TUELECTRIC

Log # TXX-96371
File # 10010.1
905.4 (clo)
Ref. # 10CFR50.55a(a)(3)(i)
10CFR50.55a(f)(i,ii)

C. Lance Terry
Group Vice President

June 3, 1996

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) - UNITS 1 AND 2
DOCKET NOS. 50-445 AND 50-446
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON
RISK-BASED INSERVICE TESTING (RBIST)
(TAC NOS. M94165 AND M94166)
(1989 EDITION OF ASME CODE, SECTION XI, NO ADDENDA,
INTERVAL START DATE: AUGUST 3, 1993,
FIRST INTERVAL UNIT 1 AND UNIT 2)

Ref: 1) TU Electric letter logged TXX-95260, from C. L. Terry to the NRC, dated November 27, 1995

2) NRC letter from Timothy J. Polich to C. Lance Terry, dated March 15, 1996

Gentlemen:

In Reference 1, TU Electric 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-based inservice testing program to determine inservice test frequencies for certain valves and pumps that are identified as less safety significant. This request was part of a pilot plant effort with Arizona Public Service Company (APS). In Reference 2, the NRC Staff provided to TU Electric a request for additional information (RAI) related to Reference 1. The NRC Staff also met with TU Electric at the CPSES site on April 25, 1996, to discuss the questions.

During the April 25, 1996, meeting, the NRC Staff suggested that TU Electric and APS revise their exemption requests related to their Risk Based IST programs to instead request approval of the Risk Based IST programs as alternatives to the requirements of 10 CFR 50.55a(f). Therefore, TU Electric requests that the proposed Risk-Based IST program, as described in Reference 1 and supplemented by the enclosures and attachments to this letter, no longer be considered as a request for exemption to 10 CFR 50.55a(f)(4)(i) and (ii), but instead be approved as an alternative to the requirements of 10 CFR 50.55a(f) pursuant to 10 CFR 50.55a(a)(3)(i).

Enclosures 1, 2, and 5 of Reference 1 are superseded by Enclosures 1, 2, and 3, of this letter respectively. Enclosure 1 to this letter describes the proposed alternative and provides justification for the alternative.

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Energy Plaza 1601 Bryan Street Dallas, Texas 75201-3411

Enclosure 2 to this letter is the Risk-Based Inservice Testing (IST) Program Description referenced by Enclosure 1. Enclosure 3 to this letter provides implementation results of the risk-based IST program at CPSES. Enclosures 3 and 4 of Reference 1 will be updated at a later date to reflect and incorporate information contained in the enclosures and attachments to this letter.

Attachment 1 to this letter provides responses to the NRC's Request for Additional Information. Attachments 2 through 7 to this letter provide supplemental information and are referenced within Attachment 1.

Should you have any questions, please contact Carl Corbin at (214) 812-8859.

Sincerely,

C. L. Terry

C. L. Terry

By: Roger D. Walker

Roger D. Walker
Regulatory Affairs Manager

CBC\cc

Enclosure 1	Request for an Alternative from 10CFR50.55a(f)(4)(i) and (ii) for Inservice Testing Frequency Under 10CFR50.55a(a)(3)(i)
Enclosure 2	Risk-Based In-Service Testing Program Description, Revision 1
Enclosure 3	Risk-Based In-Service Testing Program, Implementation Results
Attachment 1	Response to NRC Request for Additional Information on CPSES Risk-Based Inservice Testing
Attachment 2	Evaluation of Dr. W. E. Vesely's Reservations with ASME Risk-Based IST Guidelines and Their Impact on CPSES IST Study
Attachment 3	Review of the CPSES IPE for Applicability to Risk-Based IST
Attachment 4	Expert Panel Methodology
Attachment 5	Corrective Action for LSSCs in the Risk-Based IST Program
Attachment 6	Comanche Peak Steam Electric Station, Risk-Based Inservice Testing Program, Expert Panel Guidance Document
Attachment 7	Study of Dynamic Ranking Effects for CPSES IST Components
Attachment 8	Phase-in Philosophy Staggering Technique

c - Mr. L. J. Callan, Region IV
Ms. L. J. Smith, Region IV
Mr. T. J. Polich, NRR
Mr. P. M. Ray, NRR
Mr. C. Thomas, NRR
Mr. G. Bynog, TDLR
Mr. W. L. Stewart (Arizona Public Service Company)
Resident Inspector, CPSES

ENCLOSURE 1

REQUEST FOR ALTERNATIVE FROM 10CFR50.55a(f)(4)(i) AND (ii)
FOR INSERVICE TESTING FREQUENCY
UNDER 10CFR50.55a(a)(3)(i)

INTRODUCTION

This alternative utilizes a risk-based approach to change the test frequencies of certain less safety significant components (LSSCs) in the ASME Section XI pump and valve inservice testing (IST) Program. The extended frequencies are greater than those currently allowed by Section XI of the ASME Boiler and Pressure Vessel Code. The process used to identify candidates for frequency extension is discussed under "Proposed Alternative" and "Basis for Alternative."

PROPOSED ALTERNATIVE

Less Safety Significant Pumps and Valves

SYSTEM

Table 1 and Table 2 of Enclosure 3 to TXX-96371 identify components which are currently determined to be Less Safety Significant Components (LSSCs). These Tables identify system, code class, category, component number and component description. This list is considered to be a "snapshot." Components are added or removed from these tables based on the risk ranking process in the Risk-Based Inservice Testing Program Description (Enclosure 2 to TXX-96371). This alternative is requesting approval of the process described below in the sections "Proposed Alternative" and "Basis for Alternative," and in the Enclosure 2 to TXX-96371. Note that Enclosure 2 to TXX-96371 supersedes Enclosure 2 to TXX-95260. Future updates to the list of LSSCs will be included in future revisions to the IST Program Plan and provided to the NRC as administrative manual updates.

CODE CLASS

See discussion under System

CATEGORY

See discussion under System

COMPONENT NUMBER

See discussion under System

COMPONENT DESCRIPTION

See discussion under System

CURRENT REQUIREMENTS

CPSES Technical Specification (TS) 4.0.5.a requires that inservice testing of ASME Code Class 1, 2, and 3 pumps and valves shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50, Section 50.55a(f).

Regulation 10 CFR 50, Section 50.55a(f)(4)(i) states;

> Inservice tests to verify operation readiness of pumps and valves, whose function is required for safety, conducted during the initial 120-month interval must comply with the requirements in the latest edition and addenda of the Code incorporated by reference in paragraph (b) of this section on the date 12 months prior to the date of issuance of the operating license subject to the limitations and modifications listed in paragraph (b) of this section.

Regulation 10 CFR 50, Section 50.55a(f)(4)(ii) states;

> Inservice tests to verify operation readiness of pumps and valves, whose function is required for safety, conducted during successive 120-month interval must comply with the requirements in the latest edition and addenda of the Code incorporated by reference in paragraph (b) of this section 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed in paragraph (b) of this section.

The ASME Code of record for CPSES is the 1989 Edition of ASME Code, Section XI, No Addenda. The Code specifies the following test frequencies:

Test Type	Test Frequency (nominal)	Code Reference
Pump Test	3 months	OM Part 6
Valve Position Indication Verification	2 years	OM Part 10
Valve Exercising Test	3 months	OM Part 10
Valve Fail-Safe Test	3 months	OM Part 10
Valve Leak Rate Test	2 years	OM Part 10
Check Valve Exercise Test	3 months	OM Part 10
Safety/Relief Valve Setpoint Test	5 years (class 1) 10 years (class 2, 3)	OM Part 1

PROPOSED ALTERNATIVE

In lieu of performing inservice tests on pumps and valves whose function is required for safety at frequencies specified in the ASME Code, as required by 10 CFR 50.55a(f)(4)(i) during the 120-month operating interval, this alternative would allow the inservice test frequencies of those pumps and valves to be determined in accordance with an NRC approved Risk-Based IST Program Description at CPSES as follows:

(1) The safety significance of pumps and valves whose function is required for safety will be assessed in accordance with the NRC approved Risk-Based IST Program Description. These components will be classified as either More Safety Significant Components (MSSCs) or Less Safety Significant Components (LSSCs). The inservice testing of those components classified as LSSC will be performed at extended test frequencies determined in accordance with the Risk-Based IST Program Description. The inservice test methods for all pumps and valves whose function is important to safety will continue to be performed in accordance with the ASME Code.

(2) The safety significance assessment of pumps and valves will be updated, as specified in the Risk-Based IST Program Description.

This alternative will also apply to 10CFR50.55a(f)(4)(ii) for successive 120-month IST intervals.

BASIS FOR ALTERNATIVE

Section 50.55a(a)(3)(i) of 10 CFR states in part:

> Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that: (i) The proposed alternatives would provide an acceptable level of quality and safety.

TU Electric requests NRC approval to implement the Risk-Based Inservice Testing Program Description as an alternative to the requirements of 10 CFR 50.55a(f)(4)(i) and (ii). These regulations require that inservice tests on pumps and valves, whose function is required for safety, must comply with a specified ASME Code. Specifically, TU Electric requests approval to utilize a risk-based inservice testing program to determine inservice test frequencies for valves and pumps that are identified as less safety significant, in lieu of testing those components at the frequencies specified in the ASME Code. The use of the Risk-Based Inservice Testing Program Description will provide an acceptable level of quality and safety.

The current Code is based on a deterministic approach which considers a set of challenges to safety and determines how those challenges should be mitigated. The deterministic approach contains elements of probability, such as the selection of accidents to be analyzed as design basis accidents (e.g., the

reactor vessel rupture is considered too improbable to be included) and the requirements for emergency core cooling (e.g., safety train redundancy).

The Risk-Based IST Program that would be implemented with this alternative incorporates a probabilitistic approach to regulation which enhances and extends this traditional, deterministic approach, by:

(1) allowing consideration of a broader set of potential challenges to safety,
(2) providing a logical means for prioritizing these challenges based on risk significance, and
(3) allowing consideration of a broader set of resources to defend against these challenges.

First, the IPE model has identified a broader set of challenges to safety. The Risk-Based Inservice Testing Program has identified More Safety Significant Components (MSSCs) which were not in the ASME Section XI IST Program. Even though the components are outside the ASME Code class boundary, they will be tested commensurate with their safety significance. Where the ASME Section XI testing is practical, MSSCs not in the current ASME Section XI IST Program Plan will be tested in accordance with OM-1 for safety relief valves, OM-10 for active valves and OM-6 for pumps. Where the ASME Section XI testing is not practical, alternative methods will be developed to ensure operational readiness.

Components in the current ASME Section XI IST Program which are determined to be MSSCs will continue to be tested in accordance with the current Program, which meets the requirements of Section XI of the ASME Boiler and Pressure Vessel Code, except where specific written relief has been granted. Components in the current ASME Section XI IST Program which are determined to be LSSC will also be tested in accordance with the ASME Section XI IST Program, except that the test frequency will initially be extended to once every 6 years. The extended test frequency will be phased in gradually over 6 years as described in Enclosures 2 and 3 to TXX-96371. No LSSC will be deleted from the ASME Section XI IST Program.

Second, the Risk-Based Inservice Testing Program prioritizes these challenges based on the results of the CPSES IPE. The risk rankings are then complemented with rankings based on consideration of other accident initiators (e.g. fires, tornados, and earthquakes) and plant operating modes. These rankings considered importance with respect to core damage prevention, and prevention of large early releases of radiation to the public. Enclosure 2 to TXX-96371 describes the program methodology. Enclosure 3 to TXX-96371 provides the list of LSSCs from the initial implementation of that methodology. Enclosures 3 and 4 of Reference 1 also provides results from the initial implementation of program methodology and will be updated to reflect and incorporate information contained in the Enclosures and Attachments to TXX-96371.

Third, an expert panel process allows a broader set of resources to be considered to defend against challenges to safety. The expert panel is composed of experienced individuals with expertise in the areas of ASME Code,

plant operations, maintenance engineering, system engineering, design engineering, and probabilistic risk assessment. The expert panel is responsible to ensure the risk ranking input information is consistent with plant design, operating procedures, and with plant-specific operating experience. At the end of the expert panel review process every component in the CPSES ASME Section XI IST Program is reviewed. The risk-based process will assure that a defense-in-depth philosophy is maintained.

As a living process, components will be reassessed periodically to reflect changes in plant configuration, component performance, test results, industry experience, and other factors. When the list of components is affected, changes will be provided to the NRC in regular Program updates.

There could be safety enhancements obtained by focussing resources on MSSCs and reducing the testing frequency on LSSCs. Extensive testing on LSSCs could have an adverse effect on safety. Reduction of testing should reduce component wear-out, operator burden, system unavailability, cost of testing, and radiation exposure. Reduced testing could also achieve a more optimum balance between the positive impacts of testing and the negative effects of disturbing equipment from service and entering less than optimum plant configuration, such as valve misalignments.

RADIOLOGICAL CONCERNS (ALARA)

Potential radiation exposure will be diminished due to less frequent testing.

RISK-BASED INSERVICE TESTING PROGRAM DESCRIPTION
REVISION 1

The proposed alternative is a risk-based process to determine the safety significance and testing frequencies of components in the ASME Section XI IST Program, and identify non-IST components (pumps and valves) modeled in the IPE that are More Safety Significant Components (MSSCs). The process consists of the following elements:

1. Determining the safety significance of components in the ASME Section XI IST Program.
2. Extending the test frequencies of certain Less Safety Significant Components (LSSCs).
3. Reviewing the testing of MSSCs not in the ASME Section XI IST Program.
4. Evaluating the aggregate impact of the changes to ensure an acceptable level in plant safety.
5. Periodic reassessment.
6. Corrective actions.

1. Determining Safety Significance of Components in the ASME Section XI IST Program

The safety significance of components in the IST Program will be determined through a blended approach of probabilistic and deterministic methods.

The PRA methods will be used to determine the risk significance of components based on end states of interest such as core damage frequency and release of radioactivity (e.g. large early release frequency (LERF)). This information will be provided to an "expert panel" for deliberation. The expert panel will blend the insights provided by the PRA methods with deterministic data (such as plant specific equipment history and industry events) to rank components as More Safety Significant Component (MSSC) or Less Safety Significant Component (LSSC).

2. Extending Test Frequencies of certain Less Safety Significant Components (LSSCs)

The test frequency of certain LSSCs in the ASME Section XI IST Program will initially be extended to once every 6 years. All other Code testing methods, corrective actions, documentation, and other requirements will remain in effect. No LSSCs will be deleted from the ASME Section XI IST Program; their lesser contribution to safety will be reflected in their frequency of testing.

To be initially considered for extension, a component must meet both of the following criteria:

- the component must be ranked an LSSC by the expert panel, using a blend of probabilistic and deterministic methods, and
- the previous two tests must have been completed satisfactorily.

By using PRA methods, a maximum test interval will be determined for LSSCs. This test frequency has been determined to be a maximum of 6 years (with 25% margin). This information will be made available to the expert panel to be considered during their deliberations. Components with a final ranking of LSSC will be stepped into the extended test frequency. This stepped-in approach will consist of grouping components based on valve type (same manufacture/model), service condition (system, operating conditions, service environment, service medium) and valve orientation consistent with the NUREG 1482. The maximum size of the group will be 8 components. In order to ensure component reliability and availability, at least one component of the group will be tested at each outage.

If a component fails to meet established test criteria, the need to test the remaining components in that group will be evaluated under the CPSES corrective action program, as described in item 6 below.

3. Reviewing the Testing of More Safety Significant Components (MSSCs) not in the ASME Section XI IST Program.

In addition to identifying candidates for frequency extension, the risk-based process could potentially identify pumps and valves that are not currently tested in the ASME Section XI IST Program that are MSSCs. These components will be reviewed to ensure that testing is performed commensurate with their safety significance.

Where the ASME Section XI testing is practical, MSSCs not in the current ASME Section XI IST Program Plan will be tested in accordance with OM-1 for safety relief valves, OM-10 for active valves and OM-6 for pumps.

Where the ASME Section XI testing is not practical, alternative methods will be developed to ensure operational readiness. Administrative requirements of ASME Section XI will not be invoked for these components (e.g., ANII involvement).

4. Evaluating The Aggregate Impact Of The Changes To Ensure an Acceptable Change in Plant Safety

   Test frequency changes (including existing relief requests) will be evaluated to ensure that the aggregate impact on plant safety is acceptable. One or both of the following methods will be used in this evaluation:

   - The aggregate impact of the changes will be reviewed by the Expert Panel.

   - The IPE models will be updated to reflect the changes to the test frequency of modeled components, and the IPE study will be re-evaluated to quantify the aggregate impact.

5. Periodic Reassessment

   As a living process, components will be reassessed at frequency not to exceed every other refueling outage (based on Unit 1 refueling outages) to reflect changes in plant configuration, component performance, test results, industry experience, and other inputs to the process. The reassessment will be completed within 9 months of completion of the outage. When test frequencies are affected, changes will be provided to the NRC in regular Program updates. However, an emergent update may be initiated at any time, if needed, to incorporate a major plant modification or to correct an identified deficiency or for any other reason that may impact the Risk-Based IST Program.

   Part of this periodic reassessment will be a feedback loop of information to the PRA. This will include information such as components tested since last update, number and type of tests, number of failures, corrective actions taken including generic implication and changed test frequencies. Once the PRA has been updated, the information will be brought back to the Expert Panel for deliberation and confirmation of the existing lists of MSSCs and LCCSs or modification of these lists based on the new data. Additionally, the maximum test interval will be verified or modified as dictated by the PRA results.

6. Corrective Actions

   When an LSSC on the extended test frequency fails to meet established test criteria, corrective actions will be taken in accordance with the CPSES corrective action program as described below for the Risk-Based IST Program.

   For LSSCs not meeting the acceptance criteria, a ONE Form will be generated. This document initiates the corrective action process. The test results will be evaluated; to 1) determine impact on system

operability since previous test, 2) determine cause of failure, 3) determine corrective action for that component, 4) determine generic implications and generic corrective actions, 5) determine necessity to test additional components, and 6) evaluate and change, if so indicated, the test frequency for that group. The corrective action for MSSCs will continue under the current process.

7. Modification of the Risk-Based IST Program

Changes to the process described above will require prior NRC approval. Changes to the list of LSSC and MSSC based on the process described above will not require prior NRC approval. As those changes are made, TU Electric will submit them to the NRC for their information.

CPSES — Table 1: Less Safety Significant Pumps

Component	Code Class	Description	Test Schedule * (Frequency)	
			Current	Proposed
Reactor Coolant System				
CP1-DDAPRM-01	3	Reactor makeup water	3 MO.	6 YR
CPX-DDAPRM-01	3	Reactor makeup water	3 MO.	6 YR
CP2-DDAPRM-01	3	Reactor makeup water	3 MO.	6 YR
Diesel Generator Fuel Oil Auxiliary System				
CP1-DOAPFT-01	2	Fuel Oil Transfer	3 MO.	6 YR
CP1-DOAPFT-02	2	Fuel Oil Transfer	3 MO.	6 YR
CP1-DOAPFT-03	2	Fuel Oil Transfer	3 MO.	6 YR
CP1-DOAPFT-04	2	Fuel Oil Transfer	3 MO.	6 YR
CP2-DOAPFT-01	2	Fuel Oil Transfer	3 MO.	6 YR
CP2-DOAPFT-02	2	Fuel Oil Transfer	3 MO.	6 YR
CP2-DOAPFT-03	2	Fuel Oil Transfer	3 MO.	6 YR
CP2-DOAPFT-04	2	Fuel Oil Transfer	3 MO.	6 YR
Spent Fuel Pool Cooling System				
CPX-SFAPSF-01	3	Spent Fuel Pool Cooling Water	3 MO.	6 YR
CPX-SFAPSF-02	3	Spent Fuel Pool Cooling Water	3 MO.	6 YR
Vents and Drains System				
CP1-WPAPSS-01	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP1-WPAPSS-02	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP1-WPAPSS-03	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP1-WPAPSS-04	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP2-WPAPSS-01	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP2-WPAPSS-02	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP2-WPAPSS-03	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.
CP2-WPAPSS-04	3	Safeguards Building Floor Drain Sump	2 YR.	6 YR.

* For test parameters see current revision of Inservice Testing Plan.

Table of Contents for

TABLE 2 - Less Safety Significant Valves

System — Page # of Enclosure 3

CPSES			Table 2: Less Safety Significant Valves		
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
Auxiliary Feedwater System					
AF-0009	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
AF-0014	3	C	AFW Flowpath	CV/Q	6 YR
AF-0024	3	C	AFW Flowpath	CV/Q	6 YR
AF-0032	3	C	AFW Flowpath	CV/Q	6 YR
AF-0038	3	C	AFW Flowpath	CV/Q	6 YR
AF-0041	3	B	AFW Flowpath	PIT/2 YR	6 YR
AF-0042	3	B	AFW Flowpath Boundary	PIT/2 YR	6 YR
AF-0051	3	C	AFW Flowpath	CV/Q	6 YR
AF-0054	3	B	AFW Flowpath	PIT/2 YR	6 YR
AF-0055	3	B	AFW Flowpath Boundary	PIT/2 YR	6 YR
AF-0065	3	C	AFW Flowpath	CV/Q	6 YR
AF-0066	3	B	AFW Flowpath	PIT/2 YR	6 YR
AF-0067	3	B	AFW Flowpath Boundary	PIT/2 YR	6 YR
AF-0075	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0078	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0083	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0086	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0093	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0098	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
AF-0101	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
AF-0106	3	C	AFW Flowpath/AFW Flowpath Boundary & AFW Line Break Mitigation & FW Backflow Prevention During Startup	CV/CS	6 YR
1AF-0215	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0216	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0217	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0218	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0219	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0220	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0221	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0222	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0223	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0224	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0224	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0223	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0226	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0227	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0227	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0226	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0228	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR

