four risk indicators, which was the ranking for Common Cause-RAW.

	CDF F-V	CDF RAW	LERF RAW	CC RAW	Final PRA Ranking
SIE-V114	1E-2	4.63	2	15	
Ranking	High	Medium	Medium	High	High

In this case the final PRA ranking of High is based on the High ranking for CDF F-V and CC-RAW.

Question: E3-14

The explanation under "Qualitative Criteria" is difficult to understand. An example referring to how specific components were treated would help.

Response:

A complete description of the application of qualitative criteria will be provided to the NRC, as described in the response to Question E1-2.

Question: E3-15

The table and discussion regarding your requirements for Expert Panel membership show that six categories were defined and that the actual Panel reflected over 106 years of experience. How many Panel members were used in the total and what categories did each come under?

Response:

There is one member in each of the six categories. The actual experience of the Expert Panel as of March 1996 was:

Discipline	**Years**	**SRO**
Maintenance	25	yes
Operations	19	yes
Scheduling	16	no
Safety Analysis	25.5	no
Engineering	23	yes
PRA	15	no
Total	123.5	3-yes

APS intends to add IST expertise to the Expert Panel prior to the re-ranking of IST components as described in the response to question E1-2.

Question: E3-16

Under Process Considerations, System Level Screening, the approach for using the previous Maintenance Rule ranking and the PRA information is described. Please provide a summary of how the Maintenance Rule ranking was performed or refer to another document for a more detailed explanation. For example, how were cases resolved in which a component did not clearly fall either into the MSSC or LSSC categories and some additional criteria had to be applied?

Response:

As stated in the response to question E1-2, APS will re-perform the Expert Panel ranking of the IST components. When this ranking is performed, the system level screening of components based on the Maintenance Rule ranking will not be performed. No IST components will be screened as LSSC based on the maintenance rule system ranking; each component will be considered individually.

Question: E3-17

In the last paragraph, under Deterministic Evaluation, the submittal indicated that certain components of high reliability were removed from the MSSC category.

a. What criteria were used to determine when the reliability was sufficiently high to justify removal?

b. Was the determination of a sufficiently high component reliability based on plant-specific data or generic data or a mix?

Response:

The specific criteria used in the ranking process by the Expert Panel will be provided as described in the response to question E1-2. In general, reliability data used is a mix of generic data and plant specific data.

Question: E3-18

In the second bullet, under Initiating Events, it is stated that an exception to placing a component in the MSSC category was when the probability of failure was considered to be extremely low. Please define what criteria were used to determine this condition.

Response:

The specific criteria used in the evaluation of Initiating Events will be provided as described in the response to question E1-2.

Question: E3-19

Under External Events, it is stated that all components not screened out during the system level screening were evaluated based on external events information. What consideration was given to the screened-out components from the effects of external events?

Response:

As stated in the response to question E1-2, APS will re-perform the Expert Panel ranking of the IST components. When this ranking is performed, the system level screening of components based on the Maintenance Rule ranking will not be performed. Each IST component will be evaluated from an External Events Perspective.

Question: E3-20

Under External Events, what cutoff criteria were used to determine that the frequency of an event was improbable?

Response:

The specific cutoff criteria for not considering an improbable event will be provided as described in the response to question E1-2.

Question: E3-21

Under Reconciliation with Quantitative Results, it is stated that components were classified high risk if the initial disposition was high risk but the quantitative results indicated low risk. In such cases, was an attempt made to determine if modifications to the PRA were appropriate to better model component importance?

Response:

As stated in the response to question E1-2, APS will re-perform the Expert Panel ranking of the IST components. At the conclusion of this ranking, any conflicts in the ranking results of the Expert Panel with the PRA ranking will be evaluated and changes will be made to the PRA model as appropriate. It should be pointed out, however, that many of the differences in ranking were related to the consideration of shutdown risk and external events and do not reflect any conflict between the Expert Panel ranking and the PRA.

Question: E3-22

Under Reconciliation..., the Panel's procedures are described when quantitative results were in conflict with the initial disposition and that sensitivity studies were required (where possible). When such studies were not feasible or not possible, what approach was used to resolve such differences?

Response:

The specific criteria used in the ranking by the Expert Panel will be provided as described in the response to question E1-2.

Question: E3-23

Under Reconciliation..., the process described is difficult to understand. Please provide an example that refers to specific components to show how the process was carried out.

Response:

The specific criteria used in the ranking by the Expert Panel will be provided as described in the response to question E1-2.

Question: E3-24

Under Item 4.2, the 5th bullet states that both PRA and design basis functions were compared in an integrated manner. Please provide additional explanatory information to clarify what is meant by this. How was this integration carried out?

Response:

The review performed by the expert panel during the risk ranking process included a review of the component functions modeled in the PRA as well as a review of the design basis function for the component. The term "integrated" may be confusing. There was *no attempt* to "integrate" the PRA and Design Basis functions. The term "integrated" is meant to reflect that PRA and Design Basis functions were both reviewed during the risk ranking process by the expert panel.

Question: E3-25

The last sentence states that the proposed IST program is considered by the Expert Panel to have appropriate changes while maintaining an acceptable level of plant safety.

a. Has there been a requantification of the PRA to estimate the overall effect on plant CDF assuming all of the proposed changes are implemented? If so, please summarize the results. If a requantification has not been performed yet, but planned for the future, when would the results be available? For such a requantification, what risk parameters changes would be evaluated and what criteria used to judge an acceptable increase?

b. It is indicated that the PRA model will be updated to include IST components that were so far omitted from the plant's risk model. What is the schedule for submitting the results of this update?

Response:

The overall effect of test frequency changes on CDF was addressed as described in Enclosure 4 (in APS letter 102-03573, dated December 20, 1995). APS is currently in the process of a formal PRA model verification and update. This will include evaluation of un-modeled IST components. Requantification of the Level I PRA is currently scheduled for completion during first quarter of 1997. Typically PRA updates are not submitted as a matter of course but are retained on site available for NRC review. Upon completion of this update, further analysis (including appropriate sensitivity studies, re-ranking, and aggregate impact analysis) will be performed.

Question: E3-26

What criteria were used to classify check valve AFNV012 as an LSSC? Please indicate why only one valve that was outside of the Palo Verde IST program was classified as an MSSC? Were there LSSCs outside the IST program? If so, please identify them and indicate their testing under the risk-informed program.

Response:

Check Valve AFN-V012 is a non-IST component that was classified as an MSSC. This valve is the non-essential Auxiliary Feedwater Pump discharge check valve. This valve protects the pump from back flow from the steam generator to the pump which could result in steam binding of the pump. The valve was classified an MSSC based on industry events of this type and the importance of auxiliary feedwater to the PVNGS design.

The LSSCs outside the IST program are the same as the NYL valves discussed in question E5-2. See the response to question E5-2 for a discussion of these valves.
Components modeled in the PRA that were not ranked as MSSCs were not added to the testing program.

Question: E3-27

It is indicated that risk rankings of plant system components are complemented with rankings based on consideration of "external" accident initiators (e.g., fires, tornadoes, and earthquakes) and plant operating modes (shutdown). These rankings consider "importance's" with respect to core damage prevention and prevention of large early releases (LERF).

It is not clear, however, whether or not:

a. these studies are based on the updated plant model,

b. the LERFs also included the contributions due to external events,

c. the shutdown plant model includes the external events.

Please clarify these areas.

Response:

The only PRA model currently used by APS is the at-power PRA. The consideration of risk during Shutdown Operation and from External Events is performed qualitatively. The specific criteria used to perform these assessments will be provided as described in the response to question E1-2.

Question: E3-28

The staff would like to review the detailed system notebooks, the human reliability analysis, and the results of all independent IPE review activities during a site visit.

Response:

The PRA models, system notebooks, and other documents are available for review.

Question: E4-1

Why were check valves SIAV522, SIAV523, SIBV532 and SIBV533 (DWG) categorized as LSSCs even though these valves have a high shutdown risk? Please provide more information regarding the categorization decision than given in Enclosure 4.

Response:

As stated in the response to question E1-2, APS will re-perform the Expert Panel ranking of the IST components. The specific criteria used in the ranking by the Expert Panel will be provided to the NRC by September 30, 1996 along with the results of the re-ranking.

Question: E4-2

As part of a site visit, the staff would like to review the Expert Panel meeting minutes, or other relevant documentation, in order to understand the Expert Panel's basis for ranking un-modeled components. What criteria were used by the Expert Panel to classify valves? Were any valves classified as MSSCs based on maintenance considerations?

Response:

As stated in the response to question E1-2, APS will re-perform the Expert Panel ranking of the IST components. The Expert Panel criteria will be provided to the NRC by September 30, 1996 as stated in the response to Question E1-2.

Question: E4-5

The sensitivity studies do not appear to adequately explore whether components could easily change from one category to another as a function of: a.) failure rates which could be age-dependent, b.) component unavailability assumptions which tend to vary with service condition c.) small variations of the decision criteria [i.e., F-V and RAW thresholds].

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: E5-1

Specify the testing to be performed on the one MSSC that is not currently in the IST program.