CPSES Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
AF-0229	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0230	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0231	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
1AF-0231	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
2AF-0230	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0232	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0233	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0234	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
AF-0235	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR. CV/Q	6 YR 6 YR
PV-2453A	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
PV-2453B	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
PV-2454A	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
PV-2454B	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
FV-2456	3	B	Pump Miniflow Path/AFW Flowpath Boundary	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
FV-2457	3	B	Pump Miniflow Path/AFW Flowpath Boundary	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
HV-2459	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
HV-2460	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
HV-2461	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
HV-2462	3	B	AFW to SG Flowpath/AFW to Faulted SG Flow Isolation	MT/Q FO/Q PIT/2 YR.	6 YR 6 YR 6 YR
LV-2478	3	B	Non-Safety Makeup Line Isolation	PIT/2 YR.	6 YR.
HV-2480	3	B	AFW Pump Emergency Supply Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-2481	3	B	AFW Pump Emergency Supply Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-2482	3	B	AFW Pump Emergency Supply Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-2484	3	B	Condensate System to Condensate Storage Tank Isolation to Preclude Tank Overpressurization	MT/Q PIT/2 YR	6 YR 6 YR
HV-2485	3	B	Condensate System to Condensate Storage Tank Isolation to Preclude Tank Overpressurization	MT/Q PIT/2 YR	6 YR 6 YR
HV-2491A	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2491B	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2492A	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2492B	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2493A	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2493B	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2494A	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-2494B	2	B	Containment Isolation & AFW to Faulted SG Flow Isolation	MT/Q PIT/2 YR	6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
Component Cooling Water System					
CC-0003	3	C	Surge Tank Emergency Makeup Flowpath	CV/Q	6 YR
CC-0004	3	C	Surge Tank Emergency Makeup Flowpath	CV/Q	6 YR
CC-0031	3	C	CCW Flowpath / CCW Flowpath Boundary	CV/Q	6 YR
CC-0061	3	C	CCW Flowpath / CCW Flowpath Boundary	CV/Q	6 YR
2CC-0371	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
2CC-0372	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
2CC-0373	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
2CC-0374	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
CC-0611	2	C	Containment Penetration Thermal Relief	SRV/10 YR	10 YR
CC-0618	2	C	Containment Penetration Thermal Relief	SRV/10 YR	10 YR
CC-0629	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
CC-0646	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
CC-0657	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
CC-0687	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
CC-0694	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
CC-0713	2	A/C	Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
CC-0831	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
1CC-1067	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
1CC-1075	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
1CC-1076	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
1CC-1077	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
1CC-1078	3	C	RCP Thermal Barrier Rupture Isolation	CV/CS	6 YR
1CC-1079	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1CC-1080	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
1CC-1081	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1CC-1082	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2CC-1090	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
2CC-1091	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2CC-1092	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2CC-1093	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2CC-1094	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
X-PV-3583	3	B	Control Room A/C Condenser Cooling Flow Control	Note 3	N/A
X-PV-3584	3	B	Control Room A/C Condenser Cooling Flow Control	Note 3	N/A
X-PV-3585	3	B	Control Room A/C Condenser Cooling Flow Control	Note 3	N/A
X-PV-3586	3	B	Control Room A/C Condenser Cooling Flow Control	Note 3	N/A
LV-4500	3	B	Surge Tank Emergency Makeup Flowpath/Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
LV-4500-1	3	B	Surge Tank Emergency Makeup Flowpath	MT/Q FO/Q PIT/2 YR	6 YR 6 YR 6 YR
LV-4501	3	B	Surge Tank Emergency Makeup Flowpath/Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
PV-4552	3	B	Safety Chilled Water Condenser Cooling Flow Control	FO/Q PIT/2 YR	6 YR 6 YR
PV-4553	3	B	Safety Chilled Water Condenser Cooling Flow Control	FO/Q PIT/2 YR	6 YR 6 YR
HV-4574	3	B	Containment Spray Heat Exchanger Cooling Flowpath	MT/Q PIT/2 YR	6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
HV-4575	3	B	Containment Spray Heat Exchanger Cooling Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-4631A	3	B	Non-Safety Flowpath (Process Sample Cooling) Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-4631B	3	B	Non-Safety Flowpath (Process Sample Cooling) Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
FV-4650A	3	B	Non-Safety Flowpath (Ventilation Chillers, Letdown Chiller) Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
FV-4650B	3	B	Non-Safety Flowpath (Ventilation Chillers, Letdown Chiller) Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-4696	2	A	Containment Isolation & RCP Thermal Barrier Rupture Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
HV-4699	2	B	Passive Pipe Break Isolation (inside Containment)	MT/CS PIT/2 YR	6 YR 6 YR
HV-4700	2	A	Containment Isolation & RCP Thermal Barrier Rupture Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-4701	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-4708	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-4709	2	A	Containment Isolation & RCP Thermal Barrier Rupture Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
HV-4710	2	B	Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-4711	2	B	Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
Chilled Water (Safety) System					
CH-0300	3	C	Surge Tank Emergency Makeup Flowpath	CV/Q	6 YR
CH-0301	3	C	Surge Tank Emergency Makeup Flowpath	CV/Q	6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
CH-0302	3	B	Surge Tank Emergency Makeup Flowpath	ET/Q	6 YR
CH-0305	3	B	Surge Tank Emergency Makeup Flowpath	ET/Q	6 YR
HV-6720	3	B	Surge Tank Emergency Makeup Flowpath	MT/Q FO/Q PIT/2 YR	6 YR 6 YR 6 YR
Chemical and Volume Control System					
XCS-0037	3	C	Pump Miniflow Path	CV/Q	6 YR
XCS-0039	3	C	Pump Miniflow Path	CV/Q	6 YR
XCS-0041	3	C	Pump Miniflow Path	CV/Q	6 YR
XCS-0044	3	C	Pump Miniflow Path	CV/Q	6 YR
FCV-0110B	2	B	Boration Flowpath Boundary	PIT/2 YR	6 YR
FCV-0111A	3	B	Boration Flowpath Boundary	PIT/2 YR	6 YR
FCV-0111B	2	B	Boration Flowpath Boundary $ Boron Dilution Flowpath Isolation (during Mode 6)	PIT/2 YR	6 YR
8100	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
8104	2	B	Boration Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
8105	2	A	Boration Flowpath/ECCS Flowpath Boundary & Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
8106	2	B	Boration Flowpath/ECCS Flowpath Boundary	MT/CS PIT/2 YR	6 YR 6 YR
8109	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8112	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
8145	1	B	Reactor Coolant Pressure Boundary	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
8146	2	B	Boration Flowpath	PIT/2 YR	6 YR
8147	2	B	Boration Flowpath	PIT/2 YR	6 YR
8153	1	B	Reactor Coolant Pressure Boundary	MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
8154	2	A	Containment Isolation	MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR
CS-8180	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
8202A	2	B	ECCS Flowpath Boundary & Isolation of VCT Cover Gas from Charging Pumps' Suction Header	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8202B	2	B	ECCS Flowpath Boundary & Isolation of VCT Cover Gas from Charging Pumps' Suction Header	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8210A	2	B	ECCS Flowpath Boundary & Isolation of PD Pump Suction Stabilizer Gas Supply from Charging Pumps' Suction Header	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8210B	2	B	ECCS Flowpath Boundary & Isolation of PD Pump Suction Stabilizer Gas Supply from Charging Pumps' Suction Header	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-8220	2	B	ECCS Flowpath Boundary & Isolation of VCT Cover Gas from Charging Pumps' Suction Header (upon low VCT level)	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-8221	2	B	ECCS Flowpath Boundary & Isolation of VCT Cover Gas from Charging Pumps' Suction Header (upon low VCT level)	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
CS-8350A	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8350B	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8350C	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8350D	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
8351A	2	B	Containment Isolation	MT/CS PIT/2 YR	6 YR 6 YR
8351B	2	B	Containment Isolation	MT/CS PIT/2 YR	6 YR 6 YR
8351C	2	B	Containment Isolation	MT/CS PIT/2 YR	6 YR 6 YR
8351D	2	B	Containment Isolation	MT/CS PIT/2 YR	6 YR 6 YR
CS-8367A	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8367B	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR

CPSES Table 2: Less Safety Significant Valves

Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
CS-8367C	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8367D	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
CS-8368A	2	C	Containment Isolation	CV/CS	6 YR
CS-8368B	2	C	Containment Isolation	CV/CS	6 YR
CS-8368C	2	C	Containment Isolation	CV/CS	6 YR
CS-8368D	2	C	Containment Isolation	CV/CS	6 YR
CS-8377	1	C	Reactor Coolant Pressure Boundary	CV/CS	6 YR
8378A	1	C	Boration Flowpath ------------------------> Reactor Coolant Pressure Boundary -------->	CV/Q CV/CS	6 YR 6 YR
8378B	1	C	Boration Flowpath ------------------------> Reactor Coolant Pressure Boundary -------->	CV/Q CV/CS	6 YR 6 YR
8379A	1	C	Boration Flowpath ------------------------> Reactor Coolant Pressure Boundary -------->	CV/Q CV/CS	6 YR 6 YR
8379B	1	C	Boration Flowpath ------------------------> Reactor Coolant Pressure Boundary -------->	CV/Q CV/CS	6 YR 6 YR
8381	2	A/C	Boration Flowpath ------------------------> Containment Isolation --------------------> Containment Isolation -------------------->	CV/Q LTJ/TS CV/CS	6 YR Note 1 6 YR
CS-8442	2	C	Boration Flowpath	CV/CS	6 YR
CS-8473	3	C	Boration Flowpath/Boration Flowpath Boundary	CV/Q	6 YR
CS-8480A	2	C	ECCS Flowpath Boundary	CV/Q	6 YR
CS-8480B	2	C	ECCS Flowpath Boundary	CV/Q	6 YR
8481A	2	C	ECCS Flowpath & Boration Flowpath --------> ECCS Flowpath Boundary ------------------>	PS/Q CV/RF CV/Q	6 YR 6 YR 6 YR
8481B	2	C	ECCS Flowpath & Boration Flowpath --------> ECCS Flowpath Boundary ------------------>	PS/Q CV/RF CV/Q	6 YR 6 YR 6 YR
CS-8487	3	C	Boration Flowpath/Boration Flowpath Boundary	CV/Q	6 YR
8497	2	C	ECCS Flowpath Boundary	CV/Q	6 YR
8510A	2	C	High Head Safety Injection Pump Miniflow Path/ECCS Recirculation Flowpath Boundary	SRV	Note 2

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
8510B	2	C	High Head Safety Injection Pump Miniflow Path/ECCS Recirculation Flowpath Boundary	SRV	Note 2
Containment Spray System					
CT-0013	2	C	Containment Spray Flowpath	CV/Q	6 YR
CT-0020	2	C	Chemical Additive Flowpath	CV/Q	6 YR
CT-0025	2	C	Containment Spray Injection Flowpath/ Sump Recirculation Flowpath Boundary	CV/Q	6 YR
CT-0031	2	C	Chemical Additive Flowpath	CV/Q	6 YR
CT-0042	2	C	Containment Spray Flowpath	CV/Q	6 YR
CT-0047	2	C	Pump Miniflow Flowpath	CV/Q	6 YR
CT-0048	2	C	Pump Miniflow Flowpath	CV/Q	6 YR
CT-0063	2	C	Pump Miniflow Flowpath	CV/Q	6 YR
CT-0064	2	C	Pump Miniflow Flowpath	CV/Q	6 YR
CT-0065	2	C	Containment Spray Flowpath	CV/Q	6 YR
CT-0072	2	C	Chemical Additive Flowpath	CV/Q	6 YR
CT-0077	2	C	Containment Spray Injection Flowpath / Sump Recirculation Flowpath Boundary	CV/Q	6 YR
CT-0082	2	C	Chemical Additive Flowpath	CV/Q	6 YR
CT-0094	2	C	Containment Spray Flowpath	CV/Q	6 YR
CT-0142	2	A/C	Containment Spray Flowpath/ Containment Isolation	LTJ/TS CVD/RF	Note 1 6 YR
CT-0145	2	A/C	Containment Spray Flowpath/ Containment Isolation	LTJ/TS CVD/RF	Note 1 6 YR
CT-0148	2	C	Sump Recirculation Flowpath	CVD/RF	6 YR
CT-0149	2	C	Sump Recirculation Flowpath	CVD/RF	6 YR
CT-03[illegible]	2	C	HV-4782 Bonnet Overpressure Relief / Containment Isolation	SRV/10 YR	10 YR
CT-0310	2	C	HV-4783 Bonnet Overpressure Relief / Containment Isolation	SRV/10 YR	10 YR
LV-4754	3	B	Chemical Additive Flowpath/ Chemical Additive Tank Isolation	MT/Q PIT/2 YR	6 YR 6 YR
LV-4755	3	B	Chemical Additive Flowpath/ Chemical Additive Tank Isolation	MT/Q PIT/2 YR	6 YR 6 YR

CPSES			Table 2: Less Safety Significant Valves		
Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
HV-4758	2	B	Sump Recirculation Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
HV-4759	2	B	Sump Recirculation Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
FV-4772-1	2	B	Pump Miniflow Flowpath / Containment Spray Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
FV-4772-2	2	B	Pump Miniflow Flowpath / Containment Spray Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
FV-4773-1	2	B	Pump Miniflow Flowpath / Containment Spray Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
FV-4773-2	2	B	Pump Miniflow Flowpath / Containment Spray Flowpath Boundary	MT/Q PIT/2 YR	6 YR 6 YR
HV-4776	2	A	Containment Spray Flowpath/ Containment Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
HV-4777	2	A	Containment Spray Flowpath/ Containment Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
HV-4782	2	B	Sump Recirculation Flowpath/ Containment Isolation	MT/Q PIT/2 YR	6 YR 6 YR
HV-4783	2	A	Sump Recirculation Flowpath/ Containment Isolation	MT/Q PIT/2 YR	6 YR 6 YR
CTVBCA-01	3	C	Chemical Additive Tank Ventpath/ System Boundary	SRV/10 YR	10 YR
CTVBCA-02	3	C	Chemical Additive Tank Ventpath/ System Boundary	SRV/10 YR	10 YR
Demineralized and Reactor Makeup Water System					
2DD-0002	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
DD-0006	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
2DD-0008	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
2DD-0009	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
DD-0016	3	C	Pump Miniflow Path	CV/Q	6 YR
DD-0018	3	C	Pump Discharge Flowpath	CV/Q	6 YR
1DD-0020	3	B	Non-Safety Flowpath Isolation	ET/Q	6 YR
XDD-0044	3	C	Pump Miniflow Path	CV/Q	6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
XDD-0048	3	C	Pump Discharge Flowpath	CV/Q	6 YR
1DD-0064	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
1DD-0065	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
1DD-0066	3	C	Non-Safety Makeup Line Isolation	CV/Q	6 YR
XDD-0103	3	B	Non-Safety Flowpath Isolation	ET/Q	6 YR
DD-0430	2	A/C	Containment Penetration Thermal Relief/ Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
HV-5365	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5365	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Diesel Generator Auxiliary System					
DO-0004	3	C	Fuel Oil Flowpath/ Fuel Oil Flowpath Boundary	CV/Q	6 YR
DO-0005	3	C	Fuel Oil Flowpath/ Fuel Oil Flowpath Boundary	CV/Q	6 YR
DO-0016	3	C	Fuel Oil Flowpath/ Fuel Oil Flowpath Boundary	CV/Q	6 YR
DO-0017	3	C	Fuel Oil Flowpath/ Fuel Oil Flowpath Boundary	CV/Q	6 YR
DO-0049	3	C	Fuel Oil Flowpath	CV/Q	6 YR
1DO-0050	3	C	Fuel Oil Flowpath	CV/Q	6 YR
2DO-0052	3	C	Fuel Oil Flowpath	CV/Q	6 YR
DO-0058	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0059	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0060	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0061	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Test Schedule (See Notes) Proposed
DO-0062	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0063	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0064	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0065	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
2DO-0074	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
2DO-0075	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
2DO-0076	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
2DO-0077	3	C	Safety-Related Air Receiver to Non-Safety Air Supply Isolation	CV/Q	6 YR
DO-0104	3	C	Jacket Water Flowpath Boundary	CV/Q	6 YR
DO-0107	3	B	Jacket Water Temperature Control	Note 3	N/A
DO-0157	3	C	Lube Oil Flowpath	CV/Q	6 YR
DO-0158	3	C	Lube Oil Flopath Boundary	CV/Q	6 YR
DO-0204	3	C	Jacket Water Flowpath Boundary	CV/Q	6 YR
DO-0207	3	B	Jacket Water Temperature Control	Note 3	N/A
DO-0257	3	C	Lube Oil Flowpath	CV/Q	6 YR
DO-0258	3	C	Lube Oil Flowpath Boundary	CV/Q	6 YR
Feedwater System					
FW-0070	2	C	Main Feedlin Break Isolation	CV/CS	6 YR
FW-0076	2	C	Main Feedlin Break Isolation	CV/CS	6 YR
FW-0082	2	C	Main Feedlin Break Isolation	CV/CS	6 YR
FW-0088	2	C	Main Feedlin Break Isolation	CV/CS	6 YR
FW-00191	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0192	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0193	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0194	2	C	AFW Flowpath Boundary	CV/CS	6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
FW-0195	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0196	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0197	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0198	2	C	AFW Flowpath Boundary	CV/CS	6 YR
FW-0199	2	C	AFW Flowpath Boundary	CV/Q	6 YR
FW-0200	2	C	AFW Flowpath Boundary	CV/Q	6 YR
FW-0201	2	C	AFW Flowpath Boundary	CV/Q	6 YR
FW-0202	2	C	AFW Flowpath Boundary	CV/Q	6 YR
HV-2154	2	B	Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2155	2	B	Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
FV-2181	2	B	AFW Flowpath Boundary	PS/Q MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR 6 YR
FV-2182	2	B	AFW Flowpath Boundary	PS/Q MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR 6 YR
FV-2183	2	B	AFW Flowpath Boundary	PS/Q MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR 6 YR
FV-2184	2	B	AFW Flowpath Boundary	PS/Q MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR 6 YR
HV-2185	2	B	Feedwater Isolation & Containment Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-2186	2	B	Feedwater Isolation & Containment Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-2187	2	B	Feedwater Isolation & Containment Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes) Current	Proposed
HV-2188	2	B	Feedwater Isolation & Containment Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-2193	2	B	Feedwater Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2194	2	B	Feedwater Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2195	2	B	Feedwater Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2196	2	B	Feedwater Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
Main Steam System					
MS-0021	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0022	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0023	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0024	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0025	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0026	2	B	Steam Generator Tube Rupture Isolation (Isolates PORV)	ET/Q	6 YR
MS-0058	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0059	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
MS-0060	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0061	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0062	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0063	2	B	Steam Generator Tube Rupture Isolation (Isolates PORV)	ET/Q	6 YR
MS-0093	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0094	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0095	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0096	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0097	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0098	2	B	Steam Generator Tube Rupture Isolation (Isolates PORV)	ET/Q	6 YR
MS-0129	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0130	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0131	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0132	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
MS-0133	2	C	Overpressure Protection & Steam Vent Flowpath (for residual heat removal)/ Steam Line Isolation & Containment Isolation	SRV/5 YR PIT/2 YR	6 YR 6 YR
MS-0134	2	B	Steam Generator Tube Rupture Isolation (Isolates PORV)	ET/Q	6 YR
MS-0142	3	C	TDAFW Pump Steam Supply Flowpath/TDAFW Pump SteamSupply Flowpath Boundary	CV/Q	6 YR
MS-0143	3	C	TDAFW Pump Steam Supply Flowpath/TDAFW Pump SteamSupply Flowpath Boundary	CV/Q	6 YR
2MS-0663	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0664	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0665	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0666	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0667	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0668	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0669	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
2MS-0670	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0680	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0681	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0682	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0683	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0684	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0685	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
1MS-0686	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
1MS-0687	3	A/C	Safety-Related Air Accumulator to Non-Safety Air Supply Isolation	LT/2 YR CV/Q	6 YR 6 YR
HV-2333A	2	B	Steam Line Isolation/ Containment Isolation	PS/Q MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR 6 YR
HV-2333B	2	B	Steam Line Isolation/ Containment Isolation	PIT/2 YR	6 YR
HV-2334A	2	B	Steam Line Isolation/ Containment Isolation	PS/Q MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR 6 YR
HV-2334B	2	B	Steam Line Isolation/ Containment Isolation	PIT/2 YR	6 YR
HV-2335A	2	B	Steam Line Isolation/ Containment Isolation	PS/Q MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR 6 YR
HV-2335B	2	B	Steam Line Isolation/ Containment Isolation	PIT/2 YR	6 YR
HV-2336A	2	B	Steam Line Isolation/ Containment Isolation	PS/Q MT/CS FC/Q PIT/2 YR	6 YR 6 YR 6 YR 6 YR
HV-2336B	2	B	Steam Line Isolation/ Containment Isolation	PIT/2 YR	6 YR
HV-2397	2	B	Containment Isolation & HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2397A	2	B	HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2398	2	B	Containment Isolation & HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2398A	2	B	HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2399	2	B	Containment Isolation & HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR

CPSES			Table 2: Less Safety Significant Valves		
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
HV-2399A	2	B	HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2400	2	B	Containment Isolation & HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2400A	2	B	HELB Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2401A	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2401B	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2402A	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2402B	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2403A	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2403B	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2404A	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2404B	2	B	AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2405	2	B	Containment Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2406	2	B	Containment Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
HV-2407	2	B	Containment Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2408	2	B	Containment Isolation & AFW Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2409	2	B	Steam Line Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2410	2	B	Steam Line Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2411	2	B	Steam Line Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2412	2	B	Steam Line Isolation & Containment Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2452-1	2	B	TDAFW Pump Steam Supply Flowpath / Containment Isolation	MT/Q FO/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-2452-2	2	B	TDAFW Pump Steam Supply Flowpath / Containment Isolation	MT/Q FO/Q PIT/2 YR	6 YR 6 YR 6 YR
Reactor Coolant System					
RC-003o	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
HV-3607	2	B	Post Accident Vent Path / Vent Path Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-3608	2	B	Post Accident Vent Path / Vent Path Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-3609	2	B	Post Accident Vent Path / Vent Path Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR
HV-3610	2	B	Post Accident Vent Path / Vent Path Isolation	MT/CS FC/CS PIT/2 YR	6 YR 6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
8026	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8027	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8046	2	A/C	Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
8047	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Residual Heat Removal System					
FCV-0618	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
FCV-0619	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
HV-4178	2	B	RHR System to Non-Safety Process Sampling System Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-4179	2	B	RHR System to Non-Safety Process Sampling System Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
HV-4182	2	B	RHR System to Non-Safety Post Accident Sampling System Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8730A	2	C	ECCS & RHR Flowpath / ECCS Injection Flowpath Boundary	CV/CS	6 YR
8730B	2	C	ECCS & RHR Flowpath / ECCS Injection Flowpath Boundary	CV/CS	6 YR
Spent Fuel Pool Cooling System					
XSF-0003	3	C	Spent Fuel Pool Cooling Flowpath	CV/Q	6 YR
XSF-0004	3	C	Spent Fuel Pool Cooling Flowpath	CV/Q	6 YR
SF-0011	2	A	Containment Isolation	LTJ/TS	Note 1
SF-0012	2	A	Containment Isolation	LTJ/TS	Note 1
SF-0021	2	A	Containment Isolation	LTJ/TS	Note 1

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes) Current	Test Schedule (See Notes) Proposed
SF-0022	2	A	Containment Isolation	LTJ/TS	Note 1
1SF-0053	2	A	Containment Isolation	LTJ/TS	Note 1
1SF-0054	2	A	Containment Isolation	LTJ/TS	Note 1
2SF-0055	2	A	Containment Isolation	LTJ/TS	Note 1
2SF-0056	2	A	Containment Isolation	LTJ/TS	Note 1
XSF-0160	3	C	Spent Fuel Pool Emergency Makeup Flowpath	CV/Q	6 YR
XSF-0161	3	B	Spent Fuel Pool Emergency Makeup Flowpath	ET/Q	6 YR
XSF-0179	3	B	Spent Fuel Pool Emergency Makeup Flowpath	ET/Q	6 YR
XSF-0180	3	C	Spent Fuel Pool Emergency Makeup Flowpath	CV/Q	6 YR
Safety Injection System					
8800A	2	B	RWST to Non-Safety Purification System Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8800B	2	B	RWST to Non-Safety Purification System Isolation	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8801A	2	B	ECCS to Cold Legs Flowpath & Boration Flowpath / Containment Isolation & Passive Pipe Break Isolation	MT/RF PIT/2 YR	6 YR 6 YR
8801B	2	B	ECCS to Cold Legs Flowpath & Boration Flowpath / Containment Isolation & Passive Pipe Break Isolation	MT/RF PIT/2 YR	6 YR 6 YR
8802A	2	B	ECCS to Hot Legs Flowpath/ ECCS to Cold Legs Flowpath & Boration Flowpath / Containment Isolation & Passive Pipe Break Isolation	MT/CS PIT/2 YR	6 YR 6 YR
8802B	2	B	ECCS to Hot Legs Flowpath/ ECCS to Cold Legs Flowpath & Boration Flowpath / Containment Isolation & Passive Pipe Break Isolation	MT/CS PIT/2 YR	6 YR 6 YR
8807A	2	B	ECCS Recirculation Flowpath/Passive Pipe Break Isolation	MT/Q PIT/2 YR	6 YR 6 YR
8807B	2	B	ECCS Recirculation Flowpath/Passive Pipe Break Isolation	MT/Q PIT/2 YR	6 YR 6 YR
8808A	2	B	ECCS from Accumulators to Cold Legs Flowpath	MT/CS PIT/2 YR	6 YR 6 YR