Response:

Current Testing: AFNV012 (the non-class 1E Aux feedwater pump discharge check valve) is periodically disassembled per APS procedure 73AC-0XI03, Check Valve Predictive Maintenance and Monitoring Program. This valve is also monitored for back leakage on a shiftly basis by an Auxiliary Operator. The piping upstream of the check valve is monitored for temperature to ensure there is no reverse flow of steam, which could potentially bind the pump. In addition this component will be tested using ASME methodology insofar as practical, but it will not be subject to ASME administrative requirements (i.e. relief requirements).

Question: E5-2

Supply a list of the 115 valves identified as "NYL" valves. What further evaluations have been performed on these components? Have any been added to the IST program or designated for more testing commensurate to safety significance?

Response:

From a preliminary review, of the 115 valves that were listed as LSSCs that are not in the current IST program;

Sixty-nine are normally open, manual valves that would not be subjected to any further testing under the current code requirements.

Four valves were in the program at one time but removed because they were MOVs that were electrically disconnected. They are passive valves that would not be subjected to any further testing under the current code requirements. (Spray Pond valves)

Forty-two are valves whose safety function needs to be reconciled with the PRA modeling before any further testing will be done on them. This is scheduled to be done by July 31, 1996. Note, it is possible that exercising Preventive Maintenance Tasks or other monitoring are performed already on these valves that could be taken credit for because they are LSSCs.

These are the 115 valves:

eq_tag_num	MOD APP DESCRIP
1JRCNHV0446	RCP COOLER INLET VALVE
1JRCNHV0448	RCP COOLER INLET VALVE
1JRCNHV0450	RCP COOLER INLET VALVE
1JRCNHV0452	RCP COOLER INLET VALVE
1JRCNHV0447	RCP COOLER INLET VALVE
1JRCNHV0449	RCP COOLER INLET VALVE
1JRCNHV0451	RCP COOLER INLET VALVE
1JRCNHV0453	RCP COOLER INLET VALVE
1PSGNV963	ADV INSTRUMENT AIR FILTER INLET
1PSGNV964	ADV INSTRUMENT AIR FILTER INLET
1PSGNV965	ADV INSTRUMENT AIR FILTER INLET
1PSGNV966	ADV INSTRUMENT AIR FILTER INLET
1JSGNSV1131	NITROGEN SUPPLY PRESSURE RELIEF
1JSGNSV1147	NITROGEN SUPPLY PRESSURE RELIEF
1JCHEHV0532	ISOLATION FOR RWT TO BORIC ACID
1JEWAHCV0005	ECWS PUMP A INLET
1JEWAHCV0041	S/D HEAT EXCHANGER A INLET
1JEWAHCV0053	S/D HEAT EXCHANGER A OUTLET
1JEWAHCV0071	ECWS A HX INLET ISOLATION
1JEWAHCV0135	ECWS PUMP A DISCHARGE ISOLATION
1JEWBHCV0006	ECWS PUMP B SUCTION ISOLATION
1JEWBHCV0042	S/D HEAT EXCHANGER B INLET
1JEWBHCV0054	S/D HEAT EXCHANGER B OUTLET
1JEWBHCV0072	ECWS B HX INLET ISOLATION
1JEWBHCV0136	ECWS PUMP B DISCHARGE ISOLATION
1JSGNFV1113	SG 1 UPPER FW CONTROL

1JSGNFV1123	SG 2 UPPER FW CONTROL
1JSGNHV1143	FW ISOLATION BYPASS
1JSGNHV1145	FW ISOLATION BYPASS
1JSGNPCV1130	NITROGEN SUPPLY REGULATOR
1JSGNPCV1147	NITROGEN SUPPLY REGULATOR
1JSGNPV1128	NITROGEN SUPPLY
1JSIAHV0678	S/D COOLING HEAT EXCHANGER
1JSIAHV0683	LPSI PUMP SUCTION ISOLATION
1JSIAHV0684	CTMT SPRAY TO S/D COOLING HEAT
1JSIAHV0687	CTMT SPRAY ISOLATION TRAIN A
1JSIBHV0679	S/D COOLING HEAT EXCHANGER
1JSIBHV0689	CTMT SPRAY TO S/D COOLING HEAT
1JSIBHV0692	LPSI PUMP SUCTION ISOLATION
1JSIBHV0695	CTMT SPRAY ISOLATION TRAIN B
1JSPAHCV0045	ISOLATION FOR ESS COOLING WTR
1JSPAHCV0047	ISOLATION FOR ESS COOLING WTR
1JSPAHCV0125	ISOLATION FOR DG A JACKET WATER
1JSPAHCV0127	ISOLATION FOR DG A JACKET WATER
1JSPAHCV0133	ISOLATION FOR DG A LUBE OIL
1JSPAHCV0135	ISOLATION FOR DG A LUBE OIL
1JSPAHV0049A	ISOLATION FOR SP A INLET LINE
1JSPAHV0049B	BYPASS FOR SP POND A
1JSPBHCV0046	ISOLATION FOR ESS COOLING WTR
1JSPBHCV0048	ISOLATION FOR ESS COOLING WTR
1JSPBHCV0126	ISOLATION FOR DG B LUBE OIL
1JSPBHCV0128	ISOLATION FOR DG B LUBE OIL
1JSPBHCV0134	ISOLATION FOR DG B JACKET WATER
1JSPBHCV0136	ISOLATION FOR DG B JACKET WATER
1JSPBHV0050A	ISOLATION FOR SP B INLET LINE
1JSPBHV0050B	BYPASS FOR SPRAY POND B
1PAFAV002	MAIN STM SUPPLY TO AUX FW PUMP
1PAFAV006	AUX FW PUMP A SUCTION FROM CST
1PAFAV016	AUX FW PUMP A DISCHARGE
1PAFBV021	AUX FW PUMP B SUCTION FROM CST
1PAFBV025	AUX FW PUMP B DISCHARGE
1PAFNV001	AFN-P01 SUCTION ISOLATION
1PAFNV013	AFN-P01 DISCHARGE ISOLATION
1PCHEV434	BYPASS LINE FOR CHE-PDV240
1PCTAV015	COND STORAGE TANK ISOLATION TO
1PCTBV014	COND STORAGE TANK ISOLATION TO
1PECAV002	CHILLED WTR CIRC PP ECA-P01 SUCT
1PECAV011	ESS CHLR ECA-P01 OUTLET
1PECBV065	ECW CIRC PP ECB-P01 SUCT
1PECBV068	CHLR ECP-E01 OUTLET ISOLATION
1PEWAV021	ESS CHLR A SPLY ISOLATION
1PEWAV022	ESS CHLR A DISCHARGE ISOLATION
1PEWBV043	ESS CHLR B SPLY ISOLATION
1PEWBV044	ESS CHLR B DISCHARGE ISOLATION
1PRCEV090	PRESSURIZER VENT ISOLATION
1PSGEV289	SG-1 SECONDARY CHEMICAL LINE
1PSGEV290	SG-2 SECONDARY CHEMICAL LINE
1PSGEV334	CHECK N2 SUPPLY TO HY-179C
1PSGEV337	ATM DUMP ACCUM SGA X01B
1PSGEV339	CHECK N2 SUPPLY TO HY-184C
1PSGEV342	SG-1 ATM DUMP ACCUM SGA X01A
1PSGEV346	CHECK INSTR AIR TO HY184C
1PSGEV348	CHECK INSTR AIR TO HY179C
1PSGEV350	CHECK N2 SUPPLY TO HY178C
1PSGEV354	SG-1 ATM DUMP ACCUM ISOLATION
1PSGEV357	CHECK INST AIR TO HY178C

1PSGEV358	CHECK INST AIR TO HY185C
1PSGEV360	CHECK N2 SUPPLY TO HY-185C
1PSGEV363	SG-2 LINE 1 ATM DUMP ACCUM SGB
1PSGEV885	SG1 MAIN STM BYPASS TO AF TURB
1PSGEV886	SG2 MAIN STM BYPASS TO AF TURB
1PSGEV889	SG1 STM LINE BYPASS TO AF TURB
1PSGNV002	CHECK VLV FOR SG-1 AUX FW LINE
1PSGNV008	CHECK VLV FOR SG-2 AUX FW LN
1PSGNV097	ISOLATION VLV FOR SG-1 UPPER FW
1PSGNV098	ISOLATION VLV FOR SG-2 UPPER FW
1PSGNV431	CHECK VLV FOR SG-1 FW LN
1PSGNV432	CHECK VLV FOR SG-2 FW LN
1PSGNV435	N2 HDR ISOLATION TO SGN-X02
1PSGNV437	IA HDR ISOLATION TO UV130,
1PSGNV440	IA CHECK VALVE TO SG
1PSGNV441	N2 CHECK VALVE TO SG
1PSGNV959	NO OTHER DESCRIPTION VLV
1PSGNV967	SGN-X02 N2 ACCUM ISOLATION VLV
1PSGNV968	ROOT FOR SGNPSL1128
1PSIAV105	CONTAINMENT SPRAY PUMP A
1PSIAV435	LPSI DISCHARGE LINE ISOLATION
1PSIAV470	HPSI PP A SUCTION LINE ISOLATION
1PSIAV476	HPSI PP A DISCHARGE LINE
1PSIAV957	ISOLATION ON HPSI LONG TERM
1PSIBV104	CONTAINMENT SPRAY PUMP B
1PSIBV402	HPSI PMP 2 SUCTION ISOLATION
1PSIBV447	LPSI PP B DISCHARGE ISOLATION
1PSIBV478	HPSI PP B DISCHARGE ISOLATION
1PSIBV958	ISOLATION ON HPSI LONG TERM

Question: E5-3

Please list valves that are identified as "YYL" or "YNL" [any LSSC?] valves which are currently tested only during regular IST and would not be exercised for any other reason during plant operation, cold shutdowns, refueling outages or as a result of another IST test such as pump testing.