CPSES Table 2: Less Safety Significant Valves

Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
8808B	2	B	ECCS from Accumulators to Cold Legs Flowpath	MT/CS PIT/2 YR	6 YR 6 YR
8808C	2	B	ECCS from Accumulators to Cold Legs Flowpath	MT/CS PIT/2 YR	6 YR 6 YR
8808D	2	B	ECCS from Accumulators to Cold Legs Flowpath	MT/CS PIT/2 YR	6 YR 6 YR
8821A	2	B	ECCS to Cold Legs Flowpath/ECCS to Hot Legs Flowpath Boundary & Passive Pipe Break Isolation	MT/Q PIT/2 YR	6 YR 6 YR
8821B	2	B	ECCS to Cold Legs Flowpath/ECCS to Hot Legs Flowpath Boundary & Passive Pipe Break Isolation	MT/Q PIT/2 YR	6 YR 6 YR
8823	2	B	Containment Isolation & ECCS Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8824	2	B	Containment Isolation & ECCS Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8825	2	A	Containment Isolation & ECCS Flowpath Boundary	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8841A	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
8841B	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
8843	2	B	Containment Isolation & ECCS Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8871	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8875A	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8875B	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8875C	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8875D	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8877A	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
8877B	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8877C	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8877D	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8878A	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8878B	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8878C	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8878D	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8879A	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8879B	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8879C	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8879D	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8880	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8881	2	B	Containment Isolation & ECCS Flowpath Boundary	MT/Q FC/Q PIT/2 YR	6 YR 6 YR 6 YR
8882	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8888	2	A	Containment Isolation & ECCS Flowpath Boundary	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8889A	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8889B	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8889C	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8889D	2	B	ECCS Flowpath Boundary	PIT/2 YR	6 YR
8890A	2	A	Containment Isolation & ECCS Flowpath Boundary	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
8890B	2	A	Containment Isolation & ECCS Flowpath Boundary	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
SI-8900A	1	A/C	ECCS to Cold Legs Flowpath & Boration Flowpath/Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
SI-8900B	1	A/C	ECCS to Cold Legs Flowpath & Boration Flowpath/Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
SI-8900C	1	A/C	ECCS to Cold Legs Flowpath & Boration Flowpath/Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
SI-8900D	1	A/C	ECCS to Cold Legs Flowpath & Boration Flowpath/Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
SI-8905A	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
SI-8905B	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
SI-8905C	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
SI-8905D	1	A/C	ECCS to Hot Legs Flowpath/Reactor Coolant Pressure Boundary & Containment Isolation	LT/TS CV/RF	Note 4 6 YR
SI-8919A	2	C	SI Pump Miniflow Path / ECCS Recirculation Flowpath Boundary	CV/Q	6 YR
SI-8919B	2	C	SI Pump Miniflow Path / ECCS Recirculation Flowpath Boundary	CV/Q	6 YR
8922A	2	C	ECCS Flowpath / ECCS Flowpath Boundary	CV/RF	6 YR
8922B	2	C	ECCS Flowpath / ECCS Flowpath Boundary	CV/RF	6 YR
8924	2	B	Passive Pipe Break Isolation	MT/Q PIT/2 YR	6 YR 6 YR
8949A	1	A/C	ECCS to Hot Legs Flowpath/ Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
8949B	1	A/C	ECCS to Hot Legs Flowpath/ Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
8949C	1	A/C	ECCS to Hot Legs Flowpath/ Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
8949D	1	A/C	ECCS to Hot Legs Flowpath/ Reactor Coolant Pressure Boundary	LT/TS CV/RF	Note 4 6 YR
8958A	2	C	ECCS Injection Flowpath / ECCS Recirculation flowpath Boundary	CV/CS	6 YR
8958B	2	C	ECCS Injection Flowpath / ECCS Recirculation flowpath Boundary	CV/CS	6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
8964	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
SI-8968	2	A/C	Containment Isolation	LTJ/TS CV/Q	Note 1 6 YR
8969A	2	C	ECCS Recirculation Flowpath /ECCS Flowpath Boundary (during Recirculation with Loss of RHR B)	CV/RF	6 YR
8969B	2	C	ECCS Recirculation Flowpath /ECCS Flowpath Boundary (during Recirculation with Loss of RHR A)	CV/RF	6 YR
1SI-8972	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
2SI-8983	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
			Service Water System		
HV-4393	3	B	Service Water Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-4394	3	B	Service Water Flowpath	MT/Q PIT/2 YR	6 YR 6 YR
HV-4395	3	B	AFW Pump Emergency Supply Flowpath	MT/RF PIT/2 YR	6 YR 6 YR
HV-4396	3	B	AFW Pump Emergency Supply Flowpath	MT/RF PIT/2 YR	6 YR 6 YR
			Vents and Drains		
VD-0003	3	C	Sump Discharge Flowpath / Sump Discharge Flowpath Boundary	CV/RF	6 YR
VD-0004	3	C	Sump Discharge Flowpath / Sump Discharge Flowpath Boundary	CV/RF	6 YR
VD-0011	3	C	Sump Discharge Flowpath / Sump Discharge Flowpath Boundary	CV/RF	6 YR
VD-0012	3	C	Sump Discharge Flowpath / Sump Discharge Flowpath Boundary	CV/RF	6 YR
2VD-0896	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
1VD-0907	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes)	
				Current	Proposed
Misc Containment Isolation Valves (Buildings and Structures)					
1BS-0015	N/A	A	Containment Isolation	LTJ/TS	Note 1
2BS-0015	2	A	Containment Isolation	LTJ/TS	Note 1
2BS-0016	2	A	Containment Isolation	LTJ/TS	Note 1
2BS-0017	2	A	Containment Isolation	LTJ/TS	Note 1
BS-0025	2	A	Containment Isolation	LTJ/TS	Note 1
1BS-0029	N/A	A	Containment Isolation	LTJ/TS	Note 1
2BS-0029	2	A	Containment Isolation	LTJ/TS	Note 1
BS-0030	2	A	Containment Isolation	LTJ/TS	Note 1
2BS-0039	2	A	Containment Isolation	LTJ/TS	Note 1
2BS-0040	2	A	Containment Isolation	LTJ/TS	Note 1
1BS-0044	N/A	A	Containment Isolation	LTJ/TS	Note 1
2BS-0044	2	A	Containment Isolation	LTJ/TS	Note 1
1BS-0056	N/A	A	Containment Isolation	LTJ/TS	Note 1
2BS-0056	2	A	Containment Isolation	LTJ/TS	Note 1
BS-0202	2	A	Containment Isolation	LTJ/TS	Note 1
BS-0203	2	A	Containment Isolation	LTJ/TS	Note 1
Misc Containment Isolation Valves (Service Air)					
CA-0016	2	A/C	Containment Isolation	LTJ/TS CV/Q	Note 1 6 YR
HV-3468	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Misc Containment Isolation Valves (Chilled Water / Non-Safety)					
CH-0024	2	A/C	Containment Isolation	LTJ/TS CV/CS	Note 1 6 YR
1CH-0271	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
1CH-0272	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
2CH-0281	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Cate-gory	Description	Test Schedule (See Notes) Current	Proposed
2CH-0282	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
HV-0682	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-0683	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-0684	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
Misc Containment Isolation Valves (Instrument Air)					
CI-0030	2	A/C	Containment Isolation	LTJ/TS CV/RF	Note 1 6 YR
HV-3487	2	A	Conataiment Isolation	LTJ/TS MT/CS FC/CS PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Misc Containment Isolation Valves (Fire Protection)					
HV-4075B	2	A	Conataiment Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
HV-4075C	2	A	Conataiment Isolation	LTJ/TS MT/Q PIT/2 YR	Note 1 6 YR 6 YR
Misc Containment Isolation Valves (Post Accident Sampling)					
HV-5556	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5557	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5558	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR

CPSES			Table 2: Less Safety Significant Valves		
Component	Code Class	Category	Description	Test Schedule (See Notes)	
				Current	Proposed
HV-5559	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5560	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5561	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
WP-7177	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
HV-7311	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-7312	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Misc Containment Isolation Valves (Process Sampling)					
PS-0500	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
PS-0501	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
PS-0502	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
PS-0503	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR
HV-4165	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4166	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Test Schedule (See Notes) Proposed
HV-4167	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4168	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4169	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4170	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4171	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4172	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4173	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4174	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4175	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-4176	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR

CPSES — Table 2: Less Safety Significant Valves

Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Test Schedule (See Notes) Proposed
Misc Containment Isolation Valves (Radiation Monitoring)					
HV-5544	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5545	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5546	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5547	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
Misc Containment Isolation Valves (Containment HVAC)					
HV-5536	2	A	Containment Isolation	LTJ/TS MT/CS FC/CS PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5537	2	A	Containment Isolation	LTJ/TS MT/CS FC/CS PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5538	2	A	Containment Isolation	LTJ/TS MT/CS FC/CS PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5539	2	A	Containment Isolation	LTJ/TS MT/CS FC/CS PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5548	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
HV-5549	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR

CPSES	Table 2: Less Safety Significant Valves				
Component	Code Class	Category	Description	Test Schedule (See Notes) Current	Proposed
Misc Containment Isolation Valves (Containment Hydrogen Purge)					
HV-5540	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-5541	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-5542	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-5543	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-5562	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
HV-5563	2	A	Containment Isolation	LTJ/TS MT/CS PIT/2 YR	Note 1 6 YR 6 YR
Misc Containment Isolation Valves (Liquid Waste Processing)					
LCV-1003	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
7126	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
7135	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
7150	2	A	Containment Isolation	LTJ/TS MT/Q FC/Q PIT/2 YR	Note 1 6 YR 6 YR 6 YR
WP-7176	2	A/C	Containment Penetration Thermal Relief / Containment Isolation	LTJ/TS SRV/10 YR	Note 1 10 YR

Notes:

1. No change is requested for the 10CFR50.55 Appendix J Test Requirements.

2. Under the provisions of 10CFR50.55a(f)(6)(ii), the NRC staff has imposed augmented inservice test requirements for these valves. See safety evaluation dated January 29, 1993, for Unit 1 and NUREG-0797, SER Supplement 26 for Unit 2 for the frequency requirements.

3. These valves are exempt from inservice testing per OM Part 10, 1.2(a)(2).

4. The test frequency requirements of Technical Specification 4.4.5.2.2 apply for leak testing of these valves. The Technical Specification 4.4.5.2.2 test frequency requirements are more restrictive than the test frequency requirements of OM Part 10, para. 4.2.2.3(a).

TEST PARAMETERS

Leak Test

LT - Leak test Category A valve (other than containment isolation valves) per the requirements of OM Part 10, para. 4.2.2.3.

LTJ - Leak test Category A containment isolation valve per the requirements of OM Part 10, para. 4.2.2.2 (i.e., 10CFR50, Appendix J) and additional requirements of OM Part 10, paras. 4.2.2.3(e) and (f) as required by 10CFR50.55a(b)(2)(vii).

Exercise Test

MT - Exercise power operated Category A or B valve full-stroke to its safety function position(s) and measure stroke time per the requirements of OM Part 10, para. 4.2.1.

ET - Exercise manual Category A or B valve full-stroke to its safety function position(s) per the requirements of OM Part 10, para. 4.2.1.

CV - Exercise Category C check valve full-stroke to its safety function position(s) per the requirements of OM Part 10, para. 4.3.2.

CVD - Disassemble Category C check valve to verify operability per the requirements of OM Part 10, para. 4.3.2.4(c).

PS - Exercise Category A or B valve or Category C check valve part-stroke towards its safety function position(s) per the requirements of OM Part 10, paras. 4.2.1 or 4.3.2, as applicable. Part-stroke close exercising is not applicable to check valves.

SRV - Performance test Category C safety, relief or vacuum breaker valve per the requirements of OM Part 10, para. 4.3.1 (i.e., applicable portions of OM Part 1).

DT - Test Category D valve per the requirements of OM Part 10, para. 4.4.

Fail Safe Test

FO - Fail safe test Category A or B valve in the open direction per the requirements of OM Part 10, para. 4.2.1.6.

FC - Fail safe test Category A or B valve in the closed direction per the requirements of OM Part 10, para. 4.2.1.6.

Position Indicator Test

PIT - Test Category A, B, C or D valve position indication per OM Part 10, para. 4.1.

TEST SCHEDULES

Q - Perform exercise test (and fail safe test, if applicable) nominally every three months.

CS - Perform exercise test (and fail safe test, if applicable) during each cold shutdown. Such exercise is not required if the time period since the previous full-stroke exercise is less than three months. Valve exercising during cold shutdown shall commence within 48 hours of achieving cold shutdown, and continue until all testing is complete or the plant is ready to return to power. For extended outages, testing need not be commenced in 48 hours provided all valves required to be tested during cold shutdown will be tested prior to plant startup.

RF - Perform exercise test (and fail safe test, if applicable) during each refueling outage.

TS - Perform test at the applicable Technical Specification frequency.

NYR - Perform test at least once every N years. For leak tests (LT) and position indicator tests (PIT), N equals two years. For pressure relief device performance tests (SRV), N nominally equals five years or ten years for Class 1 or Class 2 & 3 devices respectively. However, other test frequencies may apply for pressure relief devices. See OM Part 1, paras. 1.3.3 and 1.3.4.

CPSES

Table 3: More Safety Significant Valves
Not In ASME Section XI IST Program Plan

COMPONENT	DESCRIPTION	VALVE/ACTUATOR	TEST	FLOWDIAG/SHT/ COORD
8341	U1 PD PMP/CCP SUCT XTIE VLV	DA/MO	OM-10	M1-0255 / - / C/06
AF-0006	CST 1-01 TO TD AFW PMP 1-01 ISOL VLV	BF/MO	OM-10	M1-0206 / 2 / A/05
AF-0007	CST 1-01 TO MD AFW PMP 1-01/1-02 ISOL VLV	BF/MO	OM-10	M1-0206 / 2 / A/06
TV-2370A	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/02
TV-2370B	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / C/02
TV-2370C	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/02
TV-2370D	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / C/02
TV-2370E	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/03
TV-2370F	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / C/02
TV-2370G	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / C/02
TV-2370H	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/02
TV-2370J	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/02
PV-2369A	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / B/04
PV-2369B	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / C/02
PV-2369C	MAIN STM DMP TO CNDSR	GL/AO	OM-10	M1-0202 / 1B / E/02
FCV-0510	SG 1/2-01 FW FLO CRTL VLV	GL/AO	OM-10	M1-0203 / 1 / B/01
FCV-0520	SG 1/2-02 FW FLO CTRL VLV	GL/AO	OM-10	M1-0203 / 1 / B/03
FCV-0530	SG 1/2-03 FW FLO CTRL VLV	GL/AO	OM-10	M1-0203 / 1 / B/04
FCV-0540	SG 1/2-04 FW FLO CRTL VLV	GL/AO	OM-10	M1-0203 / 1 / B/05
1-CI-0055	INST AIR RCVR 1-01 RLF VLV	RE/SA	OM-1	M1-0216 / - / E/04
1-PSV-3475A	INST AIR RCVR 1-02 RLF VLV	RE/SA	OM-1	M1-0216 / B / D/01
1-CI-0063	INST AIR DRYR 1-01 RLF VLV	RE/SA	OM-1	M1-0216 / A / B/03
1-CI-0072	INST AIR DRYR 1-01 RLF VLV	RE/SA	OM-1	M1-0216 / A / C/03
1-PSV-3479A	INST AIR DRYR 1-02 RLF VLV	RE/SA	OM-1	M1-0216 / B / D/01
1-PSV-3482A	INST AIR DRYR 1-02 RLF VLV	RE/SA	OM-1	M1-0216 / B /D/01
2-CI-0055	INST AIR RCVR 2-01 RLF VLV	RE/SA	OM-1	M2-0216 / - / E/04
2-CI-0739	INST AIR RCVR 2-02 RLF VLV	RE/SA	OM-1	M2-0216 / - / D/04
2-CI-0063	INST AIR DRYR 2-01 RLF VLV	RE/SA	OM-1	M2-0216 / / B/03
2-CI-0072	INST AIR DRYR 2-01 RLF VLV	RE/SA	OM-1	M2-0216 / / B/03

CPSES

Table 3: More Safety Significant Valves
Not In ASME Section XI IST Program Plan

COMPONENT	DESCRIPTION	VALVE/ACTUATOR	TEST	FLOWDIAG/SHT/ COORD
2-PSV-3600	INST AIR DRYR 2-02 RLF VLV	RE/SA	OM-1	M2-0216 / - / B/03
2-PSV-3601	INST AIR DRYR 2-02 RLF VLV	RE/SA	OM-1	M2-0216 / - / B/03
X-PSV-3475A	INST AIR RCVR X-01 RLF VLV	RE/SA	OM-1	M2-0216 / - / B/03
XCI-0681	INST AIR DRYR X-01 RLF VLV	RE/SA	OM-1	M1-0216 / B / F/04
XCI-0683	INST AIR DRYR X-01 RLF VLV	RE/SA	OM-1	M1-0216 / B / F/04

RE = RELIEF VALVE
GL = GLOBE VALVE
SA = SELF ACTIVATED
MO = MOTOR OPERATOR

BF = BUTTERFLY VALVE
DA = DIAPHRAM VALVE
AO = AIR OPERATOR

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON CPSES RISK-BASED INSERVICE TESTING

General Notes

1. When the phrase "test interval" is used in Attachments 1 through 8, it means the time between tests not the 10 year (120 month) update intervals discussed in 10CFR50.55a(f)(4)(i,ii).

LIST OF ACRONYMS
(used in Attachments 1 through 8)

AFW	Auxiliary Feedwater
ALARA	As Low As Reasonably Achievable
ARV	Atmospheric Relief Valve
ASME	American Society of Mechanical Engineers
ATWS	Anticipated Transient Without Scram
CCDP	Conditional Core Damage Probability
CCF	Common Cause Failure
CCW	Component Cooling Water
CDF	Core Damage Frequency
CHS	Chilled Water System
CIV	Containment Isolation Valve
CPSES	Comanche Peak Steam Electric Station
CST	Condensate Storage Tank
CVCS	Chemical Volume and Control System
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedures
EP	Expert Panel
ESF	Engineered Safety Feature
FV	Fussell-Vesely
HEP	Human Error Probability
HRA	Human Reliability Analysis
HVAC	Heating Ventilation and Air Conditioning
IOER	Industry Operating Eperience Report
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination of External Events
ISLOCA	Interfacing System Loss of Coolant Accident
IST	Inservice Testing
LERF	Large Early Release Frequency
LOOP	Loss Of Offsite Power

LSSC	Less Safety Significant Component
MOV	Motor Operated Valve
MSIV	Main Steam Isolation Valve
MSLB	Main Steam Line Break
MSSC	More Safety Significant Component
MTBF	Mean Time Between Failure
ORAM	Outage Risk Assessment Management
PORV	Power-operated Relief Valve
PGA	Peak Ground Acceleration
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSF	Performance Shaping Factor
RAI	Request for Additional Information
RAW	Risk Achievement Worth
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RWST	Reactor Water Storage Tank
SCWS	Station Circulation Water System
SI	Safety Injection
SGTR	Steam Generator Tube Rupture
SOER	Significant Operating Event Report
SOV	Solenoid Operated Valve
SRV	Safety Relief Valve
SSE	Safe Shutdown Earthquake
SSEL	Safe Shutdown Equipment List
SSW	Station Service Water
SWS	Service Water System
VCT	Volume Control Tank
VSBLOCA	Very Small Break Loss of Coolant Accident

I. GENERAL QUESTIONS INCLUDING THOSE RELATED TO THE CPSES TRANSMITTAL LETTER

G-1 (page 1 transmittal letter)
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 the areas that you consider significant where you deviated from the guidance in the PSA Guide and your reasons for doing so.

Response:

There were no areas where there was a significant deviation from the guidance in the PSA Applications Guide. (One area of difference was that of importance criteria. The CPSES Risk-Based IST study used a FV $\geq$ 0.001 versus a FV $\geq$ 0.005 in ranking components.) As noted in section 3.7 of the engineering report (Enclosure 4 to TXX-96371) the CPSES IPE meets or exceeds the quality standards suggested by the PSA Applications Guide. This conclusion is supported by the analysis of the CPSES IPE against the criteria of Appendix B of the Guide as presented in some detail in section 3.7. In addition to the evaluation presented in that section, a further evaluation was conducted to assure that the CPSES IPE is applicable for use in evaluating the CPSES IST program. To do this evaluation, the specific questions identified in the PSA Applications Guide were answered based on a review of the CPSES IPE and the IST program considerations. These questions included:

- problem definition
- figures of merit
- decision criteria
- success criteria
- system reliability models
- dependent failure analysis
- quantification
- plant damage state classification
- external events PSA hazards analysis
- scope
- analysis
- initiating events
- event trees
- parameter databases
- human reliability analysis
- analysis of results
- containment analysis
- shutdown PSA considerations.

TU Electric has developed a matrix of answers to the questions in sections 2, 3 and 4 of the PSA Applications Guide and a discussion of the Appendix B evaluation questions. These are provided as Attachment 3 to TXX-96371. Part 1 of Attachment 3 provides in a tabular format the evaluation of the applicability of the CPSES IPE for use in the Risk-Based IST Program using the questions provided in the sections 2, 3 and 4 of the PSA Applications Guide. Part 2 of Attachment 3 describes

the results of the review and evaluation of the CPSES IPE against Appendix B of the PSA Applications Guide. As noted above, these evaluations show that the CPSES IPE meets or exceeds the quality standards suggested by the PSA Applications Guide and is appropriate for use in the CPSES Risk-Based IST Program.

G-2 (page 1 transmittal letter)

It is indicated that the proposed risk-based process utilized the CPSES IPE and IPEEE. Were there any significant changes that needed to be made to the IPE and IPEEE PRA models? If so, please identify each change made and indicate its perceived importance with regard to this application.

Response:

No changes to the IPE or the IPEEE (i.e., fire and tornado) models were necessary for this application. The expert panel identified some valves that could be added to the model, however, no changes were necessary to obtain adequate results.

G-3

Are there any plans to perform partial-stroke testing of any check valves classified as LSSCs during the deferred testing period? (see E5-9)

Response:

There are currently no plans to partial-stroke test check valves classified as LSSC. During pump tests and system operational line-up, check valves will be exercised; however, no specific test documentation will be generated for those check valves unless they fail to operate. In that case they will be addressed through the site wide corrective action program as discussed in Section 3.6 of the engineering report (Enclosure 4 to TXX-95260) and as described further in Attachment 5 to TXX-96371.

We will continue to consider other test methods, such as non-intrusive testing and disassembly / inspection. We anticipate ASME will develop enhanced test methods in future code cases associated with Risk-Based IST. At such time TU Electric will evaluate these Code Cases and if they are not adopted, develop written technical justification.

II. QUESTIONS ON ENCLOSURE 1 - EXEMPTION REQUEST

E1-1

The exemption request (pages 2 of 4 and 4 of 4) states that:

> The Risk-Based IST Program Description may be revised without prior NRC approval, provided the changes do not have an adverse impact on plant safety.
>
> This provision is similar to the change process for other Licensing Basis Documents such as the Security Plan. The regulations for the Security Plan allow changes without prior approval provided there is no unreviewed safety question or the effectiveness of the Plan is not reduced.

More specific criteria need to be developed for determining if a change (i.e., to the NRC-approved risk-informed in-service testing (RI-IST) program) will have an adverse impact on plant safety. In the case of the Security Plan, the NRC relies on the criteria contained in 10 CFR 50.59 to determine if the proposed change involves an unreviewed safety question. These criteria may not be appropriate for this application.

a. Please list and describe the types of revisions to the IST program that would be made without prior NRC approval if the exemption request is granted.

b. Also, in cases when NRC approval is not required, what criteria will be used to determine when the NRC will, however, be notified of the revisions?

Response:

This proposed alternative is for approval of the process described in Enclosure 2 of TXX-96371, not of a specific list of LSSCs. As such, as long as the requirements of the approved process are followed, no pre-approval of changes to the list of LSSCs would be required. The NRC will be informed of all changes to the list through the normal update of the IST program plan. Any changes made to the Risk Based IST Program process will be resubmitted to the NRC for approval prior to implementation. Enclosures 1 and 2 to TXX-95260 have been updated accordingly and are provided as Enclosures 1 and 2 to TXX-96371 respectively.

E1-2

The exemption request (page 2 of 4) states that:

> Compliance with this exemption request constitutes compliance with 10 CFR 50.55a and the existing CPSES Technical Specifications.

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:

TU Electric acknowledges that nothing in the ASME Code (including the requirements of 10CFR50.55a(f) and relief from those requirements) shall be construed to supersede Technical Specification requirement 4.0.5. Specific pump and valve testing frequencies delineated in the Technical Specifications will not be changed based on this submittal.

E1-3

The exemption request (page 3 of 4) states that:

> Even though the components [that are identified as being more safety significant] are outside the Code class boundary, they will be tested commensurate with their safety significance. The expert panel will determine the appropriate compensatory measures for the safety function.

The Risk-Based IST Program Description needs to describe how the expert panel will go about doing this. (see PRA- 7 & 8)

Response:

The exemption request (page 4 of Enclosure 1 to TXX-96371) and the Risk-Based IST Program Description (page 2 of Enclosure 2 to TXX-96371) have been revised to describe the testing for MSSCs outside the Code Class boundary.

See Table 3 of Enclosure 3 to TXX-96371 for the list of MSSCs not in the ASME Section XI IST Plan and test requirements.

E1-4

The exemption request (page 3 of 4) states that:

> Components in the current ASME Section XI IST Program which are determined to be MSSCs will continue to be tested in accordance with the current Program.

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:

With respect to the less safety significant components, a sensitivity study was done and presented to the expert panel. The results of the sensitivity study could have justified longer intervals for some components in the less safety significant group, however, a decision was made to use a single, uniform treatment for all the LSSCs for ease of administration and implementation. A reasonable interval supported by the study was chosen.

The test frequency for more safety significant components are being reviewed by the ASME O&M Committee in the form of Risk Based Component Code Cases. TU Electric will evaluate these code cases and either adopt or develop written technical justification for not adopting.

Current code testing frequencies have been developed using an approach that attempts to prevent components from being out-of-service when needed. As such, maintaining the current code frequency for the MSSCs will ensure that the assumptions made in the IPE remain accurate (i.e., failure rates).

TU Electric has completed a review of the IPE failure modes for the more safety significant components and has determined the current IST tests can identify these failure modes.

E1-5

The exemption request (page 3 of 4) states that:

> LSSC will also be tested in accordance with the ASME Section XI IST Program, except that the test frequency will initially be extended to once every 6 Years.

The 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 in-service test is performed. A 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 and operating experience, to evaluate the acceptability of the proposed test frequency. Furthermore, there should be a performance based feedback mechanism in place to ensure that any ineffective test strategies that get implemented are promptly detected and revised. Please discuss.

Response:

As noted in section 4.2.4 of the engineering report, the CPSES IPE used generic data. Plant specific performance history is being collected and will be incorporated into future PRA analyses where meaningful data exists. For the IST study, the expert panel had available to it information pertaining to plant components and this was considered by the panel in the course of its evaluations. Thus, performance history was considered in the determination of a components safety significant classification.

Further, TU Electric is proposing a staggered implementation of the LSSC testing (See Attachment 8 to TXX-96371). Performance history and data, including the adequacy of compensatory measures, will be fed back through the site processes to the IST coordinator and the expert panel. (The site processes are discussed in section 3.6 of the engineering report (Enclosure 4 to TXX-95260) and discussed further in the response to question E2-4) In this way, any unacceptable performance will be detected early and can be factored into the program. If an ineffective test interval is detected, it will be evaluated through the corrective action programs and resolved through appropriate changes to the IST program. See Attachment 5 to TXX-96371, "Corrective Action for LSSCs in the Risk Based IST Program," and Attachment 8 to TXX-96371, "Phase-In Philosophy Staggering Technique," for additional information.

In addition, the risk analysis performed for the initial Risk-Based IST Program will be updated every other refueling outage. As part of the update plant-specific performance histories will be analyzed

by the PRA analysts and incorporated into the PRA models, then importances will be recalculated. The expert panel will then review the performance histories and PRA inputs and determine if any LSSCs should be re-categorized as MSSCs because of plant-specific performance and vice versa.

For a discussion of the expert panel deliberation process and the corrective action program, see Attachments 4 and 5 to TXX-96371, respectively.

E1-6

The exemption request (page 4 of 4) st tes that:

> The risk-based process will assure that a defense-in-depth philosophy is maintained.