Response:

This information is not available at this time. This information will be provided to you by July 31, 1996. Most of the LSSCs are exercised at times other than just the regular IST interval. However, there are examples where valves are not normally exercised for any reason other than the IST test, or retest after maintenance (i.e. head vent valves, containment spray header valves, essential AF system valves). APS understands the importance of exercising certain types of valves and will address this issue in the future.

Question: E5-4

Describe the difference between the valves listed in Table 2 and the valves listed in Table 4 that are low risk significant and not included in Table 2. (Note that the LSSCs in Table 4 that are not included in Table 2 are predominantly manual isolation valves but also consist of some check valves, air-operated valves, motor-operated valves and relief valves.)

Response:

Table 2 reflects only current IST components which are eligible for deferral as LSSCs. Table 4 lists all components in the PRA and IST. The titles of these tables will be changed in a future submittal to make the difference clear.

Question: E5-5

Describe in greater detail than contained in Enclosure 4, Table 4, why these valves were ultimately ranked as LSSCs.

Response:

APS will provide the detailed justification for component rankings as described in the response to question E1-2.

Question: E5-6

There were several combinations of valves noted where an LSSC was adjacent to an MSSC and it would appear that both should be in the same category. Below is a list of these combinations (there may be others). Please provide an explanation for each case.

Response:

APS will provide the detailed justification for component rankings as described in the response to question E1-2.

Question: PRA-1

The submittal (Enclosure 4, Section 4.0) states that the 1994 version of the PVNGS PRA was used as the basis for the determination of quantitative risk ranking. It also states that the methodology is consistent with the EPRI PSA Applications Guide.

a. Please describe the differences between the version of the PRA used to that submitted in the IPE process. Please provide documentation of this PRA for staff review. Also, please include the cutset equation and the associated database used for the risk importance ranking.

b. In addition, please discuss the "quality" of this PRA in terms of its applicability to IST risk ranking. Note that while the quality standards suggested by the EPRI PSA Applications Guide provide high level criteria to ensure that PRAs will meet some minimum quality standard, it does not supply sufficient details to show that PRAs are adequate for risk-informed regulation such as the extension of IST intervals. A more detailed review process is required.

c. As part of the discussion on PRA quality, please provide information on the review and QA process that the PRA has gone through including internal and external reviews. Please provide review documentation to the NRC during a site visit. The staff needs to see what the review scope and process consisted of, the review findings and the resolution to these findings. (In particular, the staff needs to see if the following were addressed: consistency with analyses for similar plants; completeness in terms of systems/components modeled, HEPs modeled, IEs modeled; accuracy; realism - generic or plant specific data, modeling of as-built, as-operated plant, assumptions; and reproducibility). Please keep in mind that, in general, the IPE studies and the NRC review of these studies alone are not sufficient to support licensing actions and other safety applications.

Response:

a.) The 1994 quantification was performed on the most recent revision to the PRA model used for the IPE submittal (1992). The revised model incorporated such things as plant design/procedure changes, testing procedure changes, etc. The 1994 quantification results were provided to the NRC. Information included the 1994 PVNGS PRA solution cutset listing, the associated solution database, generic & plant-specific data information, and unavailability calculation information. This information was submitted in electronic form (one 3.5" floppy disk).

b) The PRA will be evaluated against standards outlined in Appendix B of the PSA Applications Guide. In addition, sensitivity studies (described in response to question E3-6) are being performed to further ensure applicability of the PVNGS PRA model to the RI-IST program.

c) The IPE review process was performed in two distinct stages. During PRA development, the PRA model underwent extensive cross-checking and validation to ensure accuracy with regard to 1) plant design, maintenance, and operational considerations, 2) overall consistency in level of detail, and 3) modeling realism in terms of expected plant and operator response. Subsequently, the draft IPE report underwent a formal, independent, in-house review per requirement of GL 88-20. The review team consisted of a team of ten APS engineers having a prerequisite broad cross-section of technical expertise. The IPE review process is described in detail in the PVNGS IPE, Section 14 (transmitted in APS letter 161-04750).

The 1994 PRA quantification underwent an in-house technical review. Documentation exists for all review comments and associated comment resolutions.

Question: PRA-2

Since ranking results are influenced by the reliability data assigned to the component, please provide the component unavailability's used and note whether the data are plant specific or generic to the industry.

Response:

The unavailability data used was provided in electronic form to the NRC.

Question: PRA-3

PRA models were not used for the ranking of SSCs for containment isolation, interfacing LOCAs, external events, and outage operations. Therefore ranking for these events is somewhat inconsistent with that for the internal events. Ranking within each type of initiating event without considering the overall CDF or LERF is inconsistent. Please justify your approach.

Response:

Deterministic decision criteria are being developed to provide for consistent ranking of components for each of the non-quantifiable categories. See also the response to question E1-2.

Question: PRA-4

In terms of truncation limits used, page 24 of Enclosure 4 of the submittal stated that the final cutset equation used (after recovery was applied) contains cutsets above 1E-9. The submittal also stated that there are plans in the future to solve the model at lower limits (i.e., 1E-10 or 1E-11).

a. In the final cutset equation, were recovery actions uniformly applied to all cutsets, or only to the dominant cutsets?

b. When will the quantification results for model solutions at truncation values of 1E-10 or 1E-11 be available? In the absence of these runs, what assurance is there that the 1E-9 equation contains enough cutsets to fully represent the low ranked components? How did the licensee ensure that the importance's were not underestimated because cutsets had been truncated? Note: Studies show that (with CDFs around 1E-5) truncation limits in the order of 1E-11 to 1E-14 are needed to obtain "stable" results in terms of component ranking.

c. How will the 1E-10 and 1E-11 truncated models be applied? It is envisioned by the staff that, when completed, the 1E-10 and 1E-11 sensitivity results should demonstrate whether or not the CDF and the ranking order of components at these truncation levels are reaching an equilibrium. These studies should also show the sensitivity of results to the choice of the specific numerical criteria chosen for component classification (e.g., F-V > 1E-3, F-V > 1E-2, RAW > 2).

Response:

a) Recovery actions were applied uniformly to accident sequence solution cutsets.

b) The schedule for completion of the truncation analysis is included in the response to question E3-6. This analysis should provide insights in the area of result stability.

c) As described in the response to question E3-6, the truncation sensitivity analysis will include re-ranking of components to confirm the consistency of ranking levels. In addition, the numerical decision criteria will be evaluated as part of a further sensitivity analysis.

Question: PRA-5

B. Deterministic Considerations

The staff believes that criteria should be added to the ranking process so that the defense in depth concept is not jeopardized by the reduction in IST frequency. The numerical importance's for some systems/components are low because of diversity and redundancy. However, changing the IST requirements for one system can influence the risk importance of other systems performing the same function. Therefore, in the absence of more detailed evaluations, there should be a requirement that redundant means exist for performing the critical safety function with components that are ranked high. Adopting this concept will also minimize the potential for inter-system common cause failures which might be introduced by the decrease in test frequency for groups of similar components.

A useful way to consider defense-in-depth is to study path sets (combinations of success paths) to determine if at least one success path contains SSCs that are all ranked high. Please use this approach or provide an alternative method for ensuring that defense-in-depth is maintained.

Response:

PRA implicitly treats defense in depth. PRA analysis identifies the various levels of defense in depth by identifying the various paths available for mitigating events. These paths are modeled in the PRA through the event trees and fault trees.

The revised IST program does not change this defense in depth philosophy. The maintenance strategies used to assure the reliability will not be affected by the revised testing program. No testing of components will be eliminated. The corrective action feedback part of the program will assure that an acceptable level of component performance is maintained which will preserve the defense in depth philosophy.

Question: PRA-6

C. Expert Panel

According to the submittal (Section 4.1), the main objective of the expert panel (EP) is to determine the final ranking based on deterministic insights, plant history, engineering judgement, regulatory requirements and PRA insights. The EP also considered PRA limitations including evaluating IST components not modeled in the PRA, identifying components with operational concerns or non-severe accident risks, assessing impact on containment isolation, assessing impact on initiating event frequency, and assessing failures on operator response. (see E2-5)

a. The staff will need to review the guidance document to verify the process, procedures and philosophy used by the EP. The intent here is to ensure that the EP process is well defined, systematic, scrutable, and reproducible.

b. The first step in the EP process is a system level screening which is based on the Maintenance Rule screening. Please describe the system level screening criteria used for PVNGS for the maintenance rule.

c. The first page of Enclosure 5 (under the description for Table 2) states that performance histories for LSSCs are being reviewed. When will this review be completed? How will the performance histories be accounted for by the EP? Is there a systematic procedure to obtain plant specific component performances?