The licensee should specifically describe how the process will assure that defense-in-depth will be maintained. (see E4-21, PRA-5 & 6)

Response:

In the PRA, systems analysis is used to identify the various levels of defense-in-depth, e.g., redundant trains of equipment and diverse means of achieving safety functions, that can be employed in mitigating the effects of initiating events. The event trees and fault trees model these defense-in-depth characteristics of the plant. The barriers to fission product release are conservatively modeled in the PRA, e.g., core damage is assumed to result at core uncovery, RCS failure is conservatively modeled as initiating events, and containment integrity (containment cooling and containment isolation) is modeled. The importances of various components in maintaining these barriers were determined and are included in the determination of the safety significance of components for the IST program. Thus, the risk based IST program does not alter the defense-in-depth philosophy of prevention, mitigation and control. That is, testing and maintenance strategies that assure the reliability of components are still maintained with the proposed program. No testing of components will be eliminated. The program also has a corrective action feedback process to ensure an acceptable level of performance is maintained which assures that defense-in-depth is always maintained.

A more detailed discussion of the defense-in-depth philosophy vis a vis the Risk-Based IST Program is presented in Attachment 2 to TXX-96371, Issue 4.

E1-7

The exemption request (page 4 of 4) states that:

> There are safety enhancements obtained by focusing resources on MSSCs and reducing the testing frequency on LSSCs.

Please describe how the licensee's proposed risk-based IST process focuses resources on the MSSCs. (see E1-4 and E3-1 & 3)

Response:

If one makes the assumption that there is a limited amount of resources available for programs such as IST, then any reduction in these programs based on risk considerations assures that the resources that are available are spent on the MSSCs and not diluted by work activities that have a lower impact on risk. In this sense, the IST resources are focused on the MSSCs. For example:

- Additional MSSC valves outside Code Class boundary will be tested (See Table 3 of Enclosure 3 to TXX-96371).

- SROs /ROs will spend fewer man-hours performing system line-ups for testing and realignments after testing of LSSCs and, therefore, allowing more time for focusing on other control room functions.

- AOs will spend fewer man-hours performing system line-ups for testing of LSSCs and realignments after testing and recording test data.

- Engineering will spend fewer man-hours reviewing test procedures and test data for LSSCs.

- The plant will be in an abnormal operational line-up less frequently.

- System line-up/realignment errors will be reduced with fewer tests.

See also the response to Quesuon E1-4.

E1-8

Enclosure 1, page 4 of 4: "As a living process, components will be reassessed periodically to reflect changes in plant configuration..." Please define "periodically." (see E2-5)

Response:

The CPSES PRA will be updated at a frequency of once every two refueling outages, approximately every three years, and will be completed within 9 months of the second refueling outage. (See also the responses to Questions E1-6 and E2-5.)

For example, if the proposed alternative (Risk-Based Inservice Testing Program Description) is approved and implemented at the end of the fifth refueling outage for Unit 1, the following actions would be required to be completed no later than 9 months after the completion of the seventh refueling outage for Unit 1.

1. The PRA would be updated and the component risk ranking results provided to the Expert Panel.

2. The expert panel will reassess all the components to reflect changes in plant configuration, updated risk ranking, component performance test results, industry experience, and other inputs to the process.

3. The Inservice Testing Plan will be revised to reflect any changes resulting from the IPE update and expert panel reevaluation.

Within 9 month months after the completion of the seventh refueling outage for Unit 1, a copy of the revised IST Manual would be provided to the NRC for the purpose of a Manual update only (approval not requested or required).

III. QUESTIONS ON ENCLOSURE 2 - RISK-BASED IST PROGRAM DESCRIPTION

E2-1

The Risk-Based IST Program Description (page 1 of 2) states that:

> The proposed exemption is a risk-based process to determine the safety significance and testing frequencies [emphasis added] of components in the ASME Section XI IST Program ...

This seems somewhat misleading in that the risk-based process does not appear to adequately determine the appropriate test frequency for the LSSCs. It evaluates the risk significance of extended test intervals based on certain assumptions but it does not appear to determine the optimal test interval based on performance data, component unavailability, and risk insights. (see E1-5)

Response:

The scope of this project is to perform a review of the Comanche Peak Steam Electric Station IST program using a methodology for a risk-based approach to IST program review and enhancement that is founded on a blend of probabilistic and deterministic methods and that has as its principal results, recommendations for adjustments to test intervals for these components. The intent of the program is to blend the safety benefits and resources by determining a reasonable test interval commensurate with safety. Thus, it is not aimed at reducing the number of components within the scope of an IST program, rather at determining a reasonable test interval with these considerations.

The objectives of this project are to apply risk-based technologies to IST components to determine their risk significance; to apply risk-based technologies to risk-significant components identified in the IPE and outside of ASME Code Classes 1, 2 and 3 to determine whether additional compensatory measures are appropriate; and to apply a combination of deterministic and risk-based methods to determine the appropriate test interval (based on risk and performance) and/or compensatory measures for IST components. In doing this, performance data, component availability and risk insights are all considered.

See Enclosure 2 to TXX-96371 for a more detailed description of the Risk-Based IST Program.

E2-2

The Risk-Based IST process proposed by the licensee (page 2 of 2) will review the test strategy of MSSCs not in the ASME Section XI Program to ensure that testing is performed commensurate with their safety significance. How will the licensee determine the test strategy for these components? Would it be beneficial to do a similar evaluation for MSSC in the ASME Section XI program? (see E4-16).

Response:

MSSCs not in the ASME Section XI program will be tested where practical in accordance with the OM code. See also the response to Question E1-3. The test frequency for MSSCs in the ASME Section XI Program is discussed in the response to Question E1-4.

During the expert panel process, the IPE failure modes were compared to the IST/design basis failure modes to ensure that all necessary tests/compensatory measures are performed.

The ASME O&M Committee is developing component Code Cases to addresses test strategies for Risk-Based IST. As the Code Cases are issued TU Electric will evaluate them and adopt or develop written technical justification for not adopting.

E2-3

The Risk-Based IST Program Description (page 1 of 2) states that:

> Extended test frequencies will be phased in over the initial 6 year period in order to take advantage of the benefits that can be obtained through sampling techniques. Groups of components will be established using sampling based on guidance provided in NUREG 1482. Components in each group will be tested during each fuel cycle so that each component is tested at least once every 6 years.

The NRC will need to review the actual component groupings, the detailed grouping criteria, and sample expansion criteria in order to evaluate the adequacy of this phased-in approach. Also, please describe the implementation schedule to achieve deferred testing on a staggered basis.

Response:

Grouping will be based on NRC criteria provided in NUREG-1482 (see Attachment 8 to TXX-96371 for additional information). The required sampling techniques described in NUREG-1482/Generic Letter 89-04, Position 2 are design, service condition, and valve orientation. Groups will be populated and tested such that the entire group will have been tested within 6 years. The sequence of testing will be repeated to ensure the maximum amount of time between testing of a component does not exceed the 6 year test interval (with 25 % margin). Expansion criteria will be as described in NUREG-1482 which states, "...[I]f a potentially generic problem is identified during [a test], all valves in the group in that unit must be inspected [tested] during the refueling outage". When these groups are identified, the documentation will be made available at the site for review. As an example, a group will have 6 components, 2 will be tested each refueling outage, thereby having all 6 tested within 6 years. More specifics on implementation schedule will be provided to the NRC staff after the Risk-Based IST Program is approved.

The six year test interval was selected by the expert panel primarily because the interval seemed to be the most practical to implement based on the following information:

- six years is four 18 month refueling cycles
- staggering the testing so that approximately one fourth of the LSSCs are tested every refueling cycle seems to match well with the four loop design and the primarily two train safety system design

- the 25% allowable margin within which to perform the test is much more practical because the margin is 18 months

Panel members recognized that safety margin reduced with increasing interval and that uncertainty in that margin increased with increasing interval. The panel was presented a sensitivity study which showed that, if unavailability increases linearly with interval and if no benefit for testing improvements is considered, the six year interval increased risk within acceptable limits established by the EPRI/NEI PSA Applications Guide.

E2-4

The Risk-Based IST Program Description (page 2 of 2) states that:

> When an LSSC on the extended test frequency fails to meet established test criteria, corrective actions will be taken in accordance with the CPSES corrective action program. This corrective action will include an evaluation of the need to test the remaining components in the group.

Describe the CPSES corrective action program. What criteria would be used to initiate testing of the remaining LSSC components in that group? The corrective action should explicitly include consideration of the need for revising the test frequency.

Response:

The corrective action program is described in summary in section 3.6 of the engineering report (Enclosure 4 to TXX-95260) and further discussed in Attachment 5 to TXX-96371, "Corrective Action for LSSCs in the Risk-Based IST Program".

E2-5

Describe the periodic reassessment (page 2 of 2) that would be performed on the PRA. What events or findings would be required to initiate an update to the PRA? The periodic reassessment section of the Risk-Based IST Program Description should be revised to clarify that both the component importance ranking and the test frequency will be periodically reassessed. (see E1-8)

Response:

The CPSES PRA will be updated at a frequency of once every two refueling outages, approximately every three years, and will be completed within 9 months of the second refueling outage. There are no specific events or findings identified in procedures that would require the PRA to be updated. However, an emergent update may be initiated at any time, if needed, to incorporate a major plant modification or to correct an identified deficiency or for any other reason that may impact the Risk-Based IST Program.

The periodic (normal) IPE updates will reflect additional plant-specific information, such as configuration changes, component performance history and industry data and operating experience, as appropriate. Plant specific data will be incorporated into the generic data using appropriate updating techniques (e.g. Baysian updating). The database will be updated on the same cycle as the normal IPE updates as part of the living PRA process.

When the PRA update is completed, the components (i.e., the pumps and valves) will be reassessed for the Risk-Based IST Program. That is, the component importance rankings will be determined based on the model, and the test interval will be reassessed in light of the new information. (See also the response to Question E1-8.)

E2-6

If it is to be used, describe how the ASME Code Case OMN-1, "Alternative Rules for Pre-service and IST of Certain Electric Motor Operated Valves in LWR Power Plants," 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). TU Electric believes the enhanced testing of OMN-1 would be beneficial. TU Electric is currently in the process of evaluating OMN-1 to assure the safety benefits of the Code Case can be incorporated into the Risk Based Inservice Testing Program.

Possible Implementation Strategy for Code Case OMN-1 Implementation		
	Test	Interval
MSSCs	Exercise	Every Fuel Cycle at Refueling outage
	Enhanced OMN-1 test	Every Other Cycle at Refueling outage
LSSCs (IST) (High Margin)	Exercise	Refueling Outage
	Enhanced OMN-1 test	10 YR
LSSCs (IST) (Low Margin)	Exercise	Refueling Outage
	Group in accordance with NUREG 1482 and Enhanced OMN-1 test	6 YR

IV. QUESTIONS ON ENCLOSURE 3 - RISK RANKING DETERMINATION STUDY SUMMARY REPORT

E3-1

The Background section (i.e., Section 1.0) states that "changes that negligibly reduce plant safety should not be ruled out, especially if such changes can lead to significant plant performance improvements in other areas." The licensee should be more specific about what these other "significant plant performance improvements" are. How are the resource savings being "focused" on the MSSCs? (see E1-7 and E3-3)

Response:

A specific example was cited earlier in the section, namely graded QA. Other specific examples of initiatives that if implemented could negligibly reduce plant safety include the proposed Risk-Based In-Service Testing Program and Risk-Based In-Service Inspection and MOV Testing Programs. It is these initiatives that TU Electric had in mind in making this comment.

The focus of resources is addressed in the response to Question E1-7 above.

E3-2

The Project Scope and Objectives section (i.e., Section 2.0) states that "The ASME O&M Committee is reviewing the more safety significant components to ensure that the appropriate tests are identified and performed on those components for their respective failure modes." 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:

The ASME O&M Committee is currently developing Code Cases for the use in Risk-Based IST. These code cases will be component type specific. There will be a generic code case on how to perform risk ranking and component specific Code Cases on how to test MSSCs and LSSCs. TU Electric has membership on the Task Group that is developing these code cases. TU Electric will evaluate these Code Cases for adoption. For Code Cases not adopted, TU Electric will develop written technical justification. The O&M Committee has set the last quarter of 1996 and the first quarter of 1997 as the schedule dates for issuing the code cases.

E3-3

In the Project Scope and Objectives section (i.e., Section 2.0) under Direct Safety Enhancements, it states that:

> Greater attention and resources devoted to the high priority IST components could translate into many direct safety enhancements. First, this group of components could be subjected to, where practical and meaningful, more frequent periodic tests than the lower priority groups. The timeliness of any problem identification and resolution would be improved. Second, requirements associated with the high priority group of IST components are expected to be more rigorous and demanding in nature than for other groups. These requirements provide added assurance that any problems that may impact the functionality of the components will be identified and resolved.

It is unclear how the "improvement" and "added assurance" will be realized. (see E1-4 & 7, E2-2 and E3-1)

Response:

See the responses to Questions E1-4 and E1-7.

E3-4

The Project Approach section (i.e., Section 3.0) states that "the strength of this risk based IST program and the integrity of its results lie in the robustness of the methodology and in the work of the Steering Committee and expert panel." Therefore, the specific activities of the Steering Committee and expert panel need to be documented along with the basis (i.e., including decision criteria) used in arriving at their conclusions. (see PRA-7)

Response:

The Steering Committee was involved in the development of the overall methodology, e.g., determination of the threshold for decision criteria. This work is essentially represented in the engineering report. The methodology was validated as a result of the study. The Expert Panel Guidance Document is provided as Attachment 6 to TXX-96371.

The strength referred to was offered by the industry expertise represented on the Steering Committee, the expertise from the CPSES staff on the expert panel and by the continuity provided by common membership on the Steering Committee and the expert panel.

A summary of the methodology (i.e., a checklist of items considered by the expert panel in its deliberations) and criteria used by the expert panel are provided in Attachment 4 to TXX-96371. The results of the expert panel activities are described in the engineering report and in the expert panel meeting minutes, Tables 4.4-1 and 4.4-2 (Enclosure 4 to TXX-95260).

E3-5

In the Methodology section (i.e., Section 3.1), the licensee states:

> If RAW was significant, the component was considered by the expert panel for placement in the high category. If the panel decided the component could be ranked low, an additional requirement was imposed before a component could be classified as "less risk significant." A compensatory measure was required to be selected by the expert panel to limit degradations in reliability.

There are 32 IST components that had RAW > 2 that were categorized as less safety significant (e.g., 1-HV-2333A, 1-HV-2334A, 1-HV-2335A, 1-HV-2336A, 1CC-0060, 1CC-0061, 1CC-0621, 1CC-0062, 1CC-0657, 1CC-0694, 1CC-0713, 1-HV-4699, 1-HV-4700, 1CC-1075, 1CC-1077, 1CC-1078). How did component reliability and redundancy play into the expert panel's ranking decisions and what criteria did they use? Please describe the compensatory measures for each component and justify how each measure provides equivalent functional benefit compared with ranking the component in the high category.

Response:

When the 32 components listed above were considered by the panel, redundancy and reliability were considered as follows:

The panel was aware that a high RAW low FV component was indicated by the IPE to be highly reliable, but not necessarily highly redundant. That is, if the component failed, the remaining redundancy in the plant was limited and the condition was significant enough to noticeably increase risk.

(It is important to note that the panel did evaluate recovery actions that had not been modeled in the IPE for a number of these components. The CPSES evaluation found that a number of low FV- high RAW components have unmodeled recovery actions since their risk significance is low enough that the recovery evaluation was not needed for the IPE. When recovery actions were considered and evaluated redundancy increased, these components became low FV-low RAW components. Examples include 14 of the 32 components with RAWs greater than 2: HV-2333A through HV-2336A, PV-2453A and -2454B, HV-2459 through 62, and PV-2325 through 2328.)

The panel also was aware that truncated and low FV- low RAW components typically had redundant

flowpaths within the system. These redundancies were illustrated for the panel by the ranking results displayed on the simplified P&IDs.

Similarly, the IPE functions were compared to the IST/design basis functions and the FV/RAW were used to understand the importance of the components to the functions. Therefore, the PRA results provided an implicit measure of redundancy whose basis was understood by the panel. Consequently, the IPE ranking was in actuality the criteria for redundancy.

The reliability of the component was then considered based on CPSES operating experience. When the panel's knowledge of component performance indicated the component might be noticeably less reliable than its "peers", the component was ranked high. The criteria used by the panel was that if one member of the panel was aware of such poor performance, the component was ranked high. In general, the members of the panel providing input for this evaluation included engineers from systems and maintenance engineering and the IST coordinator.

The compensatory measure is not intended to provide equivalent functional benefit, rather it is intended to provide additional assurance (over the extended test interval) that any significant degradation in reliability will be quickly detected. The benefit of the component in providing the IPE function is reflected by the chosen compensatory action. For example, where the IST test for a check valve may require the performance of acoustic monitoring, the compensatory measures typically take credit for other functional tests (e.g., a pump flow test) that would not be satisfactory unless the check valve performed its IPE function.

The compensatory measures for each component are shown in the engineering report (Enclosure 4 to TXX-95260), Table 4.4-1 and -2.

E3-6

In the discussion of sensitivity studies (i.e., Section 3.3) conducted to test the completeness of the models, assumptions, and input data, it states:

> Less risk significant components were assumed to be influenced two at a time. Four such components were identified which, together with other components, offered the potential of becoming more risk significant. Appropriate compensatory actions designed to limit reliability degradations were imposed on these components.

What were these components and what were the compensatory actions imposed on them? What were the results of the sensitivity study conducted to evaluate whether changes to in-service testing offered the potential for common-cause-like degradations in components of different systems?

Response:

The components are valves 1CC-0031 and 1-8481B (and the sister valves 1CC-0061 and 1-8481A) and valves 1-8922A and 1-8922B. The compensatory measures are discussed in Table 4.4-1 and 2. A discussion of the methodology and the results of the sensitivity study are shown on pages 4-45 and following of the engineering report (Enclosure 4 to TXX-95260).

E3-7

In discussing the cumulative effects of test interval changes (i.e.,Section 3.4), the licensee states that "calculations indicate that the test intervals could be increased from quarterly to six years or more with acceptable increases in risk." What is the licensee's basis for determining an acceptable level of risk? In addition, a linear extrapolation of the component unavailability may not be justified because it does not take into consideration potentially age-dependent failure rates. (see PRA-24)

Response:

The basis for the statement that the calculations indicate that the test interval could be increased from quarterly to six years or more with acceptable increases in risk is based on the following. With conservative assumptions and no credit for improvement of risk from the Risk-Based IST Program, the calculated risk increase meets the criteria in the PSA Applications Guide for determining acceptable levels of risk for permanent changes to the plant. The criteria in the PSA Applications Guide were used as a check on the calculation. That is, because it was difficult to estimate improvements to safety that would result from the Risk-Based IST program, the PSA Applications Guide method was used in a sensitivity study to check the results assuming that no improvement resulted. More importantly, however, the risk results provide every indication that the change as proposed is safety neutral (see the response to PRA 24). The issue of age dependent failure rates is addressed in Attachment 2 to TXX-96371.

E3-8

The staff would like a copy of the CPSES procedures (see Section 3.6) or program documents that "provide assurance that failures of IST components will be promptly identified and addressed and modifications to the in-service testing program (e.g., changes to the surveillance intervals) are made in a timely manner."

Response:

The site procedure cited in section 3.6 of Enclosure 4 to TXX-95260 is available at CPSES for review. However, at this time, site procedures have not been fully developed to incorporate certain aspects of the Risk-Based IST Program. These procedures will be developed in conjunction with approval of the methodology described in the CPSES Risk-Based IST submittal. See Attachment 5 to TXX-96371 for a further discussion of the CPSES corrective action program and how the Risk-Based IST Program will be integrated.

E3-9

The staff would like to review the detailed system notebooks, the human reliability analysis, and the results of parts of the independent IPE review activities during a site visit. (see PRA-1)

Response:

The notebooks and other documents are available for review at CPSES.

E3-10

In the Summary of Expert Panel Process (i.e., Section 4.1), it states that "[i]n more than one case, a component's ranking was increased to high because in-service testing helped prevent entry into a limiting condition for operation (LCO)." What are the specific components involved? How did the expert panel identify them?

Response:

The components (valves 1(2)-8956A thru D) are the safety injection accumulator upstream check valves. Back leakage through these valves could cause entry into a LCO. The expert panel decided that these valves should be increased to MSSC (see page 198 of 295 of Enclosure 4 to TXX-95260) as a conservative measure. See Attachments 4 and 6 to TXX-96371 for a further discussion of the expert panel deliberation process.

E3-11

Based on the Summary of Expert Panel Process (i.e., Section 4.1), it is not clear that the expert panel was sufficiently aware of the assumptions and limitations associated with the IPE (e.g., completeness issues) to adequately compensate for them. It also was not clear how the expert panel dealt with specific concerns that the IPE did not model (e.g., fires, tornadoes, shutdown risk, seismic concerns, etc.). What guidance and decision criteria were used by the panel for each of these issues? (see E3-16 and PRA Section D)

Response:

The expert panel was given training in the various aspects of the IPE, typically during various presentations. Several members of the panel including the chairman, the operations and the PRA representatives participated in the same roles in the Maintenance Rule expert panel. The training included the general approach to modeling and the specific goals of the IPE/PRA. The accident sequences, systems analyses, initiating events, human reliability, data analysis, common cause failures (CCF), and dominant sequences and containment performance were discussed in appropriate detail. The limitations of the IPE/PRA were also discussed.

The IPE/PRA limitations important to the matters being deliberated by the expert panel were discussed during the presentations. Typically one or two members of the panel or other presenters involved in specific aspects of the study were available to provide insight and detailed discussion of the technical, operational or modeling issues. Drawings, tables, and technical evaluations were often used by the presenters as aids to discussion. The panel considered a range of limitations in the IPE, examples of which are described below:

- Because the IPE assumed the reverse flow failure mode could not occur, the panel evaluated the importance of reverse flow in each check valve and in one case elevated an unmodeled mini-flow valve to high because it might degrade the performance of more than one pump.

- To address the sensitivity of the results to common cause failures, the panel evaluated the risk ranking measures two ways, one assuming all CCF importance assigned to the associated basic event and one assuming none.

- To evaluate the sensitivity due to human action modeling, the panel noted that sensitivity studies had shown the ranking to be unchanged. In addition, the panel occasionally identified operator actions omitted by the IPE. These actions were omitted recovery actions

not credited because they were not important to the CD^F^

- To ensure that assumed alignments of systems in the IPE did not affect the ranking, the panel checked similar components in the system assigned the higher ranking.

- To compensate for use of generic data, the panel considered plant specific performance for each low ranked component. For those that were potentially high, the panel ensured that other compensatory measures were available to maintain the reliability of the component.

- To ensure that safety margins were maintained, the panel retained in-service tests of some check valves that had experienced failures that caused plant entry into LCO conditions.

In summary, to blend deterministic and probabilistic information, the panel deliberated on the limitations of IPE when it applied and made use of both plant-specific and generic information and industry operating experience.

With regard to external events, back-end importance, shutdown risk and completeness issues, each issue was discussed in detail. A summary of the methodology and criteria used by the expert panel are provided as Attachments 4 and 6 to TXX-96371.

E3-12

What criteria were used to evaluate components that were not modeled in the CPSES IPE (i.e., other than components whose failure might affect redundant trains and were subsequently ranked high)?

Response:

The components IST/design basis functions and PRA failure modes were reviewed to determine whether the component was explicitly modeled by an assumption, an evaluation or a related event such as an operator action or a sister component. Sister components were often involved when the IPE model had asymmetries, i.e., where one train or system flow path was assumed to be the one normally operating. The method used in this case was to assign the component function and failure mode the importance of the sister component and rank according to the same criteria as for the modeled components.

An example of a related event would be the case of the demineralized water pumps whose IST/design basis functions is to provide makeup water to the Reactor Water Storage Tank (RWST). The IPE contains a risk significant operator action to refill the RWST in the event that ECCS recirculation capability is unavailable. Since there are redundant demineralized water pumps as well as other pumps which can perform this makeup function, it was confirmed by the expert panel that both the FV and the RAW would be low for each individual and common cause failure mode. Hence, the corresponding IST pump and valve functions were ranked low according to essentially the same criteria as used to address modeled components.

This example is representative of a significant number of cases involving IST components performing makeup and isolation capability for tanks such as the Condensate Storage Tank (CST) and the Component Cooling Water (CCW) surge tank. However, for these cases there is no related event. Instead the IPE assumed that makeup or isolation failure was unlikely. The IST/design basis function was considered in terms of their consequence and type and number of failures which must occur. For example, if tank isolation failed, the system might fail and, for isolation to fail, a valve had to spuriously open and two normally closed, fail closed valves downstream had to fail open. The criteria used by the expert panel to rank the component low was that "system failure" would be unlikely compared to a typical system failure mode such as two pumps failing to operate.

Another typical example is the case where a component with in IST/design basis function such as flowpath boundary was not explicitly modeled by the IPE. In this case, the original IPE evaluation was based on thermal hydraulic flow calculations which indicated that the system would successfully

operate even if the component did not perform its function. The expert panel criteria was to rank these components low based on these evaluations, but often the conclusion was checked based on system operations knowledge.

The process used to perform this evaluation involved a preliminary familiarization by the PRA team with support from an SRO qualified operations expert followed by a formal evaluation by the expert panel. All component functions had to be ranked low for the component to be ranked low. This process was applied to both modeled and unmodeled components.

E3-13

Figure 3-1 of Enclosure 3 provides a decision criterion for risk importance measures. This criterion is not consistent with that discussed in the summary and conclusions in Section 4 or with the Summary of risk ranking results provided in Table 4-1. Specifically, a "medium" category is introduced in the conclusions, and in Table 4-1 "high" F-V refers to FV>0.01 not FV>0.001 as shown in Figure 3-1. Although, in final IST ranking, all "medium" F-V components were ultimately ranked high, the introduction of a medium category is somewhat confusing. Please clarify.

Response:

A discussion of the considerations for selecting the importance categories is provided in section 4.1 of the engineering report (Enclosure 4 to TXX-95260). The initial intent was to have a more discrete partitioning of the categories, particularly in the medium to high categories, to gain some additional insight /benefit from grading the components.

When the importance results were obtained, it was found that only a small fraction of components fell into the high and medium categories. The small number of components meant that the cost of a test effectiveness study for medium components that had been anticipated in the original project outweighed the economic benefits that could be gained, and therefore that study was not performed. The medium category was retained for future use or use in other ranking projects; however, for this project, the medium category components were grouped with the high category components.

Questions E3-14 through E3-16 relate to Table 4-1 of Enclosure 3

E3-14

There should be a detailed explanation as to why components changed from one category to another as a result of the expert panel process (e.g., a detailed evaluation sheet for each component). For example,

- DG fuel oil transfer pumps with high F-V and RAW were ranked LSSC.
- SI accumulator upstream injection check valves were not modeled but were ranked MSSC.
- Containment spray pumps were not modeled but were ranked MSSC.
- Boric acid transfer pumps were not modeled but were ranked MSSC.
- Bonnet relief valves for CIVs 1-8811A/B were not modeled but were ranked MSSC.
- SW vent paths for water hammer protection were not modeled but were ranked MSSC.
- CR A/C accumulator instrument air supply upstream and downstream check valves were not modeled but were ranked MSSC.
- SIP/CCP suction header cross-tie isolation valve was modeled but was ranked MSSC.

Response:

TU Electric used a deliberative process rather than a step-by-step checklist. Attachments 4 and 6 to TXX-96371 provide a description of the expert panel deliberative process. The results of this process are documented in the expert panel meeting minutes, Tables 4.4-1 and 2, of Enclosure 4 to TXX-95260. A discussion as to why components changed from one category to another as a result of the expert panel process for each of the components listed above is provided below.

Discussion of DG Fuel Oil Transfer Pumps with high F-V and RAW Ranked LSSC

As part of the risk ranking of components following expert panel review of common cause failure contributions to ranking, a check of the importance of the fuel oil transfer pumps with respect to common cause failure (CCF) was done. This was done because the contribution of these pumps to the common cause failure of electrical busses 1EA1/1EA2 was the only factor that designated the pumps as high risk importance.

In performing this evaluation, a review of the common cause failure basic event of 1EA1/1EA2 (EPCCFT), was done to determine the contribution from various common cause failures. The EPCCFT consists of four major common cause events/contributors. They are:

- Diesel Generator CCF
- Diesel Generator Circuit Breaker CCF
- Diesel Generator Ventilation CCF
- Diesel Fuel Oil Transfer Pump CCF

It was determined that the first three items account for almost 95% of the EPCCFT failure probability. Only ~5% is due to the fuel oil transfer pumps. The diesel fuel oil transfer pumps themselves rank low or none when CCF is not considered. The high ranking was artificial in that all of the EPCCFT was assigned to each of the CCF components within it when the importance measures were individually calculated. In other words, the diesel generators and the diesel fuel oil transfer pumps were assigned the same CCF contribution, even though only 5% can be attributable to the transfer pumps. Thus, the FV for the CCF of the diesel fuel oil transfer pumps was determined to be artificially high. When this artificiality was removed, the importance of the pumps was low.

Another consideration was that in the modeling of the CCF for the diesel fuel oil pumps, even though there are four pumps and all four must fail to cause the loss of both diesels, the existing model assumes that any three failures will have that result. This conservative assumptions was based on the fact that for the majority of the IPE modeled systems, CCF of three or more components would fail both trains. If the model were expanded to include triples plus random failures and the CCF of four or more components, it appears that the FV for the diesel fuel oil transfer pumps would further reduce the importance of the pumps.

It was also determined that the RAW for these components would likely remain above the high/low cutoff. Thus, the diesel fuel oil transfer pumps were categorized as a low FV, high RAW component.

For these items the expert panel considered compensatory activities in deciding whether the test interval for IST could be increased.

The diesel fuel oil transfer pumps are periodically (monthly) tested for operability per Technical Specifications (Tech Spec). These operability tests serve as compensatory tests for the IST quarterly tests. Common cause failures (fails to start/fails to run) are the dominant failure modes for these pumps. The Technical Specification surveillances test these failure modes and ensure that there is no significant degradation of the components.

Therefore, based on the insights gained from the two part evaluation of diesel fuel oil transfer pump CCF, the expert panel concluded that these pumps should be designated low FV/high RAW with the monthly Tech Spec surveillance test being credited as compensatory measure and the IST test intervals extended.

Discussion of SI Accumulator Upstream Injection Check Valves not Modeled but Ranked MSSC

The SI accumulator upstream injection check valves were modeled but were truncated in the quantification of the model. The expert panel determined that these valves should be ranked MSSC because of operational concerns with the valves. Back-leakage through these valves causes entry into an LCO. The expert panel observed that entry into an LCO was a major operational concern (the valves are located inside containment) for both the upstream and downstream check valves. The downstream check valves were ranked high for other reasons (they are part of shared flow paths), however, regardless of the ranking the expert panel believed that both sets of valves should be ranked high. For this reason, the expert panel decided that the current IST interval should be retained for these valves

Discussion of Containment Spray Pumps not Modeled but Ranked MSSC

The containment spray pumps were modeled for large, early release considerations. The containment spray system was determined to be low safety significance for both large early release frequency (LERF) and CDF considerations. However, based on past performance history, namely vibration problems, the expert panel determined that these pumps should be categorized as MSSC. The expert panel noted that the IST for the pumps specifically tests pump vibration.

Discussion of Boric Acid Transfer Pumps not Modeled but Ranked MSSC

The Boric Acid Transfer Pumps were modeled as part of the chemical and volume control system

for emergency boration but were truncated in the quantification of the model. Thus, for the IPE importance, they were ranked LSSC. However, the expert panel noted that the performance history for these pumps shows that they degrade due to steady and gradual wear of the carbon bearings. Pump degradation does not result in pump failure but the pumps enter the alert stage per IST. When the pumps enter the alert stage due to pump degradation, the pumps will still perform their safety function for emergency boration. However, the expert panel determined that the pumps should be categorized as MSSC and the IST interval retained to identify the pump degradation.

Discussion of Bonnet Relief Valves for CIVs 1-8811A/B not Modeled but Ranked MSSC

The bonnet relief valves were not modeled in the IPE but were ranked high by the expert panel due to operational/performance problems.

SW Vent Paths for Water Hammer Protection not Modeled but Ranked MSSC

These vacuum breakers were not modeled in the IPE because the station service water system is normally running. However, the valves were categorized as MSSC by the expert panel based on the importance of the Station Service Water System and the observation that if they failed to function, water hammer that could damage the system may occur.

CR A/C Accumulator Instrument Air Supply Upstream and Downstream Check Valves not Modeled but Ranked MSSC

The control room A/C accumulator instrument air supply upstream and downstream check valves were not modeled in the IPE because they are not important to control room habitability following an initiating event. However, these valves are important to normal operation of the control room HVAC system. They provide air via the accumulator to a damper that provides outside air to the control room. This damper is a normally open, fail closed component that is required to be closed for control recirculation mode which is modeled in the IPE. The expert panel ranked these components as high based on the impact of their failure on control room habitability and electronic equipment during normal operation.

SIP/CCP Suction Header Cross-tie Isolation Valve modeled but Ranked MSSC

The SIP/CCP suction header cross-tie isolation valve (valve 1-8924) was modeled and the expert panel confirmed that it should be ranked LSSC. Table 5-1 of the Engineering Report contains a

typographical error; it should show the valve as LSSC. Table 4.4-1 of the Engineering Report shows the results of the expert panel deliberation where the valve ranking is confirmed as LSSC.

E3-15

In Tables 4-1 and 5-1, what is the difference between N/A and None in the columns (e.g., initial ranking column)? What does it mean when a component, such as the SI pump suction valves, have a F-V and RAW calculated but the initial ranking is listed as "None?" Why does it say "low" for certain ranking changes due to expert panel review (i.e., as opposed to increased, decreased, or no change)?

Response:

The following is generally the rule (though perhaps not consistently used) for the 'None' and 'N/A' designations. 'None' generally means the component was considered/modeled in the IPE but has no FV or RAW (e.g., the values were below the decimal cutoff). N/A generally means that the component was not modeled.

In cases where a FV and RAW was calculated but the initial ranking is listed as 'None', the value of the importance measure was less than the decimal cutoff (for FV this is less than 1E-04).

A 'Low' entry implies that the expert panel conclusion is the only basis for the ranking (it was not part of the IPE), whereas 'increased', 'decreased', or 'no change' implies that there was some other basis such as a ranking of the component based on the IPE or other consideration that was reviewed by the expert panel.

Enclosures 3 and 4 to TXX-95260 will be revised to assure consistent use of the terms 'None', 'N/A', 'Low', 'increased', 'decreased', and 'no change'.

E3-16

How did the expert panel deal with IPEEE Fire & Tornado F-V Ranking, Outage Risk Ranking, LERF Ranking, Seismic Risk Ranking, CDF Ranking Changes w/o CCF? What decision criteria were used? Was there an orderly procedure to address each of these issues? How did the expert panel deal with other limitations of the PRA (e.g., truncation limits, generic vs. plant specific failure rates and unavailability information)? (see E3-11 and PRA Section D)

Response:

Each area was reviewed by the expert panel as discussed in the response to question E3-11 above. The specifics of each review area are as described in sections 4.1 thru 4.4 of the engineering report (Enclosure 4 to TXX-95260). See also Attachments 4 and 6 to TXX-96371 for a discussion of the expert panel deliberation process.

V. QUESTIONS ON ENCLOSURE 4 - RISK RANKING DETERMINATION STUDY

E4-1

The costs identified in the Risk Ranking Determination Study (pp 1-2/3) and in the Summary Report (pp. 1-2/3) inappropriately assume that design basis testing (i.e., as described in the letter from James E. Richardson, NRC, to Forrest T. Rhodes, ASME, dated 9/9/91) is or will be required for all components currently in the plant IST program.

Response:

The industry interpretation of the letter was the potential for expanded design basis testing.

E4-2

On page 2-1 of the licensee's submittal it is stated that the scope of this project is to optimize the safety benefits in assuring pump and valve performance. How will this be done if the only substantive change to the IST program is to extend the test interval for the LSSC components (other than adding a few MSSC not in the current IST program and taking compensatory measures for components with RAW > 2 determined to be LSSC)? If component wear out and operator burden are the reasons, what data support this claim?

Response:

See the response to Questions E1-7 and PRA-24, which indicate respectively the operator burden and the substantial safety benefits potentially obtained.

E4-3

The Indirect Safety Enhancement section (p. 2-2) states that "these analyses identify important scenarios that provide information with regard to the operational demand that may be placed on a given component. Such information is valuable because it relates the performance of the IST component to the broader context of plant safety." How is this information used to adjust the IST program?

Response:

An example of how this information was used is in regard to valves 1 (2) CC-713. These valves have high RAW importances for the IPE failure mode, not the IST failure mode which caused (by the Risk-Based IST Program) the addition of compensatory measures and increased awareness of the importance of the component.

E4-4

On page 3-2 of the licensee's submittal it states that "it was important to ensure that a reduction in test intervals [presumably "frequency" as opposed to "interval"] did not allow unintended consequences, i.e., a compromise in safety resulting from a degradation in reliability." How does the licensee plan to monitor LSSC performance or reliability to ensure that it will not degrade (i.e., including LSSC with RAW < 2)? Please discuss why the current Code test methods are acceptable for components whose test interval will be extended. Could extending the test interval make different failure causes (e.g., age dependent failure mechanism) more important to detect? Will the current Code test detect these failures or impending failures?

Response:

See the response to Questions E1-5 and E2-4. Also see Attachment 2 to TXX-96371 for a discussion of potential aging effect.

E4-5

On page 3-5 of the licensee's submittal it states that "there was a systematic review of components that were not explicitly modeled in the IPE." How was this review conducted? Please identify the components that were reviewed.

Response:

The components that were reviewed are listed in Table 4.4-2 of the engineering report (Enclosure 4 to TXX-95260). A discussion of the IST function not modeled, the panel decision and the panel basis are also provided in the table. See also the response to Question E3-12.

Included in the Table below is a summary of IST valves not explicitly modeled in the IPE (previously provided as Table 1 of Enclosure 5 to TXX-95260).

CPSES		Table 1: Valve Population Summary		
IST	IPE	Risk Significance	# Valves (Unit 1 & common)	Comments
Yes	Yes	High	~ 119	Already included in IST Program; continue testing in accordance with the ASME Section XI Code.
Yes	Yes	Low	~ 256	Already included in IST Program; continue Code testing except extend test intervals. Extended test intervals will be implemented on a staggered test basis.
Yes	No	High	~ 19	Already included in IST Program; continue testing in accordance with the ASME Code.
Yes	No	Low	~ 293	Already included in IST Program; continue Code testing except extend test intervals.
No	Yes	High	~ 25	Test commensurate with safety significance.
No	Yes	Low	~ 723	No action required.

E4-6

In the first paragraph on page 4-3, a statement was made that the RAW provides a measure of functional importance that is independent of the reliability of the component. Please explain.

Response:

From a theoretical perspective, the RAW measure is high when the assumed failure of the component significantly increases the core damage probability. From a practical perspective, the increase in core damage frequency corresponds essentially a situation where the remaining redundancy in the plant systems available to perform a critical safety function is related to two or three trains. The RAW value in this calculation is the same for any two components that perform the same function. For example, a pump and its discharge check valve have the same RAW value even though their reliabilities may differ by more than an order of magnitude. In this sense, the RAW provides a measure of functional importance. In the previous example, the FV measure of the pump would be high, but for the discharge check valve the FV would be low. Hence, the RAW measure complements the FV measure, indicating those cases where the component's function is important even though its relative contribution to safety might not be. When the CPSES importance results were reviewed deterministically, e.g., by placing them on the simplified P&IDs, this expectation for the RAW was verified.

E4-7

On page 4-4 of the licensee's submittal it states that "if the assessment of common-cause events results in a group of components having a significant impact on CDF, then those components should be added to the high importance category as well." What components were added to the high category based on common cause failure (CCF)?

Response:

Table 4.2-3 shows the rankings of components with and without common cause failure. The table shows several valves that were ranked MSSC as a result of including common cause failure. However, valves such as 1(2)-8809A&B were ranked MSSC for reasons other than the IPE ranking, namely outage risk considerations.

E4-8

Table 4.1-3 identifies 20 components that were more risk significant for fire [and tornado] than they were in the IPE. The section on Fires and Tornadoes goes on to state that:

> The expert panel confirmed that the basis for the ranking and the corresponding risk insights were reasonable (i.e., the risk importance of these components increased because the direct effects of the external event affected the ability of components in the opposite train to perform their intended function).

How does a fire in one train affect the ability of a component in the opposite train to perform its intended function (i.e., as opposed to increase the importance of the component in the opposite train)?

Response:

It is correct that the fire increased the importance of the function of components in the opposite train. If the increase is significant enough, reliable components that are not important in the IPE can become important in the fire analysis. In the cases referred to in the question, the twenty (20) components are important because the fire has damaged (due to the directs effects of the fire) the sister or equivalent component in the opposite train.

E4-9

On page 4-13 of the licensee's submittal it states that "[t]he experience data (Ref. 9, Appendix A) shows that some pumps wear out faster after earthquakes, possibly because of mis-alignment; however, given the relatively short mission time, this is not an important consideration." What is the basis for this conclusion?

Response:

This is an inference from a statement in EPRI NP-6041, "A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)", which states "There is evidence that pumps wear faster after earthquakes, but these pumps have operated satisfactorily during and following a seismic event. Experience data indicate that many pumps have survived earthquakes without damage for 0.5g pga." The statement would be improved by stating '... given the relatively low seismic acceleration for the SSE (0.12g) at CPSES, the general seismic ruggedness of pumps, and the relatively short mission time ....'.

E4-10

In the Outage Risk Importance section (p. 4-15) it states that "components in key trains were ranked into three categories using a qualitative set of rules." The rules are then summarized on pages 4-18 and 4-19. Why was outage risk importance considerations limited to components included in the IPE?

Response:

The IPE systems were the starting point for the evaluation. However, all the systems tnat support the safety functions important to shutdown were included in this review. The safety functions include Low Temperature Over-pressure Mitigation, Shutdown Cooling Mode of Residual Heat Removal (RHR), Spent Fuel Pool Cooling, Inventory Control, Reactivity Control, and Containment Integrity. These safety functions are consistent with the Outage Safety Functions Guide and the ORAM software used for shutdown evaluation.

E4-11

On page 4-17 of the licensee's submittal it states that "[t]here can be times when almost any component can become more risk significant depending on the outage scenario." It is not clear if the licensee has a rigorous process for dealing with dynamic risk as it relates to risk ranking for IST purposes. Please discuss. (see PRA-21)

Response:

As part of the CPSES Risk-Based IST Program, a study of the dynamic ranking effects for IST components was performed. That study evaluated both instantaneous and integrated dynamic effects of configuration changes on the ranking of IST components. Attachment 7 to TXX-96371 provides a discussion of the overall approach used in the study and the results and the conclusions of the study. That study is based in part on joint work done by the NRC and its contractors, Brookhaven National Labs, and TU Electric to review the risk profile for various equipment outage configurations for CPSES Unit 1.

The study shows that the magnitude of the ranking changes associated with configurations changes was low whether it was considered in an instantaneous or an integrated manner. The effect on all components was low in general and, in particular, the effect was low for those components that temporarily experienced a ranking threshold change. On this basis, it was concluded that the existing Risk-Based IST Program results adequately address both temporary and integrated effects that are likely to result from plant configuration changes.

E4-12

It is not clear how each of the seven safety functions identified on page 4-15 as being important to shutdown risk are addressed in the discussion of outage risk. This section (i.e., Section 4.1.3) discusses specific safety functions and system configurations but it is not clear from reading the licensee's submittal what methodology was used by the expert panel in order to ensure comprehensive and repeatable results (e.g., the expert panel decided to require compensatory measures if certain valves [important to LERF or containment isolation] were not otherwise ranked high). It was not clear from reading the licensee's submittal how the expert panel reconciled Category 1/Category 2/Category 3 ranking components important to outage risk with High/Medium/Low rankings for components associated with back-end considerations and with MSSC/LSSC based on direct IPE/PRA results (i.e., a given F-V or RAW value).

Response:

The discussion provided in Section 4.1.3 of the engineering report (Enclosure 4 to TXX-95260) was presented to the expert panel and deliberated. The approach for shutdown risk considerations used a qualitative means as opposed to a quantitative one, i.e., no importance measures for the components were directly computed. A binning approach was used that equates function, configuration, and positioning requirements to the outage ranking categories, Category 1, 2, and 3. The methodology and the preliminary ranking/binning were presented to the expert panel. The correlation between the preliminary outage rankings and the high and low categories of the IST was also presented in detail. The expert panel made the determination whether the components should be ranked MSSC or LSSC. In making this determination, the panel considered the safety function and the associated components on a qualitative basis. Thus, a Category 1 is equivalent to High /Medium IST - MSSC; Category 3 is equivalent to Low - LSSC; and Category 2 is equivalent to a Low FV, High RAW and becomes either MSSC or LSSC depending on the expert panel review and whether or not a compensatory action was available.

E4-13

Table 4.1-5 and the CIV write-up on page 4-27 are inconsistent (i.e., 1-8153 vs 1-8152).

Response:

The table is correct and the write-up on page 4-27 is in error. The write-up should read 1-8152.

E4-14

As part of a site visit, the staff would like to discuss and review more detailed documentation of the expert panel's deliberations and meeting minutes (not just the summary of the results as presented in Tables 4.4-1 and 4.4-2) in order to understand the basis for ranking unmodeled components. For example, why were the unmodeled SG safety valves categorized low by the expert panel? On page 4-33 of the licensee's submittal it states that the expert panel's evaluation of unmodeled components were documented in two forms. What documentation, other than the expert panel meeting minutes, is available? (see PRA-7)

Response:

The unmodeled steam generator safety valves were determined to be LSSCs by the panel based on redundancy and configuration. The ARVs which perform a similar function to the safety valves were low for all considerations except for fire and tornado. Had the safety valves been modeled, both the ARVs and the safety valves would likely have been ranked low for all considerations, including fire and tornado. The expert panel chose not to reduce the ARV categorization and it chose to retain the SRV categorization as low.

With respect to the question concerning documentation of unmodeled components, the statement of two forms should be clarified to say, the expert panel evaluation was done in two forms (parts) and documented in the expert panel meeting minutes. As mentioned, the first part is the functional review and ranking, and the second is a ranking using a qualitative assessment based on performance insights. As described in the Expert Panel Guidance Document, this assessment of risk significance was based on the consequences and likelihood of component failures for unmodeled failure modes and accident scenarios addressed by the IST program but not addressed by the IPE. The IST functions of the unmodeled IST components considered by the expert panel and a comparison of IPE to IST functions are shown in Tables 4.1-6a and 4.1-6b of Enclosure to TXX-95260. The results of the evaluation are documented in the Expert Panel Engineering Report in tables similar to Table 4.4-2 of Enclosure 4 to TXX-95260.

E4-15

In the High-Risk Components section (i.e., § 4.1.6) it states that:

> An evaluation of such components was done as part of this study. This involved careful evaluation of the IPE modeling assumptions and conservatisms, component failure modes, operator action, recoveries and any other effects that could substantiate the ranking. These were reviewed by the expert panel.

How was this careful evaluation and review conducted? What methodology was used and how was it documented (the detailed process that led to the reported results)? (see E4-30 and PRA7)

Response:

The expert panel used general guidelines, namely the Expert Panel Guidance Document (See Attachment 6 to TXX-96371) in doing its work. The guideline did not specify a detailed step-by-step process for the expert panel to use in reaching its conclusions. Rather, it presented a process that was deliberative in nature. Section 4.4 of the engineering report (Enclosure 4 to TXX-95260) describes the role of the expert panel. The bases for the panel's conclusions are the information presented in sections 4.1 and 4.2 of the engineering report. The panel was made aware of the limitations of the IPE and evaluated the other considerations such as external events, back-end importance, shutdown risk and completeness issues in detail. Refer to Attachments 4 and 6 to TXX-96371 for a further discussion of the expert panel deliberation process.

See also the response to Question E3-11 above.

E4-16

Table 4.4-2a states that for instrument air relief valves not protected by check valves that can depressurize the common header:

> An evaluation will be performed to determine the appropriate equivalent IST compensatory actions for the IPE failure modes.

The staff needs to understand the evaluation and know the alternative IST proposed before it can approve the exemption request. Why is testing for the IPE failure modes appropriate for MSSC not in the current IST program and not for the other MSSC (i.e., components that are already in the current IST program)? (see E2-2)

Response:

See Attachment 4 to TXX-96371 for discussion on expert panel deliberation process on IPE failure mode for components in the current IST Program.

E4-17

The CST to AFW pump isolation valves and the PMP/CCP suction cross-tie valve are shown (in Table 4.4-2a, High Ranked IPE Components Not in the Current IST Program) to be MSSC by the IPE and expert panel, but the Compensatory Actions and Comments sections state:

> No applicable in-service test for normally open manual valves without remote position indication.
>
> Current plant programs are adequate to maintain a low failure probability. Programs include the quarterly IST pump test which will verify position is open and either the locked valve program or position surveillances every 30 days per technical specifications. The IPE did not credit operator recovery by opening the valve if it was left closed.

It is not clear that the IPE failure mode that caused these valves to be MSSC are addressed by the proposed test strategy. While the quarterly pump test may be adequate to test the suction valve, the Risk-Based IST Program should document the testing of each MSSC.

Response:

There is no applicable in-service test for normally open manual valves without remote position indication. See also the response to Question E1-3.

E4-18

Table 4.4-2a, High Ranked IPE Components Not in the IST Program, should identify the proposed compensatory actions (i.e., not TBD).

Response:

See the response to Question E1-3.

E4-19

There does not seem to be a one-to-one map between the completeness issues described in Section 4.2 and the subsequent sub-sections (e.g., to compensate for PRA limitations the expert panel is required to identify components with operational concerns, but this issue does not seem to have a companion sub-section). Please discuss.

Response:

The introductory paragraph of Section 4.2 provides a list of issues that were addressed to assure completeness of the work. Each of the issues, excepting the expert panel / operational concerns, is discussed in the subsections that follow. The expert panel activities are discussed primarily in section 4.4. The expert panel / operational concerns deals in part with the matter of generic versus plant specific data. While not fully developed in the discussion, section 4.2.4 provides a discussion of the data limitations. See Attachments 4 and 6 to TXX-96371 for a further discussion of the expert panel deliberation process.

E4-20

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, and

c. small variations of the decision criteria [i.e., F-V and RAW thresholds].

(see PRA-15 through 22)

Response:

See the response to question E3-7.

See Attachment 2 to TXX-96371, Issue 5, for a discussion of aging effects.