Response:

a. The Expert Panel criteria will be provided to the NRC as stated in the response to Question E1-2.

b. In the re-ranking process, the Expert Panel will not make use of the System Level Screening based on the Maintenance Rule ranking.

c. The review of LSSC performance will be conducted by an IST engineer as the valves are phased into the revised testing program.

Question: PRA-7

The integration of PRA insights with deterministic considerations for final ranking of components is summarized in Table 3 of Enclosure 4. This integration process allows for the EP to re-rank a component that was originally ranked by the PRA as High or Medium to a final ranking of Low. (see PRA-2)

a. The criteria to allow for this re-ranking are not clear. Are there rules specified and documented?

b. One of the EP criteria is that "components ... were considered of high safety significance unless there was a high degree of confidence in the high reliability of the component." How is the effect of lowering IST frequency on component reliability taken into account for these cases?

c. A review of Appendix C of Enclosure 4 shows that many components were ranked lower in the final analysis (than the PRA ranking) based on qualitative arguments on redundancy, and/or on low probability of failure. The fact that there is redundancy or that the failure probability is low is already factored into the PRA importance ranking. For example, the F-V rankings already account for multiple train configurations and basic event unavailability's. The EP should only be allowed to modify the ranking in these cases if it has justifiable reasons to feel that the PRA model or input is not correct. Please justify your approach.

d. Conversely, Appendix C of Enclosure 4 also shows that many components were ranked higher in the final analysis than the PRA ranking. (Examples include the pressurizer safety valves, steam supply to the AWF pump, MSIVs, and main steam relief valves.) The likely causes of a low PRA ranking are redundancy of the components and/or low probabilities of failure. The inconsistency in the treatment of this set of components to those in the previous comment has to be resolved.

Response:

The Expert Panel criteria will be provided to the NRC as stated in the response to Question E1-2.

Question: PRA-8

When component ranking is modified by the expert panel, the EP should investigate the reason why the PRA results are not correct and whether or not the PRA needs to be modified. When, the EP raises a ranking, this could imply that plant specific data or operating practices show a component to be important and should therefore be included in the PRA. When the EP lowers a rank, this could mean that PRA assumptions, input, etc. are incorrect and/or conservative. This later case could cause a masking effect on the other plant components. Please describe how these concerns were addressed. (see E4-2)

Response:

It is implicitly assumed in the formulation of this question that lowering or raising a component ranking from the PRA ranking by the Expert Panel is indicative of a conflict. In fact, the case is usually that qualitative evaluations of a non-PRA area, such as, shutdown risk is the reason for the change. In the case where an actual conflict is identified it will be evaluated and if necessary, changes made to the PRA. For example, valves SPAHV49A and SPBHV50A are modeled in the PRA as MOVs and had a High PRA ranking. The valves were ranked as LSSCs by the Expert Panel due to the fact that they are normally open valves that are required to be open for the system to perform its safety function. The MOVs have been electrically disconnected and are not subject to spurious closure as there is no motive force. In this case, the PRA model will be modified to reflect this plant configuration.

Question: PRA-9

External Events risk ranking: According to the submittal (Section 4.1.3.4), "each component was reviewed to determine if it had a function during an external event that was different from the function of the component for internal events. If there was a difference in function, the relative importance was determined by assessing the impact of failure of the component and the relative likelihood of the external events." The following are staff comments on this process:

a. The above analysis, by itself, might not be sufficient because:

(i) External events could result in plant initiators (e.g., LOCAs from spurious open PORVs, seal LOCAs, LOSP or SBO, etc.) that could result in relative importance of SSCs being changed. That is, since external events (especially for fires) may contribute significantly to the internal events CDF, the initiating events they result in could cause a relative shift in the overall initiator mix. Consequently, the relative importance of systems/components depended upon for accident mitigation will also change.

(ii) Spatially dependent CCFs which are unique to the external event initiators cannot be taken into account in the simplified analysis.

(iii) The loss of one train of one or more systems (for example, from the loss of one electrical division) from these initiators could cause the relative importance of components in the other train to be changed.

(iv) Components lost as a result of the external event are likely not to be recoverable.

Based on the above, please justify your approach, or provide a revised assessment of the external event risk.

b. A preliminary review of the results in Appendix C of Enclosure 5 shows that there were no components that were re-ranked high because of external event initiators. Is this correct?

c. Does the expert panel contain members that are familiar with the seismic qualification of plant SSCs (for seismic risk) or members that are familiar with plant fire protection (safe shutdown analysis, Appendix R evaluation, etc), or are all insights from the external events evaluation provided by the PRA/IPEEE engineer?

Response:

The consideration of risk from External Events is performed qualitatively. The specific criteria used to perform these assessments will be provided as described in the response to question E1-2.

Question: PRA-10

Shutdown risk ranking: The submittal stated that "IST valves important to shutdown were identified by a qualitative review." (see E4-1)

a. Please provide the criteria used for this qualitative analysis.

b. For shutdown risk ranking, there has to be evidence that all shutdown modes and operations have been evaluated. Internal flooding from maintenance actions can also be important in this case. Risk from fire must also be investigated because of the removal of fire barriers during shutdown operations. Finally, one of the conclusions from the shutdown study at Surrey (NUREG/CR-6144) is that the LERF risk is on the same order of magnitude as the risk at-power even though the CDF risk is an order of magnitude smaller since many shutdown operations are performed with the containment not intact. Please address the above in terms of your qualitative criteria.

Response:

The evaluation of risk during Shutdown Operation is performed qualitatively. The specific criteria used to perform these assessments will be provided as described in the response to question E1-2.

Question: PRA-11

Containment risk importance:

a. For LERF, please provide the PVNGS definition for "Large" and "Early." Please indicate which release categories in your level II study are included in the LERF definition.

b. Discuss how LERF is adequate to cover latent health risks from large, late releases.

c. Why is there a criterion for LERF RAW and not one for LERF F-V, i.e., why isn't LERF F-V used for ranking?

d. Are cutsets carried forward to the end of the Level II analysis (source term bins)? If not, how is the LERF RAW calculated?

e. What does a "yes" in the "Large Early Release RAW" column in Table 4 of Enclosure 5 signify? If this means that the LERF measure might be important, please provide the basis as to why many components with "yes" in this column are ranked low?

f. A review of Appendix C of Enclosure 4 shows that only four components (i.e., AFA-V079, AFB-V080, SPA-HV49A, and SPB-HV50A) have LERF RAW greater than 10. Of these, the first two were ranked high. Does this imply that only two valves are important to the LERF risk? Please clarify, and if applicable, point out any other components that might be important in terms of LERF.

g. The submittal stated that Level II results are dominated by SGTR (Section 5.4.5 of Enclosure 4). In the IST risk ranking, what considerations have been given to SGTR isolation?

h. Most containment isolation valves and all interfacing systems LOCA valves were ranked low either because of redundancy or low event frequency (when compared to SGTR). What is the LERF RAW for the containment isolation valves and the ISLOCA valves? Keeping in mind the defense-in-depth philosophy, shouldn't some of these valves be ranked high? Also, how will the ISLOCA initiating event frequency and the loss of containment isolation probability be affected by the proposed extended frequencies for low ranked valves (including the effects of potential common cause failures)?

Response:

a. The definitions used for "Large" and "Early" are based upon EPRI PRA Applications definitions. Large is defined as involving the rapid, unscrubbed release of airborne aerosol fission products to the environment. Early is defined as occurring before the effective implementation of off-site emergency response and protective actions.

The sequences that apply to the definition of a large, early release are the Steam Generator Tube Rupture (Source Term Category, STC 23), Event V (STC 21), induced SGTR (STC 22) and those sequences which lead to a failure of Containment Heat Removal (Shutdown Heat Exchangers and related valves) contained in STC 3. Source Term Categories which result in a large release only, are STCs 10, 16 and 17 which include failure of both emergency core cooling systems (ECCS) and containment spray function. It is important to note that the early release STCs are both large and early.

The PVNGS PSA incorporates a level 3 model. Public health consequences results are generated using the MELCOR Accident Consequence Code System (MACCS) code. MACCS includes models for both early and latent fatality consequences. The MACCS early response model was important in determining the effectiveness of offsite emergency response and subsequent categorization of an early release. All source term categories that result in an early fatality are by definition categorized as a early release (Early fatalities are those which occur within one year of the accident including acute fatalities which result from exposure during the emergency phase of the accident. The emergency phase applies to evacuation within 10 miles from the site with a duration of one week).

b. LERF, as defined above, was considered to be an adequate risk indicator for public risk measures for the following reasons:

1. Early exposure during the emergency phase of an accident can result in both early and latent cancer fatalities due to direct exposure of a passing radioactive plume. During the intermediate and long term phase (after evacuation), it is assumed that the population will be limited to low levels by mitigative actions. It was, therefore, concluded that there exists a larger degree of certainty during the early phase of an accident in terms of source term migration behavior and mitigation strategies.
2. Late large releases will impact latent fatality consequences but not in orders of magnitudes over the large releases that were early. Since the LERF RAW is reported as a relative increase over the baseline risk and not as absolute consequences, this risk measure was determined to be a sufficient indicator. It is also important to note that all of the late primary and secondary radioactive releases (modeled in Modular Accident Analysis Program) originated during the emergency phase of the accident.

c. For the initial IST valve risk computations, the impact of valve unavailability on LERF was considered most important for the scope of the study. Also, there were computation limitations in calculating the F-V risk measure at the time the study was initiated. As the technological capabilities improve for level 2 and 3 risk measure determinations, the F-V risk indicator will be included in order to determine additional LERF insights.

d. Yes, Plant Damage State trees were developed for each core melt sequence resulting from the level 1 PRA. The core melt sequence is the starting equation in the PDS event tree with the applicable bridging events addressed downstream. The cutsets generated after the PDS event tree is quantified are retained in one of many PDS sequences. Each one of the PDS sequences is assigned to a PDS bin based upon a grouping logic diagram previously configured. The summed frequencies of the cutsets in each bin are then passed through a level 2 and 3 quantification tool. This tool is a spreadsheet that contains the CET matrix split point probabilities for each PDS and STC derived from the PRA IPE. Portioning of PDS grouping frequencies into each relevant STC utilizing the CET matrix split point probabilities and the resulting summed STC frequencies are calculated within the spreadsheet.

LERFs are calculated by manipulating the cutsets within a database where the PDS sequences are located by changing the relevant basic event unavailability's and passing the new PDS sequences frequencies throughout the level 2 spreadsheet. The resulting LERF is compared to the base case results and the appropriate risk measure calculated.

e. The "yes" indicates a LERF RAW value was determined. Actual LERF RAWs for each applicable valve are located in Enclosure 4, Appendix C.

f. Every valve that has a LERF RAW value greater than 0 indicates a certain element of importance (valves that were truncated are indeterminate). A RAW value of 10 or greater is considered to be a High risk valve for LER potential. A RAW value between 2 and 10 is considered a Medium risk contributor. A RAW value less than 2 is considered of Low importance (risk ranking criteria explained in section 4.2.1.4 of Enclosure 4). The final risk categorization for the valve, however, is not solely based upon any one risk measure (i.e. LERF, CDF, SDR), but a composite of risk measures and expert opinion. Sensitivity studies, which are currently under way, may also provide insight to the relevant importance of each valve based on LER. The risk measures submitted to date were derived from the base case PRA model.

For the valves SPA-HV49A and SPB-HV50A, a high LERF RAW was calculated. However for this particular case, the overall risk was determined to be low due to valve being normally open and de-energized. The 1994 quantification did not reflect this configuration, thus resulting in a high LERF RAW. An update of the PRA in 1996 will incorporate the current configuration.

g. The SGTR event is a containment bypass failure mode. No separate containment phenomenological or plant damage state trees were developed for this event. The isolation criteria and applicable components are those required in the Level 1 PRA.

h. A Containment Isolation and Interfacing System LOCA valve risk importance analysis will be included in a separate study as described in question E1-2.

Question: PRA-12

Final ranking results:

a. Valves AFA-V137, AFB-V138, AFB-HV30, AFB-HV31, AFB-UV34, AFB-UV35, AFA-HV32, AFC-HV33, AFC-UV36 and AFA-UV37 were ranked as Low in Table C15 of Enclosure 4. The valves were re-ranked as high in Section 5.5.1 in the same enclosure. Please correct the inconsistency. Also, in regard to these valves, why are valves AFA-V015 and AFB-V024 ranked low when the companion valves AFA-V137 and AFB-V138 are re-ranked high?

b. The following valves had a final ranking of low even though quantitative and qualitative insights would indicate otherwise. Please provide justification for the low ranking.

Response:

a) The inconsistent ranking is noted, and correction will be reflected in a revised program to be submitted to the NRC at a later time. Table C15 now indicates a High Risk Significance (RS) ranking for the noted valves. Valves AFA-V015 and AFB-V024 are check valves located on the discharge side of the associated essential AF pump, upstream of the pump miniflow line. These valves are currently tested quarterly (with the pump recirculation test). Valves AFA-V137 and AFB-V138 are also on the respective pump discharge lines, downstream of the miniflow line; therefore, these valves are tested every 18 months (with the pump full-flow test). This large disparity in test frequency translates to a variation in component importance and the noted variation in ranking.

b) The requested information is included in Enclosure 4, in the "Comments" column of Appendix C tables, as follows:

AFB-V024	Low prob of failure (compared to pump failure prob) and 3 redundant AF pumps
AFV-V025	Surveillance testing of pump validates low probability of failure and also tests the valve
CHA-HV531 and CHB-HV530	Valves are normally open and do not receive a close signal that could cause a spurious closure. Impact on indirect release also considered low due to redundant check valves.
SIA-HV657 and SIB-HV658	Other valves are used for throttling SDC. Only spurious closure of the valve will fail the function while SDC is in operation.
SIA-HV683 and SIB-HV692	Valves are backed up by check valves.
SIA-HV687 and SIB-HV695	Other valves are available for SDC.
SIA-HV698 and SIB-HV699	Valves are only required for low probability events and multiple trains are available.
SIA-V201 and SIB-V200	Low prob of failure compared to pump failure prob.
SIA-V470 and SIB-V402	Valves are normally open.
SIA-V404 and SIB-V405	Low prob of failure compared to pump failure prob.

SIA-V424 and SIB-V426	Low prob of failure compared to pump failure prob.
SIA-V434 and SIB-V446	Low prob of failure compared to pump failure prob.
SIA-V435 and SIB-V447	Valve is normally open.
SIA-V451 and SIB-V448	Low prob of failure compared to pump failure prob.
SIA-V476 and SIB-V478	Valve is normally open.
SIA-V522 and SIB-V532	Valves are only required for low probability events, and multiple trains are available.
SIA-V523 and SIB-V533	Valves are only required for low probability events, and multiple trains are available.
SIA-V957 and SIB-V958	Valves are locked open.
SPA-HV49A and SPB-HV50A	Valves are normally open, and are physically disabled (electronically disconnected at the valve circuit breaker).

Question: PRA-13

A comparison of the PVNGS decision criteria to trial criteria being considered by the staff is as follows:(SEE ORIGINAL QUESTION LIST FOR TABLES AND DISCUSSION) *

Total includes 172 IST components that are truncated in IPE and 350 IST components that are not modeled in the IPE. For the purposes of this comparison, these were added to the low category.

The above trial criteria is based on (i) the staff's belief that the components with RAW > 10 should be ranked high regardless of the F-V value; and (ii) a F-V > 0.001 would result in ranking results that are more stable when truncation levels in the range of 1E-9 or 1E-10 are used.

As can be seen above, the PVNGS criteria are similar to the trial NRC criteria (if we assume that the PVNGS medium's are ranked as high). If you adopt the staff criteria, the following 24 PVNGS components will be added to the high category (in terms of PRA ranking).

As can be seen above, of the 24 new "high" components, 18 were already ranked as high by the PVNGS expert panel. The remaining six that were ranked low are also present in the "inconsistent" list provided in comment PRA-12b and should therefore also be ranked high based on other considerations. Please justify the PVNGS criteria or justify why any of the above 24 components should be ranked as low. (see E1-2 and E5-5)

Response:

The requested information is included in the response to question PRA-12, b.

Question: PRA-14

Another potential risk-ranking approach that we have given some consideration to is shown in the plot of Figure 2. Some typical basic event data are shown plotted as Fussell-Vesely importance ranking Vs Birnbaum ranking. The data points are shown in some tentative quadrants, Hi-Hi, Lo-Lo, Hi-Lo, etc. Would the Expert Panel gain any useful insights by evaluating such a plot? Would it have any significant effect on the ranking results?

Response:

APS is currently investigating the adequacy of certain importance measures, as related to each of the sensitivity studies discussed in the response to question E3-6. Results of this analysis may provide additional insight into usefulness of graphical analysis.

Question: PRA-15

Effect of initiating events on ranking: Detailed modeling of initiating events (to the component level) is generally required to properly rank components. Representing initiating events (especially those caused by the loss of support systems) by single frequency numbers (black box model, modules, etc.) will result in inaccurate rankings for components within support systems and balance-of-plant components. The PVNGS IST submittal (Section 4.1.3.3) followed a slightly different strategy in that it looked for "those components whose failure would directly cause an initiating event and those components whose failure could cause a complicated initiating event without operator action to prevent the event." These components would be ranked high unless the failure probabilities were extremely low.

A review of Appendix C of Enclosure 4 shows that there were no components that were ranked above a "low" in the "IE" column. Does this mean that the failure of all components which could result in a plant initiator was either easily recoverable by operator actions or was very low in frequency? Please list, by component, the HEP or the failure probability of components which might result in plant transients?

Response:

The specific criteria used in the evaluation of Initiating Events will be provided as described in the response to question E1-2. Upon completion, component rankings that result from the application of these criteria will also be provided.

Question: PRA-16

Effect of CCFs: PRA ranking should assure that (a) ranking of components in the low category is not the result of lack of, or low estimates for, CCF contributions; and (b) the ranking and categorization are robust against the uncertainties associated with CCF contributions. This issue can be addressed first by re-examining the CCF rates for the low category components to make sure the PRA assumptions are valid, and secondly by setting all CCF rates to zero and investigating which low category components may become important.