Service conditions are reflected in the failure rates and performance history used for the components and therefore do not need to be explicitly considered for each component. Variations in such conditions that affect failure rates were addressed by the expert panel. The accumulator discharge check valves (e.g., 1-8956A through D) are good examples where service conditions affected CPSES component failure rates and ranking. It should also be noted that components for which service conditions are important will have either a high FV or a high RAW. These components are either MSSCs or they are LSSCs with compensatory actions and monitoring. Therefore, any future impact of service conditions will be quickly uncovered by the CPSES RB-IST Program.

Small variations in the decision criteria will not affect the CPSES ranking results. The selection of a natural break point in the results compensates for such variations. The expert panel selected a break point in the results based originally on the IPE-based results. The panel found that when a few components with both FVs and RAWs near the threshold (~0.0009 and ~1.94 respectively) were moved to the MSSC category, the results were more naturally grouped. (The above components included LCV-112B through E.)

After completion of the ranking and in response to questions from the NRC staff, the natural break point was again reviewed for the final results, i.e., after fire, outage, and LERF contributors were

evaluated and sensitivity studies were performed. The expert panel set the cutoff at 0.0009. The next highest FV in the final results is about 0.0005, nearly a factor of two lower. This would imply that a factor of two variation in the FV criteria would be required to numerically change the ranking results. However, the next highest FV without a compensatory action assigned is 0.00025, nearly a factor of four lower. In conclusion then, small variations in the decision criteria will have no impact on the final ranking results from CPSES.

E4-21

Truncation (Table 4.2-1) of all valves in the containment spray system (i.e., because they are "not required for CDF and not significant for LER") may not be appropriate because it removes defense-in-depth and could affect containment failure probability and health effects. Please discuss. (see PRA-5 & 6)

Response:

The CPSES IPE concluded that the containment spray system provides adequate protection to the public. That is, containment integrity as a defense-in-depth measure is assured. See the response to question E1-6 for a discussion of defense-in-depth.

The statement that the containment systems are "not required for CDF and not significant to LERF" is based on the following two derivations from the CPSES IPE. First, the success or failure of the containment spray has no effect on CDF. This point is self evident. Second, success or failure of containment spray has no significant effect on large early release frequency. In order to see this second point consider that from Figures 7-1, 7-2.1 and 7-2.2 of the Enclosure to TXX-92490 (letter from William J. Cahill to the NRC, dated October 30, 1992, submitting the CPSES IPE backend portion) the LERF that could be affected by containment spray is less than 8.1% (Figure 7-2.2) of 9.4% (Figure 7-2.1) or 0.76% of the CDF. Assuming: (1) that all of the successes, i.e., all the no containment failure cases, 39.5% in Figure 7-1, would become containment failures if the sprays were to fail and (2) that the spray failure probability would become 1.0, and (3) that the proportion of early failures would be the same in these added failures as it is in the actual case, then: the LERF would increase by $0.0076*0.395/(1-0.395)=0.00497$ of the CDF, i.e. it would become 9.4% + 0.5% = 9.9% of the CDF. This is not a significant increase. Furthermore, with the exception of steam generator tube ruptures, all other failure modes which were classified as early failures in [IPE BACKEND REF] have frequencies nearly at or below the IPE reporting cutoff level of 1E-07 and failure of the sprays would not increase these by much as illustrated above.

Nevertheless, it is acknowledged that the long term post-accident containment performance is affected by containment spray. Clearly, the successes in Figure 7-1 are due to the success of containment spray. If the sprays were to have a failure probability of 1.0 then the non-failure cases, namely 39.5% in Figure 7-1, would become much less. Note that reducing inspection on the spray pumps does not make spray failure probability equal to 1.0.

In conclusion, because of the concern stated in the previous paragraph and in spite of the

considerations presented in the first two paragraphs, the risk-based IST program resulted in containment spray pumps being designated MSSCs. In addition, the system MOVs have existing operability and slave relay tests that provide indication of system degradation. Thus, the containment spray function is essentially tested and its failure probability is unaffected.

E4-22

On page 4-42 it states that "Safety Chilled Water is a system that meets the qualitative definition of initiator importance but not the quantitative one. To be conservative, this system was added to the list of important initiators." This does not appear to be reflected in Table 4.2-2 and Table 4-1 (e.g., pumps appear to have a marginal to high F-V, valves are all ranked low). Is this "[b]ecause these three systems cumulatively contribute less than 6 percent to total CDF, the small change in initiating event frequency (due to the relatively small number of components affected) ensures that the cumulative effects on the CDF and LERF due to IST test interval changes [are] insignificant?"

Response:

The answer to the question is 'Yes'. Table 4.2-2 shows the safety chilled water initiator as %X2, Loss of HVAC with a CCDP of about 1.03 E-05. When it says the safety chilled water initiator was added to the list of important initiators, it means that it was flagged to be evaluated further. That is, evaluate the change in initiating event frequency and the subsequent change in CDF as a result of the interval increases. Based on the results of this evaluation, components in the safety chilled water system did not change category. This was part of the expert panel deliberations.

E4-23

In the sensitivity study section, it states that the CCW, SI, and CVCS pump discharge check valves (p. 4-47) all had elevated importance for fire and large early releases and that "the sensitivity study seems to confirm a pattern of underlying importance for selected components in these systems despite the fact that they did not meet the original importance thresholds." Why is it then that the CCP and CCW pump discharge check valves are not ranked as high in Table 4-1?

Response:

The sensitivity study indicated that these components had a high RAW importance. However, as noted on page 4-46, in every case in the study, the FV measures remained low. Thus, the issues here for the expert panel were understanding the study and assuring that compensatory measures were identified, because of the high RAW, for each of these components.

E4-24

Section 4.3 states that a 66 percent increase in CDF and a 70 percent increase in LERF is "much less than any reasonable acceptance criteria for classifying something as safety neutral." The staff does not agree with the licensee that increases less than a factor of 2 are necessarily safety neutral just because these increases are within the uncertainty bounds of the original estimate.

Response:

The extreme of the sensitivity study shows an increase in CDF which is within the uncertainty of the study. It is not proposed to operate at this extreme. In fact, as discussed on the page that follows the quoted material (page 4-52) a value significantly less than this extreme, namely 13%, is proposed. This value is within the limit for permanent plant changes suggested in the PSA Applications guide.

We agree with the observation regarding safety neutral. The conclusion that the Risk-Based IST Program is safety neutral is not based solely on the small factor of increase as shown in the sensitivity study. It is also based on the cumulative impact of the components whose intervals were increased compared to the not modeled components that were added to the program as discussed in the response to Question PRA-24.

E4-25

The licensee states (Section 4.3, page 4-53) that the total risk may in fact decrease because high-ranked valves not in the current IST program are being considered for increased testing. The only "additional" testing identified in the licensee's exemption request were for the CST to AFW pump isolation valves and the PMP/CCP suction cross-tie valve which will be tested by having the associated pump quarterly IST and either locked valve program or 30-day TS surveillance. It appears that no additional testing (other than that currently being done) has been proposed.

Response:

See the response to Question E1-3.

E4-26

Page 4-63: Was the unmodeled valve that the expert panel moved to the high category (i.e., because it might degrade the performance of more than one pump) the RHR pump mini-flow valve? If so, Table 4-1 seems to suggest that it was modeled.

Response:

The unmodeled valve in question is an auxiliary feedwater mini-flow valve.

E4-27

The expert panel section (i.e., Section 4.4, page 4-65) states that:

> Evaluations were performed to determine how to use existing in-service testing techniques most effectively to address the more safety significant failure modes in the IPE. The following three questions were normally asked for these evaluations:
>
> - Does in-service testing apply to the failure modes that are risk significant?
> - What testing is currently being done?
> - Does ranking justify an improvement in testing to an IST-type testing program?
>
> For components or IST functions not modeled in the IPE, the same systematic approach was taken as for modeled components.

How was this evaluation normally conducted? Was it documented (e.g., component-by-component)? (see E4-30 and PRA-7)

Response:

This evaluation was conducted as part of the expert panel deliberations. Typically, members of the expert panel who were knowledgeable of testing provided answers to the first two of these questions. The third question was then deliberated based on these inputs and the ranking. The results of these deliberations are documented in the expert panel meeting minutes, Tables 4.4-1 and 4.4-2. See Attachments 4 and 6 to TXX-96371 for a discussion of the expert panel deliberation process.

E4-28

HV-4699 & HV-4700 and HV-4696 & HV-4709 were ranked LSSC and had RAW > 2; however, the expert panel proposed no compensatory actions. Why? While current IST may not check the IPE failure mode, some other test or compensatory action may be appropriate.

Response:

No compensatory action, i.e., a test, was proposed for these valves because the plant failure mode that is important (high RAW) is the spurious closing of the valve, a failure mode that would be detected by thermal barrier low flow and high temperature alarms. In addition, these valves are stroked during outages for maintenance work. That is, the expert panel determined that there is no practical test for detecting or preventing spurious closure. However, degradations in valve performance, e.g., valve drift, could potentially be detected indirectly based on flow and temperature alarms. The Risk-Based IST Program hopes to reduce risk by increasing awareness of the importance of early detection before failure of these valves for the spurious closure failure mode. This awareness will be accomplished by providing cautions in system operating procedures.

Valves HV-4699 & HV-4700 and HV-4696 & HV-4709 are covered by Appendix J. It should be noted that Appendix J testing is not changed by the Risk-Based IST Program.

E4-29

The compensatory actions described by the licensee (i.e., in Tables 4.4-1, 4.4-2, and 4.4-2a) do not seem to explicitly check for degradation in valve reliability and nothing new is proposed (e.g., the valve gets cycled for some other maintenance or testing activity, or degradation/failure would be detected by an alarm). Please discuss. (see E3-5)

Response:

Certain valves have been ranked low only if an available "compensatory measure" was judged to be adequate by the expert panel. To understand the objective of the compensatory measure, it is important to understand the risk implications for the conditions in which it is applied. A compensatory measure is applied to a component that is functionally important based on the PRA model, but its numerical contribution to risk is low, i.e., high RAW, low FV. This type of component is ranked low principally because it is a reliable component.

The expert panel first determines that the component is indeed reliable. That is, poor performance has not been experienced. The panel then must determine that an adequate program exists that will provide timely information to the IST coordinator that reliability has degraded. If such a determination is made and the component is no longer deemed reliable, then the in-service test interval would be reduced.

The most common compensatory actions were the IST pump test for pump discharge check valves and slave relay surveillance tests for MOVs. Since neither of these tests can be considered satisfactory if the check valve or MOV fails to perform its risk significant function, a test failure would be recorded. The recorded information could then be used to assess whether a significant change in component reliability has occurred such that the component would merit a change in test interval.

E4-30

Section 8, "Appendices" of the licensee's submittal states that "Comanche Peak Steam Electric Station Risk-Based In-Service Testing Expert Panel Guidance Document" will be provided later. The substance of what the expert panel considered and how they resolved issues needs to be reviewed by the staff. Please include the schedule for providing this document. (see PRA-7)

Response:

The Expert Panel Guidance Document was provided for review at the CPSES site during the public meeting on April 25, 1996. See Attachment 4 to TXX-96371 for a discussion of the Expert Panel Methodology and Attachment 6 to TXX-96371 for a copy of the Expert Panel Guidance Document.

E4-31

The positive displacement charging pump is not listed on Table 4-1 along with the other charging pumps. Was the positive displacement charging pump modeled in the CPSES PRA? What was the result of the risk-ranking for this pump? What testing strategy is proposed for this pump?

Response:

The positive displacement pump (PDP) was modeled only for the normal charging function. It was not used/ credited in any accident sequence mitigation function modeled in the IPE. Therefore, it has no IPE risk rank. The PDP is referenced in Emergency Operating Procedures (EOPs) (e.g., FRS 0.1A, "Response to Nuclear Power Generation/ATWT") only as a last resort (i.e., using non-safety equipment for a safety function as a last resort). The IPE did not credit the PDP because to use it would require the restoration of multiple support systems, some of which are not safety related.

E4-32

Page 4-42 states that:

> Safety Chilled Water is a system that meets the qualitative definition of initiator importance but not the quantitative one. To be conservative, this system was added to the list of important initiators.

Why are the safety chiller CCW return valves (1-PV-4552 & 1-PV-4553) ranked low?

Response:

When it says the safety chilled water initiator was added to the list of important initiators, it means that it was flagged to be evaluated further. That is, evaluate the change in initiating event frequency and the subsequent change in CDF as a result of the interval increases. Based on the results of this evaluation, components in the safety chilled water system may or may not have changed category. This was part of the expert panel deliberations. The safety chiller CCW return valves (1-PV-4552 & 1-PV-4553) ranked low because on further evaluation of the loss of safety chilled water initiator, these valves were determined not to be important. These valves were determined not to be significant contributors to the initiating event frequency.

E4-33

In the summary and conclusions (section 5), references were made to a "decrease in plant risk" and "safety neutral." Please provide a basis for these assertions or quantify the risk decrease.

Response:

The basis for the above statements ("decrease in plant risk", safety neutral") is the consideration that the FV associated with the valves being added to the program compared to the FV of the components with elongated test intervals shows a potential for improvement or reduction in risk. Further, there is no industry wide consensus that defines a correlation between a change in the test interval vs. the reliability of the component. However, in this submittal qualitative arguments have been made to support this philosophy that elongated test intervals do not necessarily result in increased component unreliability (also refer to responses for Questions E1-7, E3-7, and PRA-24).

VI. QUESTIONS ON ENCLOSURE 5 - IMPLEMENTATION RESULTS AND SYSTEM DRAWINGS

E5-1

DWG M1-0257: Why are boric acid transfer pumps TCX-CSAPBA-01 and 02 not ranked as being more safety significant when boric acid transfer pumps TBX-CSAPBA-01 and 02 are MSSC?

Response:

All four boric acid transfer pumps are MSSC as shown in Table 4.4-1 (page 191 of 295 of Enclosure 4 of TXX-95260). Tables 4.1 and 5.1 show only Unit 1 and Common components.

E5-2

Generic Response Questions in this group:

In general, the importances of components are based on function, reliability and redundancy, and not on function alone. The importance of certain components is dependent upon whether the component affects a train (a train-wise failure) or redundant trains. For others, the importance is affected by common cause considerations. Both of these considerations involve redundancy and reliability. In some of the cases cited below, the failure rate of one component type (e.g., a check valve) is considerably lower than another component type (e.g., a MOV) in the same flow path. In some cases, the initiator is important to the determination of component importance. For example, the importance of one component may be high and its sister valve low because fire disables the sister valve.

a. Why is 1-8969A/B ranked low when 1-8924 and 1-8804 are ranked high (DWG M1-0261)?

b. Why is 1-8958 ranked low when 1-8812A/B are ranked high (DWG M1-0263 Sheet 5 of 5)?

c. Why are 1-8730A/B ranked low when 1-HCV-0606/0607 and 1-8716A/B are ranked high (DWG M1-0260)?

d. Why are 1SI-8919A/B ranked low when 1-8814A/B are ranked high (DWG M1-0263 Sheet 4 of 5)?

e. Why are valves 1-8922A/B ranked LSSC when the SI pumps and other valves in the injection flow paths to the cold legs are ranked MSSC (DWG M1-0263 Sheet 4 of 5)?

f. Why are the high head SI pump cross-tie valves (i.e., 1-8821A/B) ranked LSSC (DWG M1-0263 Sheet 4 of 5) when the low head SI (i.e., RHR pump) cross-tie valves (i.e., 1-8716A/B) (DWG M1-0260) are ranked MSSC?

g. Why would not 1-HV-4776 and 1-HV-4777 be MSSC if the CS pumps are MSSC (DWG M1-0232 Sheet 1 of 2)? Why would 1CT-0013/0042/0065/0094 and 1CT-0142/0145 check valves in this same flow path, not also be ranked high?

h. Why are valves in the auxiliary feedwater (AFW) flow path ranked low when the AFW pumps are ranked high (DWG M1-0206)?

I. Why are 1-8801A/B ranked low when 1-8815 is ranked high (DWG M1-0261)?

Response:

a. Valve 1-8924 is ranked low. Valves 1-8804 A&B and 1-8814 A&B are high solely because of common cause. The importances of these components are based on function, reliability and redundancy.

b. Valves 1-8812 A&B are ranked high solely because of common cause failure.

c. Valves 1-8730 A&B are ranked low because they cause only train-wise failure. 1-HCV-0606/0607 are low for IPE but are high because they are used for flow control during refueling outages. Valves 1-8716 A&B are ranked high for common cause failure for MOVs during hot leg recirculation.

d. Valves 1SI-8919 A&B are ranked low because they cause only train-wise failure, whereas valves 1-88714 A&B are ranked high for common cause failure for MOVs.

e. The difference is primarily the failure mode and reliability. Valves 1-8922A&B are check valves. The others are low for IPE but high for fire considerations.

f. The high head SI pump cross-tie valves, valves 1-8821A/B, are low because for CPSES, the Safety Injection System and the Chemical and Volume Control System are essentially redundant. The low head SI cross-tie valves, valves 1-8716A/B, are ranked MSSC due to common cause failure.

g. The containment spray system components are LSSC for CDF and LERF. The containment spray pumps were determined by the expert panel to be MSSC because of performance history of the pumps.

h. The importances of the components in the AFW system are based on function, reliability and redundancy. The pump failure rates (e.g., fails to start) typically dominate the train failures by an order of magnitude.

I. For the IPE, all these valves are ranked low. However, if a fire disables the redundant function (i.e., the SI high head injection), this path has added importance. Since MOVs in

parallel (valves 1-8801 A&B) are more reliable than a single check valve (1-8815), the check valve has greater importance in this scenario.

E5-3

What testing is proposed for the main steam dumps to the condenser (1-TV-2370A, B, C, D, E, F, G, H, and J) and the steam generator flow control valves (1-FCV-0510, 1-FCV-0520, 1-FCV-0530, and 1-FCV-0540)? These are valves that are not in the current IST program but were high risk in the IPE.

Response:

See the response to Question E1-3.

E5-4

[a.] What testing is proposed for the following LSSC valves?

CCW System:

X-PV-3583 (DWG M1-0229 Sheet 2 of 8)
X-PV-3584 (DWG M1-0229 Sheet 2 of 8)
X-PV-3585 (DWG M1-0229 Sheet 3 of 8)
X-PV-3586 (DWG M1-0229 Sheet 3 of 8)

CVCS System:

1-8104 (DWG M1-0255 Sheet 2 of 3)
1-8105 (DWG M1-0255 Sheet 1 of 3)
1-8106 (DWG M1-0255 Sheet 1 of 3)
1-8109 (DWG M1-0255 Sheet 1 of 3)
1-8112 (DWG M1-0253 Sheet 1 of 2)
1-8145 (DWG M1-0253 Sheet 2 of 2)
1-8146 (DWG M1-0253 Sheet 2 of 2)
1-8147 (DWG M1-0253 Sheet 2 of 2)
1-8153 (DWG M1-0253 Sheet 2 of 2)
1-8154 (DWG M1-0253 Sheet 2 of 2)
1-8210A&B (DWG M1-0255 Sheet 1 of 3)
1-8202A&B (DWG M1-0255 Sheet 1 of 3)
1-FCV-0111A&B (DWG M1-0255 Sheet 2 of 3)
1-FCV-0110B (DWG M1-0255 Sheet 3 of 3)
1-HV-8220 (DWG M1-0255 Sheet 3 of 3)
1-HV-8221 (DWG M1-0255 Sheet 3 of 3)

CS System:

XCS-0037 (DWG M1-0257)
XCS-0039 (DWG M1-0257)
XCS-0041 (DWG M1-0257)
XCS-0044 (DWG M1-0257)

Liquid Waste Processing System:

1WP-7176 (WP-7196?) (DWG M1-0264)
1WP-7177 (DWG M1-0264)

1-HV-7311 (DWG M1-0264)
1-HV-7312 (DWG M1-0264)

PASS System:

1-HV-4182 (DWG M1-0228)

Main Steam System:

(DWG M1-0202)

1-HV-2333A
1-HV-2334A
1-HV-2335A
1-HV-2336A

1-MS-0021, 0022, 0023, 0024, 0025
1-MS-0058, 0059, 0060, 0061, 0062
1-MS-0093, 0094, 0095, 0096, 0097
1-MS-0129, 0130, 0131, 0132, 0133

1-HV-2452-1
1-HV-2452-2

1-HV-2397 A&B
1-HV-2398 A&B
1-HV-2399 A&B
1-HV-2400 A&B

[b.] Why are the main steam safety valves and main steam isolation valves LSSC for CPSES? Does the FSAR transient analysis take credit for these valves?

[c.] Why are the main steam supply valves to the auxiliary feedwater pumps LSSC for CPSES? Does the FSAR transient analysis take credit for these valves?

Response:

[a] Table 2-V, "Less Safety Significant Valves," of Enclosure 5 to TXX-95260 has been superseded by Table 2, "Less Safety Significant Valves," of Enclosure 3 to TXX-96371. The new Table 2 includes LSSC valves which were inadvertently omitted from Table 2-V of Enclosure 5 to TXX-95260 and corrects minor typographical errors from the previous table. The valves listed above have been repeated below along with the appropriate comments.

For valves which exist in both Unit 1 and Unit 2 and for which the test requirements are the same, the unit designator prefixes have been dropped from the valve numbers shown in Table 2-V of Enclosure 5 to TXX-95260, Tables 2 and 3 of Enclosure 3 to TXX-96371. The valve numbers in this case should be understood to be prefixed by "1" (or CP1) and "2" (or CP2), as appropriate. If a valve is in a common system, exists in one unit only, is numbered differently between units or has different test requirements between units, then the unit designator is shown.

CCW System:

X-PV-3583 (DWG M1-0229 Sheet 2 of 8)	Note 1
X-PV-3584 (DWG M1-0229 Sheet 2 of 8)	Note 1
X-PV-3585 (DWG M1-0229 Sheet 3 of 8)	Note 1
X-PV-3586 (DWG M1-0229 Sheet 3 of 8)	Note 1

CVCS System:

1-8104 (DWG M1-0255 Sheet 2 of 3)	Note 2
1-8105 (DWG M1-0255 Sheet 1 of 3)	Note 2
1-8106 (DWG M1-0255 Sheet 1 of 3)	Note 2
1-8109 (DWG M1-0255 Sheet 1 of 3)	Note 2
1-8112 (DWG M1-0253 Sheet 1 of 2)	Note 1
1-8145 (DWG M1-0253 Sheet 2 of 2)	Note 2
1-8146 (DWG M1-0253 Sheet 2 of 2)	Note 2
1-8147 (DWG M1-0253 Sheet 2 of 2)	Note 2
1-8153 (DWG M1-0253 Sheet 2 of 2)	Note 2
1-8154 (DWG M1-0253 Sheet 2 of 2)	Note 2
1-8210A&B (DWG M1-0255 Sheet 1 of 3)	Note 2
1-8202A&B (DWG M1-0255 Sheet 1 of 3)	Note 2
1-FCV-0111A&B (DWG M1-0255 Sheet 2 of 3)	Note 2

1-FCV-0110B (DWG M1-0255 Sheet 3 of 3)	Note 2
1-HV-8220 (DWG M1-0255 Sheet 3 of 3)	Note 2
1-HV-8221 (DWG M1-0255 Sheet 3 of 3)	Note 2

CS System:

XCS-0037 (DWG M1-0257)	Note 3
XCS-0039 (DWG M1-0257)	Note 3
XCS-0041 (DWG M1-0257)	Note 3
XCS-0044 (DWG M1-0257)	Note 3

Liquid Waste Processing System:

1WP-7176 (WP-7196?) (DWG M1-0264)	Note 4
1WP-7177 (DWG M1-0264)	Note 5
1-HV-7311 (DWG M1-0264)	Note 5
1-HV-7312 (DWG M1-0264)	Note 5

PASS System:

1-HV-4182 (DWG M1-0228)	Note 6

Main Steam System:
(DWG M1-0202)

1-HV-2333A	Note 1
1-HV-2334A	Note 1
1-HV-2335A	Note 1
1-HV-2336A	Note 1
1-MS-0021, 0022, 0023, 0024, 0025	Note 1
1-MS-0058, 0059, 0060, 0061, 0062	Note 1
1-MS-0093, 0094, 0095, 0096, 0097	Note 1
1-MS-0129, 0130, 0131, 0132, 0133	Note 1
1-HV-2452-1	Note 1
1-HV-2452-2	Note 1
1-HV-2397 A&B	Note 7
1-HV-2398 A&B	Note 7
1-HV-2399 A&B	Note 7

1-HV-2400 A&B	Note 7

Notes:

1. This valve was inadvertently omitted from Table 2-V of Enclosure 5 to TXX-95260 and has been added to Table 2 of Enclosure 3 to TXX-96371.
2. This valve was included in Table 2-V of Enclosure 5 to TXX-95260 and is also included in Table 2 of Enclosure 3 to TXX-96371.
3. This valve was included in the CVCS System of Table 2-V of Enclosure 5 to TXX-95260 and is also included in Table 2 of Enclosure 3 to TXX-96371.
4. Valve 1WP-7176 was incorrectly listed as WP-7196 in Table 2-V of Enclosure 5 to TXX-95260. This error has been corrected in Table 2 of Enclosure 3 to TXX-96371.
5. This valve was included in the Misc Containment (Post Accident Sampling) System of Table 2-V of Enclosure 5 to TXX-95260 and is also included in Table 2 of Enclosure 3 to TXX-96371.
6. This valve was included in the Residual Heat Removal System of Table 2-V of Enclosure 5 to TXX-95260 and is also included in Table 2 of Enclosure 3 to TXX-96371.
7. This valve was inadvertently omitted from Table 2-V of Enclosure 5 to TXX-95260 and has been added to Table 2 of Enclosure 3 to TXX-96371. Please note that the valves "1-HV-2397 A&B" are listed as valves "HV-2397" and "HV-2397A" (similar comment for 2398, 2399, and 2400).