In the PVNGS submittal (Section 4.2.1), a study was done (by calculating CCF RAW) to determine the effects of having CCF rates that might be too low. However, the second part of the sensitivity study is not addressed. This would involve setting all CCF rates to zero and investigating which low category components may become important. In this way, components where CCF was not modeled will not be masked by those where CCF might dominate. Also, components that were ranked low because CCF was not included in the PRA model would be revealed. Please provide this second sensitivity study so that there could be assurances that the assumption of no CCF for certain components will not affect ranking. Also, please address the fact that the assumption of no CCF for certain components is still valid, even with extended IST frequencies.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies. This listing includes details of the planned Common Cause sensitivity analysis.

Question: PRA-17

Effect of human recovery actions: Large uncertainties associated with recovery actions, and the non-uniform application of recovery actions (which are usually applied only for the dominant sequences) can mask out the importance of some components. The issue can be addressed by performing ranking with and without recovery actions. The submittal (Section 5.4.6.2) stated that there are plans to perform this sensitivity study before implementation of risk based IST program. When will this be completed? Please make available the results of this study for NRC review.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: PRA-18

Multiple component importance: There has to be assurance that the aggregate effect of components that are ranked low cannot impact risk significantly as a result of relaxing requirements. Two approaches were identified by the staff to study the potential effects of the failure of a group of components: first, to examine those minimal cutsets containing two or more components belonging to the low category, and secondly, performing sensitivity analyses by increasing the failure rates of components in the low category to identify those sequences and minimal cutsets that are most affected. The submittal (Section 5.4.6.4) stated that no plant specific study on the effect of multiple component failures has been done to date. In a joint effort with Comanche Peak, PVNGS wants to study CPSES results to see if this is an important issue. If important, PVNGS plans to perform this sensitivity study before implementation of the risk-based IST program. How does PVNGS plan to justify that the CPSES comparison is valid since multiple component considerations are very configuration specific (and thus, plant specific)?

Response:

Upon completion of the expert panel component ranking, an aggregate impact analysis will be performed, as described in the response to Question E3-10. Subsequently, a final re-ranking will be performed to ensure that the E.P. ranking is unaffected by the test program changes.

Question: PRA-19

Ranking from dynamic plant configurations: An evaluation should be made to determine the impact on ranking if the static PRA is modeled to reflect the on-line maintenance strategies. It is expected that some components that are ranked low in the static model be shifted to the high category for specific maintenance states. The areas where this might be important are periods where there are scheduled maintenance or rolling maintenance when pre-specified sets of components are brought down for maintenance for a pre-specified amount of time.

The submittal (Section 5.4.6.5) states that PVNGS plans to perform a sensitivity study for the 12-week maintenance schedule before implementation of RB IST program. When will this be completed? Please make available the results of this study for NRC review.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: PRA-20

PRA Uncertainty: One of the ways to check for uncertainty effects is to identify the major uncertainties in the PRA and to evaluate the effects on the risk importance. The evaluations can be qualitative or quantitative. The PRA modeling effects on risk importance evaluations can be evaluated by using sensitivity calculations (like those proposed above). The effects of PRA data uncertainties can be evaluated by carrying out uncertainty propagation for selected risk importance values. An importance analysis using the fifth and ninety-fifth percentile of the unavailability distributions could be performed to determine the range of variations in F-V measures. Ranking of some components with large uncertainties (such as check valves) could vary and these components should be ranked in the higher category to account for the uncertainty distribution. Please describe how uncertainty has been addressed in the PVNGS risk ranking process.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies. This listing includes a discussion on planned unavailability sensitivities for similar valve types (MOV, SOV, AOV, etc.).

Question: PRA-21

A calculation was performed to determine the increase in CDF due to the increase in failure probabilities of LSSCs. CDF, LERF and public consequences were re-calculated using the increased failure probabilities. It is not documented how the sensitivity calculation was performed, whether or not the core damage cutsets were re-generated with the modified basic event probabilities. If the cutsets were not regenerated, serious numerical errors could occur. The main reason is that the base case core damage cutsets were generated with a truncation limit of 1E-9, and those basic events with F-V less than 0.001 may have barely survived the truncation. If a lower truncation were used, many additional cutsets and basic events would have appeared. These additional cutsets constitute the error due to non-re-generation of the cutsets. Please provide evaluation details on this V&V study.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

The previous aggregate impact analysis, described in Enclosure 4, Section 4.5 , was performed by modifying component basic event probabilities. These updated values were then applied to the 1994 PRA accident sequence solution cutsets. Cutsets were not regenerated.

Question: PRA-22

In the V&V sensitivity study, the test interval was varied; however, the failure rate was left constant. Given the fact that the study increased test intervals by factors of up to sixty, it is very hard to postulate that the failure rate would stay constant. [Data that are available are based on the current test intervals, i.e., 3 months, 1 year, or maybe 18 months. Therefore, to apply the current failure rates for test intervals of up to 6 years is not justified.] The staff does not have confidence that constant failure rates would be valid for the test intervals proposed in the submittal. It would be logical to assume that after a certain time period the effects of aging, corrosion, material deposition etc., will result in an increase in component failure rates.

Response:

The response to question E3-6 provides a listing, description, and schedule for planned sensitivity studies.

Question: PRA-23

The V&V results are based solely on increases in the internal event initiators. How would this increase be affected when external events and shutdown risks are included?

Response:

Further analysis/documentation of deterministic decision criteria is scheduled for completion by September 30, 1996. These analyses are intended to address shutdown and transition risk, as well as external events including fire, seismic, tornado, containment isolation, and initiators (interfacing systems LOCA).

Question: PRA-24

Does V&V include the potential increase in initiating event frequencies for the failure of support systems and components that are ranked as LSSC?

Response:

Increase in initiating event frequencies was not explicitly considered in the component ranking. In general, IST components are related to accident mitigation equipment and not capable of causing a plant trip. For PVNGS, component failures which have the potential to cause a plant trip include control system failures and loss of power events.

Question: PRA-25

In the summary and conclusions, a statement was made that "results ...[were] found to be safety neutral by an evaluation of cumulative effects." The staff does not necessarily consider increases in CDF by 8 percent and LERF by 18 percent to be safety neutral even though these small changes are likely within the bounds of the uncertainty for the analyses. A statement was also made that the risk based IST program "can be achieved while maintaining or even improving plant safety." However, the only "improvement" that is listed in the submittal (Enclosure 5, Table 3) is the identification of a non-IST valve AFNV012 as MSSC. This AFW discharge check valve will be verified to be closed once every shift by checking the temperature of the piping between the pump and the valve. This "testing" is currently done, and credit for this action is apparently already taken in the IPE since steam binding of the non-class AFW pump is not a dominant failure mode. Therefore "improving plant safety" as a result of the IST risk based program is misleading.

In summary, the staff does not believe that the above statements on risk neutrality and improvement of plant safety are appropriate unless you can quantify this risk decrease.

Response:

Statements related to safety neutrality will be removed from the text of the results and summary of a revision to the RI-IST program to be submitted to the NRC at a future date. These statements will now indicate that results were "of low safety significance".

In the above discussion on improved plant safety, it was noted that safety enhancements may be made through identification and subsequent correction of system and/or programmatic weaknesses. In addition, it is possible to enhance plant safety through optimal allocation of resources. When the proper level and frequency of component testing and maintenance is applied throughout the plant, overall improvement in plant safety should result. Such improvement will be evident through component failure trending after implementation of risk-informed programs.

Question: PRA-26

Table B2 of Enclosure 4 lists the Maintenance Rule low risk significant systems. Because the systems are ranked low, components within these systems are also ranked low for the IST risk ranking. Please address the following concerns:

a. The feedwater, condensate, and instrument & service air systems contain components that are potential plant trip initiators. Please justify how all components in these systems are ranked low.

b. The control building HVAC is ranked low. Please address the effects of the loss of control room HVAC on equipment operation and on operator action.

c. The containment isolation system is ranked low. However, failure of containment isolation will result in a significant increase in LERF. Please justify why containment isolation valves can be ranked low.

Response:

In the re-ranking process described in the response to question E1-2, the maintenance rule screening will not be used. Each IST component will be considered explicitly.

Question: PRA-27

In Table D2 of Enclosure 4, "Changes to Basic Event Probabilities," please address the following apparent inconsistencies:

a. For valve AFAV007, the tabulated increase was by a factor of 36. Increasing frequency from quarterly to 3 years should only increase probability by 12.

b. For valves CHAHV531 and CHBHV530, the test interval was listed as four months. Table 2 of Enclosure 5 lists this interval as 18 months (CSD).

c. For valve SGAUV500P, the probability included the impact from the 500Q valve. How about the impact from the 500S and the 500R valves?

Response:

a. The base model for valve AFA007 had a monthly test interval; therefore, the correct multiple for an increase in test interval to 3 years is 36.

b. The base PRA model used a quarterly test period for these valves, rather than the four months as stated. The failure mode of concern is fail-to-remain-open. Verification of valve open position is accomplished by the quarterly Safety Injection pump test (pump discharge flow is routed to the Refueling Water Tank (RWT) and supplied to the pump suction via these valves.) Appropriate correction to component unavailabilities, stated in Table D2 of Enclosure 4, will be made.

c. The impact for the valves 500S and 500R is included implicitly with valve 500Q because SGTR is only modeled to occur in Steam Generator #1.

Question: PRA-28

In Table D3 of Enclosure 4, "Changes to Unavailability's for Alternate Test Intervals," the unavailability's for valves AFAB015, AFBV024, SIBV405, and SIAV404 appear to be slightly in error. According to our calculations, these unavailability's should be 7.88E-2, 1.18E-1, 1.58E-1, and 1.97E-1 for the
6-year, 9-year, 12-year, and 15-year intervals, respectively. Please justify or make the appropriate corrections.

Attachment: Figure 1/Figure 2

Response:

The values calculated by the staff are correct. The values listed in table D3 of enclosure 4 are typographical errors and will be corrected in a revision to the RI IST program to be submitted to the NRC at a future date.

ENCLOSURE 1

ATTACHMENT 1

LSSC Interval Adjustment Examples 'Doubling'

(Question E2-2)

Enclosure 1
Attachment 1

LSSC Interval Adjustment Examples 'Doubling'

(General Examples)

Example 1 (Illustration of general philosophy)

- A valve is full-stroke tested quarterly in Y1Q1 and Y1Q2. Now 6 months of good performance is documented, interval can be extended to 6 months (next test due Y1Q4).
- Pass in Y1Q4, 1 year of good performance documented (Y1Q1 to Y1Q4), extend interval to 1 year (next due Y2Q4).
- Pass in Y2Q4, 2 years of good performance documented (Y1Q1 to Y2Q4), extend interval to 2 years (next due Y4Q4).
  Pass in Y4Q4, 4 years of good performance documented (Y1Q1 to Y4Q4), extend interval to 4 years (next due Y8Q4).
- Pass in Y8Q4, 8 year of good performance documented (Y1Q1 to Y8Q4), extend interval to 6 years (max. analyzed interval, next due Y14Q4).
- Continue testing on 6 year interval unless reduction or extension is justified.
- Valve is exercised once per cycle**

Example 2 (valve with part-stroke)

- Valve can be part-stroked at power, but is not practical to full-stroke at power or cold shutdown. It was full-stroked during refueling outage in Y0Q4.
- Part-stroke was performed in Y1Q1 and Y1Q2, and. Now 6 months of good part-stroke performance is documented, part stroke interval can be extended to 6 months (next due Y1Q4).
- Pass part-stroke in Y1Q4, 1 year of good part-stroke performance documented (Y1Q1 to Y1Q4), part-stroke interval can be extended to 1 year (next due Y2Q4), but the valve is full-stroked during refueling outage in Y2Q2. Now have 18 months of good full-stroke performance documented (Y0Q4 to Y2Q2). Full-stroke interval of 18 months now supersedes part-stroking. Next test is full-stroke in 18 months (next due Y3Q4).
- Pass in Y3Q4, 3 years of good full-stroke performance documented (Y0Q4 to Y3Q4), extend interval to 3 years (next due Y6Q4).
- Pass in Y6Q4, 6 years of good full-stroke performance documented (Y0Q4 to Y6Q4), extend interval to 6 years (next due Y12Q4).
- Continue testing at maximum analyzed interval of 6 years unless reduction or extension is justified.
- Valve is exercised once per cycle**

Example 3 (valve with cold shutdown test)

- Valve can only be full-stroke tested at cold shutdown or refueling. It was full-stroked during refueling outage in Y0Q4.

LSSC Interval Adjustment Examples 'Doubling'

(General Examples)

- Test at cold shutdown frequency (note: there may never be a cold shutdown between refueling outages) during current fuel cycle until refueling outage in Y2Q2 when 18 months of good performance will be documented.
- Valve is tested during refueling outage in Y2Q2. Now have 18 months of good performance documented (Y0Q4 to Y2Q2). Test interval of 18 months now supersedes cold shutdown interval. Next test is in 18 months (next due Y3Q4).
- Continue to extend intervals for good performance as in Example 2.
- Valve is exercised once per cycle**

Example 4 (use of past history to extend intervals)

- A valve has 4 years of documented good performance of quarterly tests without any IST failures from Y-3Q2 to Y1Q2.
- Extend interval to 4 years based on 4 years of good performance (Y-3Q2 to Y1Q2). Next test due Y5Q2.
- Pass in Y5Q2, 8 years of good performance documented (Y-3Q2 to Y5Q2), extend interval to 6 years (max. analyzed interval, next due to Y11Q2).
- Continue testing on 6 year interval unless reduction or extension is justified.
- Valve is exercised once per cycle**

Example 5 (failure requires interval adjustment)

- Current test interval is 4 years. Last successful test was performed in Y4Q4. Next test due in Y8Q4.
- Valve fails test in Y8Q4. Cause is determined to be stem fatigue (aging-related). Interval is shortened to 1 year in order to monitor for future failures more effectively. Similar valves are evaluated for susceptibility to the same failure mechanism.
- Valve is exercised once per cycle**
- Valve will remain on the one year testing frequency as determined by the IST engineer as part of the evaluation process.
- Valve is exercised once per cycle**

Example 6 (failure does not require interval adjustment)

- Current test interval is 4 years. Last successful test was performed in Y4Q4. Next test due in Y8Q4.
- Valve fails test in Y8Q4 due to bent stem after being run over by a runaway fork lift. Cause is determined to be random (not aging-related). Interval continues to double (up to the six year maximum analyzed interval) out to Y14Q4 since increased monitoring is not required for this failure mechanism.
- Valve is exercised once per cycle**

LSSC Interval Adjustment Examples 'Doubling'

(General Examples)

Example 7 (use of analysis to justify longer intervals)

- A valve has documented good performance of quarterly tests without any IST failures from Y-3Q2 to Y1Q2.
- Extend interval to 4 years based on 4 years of good performance documented (Y-3Q2 to Y1Q2). Next test due Y5Q2.
- Pass in Y5Q2, 8 years of good performance documented (Y-3Q2 to Y5Q2). Perform PRA analysis to show that the aggregate impact on plant safety from extending this test interval to 8 years with all other current testing intervals is acceptable. Extend interval to 8 years (next due Y13Q2).
- Continue testing on 8 year interval unless reduction or extension is justified.
- Valve is exercised once per cycle**

LEGEND

P=Routine test which PASSES
F=Routine test which FAILS
FS=Full stroke test
PS=Part stroke test
E=Exercised
**This exercise may be performed in the course of preventative maintenance, corrective maintenance, routine operation or a formal In Service Test. The best information we currently have suggests that we should ensure that all SOVs, AOVs and MOVs are exercised a minimum of once per cycle. We will incorporate any new information we gain and possibly modify that decision, (i.e. new ASME Code cases)

LSSC Interval A ment Examples
"Doubling"

EQUID	CYCLE 1								CYCLE 2								CYCLE 3								CYCLE 4		
	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6				YEA	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
EXAMPLE 1	P	P		P				P								P								E		
EXAMPLE 2	PS/P	PS/P		PS/P		FS/P						FS/P						E						FS/P		
.																										
EXAMPLE 3						P						P						E						P		
.																										
EXAMPLE 4	P	P										E						P						E		
.																										
EXAMPLE 5	P	P		P				P								P								E		
.																										
EXAMPLE 6	P	P		P				P								P										
.																										
EXAMPLE 7	P	P										E						P						E		
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LSSC Interval A ment Examples
"Doubling"

CYCLE 5				CYCLE 6						CYCLE 7						CYCLE 8						CYCLE 9						CY		
7		YEAR 8				YEAR 9				YEAR 10				YEAR 11				YEAR 12				YEAR 13				YEAR 14				
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
			E		P										E						E						E		P	
			E						E						E						FS/P						E			
			E						E						E						P						E			
			E						E						P						E						E			
			E		F				P				P				P				P				P				P	
					F				E						E						E						E		P	
			E						E						E						E		P							

LSSC Interval A[illegible]ment Examples
"Doubling"

E 10			CYCLE 11						CYCLE 12						CYCLE 13						CYCLE 14					
YEAR 15			YEAR 16				YEAR 17				YEAR 18				YEAR 19				YEAR 20				YEAR 21			
58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
								E						E								P				
		E						E						FS/P						E						E
		E						E						P						E						E
		E						P						E						E						E
		P				P				P				P				P				P				P
								E						E						E		P				
		E						E						E						E				P		

ENCLOSURE 1

ATTACHMENT 2

LSSC Interval Adjustment Examples 'Staggering'

(Question E2-2)

LSSC Interval Adjustment Examples 'Staggering'

(General Examples)

Example 1 (Ideal case, no failures)

- Valves can only be full-stroke tested at refueling. All were full-stroked during refueling outage in Y0Q4.
- The valves are staggered into testing by refueling outages. The outages are alternately designated as "A" or "B" train. In this case there are two "A" and two "B" train valves. They are alternate tested so that one valve is tested during each refueling outage. No more than six years is allowed to pass in between tests for each valve.
- Valve is exercised once per cycle**

Example 2 (failure does not require interval adjustment)

- Valves can only be full-stroke tested at refueling. All were full-stroked during refueling outage in Y0Q4.
- Valve 1JSIBUV0624 fails in Y3Q4 due to bent stem after being run over by a runaway fork lift. Cause is determined to be random (not aging-related). Interval is still extended out to the six year maximum since increased monitoring is not required for this failure mechanism.
- Valve is exercised once per cycle**

Example 3 (failure requires interval adjustment)