[b.] See the response to Question E4-14.

The MSIVs are not important to CDF or LERF. The highest cutset with MSIV closure failure is about 2.5E-09. The FV for the valve is 5E-05. In the CPSES IPE model, all the SGTR frequency is assigned to one steam generator for ease of analysis. Thus, the actual importance of each MSIV is less than this value. Closure of the MSIVs in the event of a SGTR is proceduralized and is part of operator training.

The transient analysis in Section 15 of the FSAR credits these MSIVs to close for MSLB, SGTR and Feedwater Line Break. The main steam safety valves are credited to open when required to protect the steam system from over pressurization.

[c.] The steam supply valves, 1-HV-2452-1 and -2, are low for all considerations primarily

because of redundancy. See also the response to PRA-12d. The transient analysis in Section 15 of the FSAR credits the availability of steam supply to the Turbine Driven Auxilary Feedwater (TDAFW) pump for accident mitigation.

E5-5

What testing is proposed for the following LSSC pumps?

- Spent fuel pool cooling water pumps CPX-SFAPSF-01/-02 (DWG M1-0235 Sheet 1 of 2)
- Safeguards Building sump pumps CP1-WPAPSS-01/-02/-03/-04 (DWG M1-0236)

Response:

Spent fuel pool cooling water pumps COX-SFAPSF-01/-02 are ranked LSSC. These pumps were inadvertently omitted from Table 2-P of Enclosure 5 to TXX-95260 and have been added to Table 1 of Enclosure 3 to TXX-96371.

The safeguards building sump pumps will be tested as discussed in the response to Question E2-2.

E5-6

Why are 1-8825 and 8890A/B Appendix J leak rate tested per technical specifications whereas 1-8881, 1-8823, and 1-8824 are not?

Response:

Valves 1-8824 and 1-8881 compose a penetration that is part of the engineered safety feature system supplying SI pump flow (valves opened) to the Hot Legs of the RCS during Hot Leg Recirculation mode of operation. During Cold Leg Injection and Cold Leg Recirculation this penetration is not in service (valve closed) but is pressurized by the safety injection pumps to a pressure in excess of containment design pressure. This ensures that leakage path for containment atmosphere is not available during a LOCA.

Valve 1-8823 is contained within a penetration that is part of the engineered safety feature system supplying SI pump flow (valves opened) to the Cold Legs of the RCS during Cold Leg Injection and Cold Leg Recirculation mode of operation. During Hot Leg Recirculation this penetration is not in service (valve closed) but is pressurized by the safety injection pumps to a pressure in excess of containment design pressure. This ensures that leakage path for containment atmosphere is not available during a LOCA.

The flow paths and pressurizations discussed above meet single failure criteria and will be maintained during the penetrations modes of operation. The SI system outside containment meets the requirements for a closed system outside containment i.e., missile protected, Seismic Category I, Safety Class 2, designed temperature and pressure at least equal to containment and are tested per the requirements of NUREG-0737, Section III.D.1. Thus ensuring a secondary protection for leakage should it occur. Based on the above considerations the containment isolation valves in these penetrations will be exempt from Appendix J, Type C testing.

E5-7

In the CVCS system (DWG M1-0253 Sheet 2 of 2), is 1CS-8393 (spring-loaded check valve) in the CPSES IST program? If not, why not?

Response:

Check valve 8393 is required to relieve pressure build-up in the tube side of the regenerative heat exchanger and in the charging line in the event that the normal charging line, alternate charging line, and auxiliary spray line are isolated while high temperature letdown continues on the regenerative heat exchanger shell side.

When a check valve is used to relieve this pressure build-up to the charging line downstream of the normal charging line isolation valve, the check valve must be spring loaded to keep it from opening when the alternate charging line is in service and the normal charging line is isolated. Failure to do so would mean that the normal charging RCS cold leg nozzle could not be isolated from charging line flow and temperature transients when the alternate charging line is in service. The spring-loaded check valve is required to open with a differential pressure of 250 psi. This pressure difference far exceeds that required to prevent the check valve from opening when the alternate charging line is in service and will prevent the pressure in the regenerative heat exchanger from exceeding 110 percent of design pressure when the RCS is at 103 percent of the pressurizer safety valve set pressure.

E5-8

Valve 1-8924 (Unit 1 SIP/CCP suction header cross tie isolation valve) (DWG M1-0261) is ranked as an MSSC but the implementation results treat it as an LSSC. Why?

Response:

The expert panel notes and all the individual tables of results show valve 1-8924 to be LSSC. An error was made in transposing to Tables 4-1 and 5-1. The tables should show valve 1-8924 to be LSSC.

E5-9

Are there any plans to perform partial-stroke testing of any check valves classified as LSSCs during the deferred testing period? Are other test methods, consistent with OM-22, being considered? (see G-3)

Response:

See the response to Question G-3.

E5-10

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 interval between tests? IS the licensee considering any more frequent exercising of solenoid valves that are not exercised during their deferred test interval? Please comment. (Note NUREG-1275, "Operating Experience Feedback Report - Solenoid-Operated Valve Problems.")

Response:

TU Electric understands that SOVs left in one position for long periods without exercising may be a concern. Stroke timing may be of little value where operational readiness of SOVs are concerned.

There are 22 SOVs in the IST/PRA Program, 2 are MSSCs and 20 are LSSCs. A preliminary review indicates they are exercised during normal plant operations. TU Electric will ensure that all these SOVs are exercised a minimum of once per cycle.

VII. QUESTIONS ON THE USE OF PRA TO RISK-RANK COMPONENTS FOR IST

A. PRA Quality and Scope

The NRC position on PRA quality as articulated in a Staff Requirements Memorandum (SRM) dated April 28, 1995, is that IPE reviews are not of sufficient depth to allow the staff to indicate approval of, or concurrence with, the absolute values and conclusions. The Commission suggested that if there is to be further use of PRAs as a basis for risk-informed regulatory changes, then the industry should, in coordination with the staff, initiate the actions necessary to develop PRAs that are acceptable for regulatory use (i.e., standardized methods, assumptions, level of detail).

Section 3.7 (page 3-11) of Enclosure 3 states that "the CPSES IPE meets or exceeds the quality standards subsequently suggested by the EPRI PSA Applications Guide." While the staff believes that the EPRI guide provides 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. Please provide additional information as identified below.

PRA-1

Page 3-4 of Enclosure 4 discusses the review and QA process that the IPE has experienced including internal and external reviews. Please make review documentation available for review 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.) (See E3-9)

Response:

The requested information is available for review.

PRA-2

Potential areas of concern developed from the IPE submittal that may impact IST issues:

a. Inter-unit cross ties are modeled in the IPE. What is the current operational status of inter-unit cross ties at CPSES? When one unit is in shutdown, are systems depended upon from the other (i.e., operating) unit? Are the cross-tie systems ranked high? Are cross-tie valves ranked high? If not, please justify their omission.

b. The IPE states that post initiator human actions "may or may not be covered by procedures." What SSCs are affected by HEPs that are based on non-proceduralized recovery actions? How was SSC importance adjusted to account for greater uncertainty associated with non-procedural recovery actions?

c. The CPSES IPE relies mostly on generic data. The Expert Panel has re-ranked components higher for IST based on plant operating experience. Are there procedures to systematically collect plant specific data for IST ranking to ensure that SSC ranking is not invalidated by new data? (i.e., please discuss how your plant PRA model will be updated to reflect operating experience)

Response:

a. The only cross-tied systems that were credited in the IPE are the Component Cooling Water (CC) System and the Station Service Water (SW) System. Note that these are not shared systems, rather each unit has its own systems. In the IPE, the use of the cross-tie was a point estimate that considered both human recovery actions and opposite unit cross-tie availability. The point estimate was assumed to be driven by the human action, and not by component reliability or system availability. In addition, since these are manual valves, if they were explicitly modeled, their importance based upon component reliability, hence the low ranking.

b. The statement that post initiator human actions "may or may not be covered by procedures" is a statement of the methodology that addresses non-proceduralized human interactions. However, in the implementation of the methodology, non-proceduralized human interactions were not credited.

c. The CPSES PRA will be updated at a frequency of once every two refueling outages (based on Unit 1 refueling outages), approximately every three years, and will be completed within

9 months of the end of the second refueling outage. (See also response to Question E1-8.)

A discussion of this updating and component re-ranking is provided in the response to Question E2-5 above.

PRA-3

PRA models were not used for the ranking of SSCs for containment isolation, interfacing LOCAs, seismic 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 or provide a revised assessment.

Response:

PRA models were used for the ranking of SSCs for containment isolation. Importance measures were not directly available due to the nature of the models and the software. In estimating these measures, some simplifications were made that in essence led to a determination of whether the components were above or below the criteria, i.e., FV > 0.001, rather than directly estimating importance measures. Nevertheless, the process and basis were essentially the same as the analysis of other plant systems using the internal events.

The CIV analysis evaluation was reviewed by the expert panel with respect to which containment penetrations required detailed evaluations. It was concluded that the analysis assumptions in the IPE pertaining to important penetration valves was acceptable. The IPE determined, in general, that only a limited number of penetrations/valves were important to containment isolation failure and were required to be quantified. Many valves did not require quantification because their contribution to containment isolation failure probability is insignificant based on considerations such as locked closed-manual valves, valves used in ESF system, valves that are closed prior to an accident and remain closed, and valves in lines in high pressure, closed loop systems.

The ratio of total CIV to total LERF was used to determine conditional probabilities for LERF contributions from containment isolation failures. The cutsets were reviewed for each set of CIVs (penetration lines) to determine which would have the equivalent of a high FV with respect to LERF. Four lines were found to dominate the contribution of CIV to LERF. Based on the value of the contribution of these four lines, it was determined that any single line would have a FV LERF of about 5.0E-03 or a medium FV ranking. Using the IPE results for CIV, each component in each line was reviewed to determine if its contribution to the line was greater than 1% to the total cutset CIV and therefore when combined with the FV LERF measure calculated above, would remain above the high/medium-low cutoff. The remaining quantified valves and those valves not explicitly modeled in the IPE would be considered low in ranking. A similar method was used for SGTR and ISLOCA importance determinations.

For outage considerations, we do not believe there is an inconsistency. Outage risk ranking used a qualitative approach derived from the results of the internal events analysis. Rules were applied that assured a consistent approach. Hence, it is essentially consistent with other parts of the analysis.

For the qualitative seismic margins evaluation, two seismically qualified, redundant trains were defined for each success path. The evaluation of seismic risk was determined to be sufficiently low such that ranking calculations were unnecessary.

PRA-4

In terms of truncation limits used, page 4-36 of Enclosure 4 of the submittal stated that the IPE contains all cutsets above 1E-9. Some cutsets between 1E-8 and 1E-9 were recovered, the others were not. So that recovery actions are uniformly applied, only cutsets above a 1E-8 truncation limit were used in the IST submittal. By reviewing these cutsets and comparing those components that were ranked low but were just below the cutoff in the 1E-8 model with the basic events in the 1E-9 list, CPSES concluded that changing truncation limit from 1E-8 to 1E-9 will not change the ranking of the IST components. The staff has the following concerns regarding the approach. Please justify the adequacy of your approach with respect to the following:

a. The CPSES study of truncation limits consisted of a review of a list of events in the 1E-8 cutset equation versus the 1E-9 cutset equation. The staff concern here is that even though a component is not be to truncated, there may not be enough cutsets to fully represent the component. Therefore, F-V importances could be underestimated if there are many relevant cutsets that are truncated. (For example, with the IPE CDF at 5E-5, a truncation limit of 1E-8 and a F-V criteria of 1E-3, the truncation of as few as 5 cutsets could result in a component being ranked low as opposed to high.)

b. Preliminary sensitivity studies for other plants show that (with CDFs of around 1E-5), truncation limits on the order of 1E-11 or lower are needed to obtain "stable" results in terms of component ranking. These studies show that, because less than 20 percent of the cutsets are kept when truncation limits are increased by factors of ten (e.g., 1E-9 to 1E-8 or 1E-10 to 1E-9), there is usually an insufficient amount of cutsets/sequences at the 1E-8 truncation level to produce robust ranking results. Therefore, to show that CPSES results are not affected by truncation limits, sensitivity studies should be provided to show the CDF and the ranking order of components at truncation levels of 1E-10 and 1E-11. 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).

c. Based on a review of the tabulated results (Table 4.1-1 of Enclosure 4), there are 27 components that have F-V of 0.0 and 6 components that have a F-V of 1E-4. Supposedly, these events were modeled in the IPE and appeared in some core damage cutsets. Otherwise, they should have been assigned "n/a" under the F-V column. This needs to be clarified, because any event that appears in any core damage cutset should have a F-V of at least 1.75E-4 (with a total CDF of 5.7E-5 and a truncation value of 1E-8, the F-V of a cutset with frequency of 1E-8 should be 1.0E-8/5.7E-5 = 1.75E-4). It should be noted that considerations such as this could provide a basis for the determination of the truncation limit

needed based on total CDF and risk ranking criteria.

Based on the above, please justify why a lower truncation limit should not be utilized for ranking SSCs.

Response:

The "effective truncation limit" for the CPSES study is much less than 1E-8 due to the use of modules/supercomponents. Modules consist of a number of logically ORed components of a system, typically a pump and valves in the flow path and includes all the associated failure modes for each component. For example, module AFSEGA2 consists of the motor driven auxiliary feedwater pump (fails to start, fails to run, and train latent human error), pump suction and discharge valves (manual valve plugs and check valve fails to open on demand), and discharge flow element (plugs/ruptures). When these modules are expanded, cutsets as low as 1E-24 are found to be included. Thus, the staff concern is satisfied because functionally important, but highly reliable components, such as pump discharge check valves, are included in as many cutsets as the equivalent risk significant components such as the pump. Hence, the calculations presented in items a and c and the point raised in item b do not apply to the CPSES calculations. Further, the qualitative evaluation of the truncated components (see Section 4.2.1 of Engineering Report, Enclosure 4 to TXX-96371) indicates that these components are indeed insignificant based on cutset order (as well as practical engineering judgement). A component truncated because of both probability and order is insignificant.

B. Deterministic Considerations

The staff believes that a 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 importances 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, redundant means should exist for performing critical safety functions with components that are ranked high.

PRA-5

Maintaining defense-in-depth is mentioned in several places in the submittal, for example in the first paragraph of page 4 of Enclosure 1. However, we do not see evidence of how this is applied. Please provide details of how you met this objective.

Response:

See the response to Question E1-6.

PRA-6

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. This approach, or other alternative methods, should be used to demonstrate that defense-in-depth is maintained.

Response:

See the response to Question E1-6.

C. Expert Panel

PRA-7

The main objective of the expert panel (EP) was to ensure that the risk ranking is consistent with plant design and operating experience. The EP also reviewed rankings and their associated technical basis for IPEEE, outage risk, and LERF (including ISLOCA scenarios and containment isolation valves). For those SSCs not modeled in the IPE, the EP ranked them based on insights from other work.

a. Appendix A to Enclosure 4 is intended to document the Expert Panel Guidance document. This was not made available in the submittal. (Also, the top of page 3-9 of Enclosure 3 references a "Section 4" for the expert panel process. This appears to be an incorrect reference.) The staff will need to review the EP guidance document to verify that the EP process is well defined, systematic, scrutable, and reproducible.

b. If not already included in the EP guidance document, please define the process used to integrate PRA insights with deterministic considerations.

c. Again, if not already included in the EP guidance document, please clarify the following statements from page 4-64 of Enclosure 4:

- "determine, if practical that whether or not mitigating operator actions were included in the IPE." What does the EP do with this information?

- "validate or change the IPE-based ranking, as appropriate." Please describe the validation process and the rationale for changes.

Response:

a. The Expert Panel Guidance Document is provided as Attachment 6 to TXX-96371.

b. See Section 4.4, Expert Panel, page 4-62 of Engineering Report (Enclosure 4 to TXX-95260). Refer also to Attachment 4 to TXX-96371 for a discussion of the expert panel deliberation process.

c. During the expert panel process a few components (generally those with low FV and moderate RAW) were ranked low due to the IPE not modeling certain operator recovery

actions. These recovery actions were not modeled in the IPE since the cutsets involved were already insignificant contributors. The expert panel (which included both operations and PRA experts) concluded that if the recovery actions had been explicitly modeled, the importance measure would be reduced below the threshold value. On this basis, the expert panel could have lowered the IPE ranking if it were not high for some other consideration (e.g., fire or LERF).

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 latter case could cause a masking effect on the other plant components. Please describe how these concerns were addressed.

Response:

Overall, very few such changes to rankings were made by the expert panel considering IPE results. The EP lowered a ranking only as described in PRA-7. The EP raised a ranking generally when plant operating experience provided an indication that component failure rates might be underestimated by the PRA. In some cases, operating experience indicative of degradation rather than failure was used conservatively to raise a ranking, e.g., see basis for ranking for the Boric Acid and Containment Spray pumps. These types of changes were not so significant to the total results so as to lead to masking effects on other plant components.

D. SSC Ranking

PRA-9

When ranking for fires and tornados using IPEEE models (page 4-11 of Enclosure 4), what were the importance criteria used? What was the truncation value used for cutset equation and how many cutsets were in the concatenated equation? What was the CDF from fires and tornadoes and what percent was represented in the concatenated cutset equation?

Response:

The criteria used to rank the fire and tornado IPEEE models were the FV and RAW criteria used throughout the study. The importances of components due to fire and tornado were calculated based on the fire/tornado CDF rather than on the combined CDF of internal and external events. This is a conservative approach that increases the importance of a component due to fire/tornado considerations and was used to assure that no components were masked.

For fire, the truncation value used for cutset equation was 1E-10 and the number of cutsets in the concatenated equation was 9113. For tornado, the numbers were 1E-10 and 1220.

The CDF from fires was 2.05E-05 and from tornadoes 6.11E-06. This represents 99.66% of the CDF for fire (or 9113 of 14776 cutsets) and 99.98 % of the CDF (or 1220 of 1244 cutsets) for tornado represented in the concatenated cutset equation.

PRA-10

Seismic ranking: The CPSES IPEEE chose the reduced scope seismic margin evaluation to evaluate seismic vulnerabilities, therefore, no PRA models were available to determine seismic risk. The IST component ranking for seismic is based on qualitative arguments (pp. 4-12 through 4-15 of Enclosure 4). In the qualitative assessment, a LOSP and very small break LOCA, and main steam line break were assumed as initiators. The evaluation does not assume that anything else is failed by the earthquake. A comparison of initiator frequencies with those from the IPE and using the IPE CCDPs, the submittal summarized that seismic risk was not significant. Therefore, no components were added to the high category by the expert panel as a result of seismic considerations. In making these judgements, does the expert panel contain members that are familiar with the seismic qualification of plant SSCs, or are all insights from the above evaluation provided by the PRA/IPEEE engineer?

Response:

The membership of the expert panel included two members who took part in the CPSES seismic margin study. These individuals completed the industry training courses related to the seismic margin evaluation, developed the safe shutdown equipment list, and participated in the walkdown and evaluation of the safe shutdown equipment. Other members of the panel were familiar with the seismic design requirements of plant SSCs. The inputs provided to the expert panel regarding the seismic margin evaluation included a general overview of the evaluation. The evaluation, including the walkdown effort and the results, was based on the work of industry seismic experts and plant civil/structural engineers thoroughly familiar with the seismic design of CPSES. Thus, the expert panel did not have to make any evaluations as to seismic ruggedness of components, rather in the context of the design basis, to evaluate whether the results of the IPEEE as applied to the IST program were reasonable. The seismic margin evaluation concluded that there is no seismically vulnerable safe shutdown equipment. Given the very low seismicity of the plant, the general ruggedness of the plant design, and the general ruggedness of pumps, valves and piping systems, the expert panel concluded that the results of the seismic margin evaluation showed that no additions to the IST importance were necessitated by seismic IPEEE concerns.

PRA-11

Outage risk ranking: A qualitative assessment was done to determine the effect of shutdown modes on component ranking since CPSES does not currently have a shutdown PRA. The following are staff comments on this process:

a. The second paragraph on page 4-17 of Enclosure 4 states that "[o]utage risk evaluations indicate that the outage risk is lower than at power risk. Therefore, there should be no time period of increased risk that would cause an unimportant component at power to be important during an outage if the component performs the same function." Based on this, the CPSES approach to risk ranking for outage configurations assumes that "if a component performs the same function and is in the same initial state as at power, the at power ranking is assumed to bound the outage ranking." The staff agrees that the CDF during an outage is usually (but not always) lower than the at power risk; however, even with a lower CDF, the risk from shutdown operations could be high when compared to those at full power. For example, NUREG/CR-6144 Vol. 6 Part 1, shows that latent cancer risk from mid-loop operations alone (at Surry) is very similar to the risk for all operations at full power. The reason for this is that the containment is likely to be unisolated for a significant fraction of the accidents; therefore, the release to the environment is potentially large. Thus, using CDF alone in this case is not a good measure of risk. Note: A qualitative argument is presented on page 4-19 under "Containment Integrity" to state that the "causes of large early release for shutdown are bounded by the IPE." This argument depends on operator actions to isolate the containment. NUREG/CR-6144 shows that the HEP for this case is large and the HEP is the dominant cause of the large offsite dose risk. Please address these shutdown issues and re-rank the SSCs as necessary.

b. In addition to the above, during an outage, there is a greater likelihood that the redundant train of a system is not available because of maintenance, etc. Therefore, the importance ranking for full power operations might differ from that for outage operations even if the system function is the same. Please address.

c. Although there is no direct one-to-one correlation between the CPSES shutdown categories 1, 2 and 3 components to the high, medium, and low components, the rules used for risk ranking for shutdown (pp. 4-18 and 4-19 of Enclosure 4) appear reasonable when comments from (a) and (b) are taken into account. The staff has some concerns that some components that might be placed in category 2 might belong in category 1 if a more rigorous analysis was performed (for example, the check valves for which reverse flow can fail redundant trains); however, since CPSES is treating both categories 1 and 2 as being "high," this point is

currently not relevant. IS there a possibility of shutdown category 2 components being ranked as low risk significant in the future? If not, what is the advantage of having three categories?

Response

a. The condition indicated at Surry is not applicable at CPSES because procedures are in place to ensure containment isolation capability during reduced inventory operations. The integrated plant operating procedure contains a shiftly checklist which requires that the personnel and /or equipment hatch be capable of being closed prior to core boiling. Additionally, impaired containment penetrations are tracked by an administrative procedure and work packages are reviewed to verify that a means of quickly sealing a penetration is available at the work site prior to the commencement of work. These temporary seals must be capable of being installed prior to core boiling. Lines running through equipment hatches must have isolation and disconnect capability. For other plant conditions during shutdown, if decay heat removal is lost (e.g., loss of offsite power), the abnormal conditions procedure directs operators to perform a containment closure instruction.

b. The fact that the risk is lower however implies that when the redundant train is removed from service, other comparable means are available to protect the core, e.g., gravity drain of the RWST, or more certainty exists that in the functional train's reliability, i.e., it is operating rather than in standby.

c. Category 2 components are equivalent to low FV and high RAW. Hence, these components can be allowed to have extended surveillance intervals, but a compensatory measure must be established by the expert panel. It is for this difference from both categories 1 and 3 that this distinction is necessary. In addition, no check valves that could cause failure of redundant trains were identified as part of the shutdown evaluation and expert panel review.

PRA-12

Issues related to containment performance: Please address the following.

a. For LERF, please provide the CPSES definition for "Large" and "Early." When referring to the IPE submittal, are all the unisolated and bypass release categories (i.e., V sequence, SGTR and ISGTR, and isolation failures) as well as release categories I and III defined as large early releases? If not, please explain why not.

b. A sentence at the top of page 4-25 states that "... compensatory actions were required for large releases that were not classified as early ..." The staff agrees with the fact that all large releases have to be addressed, since many Level III studies have shown that population dose and latent cancer fatality risks can be dominated by late releases.

- Does this then include IPE release categories V, VII, and IX?
- What components were re-ranked as high because of this definition?
- What are the compensatory actions?

c. Containment spray system components (with the exception of the spray pumps) are ranked low because they are not risk significant in terms of LERF (Table 4.2-1). How significant of a role does containment spray play in long term containment heat removal and in condensation of steam buildup from CCI, i.e., are containment sprays important in terms of all large releases? Again, referring to the IPE, can the operation of containment spray result in the shifting of core damage sequences from the "rupture" to "leakage" categories (i.e., from the large to small release categories) or from the "early" to "late" categories?

d. Concerning SGTR isolation (page 4-27 of Enc. 4), the expert panel ranked as low many steam line isolation valves because of operator actions specified in EOPs that can isolate the leak path. Are the valves specified in the EOPs for isolation purposes ranked high? How much time is available for isolation? What is the HEP?

e. The submittal does not provide enough details on how components were ranked for I) ISLOCA, and ii) safety systems uniquely important to preventing high pressure core melt scenarios. Please provide additional details. Also, in terms of ISLOCA, how will the ISLOCA initiating event frequency be affected with the proposed extended frequencies for low ranked valves?