- Valves can only be full-stroke tested at refueling. All were full-stroked during refueling outage in Y0Q4.
- Valve 1JSIAUV0644 fails in Y5Q2. Cause is determined to be stem fatigue (aging-related). Interval is shortened to once per cycle to monitor for future failures more effectively. The remainder of the valves in this group are evaluated for susceptibility to the same failure mechanism. Valves will remain on the once per cycle testing frequency as determined by the IST engineer as part of the evaluation process. Later the valves are reevaluated and staggered back onto the six year program after the stem fatigue problem has been corrected.
- Valve is exercised once per cycle**

LSSC Interval Adjustment Examples 'Staggering'

(General Examples)

LEGEND

P=Routine test which PASSES
F=Routine test which FAILS
E=Exercised
**This exercise may be performed in the course of preventative maintenance, corrective maintenance, routine operation or a formal In Service Test. The best information we currently have suggests that we should ensure that all SOVs, AOVs and MOVs are exercised a minimum of once per cycle. We will incorporate any new information we gain and possibly modify that decision, (i.e. new ASME Code cases)

LSSC Interval A[illegible]ment Examples
"Staggering"

EQUID	CYCLE 1						CYCLE 2						CYCLE 3						CYCLE 4					
	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
EXAMPLE 1																								
1JSIAUV0634						P						E						E						E
1JSIAUV0644						E						E						P						E
1JSIBUV0614						E						E						E						P
1JSIBUV0624						E						P						E						E
.																								
EXAMPLE 2																								
1JSIAUV0634						P						E						E						E
1JSIAUV0644						E						E						P						E
1JSIBUV0614						E						E						E						P
1JSIBUV0624						E						F						E						E
.																								
EXAMPLE 3																								
1JSIAUV0634						P						E						P						P
1JSIAUV0644						E						E						F						P
1JSIBUV0614						E						E						P						P
1JSIBUV0624						E						P						P						P

LSSC Interval A[illegible]ment Examples
"Staggering"

CYCLE 5						CYCLE 6						CYCLE 7						CYCLE 8						CYCLE 9			
YEAR 7				YEAR 8				YEAR 9				YEAR 10				YEAR 11				YEAR 12				YEAR 13			
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
					P						E						E						E				
					E						E						P						E				
					E						E						E						P				
					E						P						E						E				
					P						E						E						E				
					E						E						P						E				
					E						E						E						P				
					E						P						E						E				
					P						E						P						E				
					P						E						P						E				
					P						P						E						P				
					P						P						E						E				

LSSC Interval Assessment Examples
"Staggering"

		CYCLE 10						CYCLE 11						CYCLE 12						CYCLE 13						CYCLE 14					
YEAR 14				YEAR 15				YEAR 16				YEAR 17				YEAR 18				YEAR 19				YEAR 20				YEAR 21			
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	P						E						E						E						P						E
	E						E						P						E						E						E
	E						E						E						P						E						E
	E						P						E						E						E						P
	P						E						E						E						P						E
	E						E						P						E						E						E
	E						E						E						P						E						E
	E						P						E						E						E						P
	P						E						E						E						P						
	E						E						P						E						E						
	E						E						E						P						E						
	E						P						E						E						E						

ENCLOSURE 1

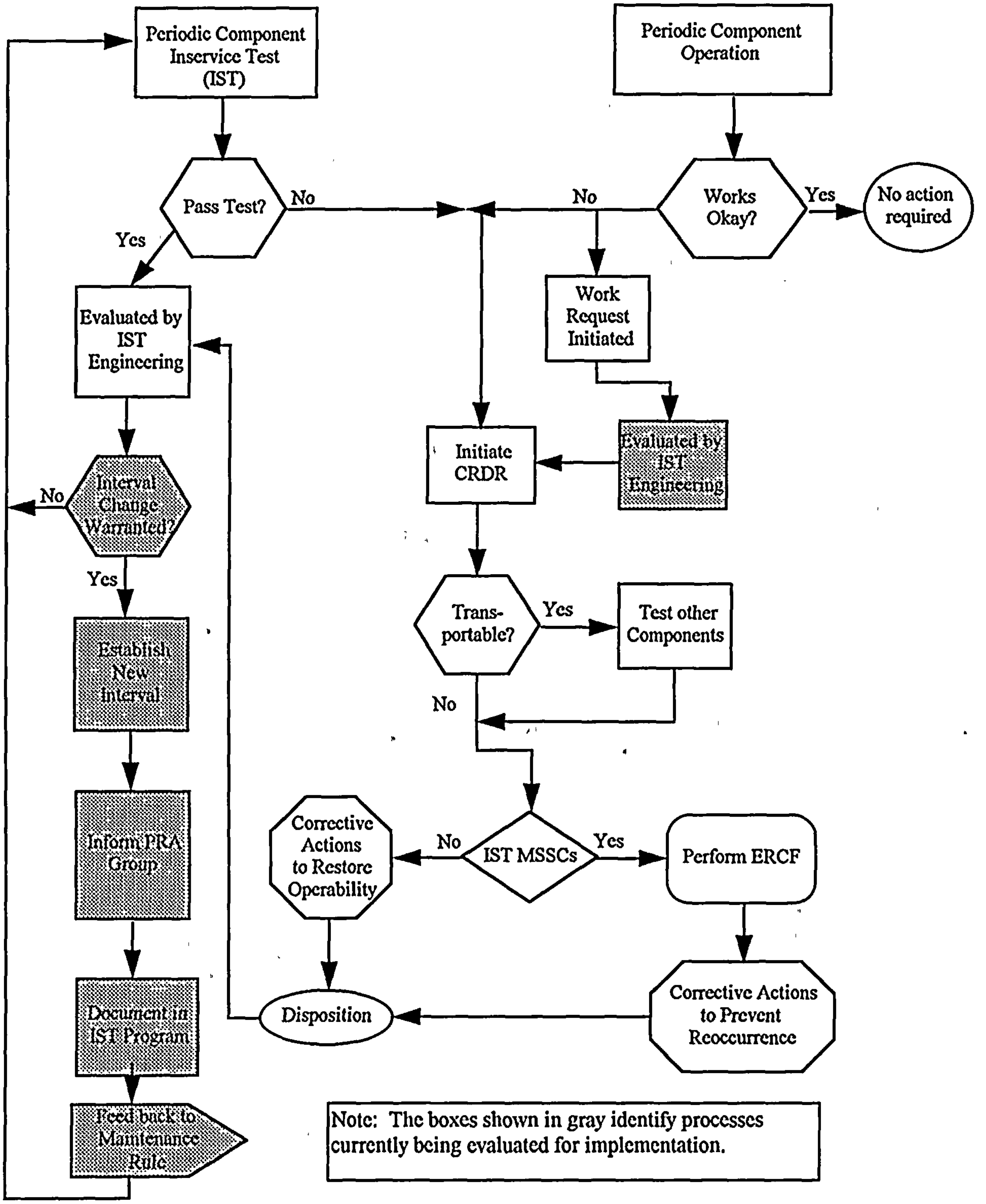
ATTACHMENT 3

Corrective Action/Feedback Mechanism For Risk Informed IST Program

(Question E2-4)

Enclosure 1
Attachment 3

Corrective Action/Feedback Mechanism for Risk Informed IST Program



Note: The boxes shown in gray identify processes currently being evaluated for implementation.

ENCLOSURE 2

Additional PRA Information Related to

Risk-Informed IST

Additional PRA Information Related to Risk-Informed IST

Risk Ranking Criteria

In the April 22 and 23, 1996 meetings with NRC Staff, several questions were discussed related to the specific decision criteria used by the Expert Panel to classify IST components as More Safety Significant Components (MSSCs) and Less Safety Significant Components (LSSCs). In several instances, the staff requested information on decision criteria related to PRA rankings as well as decision criteria used to evaluate components for External Events, Shutdown Risk and other areas that are not evaluated using PRA techniques by APS.

The NRC staff stated that the risk ranking process should be documented, with established decision criteria to ensure the process is repeatable to the greatest extent possible. APS agrees with this position and has developed an implementation plan that reflects the NRC request for this detailed information.

Major Milestones	Completion Date
Complete the PRA sensitivity studies	August 31, 1996
Develop decision criteria for deterministic considerations	September 30, 1996
• Shutdown Operation	
• External Events	
• Initiating Events	
Develop Expert Panel Decision Criteria	September 30, 1996
Expert Panel Re-rank IST components using established decision criteria	September 30, 1996
Complete update to PVNGS PRA model	March 31, 1997
Expert Panel review of updated PRA model ranking results	March 31, 1997

As shown on the schedule, APS intends to continue to develop and document the methodology for component ranking. This methodology will be used by the Expert Panel to re-review the ranking of the IST components by September 30, 1996. APS expects that this will demonstrate the methodology in sufficient detail for the NRC staff to approve the ranking process. This work will be performed based on the 1994 PVNGS PRA model.

Revised Risk-Informed IST Program Implementation

APS has determined that the PVNGS plant configuration and testing programs have changed sufficiently since development of the 1994 model such that the updated PRA model should be completed, and the effect on the component ranking re-reviewed by the Expert Panel, prior to implementation of the Risk-Informed Inservice Testing Program. Since these activities are scheduled to be completed by March 31, 1997, APS proposes to begin implementing the Risk Informed IST Program during the second quarter of 1997, if approved by the NRC.