Response:

a. The definition used in this study is as follows:

A large, early release is a radioactive release from the containment that is both large and early. Large is defined as involving the rapid, unscrubbed release of airborne fission products to the environment. Early is defined as occurring before the effective implementation of the off-site emergency response and protective actions.

This definition is taken from the PSA Applications Guide, Appendix A.

SGTR releases that resulted from ECCS recirculation failure and stuck open secondary safety relief valves were classified as large but late releases. Emergency planning procedures would require early activation of the emergency planning actions such that the LERF definition criteria of "effective implementation of the offsite emergency response and protective actions" was judged to be applicable.

b. IPE release categories V, VII, and IX were not in the calculation which determined whether compensatory actions were required or not. The contribution of these categories is small, less than 1% of the CDF.

These components were not ranked high. The expert panel could extend intervals provided a compensatory measure was available.

The compensatory actions are the same type of actions considered elsewhere, e.g., components with low FV, high RAW.

c. The role of containment spray is reduced primarily because they are unavailable for the most likely core damage sequences, e.g., station blackout and ECCS recirculation failures.

Operation of containment spray does not result in the shifting of core damage sequences from the "rupture" to "leakage" categories or from the early to late. The probability of early containment failure caused by in-vessel steam explosion or high pressure melt ejection is not related to spray operation. Other than these catastrophic modes of containment structural failure, it is the structural response of the containment that affects the relative probability of the rupture and leakage failure modes.

d. The actions considered by the panel are specified in the EOPs. Because the scenarios are late core damage accidents, a significant amount of time, e.g., many hours, is available for isolation prior to core damage. HEPs were not required to be estimated because the long time available and the nature of the event indicated a low HEP was appropriate. Even a moderate HEP would not change the ranking of the valves. The timing for operator actions to isolate is scenario specific and range from greater than 30 minutes to less than 2 hours. The HEPs range from 1E-02 to 1E-03.

Valves 1-HV-2452-1 and 2 are ranked low. These IST valves are AOVs that fail open. Manual valves are used to isolate the required lines.

The steam generator ARVs are ranked high for fire/tornado.

The MSIVs are ranked low, but are Appendix J tested.

e. ISLOCA initiating event frequencies were explicitly part of the sensitivity calculation for increase in CDF and LERF. As stated earlier (see PRA-3), ISLOCA scenarios were explicit parts of the IPE model and the cutset lists. Because of the nature of how they were considered, importance measures had to be estimated by dis-aggregating component level results from event scenario importances.

Regarding high pressure core melt scenarios, it was noted in evaluating the LERF importance results that certain components were important that were not important in the internal events, other than ISLOCA and Containment Isolation. Upon examining these components in more detail, it was noted that they were part of functions related to preventing high pressure core damage scenarios. These scenarios were more important to LERF because the conditional probability for early containment failure was substantially higher than other core damage scenarios. The principal cause of this difference in early containment failure probability was direct containment heating.

PRA-13 Questions on the ranking results, Table 4-1 of Enclosure 3:

a. Questions on Table 4-1 of Enclosure 3:

- What is the basis used by the expert panel when they decreased the ranking for the EDG fuel oil transfer pumps to low (F-V=0.05, RAW=140)?

- Why is there "no change" for the Containment Spray pumps and its associated components when LERF is considered?

b. Questions on AFW system ranking:

- The turbine-driven pump (TDP) is ranked high. A single failure of the steam supply valve 1-HV-2452 will fail the TDP. Why isn't this valve also ranked high? Similarly, why aren't valves 1-HV-2452-1 and 1-HV-2452-2 ranked high?

- Each of the three AFW pumps can feed each of the four SGs via several redundant paths. Presumably, because of this redundancy, none of the valves in the AFW pump - SG flow path were ranked high. Was there any consideration given to rank some valves as high to assure at least one success path? Also, was there consideration given that the CCF of the valves could increase given increased IST frequency?

c. RHR system: It appears that valves 1-8890A and 1-8890B could result in a flow diversion that could fail system function (somewhat similar to that caused by valve 1-8717). Valve 1-8717 is ranked high, while the other two are ranked low. Why is this the case?

d. Questions on CVCS ranking:

- Valves 1-LCV-112B, 1-LCV-112C, and 1-8440 are in series. The first two are ranked high, while the last is ranked low. Why is this the case?

- IS there a redundant path for emergency boration other than through the low ranked valve 1-8104?

e. FW system: What is the basis for the expert panel in ranking valves 1-HV-2134/2135/2136/2137 high when there are many other low ranked valves in the system which might also fail and cause a loss of feedwater transient?

Response

a.1. The original importance was based on common cause failure of the 6.9kV busses which included failure of the busses due to common cause failure of the diesel fuel oil transfer pumps. In the initial round, all of the importance of the common cause was assigned to the pumps. This approach was thought to be very conservative, therefore some additional evaluations were performed. It was shown that the common cause failure of the diesel fuel oil transfer pumps was a small contributor to common cause failure of the 6.9 kV busses and therefore only a small fraction of the importance should be imputed to them. This resulted in the pumps being categorized as LSSCs.

a.2. See the response to question PRA-12.

The containment spray system has little effect on large, early releases. This is primarily because for the sequences that involve large, early release, the containment spray system is unavailable due to loss of its supporting SSCs.

b.1. In general, the IPE treated all equipment mounted on a skid as a single component for modeling purposes. This is based on the fact that failures of equipment mounted on the skid are assigned to the skid and not to the individual components. In the case of the TDAFW pump, the governor valves and the trip and throttle valve (1-HV-2452) are modeled as part of the pump. As a skid mounted component, the trip and throttle valve is tested with the pump.

Valves 1-HV-2452-1 and -2 are low for all considerations primarily because of redundancy.

b.2. We do not agree that ranking a component low implies that no success path is available. [See E1-6].

c. Valves 1-8890 A&B were determined to be an insufficient flow diversion path to threaten loss of function. These valves are 3/4" valves. Valve 1-8717 is an 8" valve and is ranked high for ISLOCA as a single failure point to the RWST.

d.1. The valves perform altogether different functions. Valves 1-LCV-112 B &C are required to close to satisfy ECCS interlocks whereas valve 1-8840 is not required for accident

mitigation, only for normal operation.

d.2. There are two additional paths. One is via the VCT to the normal charging path (CCP suction). The second is via manual valve 1CS-8439 to the CCP suction. Neither of these two paths were credited in the IPE.

e. These valves were ranked high for plant specific performance reasons.

E. Risk Metrics and Numerical Decision Criteria

PRA-14

Define LERF. Discuss how this is adequate to cover latent health risks (i.e., cancer) for CPSES.

Response:

The definition used in this study is as follows:

> A large, early release is a radioactive release from the containment that is both large and early. Early is defined as involving the rapid, unscrubbed release of airborne fission products to the environment. Early is defined as occurring before the effective implementation of the off-site emergency response and protective actions.

This definition is taken from the PSA Applications Guide, Appendix A.

This definition was not designed to specifically address latent health effects. Per the PSA Applications Guide, the combination of LERF and CDF measures are intended to work as follows:

> Large, early release fraction (LERF) is the preferred Level 2 PSA figure of merit. LERF represents a measure of the ability of the plant to prevent significant releases with the potential for early health impacts on the public (i.e., before protective actions can be taken). In combination, CDF and LERF address both prevention (CDF) and mitigation (LERF) and provide assurance that both early and long-term health effects are considered.

Latent health effects are typically dominated by two sources, frequent core damage accidents and infrequent large (but often early releases). Since at times large, late releases will dominate latent health effects, CDF and LERF are not guaranteed to provide the best risk measure for latent health effects. The CPSES project (for this and other reasons) considered it was prudent to be cautious about the influence of large late releases on risk ranking results. For this reason, compensatory actions were required for components that were important for this and only this reason. The nature of the issue and the uncertainty of the results were reviewed with the expert panel. Based on this discussion (and also in part because the panel felt that the SGTR scenarios causing the large late releases were conservatively modeled by the IPE), the panel concluded that compensatory actions and extended test intervals were adequate for these components.

PRA-15

A comparison of the CPSES decision criteria to trial criteria being considered by the staff is as follows:

Final Comanche Peak IST Criteria				
	FV < 0.001	FV ≥ 0.001	FV ≥ 0.005	FV ≥ 0.01
RAW ≥ 10	L*	H	H	H
RAW ≥ 5	L*	H	H	H
RAW ≥ 2	L*	H	H	H
RAW < 2	L	H	H	H

* Low with compensatory measures

Staff Trial Criteria				
	FV < 0.001	FV ≥ 0.001	FV ≥ 0.005	FV ≥ 0.01
RAW ≥ 10	H	H	H	H
RAW ≥ 5	M	H	H	H
RAW ≥ 2	M	H	H	H
RAW < 2	L	M	H	H

The above trial criteria are 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 from the tables above, the final CPSES criteria (i.e., treating all medium ranked valves as high) are very similar to the trial NRC criteria (if we assume that the NRC "medium" is equivalent to the CPSES "low with compensatory measures"). The only difference is in SSCs with F-V < 0.001 but RAW > 10. If we adopt the NRC criteria, the following four CPSES components will have to be added to the "high" category: 1-HV-4699, 1-HV-4700, 1CC-0061, and 1CC-0031 (by symmetry). Please justify the CPSES criteria, or justify why the above four valves should be ranked low.

Response:

These four valves were not initially ranked low. As valves with low FV but high RAW, the expert panel was required to establish adequate compensatory measures on each component. These measures are needed to prevent significant degradations in component reliability. In the case of these valves, large degradations in equipment reliability would be required for the component to be risk significant.

F. Sensitivity Studies (see E4-20 & 25)

PRA-16

Effect of initiating events on ranking: The submittal (Section 4.2.5) identified the component cooling water system, service water system, and safety chilled water system as being potentially important systems (with respect to IST) that contribute to both core damage mitigation and initiating event frequency. Fault trees were used to determine the initiating event frequency. The submittal then stated that the components that are important to core damage mitigation are also the same ones that are important as trip initiators. There was no requantification of the model with the initiators represented by fault trees (single basic events were used to represent the initiating events). In order to better understand the CPSES conclusion, please provide the staff with the fault tree models for each of these systems, both as initiating events and as core damage mitigating systems.

Response:

The initiating event fault tree models were used to understand the importance of component basic event contributions to initiators. The models were requantified for the sensitivity study to estimate the potential impact of increase test intervals on CDF and LERF. The fault trees are available for review.

PRA-17

As a follow-up question, how has the loss of MFW initiating event (which is a 8.8% contributor to CDF according to the IPE) been considered?

Response:

This evaluation concluded that those components of systems that are associated both with initiators and with significant mitigating functions are important for both, and have been adequately treated in the IPE importance rankings based on mitigation. These initiator systems are characterized by a high Conditional Core Damage Probability (CCDP). The other systems associated with initiators are generally not used for mitigation, such as the main feedwater system, have low CCDPs and have been appropriately ranked.

PRA-18

Effect of common cause failures (CCFs): In the IPE, the Multiple Greek Letter (MGL) parameters applied in the CCF analysis were obtained by the Bayesian updating technique: generic CCF data had been screened to determine Comanche Peak specific "prior parameter distributions" which were then updated with CCF events ("evidences") experienced at the plant. The process resulted in proper "posterior" MGL parameters. In the absence of plant specific events, the posterior MGL parameters are "prior dominated," i.e., strongly biased (usually downward) by the screening process. (The process seems to allow neglect of CCF events that have not yet occurred at the plant or were not identified.) The staff has concerns that the increase in IST frequencies might influence plant specific CCF events and therefore the IPE estimates of CCF probabilities.

For those components for which CCF contributions are not included in the PRA models and this exclusion is justified based on the historical and engineering evidence driven by current requirements, there would be no assurance that the CCF contribution will not become significant under the proposed exemption request. Therefore, sensitivity studies could identify those components which can shift to a high category as a result of uncertainties in CCF rates.

In discussing the results of the CCF sensitivity study, the IST exemption submittal included the effects on components where CCFs were already modeled. Did the importance of components where CCF was not modeled increase as a result of the removal of CCFs from all components? (i.e., did CCFs mask the importances of components that are not originally modeled with CCFs?) Also, were there components that were ranked low because CCF was not included in the PRA model. If so, the CCF models should be revisited to provide reasonable assurance that the assumption of no CCF is still valid with extended IST frequencies.

Response:

The screening process for selection of the CCF events applicable to CPSES did not eliminate any CCF events because they have not occurred at CPSES. Rather, those events that did not apply to CPSES plant specific design and configurations were screened out. In other words, any CCF event in the generic database that could physically occur at CPSES was included in the prior/posterior distributions regardless of whether or not it has actually occurred at CPSES.

It is important to point out that in many cases, the IST activities do not look for CCF events. That is, their impact on CCF contributions is negligible. Therefore, the influence of the IST program on CCFs should not be overestimated.

All important component types considered in the IPE have modeled common cause contributions. The common cause events that were found to be important or not important are based on the vulnerability of the plant design to specific common cause failures. Therefore, we would expect no component would shift into a high category unless there was a substantial change in CCF failure rates. If industry and CPSES experience indicates that such a change has occurred, the proposed update of the PRA would provide timely feedback of information on affected components.

The concern about specific contributors masking importance of components was addressed when those contributions might be significant. A review of the CPSES cutsets indicated that there are two potentially significant sources of masking effects. One such affect was the dominance of the top cutsets by human actions. A sensitivity study was performed to address this issue. The second source was the large number of cutsets with frequency between 1E-08 and 1E-09. This masking effect was addressed by the selection of the truncation at 1E-08 and the associated sensitivity studies referred to in Section 4 of the engineering report (Enclosure 4 to TXX-95260). No other sources of masking are considered to be significant, including CCF.

A question was raised as whether the importance of components where CCF was not modeled increased as a result of the removal of CCFs from all components. As mentioned in the submittal (Enclosure 4 to TXX-95260), a sensitivity study was performed where CCF contributions were all set to zero. The results demonstrated that, in general, the importance measure for many components became lower without the consideration of CCFs. However, a more detailed review of the results will be performed to determine whether the CCF contribution could mask the importance of non-CCF components. If so, appropriate adjustments will be made to the component importance measures. In addition, as suggested by the NRC staff, a review of the CCF models was done to confirm that the assumption of no CCF contributions for the rest of the component types not included in the CCF analysis is still valid with the extended IST test intervals.

PRA-19

Effect of recovery actions (component importance due to human errors): The concern in this area stems from situations where very high success probabilities are assigned to recovery actions in sequences, therefore resulting in related components being risk insignificant. Furthermore, it is not desirable that the ranking of SSCs be significantly impacted by recovery actions which are only modeled for limited scenarios. Therefore, SSCs should be re-ranked without recovery actions. The CPSES submittal indicated that risk ranking was not affected by the removal of recovery actions. Similar to a question raised earlier on the "quality" of the PRA, can you please discuss the effect of non-proceduralized recovery actions on ranking? Please also provide a list of SSCs that are affected by non-proceduralized HEPs, the HEPs used, and a justification for the HEPs.

Response:

A ranking with and without human actions (divided into recovery and dynamic actions) was done as part of the Risk-Based IST Program to determine if the results were overly or uniquely sensitive to human error values. This was done with the following cases being run:

- case 1 - set both recovery actions and dynamic actions to 1
- case 2 - set recovery actions only to 1
- case 3 - set dynamic actions only to 1

For this evaluation, a dynamic action was defined as an operator action performed in the ordinary course of controlling a system; a recovery was defined as an operator action performed to restore failed equipment or functions. Component importance measures for each of the cases were developed and the resulting values compared to the values determined previously, i.e., including recoveries.

The results indicate that there is no increase in risk ranking category compared to the IPE/IST risk rankings. In other words, human recovery/dynamic actions did not mask the importance of any IST components.

HEPs that are not proceduralized were not applied in the IPE. These considerations are part of the methodology but were not used in the implementation.

PRA-20

Multiple component importance: In risk ranking, the SSCs are binned based on single event importances. For those components assigned in the low category, one needs to have reasonable assurance that the aggregate impact of multiple components is negligible. The multiple component importance measure should identify which combination of SSCs might be risk significant, therefore requiring them to be shifted to a higher category.

The CPSES submittal calculated the RAW of components taken two at a time, and identified two components that had low RAW individually and high RAW when combined with other events. These 2 components were ranked as if their individual RAW was high. F-V rankings were not affected.

a. In general, multiple component cutsets (containing three or more events) are lower in frequency. Therefore, it would be reasonable to expect more multiple component combinations when using lower truncation values. When comparing the 1E-9 cutset list to the 1E-8 list for CPSES, how many more multiple component cutsets (ranked low) are identified? (i.e., does the 1E-8 equation contain sufficient combinations to this study to be effective?) (See PRA-4)

b. How did the submittal treat super-components that might contain low ranked components in their search for low ranked SSC combinations?

Response:

a. See PRA-4

b. There were few IST components contained in supercomponents, specifically diesel generator related components, e.g., lube oil pumps and valves. The study did not treat combinations of components involving supercomponents. Each of the above components was either ranked high or provided with a compensatory measure. Since combinations were treated with compensatory measures, there was no need to evaluate these components.

PRA-21

Ranking from dynamic plant configurations: The submittal did not evaluate the effects of the different plant configurations on component ranking. 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. This issue should be addressed.

Response:

See the response to Question E4-11.

PRA-22

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 (as was done by CPSES for issues like CCF, recovery factors, initiating events, etc.). 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 component should be ranked in the higher category to account for the uncertainty distribution.

Response:

The ranking methodology used for CPSES implicitly treats the type of uncertainty described in the statement, e.g., reliability of check valves. For the reliability of a check valve to be important (when its mean FV is not), the check valve would also have to have a high RAW. Components with a high RAW are required to be evaluated by the expert panel for an adequate compensatory measure. The compensatory measure ensures that measurable impacts of the uncertainty, namely a change in component reliability, will be adequately detected and evaluated by the IST program. A more detailed discussion of uncertainties, decision criteria thresholds and sensitivity studies is provided in Attachment 2 to TXX-96371. See also the response to Question E4-20c.

G. Verification and Validation Cases

PRA-23

A calculation was performed to determine the increase in CDF due to the increase in failure probabilities of LSSCs. Two cases were considered: one assumes that compensatory measures (assumed to be as effective as the IST program) were applied to LSSCs with high RAW values, and the other assuming no compensatory measures. In the first case, CDF increased by 75%, given a factor of 100 increase in the failure probabilities of LSSCs. In the second case, the increase is 25%.

a. The above results appear to be an underestimation of the risk impact from all components in the low or non risk category, as compared with a simple lower-bound estimate of the increase in CDF using the component F-V importance. There are approximately 50 IPE components in the low risk category. They have a total F-V of approximately 1.67E-2, obtained by simply summing the FVs of the components. Summation is done based on the assumption that these components do not appear in the same core damage cutset. This assumption leads to a lower bound estimate of the resulting increase in CDF, because if the components appear in the same cutset, the increase in CDF would be higher. Considering the case that the failure probabilities of the low risk components

Response:

a. There are approximately 80 modeled components with a total FV of approximately 1.69E-02 if only the IPE ranking is considered. When this list is reduced to account for the components that are important for other reasons, e.g., fire, the number of components drops to about 50 modeled components with a total FV of approximately 8.26E-03. With this approximate total FV, the total change of 75% for a factor of 100 in a sensitivity study seems reasonable.

PRA-24

In the 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 a hundred, it is very hard to postulate that the failure rate would stay constant. [Data that is available is 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 that increase by factors of up to 100 does not appear appropriate]. 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.

Finally, the submittal pointed out that the risk increase starts to become non-linear when component unavailabilities are increased by factors of 40 or more. With the proposed IST frequency increase from 3 months to 6 years for many components, the increase in the failure rate is assumed to be 24 (6 x 12 / 3 = 24). Therefore, even if you are off by a factor of two in your assumption of failure rates because of lambda being non-linear, (i.e., if failure rates for IST frequency increase from 3 months to 6 years is 48 instead of 24), we are into the non-linear zone for risk increases.

Keeping the above discussion in mind, please justify the assumption on linear failure rates, and your proposed test interval.

Response:

Constant Failure Rate Issue

In the sensitivity study to determine the cumulative impact of test interval changes on total CDF, the failure rate was not assumed to be constant. In fact, failure on demand and failure rate were both assumed to increase.

The component unavailability equations are as follows:

$Q_1 = \lambda_{OD} + \lambda\ (t)$ for active components required to change state

$Q_2 = \lambda\ (t + T/2)$ for passive components required to stay as is

Where: $Q_1 =$ total component unavailability due to hardware failure
$\lambda_{OD} =$ component unavailability on demand

λ = component failure rate (hr^{-1})

t = mission time (i.e., 24 hrs.)

T = time between any test that verifies operability of the component

The total component unavailability was assumed to increase by the same factor as the increase in the test interval. For example, a change in the test interval from quarterly to annually would increase the total component unavailability by a factor of 4 in both equations Q_1 and Q_2. This assumes that both the failure on demand (λ_{OD}) and the failure rate (λ) would increase by the same factor of 4. In other words, equations Q_1 and Q_2 would both be multiplied by a factor of 4 for all LSSCs. Then, the new CDF and LERF would be calculated with new increased LSSC unavailabilities to obtain the cumulative impact of changes in IST intervals on total plant risk. This assumption that the increase in component failure on demand and the component failure rate are both directly proportional to the change in their test interval is conservative since, in reality, it will never be the case.

It should be pointed out that in cases presented by equation Q_2, the term (T/2) in baseline PRA does not usually represent the IST test interval, but rather other surveillances that are required by other programs such as Technical Specifications. Despite the other tests and actual value of the term T/2, the failure rate λ in equation Q_2 was always multiplied in the sensitivity study by a factor equal to the IST-related test interval increase. This was, again, based on the assumption that the component failure rate change would be proportional to the IST test interval increase. Therefore, the failure rate, in most cases, was not kept constant except when the only operability test was the IST test.

Non-linear Failure Rate Issue

In the case of non-linear failure rates, the following was considered. First, evidence suggests that frequent testing or other preventative maintenance activities increases component unavailability and/or failure rates. Further, this evidence tends to show that "too frequent testing" is a much stronger influence on components than " too infrequent testing". These observations imply that it is conservative to extend intervals when uncertainty exists.

Unfortunately, in performing this study, it was felt that no definitive data is available for inclusion in the calculation. The sensitivity study does not consider an initial improvement in components performance followed at some point by a degradation.

Second, the comments in Question PRA-24 do not fully reflect what evidence does exist. It is important to consider that for the majority of the factor increase in test intervals, data does exist. Check valves make up the largest number of low risk components modeled in the IPE. For them,

it appears from the limited information available that over the initial portion of the test interval increase, namely from a quarterly to an 18 month interval, there appears to be no substantial change in component performance. Possibly, there is an improvement in performance. The paucity of data that concerns the staff is more representative of the 18 month to 6 year portion of the change.

It was considered unlikely that for an increase in test interval of a factor of 6, failure rates might slightly improve and then for an increase of a subsequent factor of 4, they would substantially degrade. Even if the failure rates increased non-linearly, compensatory actions on LSSCs would be expected to identify the change. More importantly, the risk improvement expected would more than compensate for any possible changes.

External events

While no explicit calculation was performed, the study concluded based on the findings of the internal events analysis that an increase in risk would be unlikely. The nature of the approach to external event risk is such that similar insights from a sensitivity calculation would be obtained, making such a calculation unnecessary.

PRA-25

Since ranking was done within each PRA model and does not account directly for IPEEE and shutdown risk, the calculated V&V increase is only based on internal events results. How will the V&V results and conclusions be affected if external events and shutdown risk were included?

Response:

See PRA-24 response

PRA-26

Does the V&V include the increase in initiating event frequencies from the loss of the CCW, SWS and SCWS support systems? Increased unavailabilities from components ranked as LSSC in these systems could affect the initiating event frequencies.

Response:

Yes, the evaluation include the increase in initiating event frequencies from the loss of the CCW, SSW and CHS support systems. It also considered the effects of the increase on ISLOCA. See Section 4.2.2 of the engineering report (Enclosure 4 to TXX-95260).

COMANCHE PEAK STEAM ELECTRIC STATION

Evaluation of Dr. W. E. Vesely's Reservations with ASME Risk-Based IST Guidelines

and

Their Impact on CPSES IST Study

May, 1996

Evaluation Of Dr. W. E. Vesely's Reservations With ASME Risk-Based IST Guidelines And Their Impact On CPSES RBIST Study

Dr. W. E. Vesely of SAIC, in a memorandum to Mr. Mark Cunningham of NRC dated April 17, 1996, expressed reservations about the way the Fussell-Vesely importance measure is being used in the ASME guidelines for risk-based Inservice Inspections (ISI) and risk-based Inservice Testing (IST). In his paper entitled "Reservations With ASME Risk-Based Inservice Inspection and Testing - An Outlook to the Future", dated April 23, 1996, he expanded this view.

The purpose of this paper is to carefully review Dr. Vesely's paper in order to:

- Better understand his reservations with the ASME risk-based IST approach;
- Highlight the main points of his paper; and
- Determine the impact of his objective observations of FV importance measure used in the ASME guidelines on the CPSES risk-based IST study.

In general, Dr. Vesely believes that the way the FV importance is used in the ASME paper can produce erroneous results and will not necessarily preserve the defense-in-depth approach.

His main points of concern and their relevance to the CPSES risk-based IST study are presented below. In summary, all his comments and reservations were reviewed and determined to be adequately addressed in the CPSES risk-based IST study.

- Issue #1: The FV importance is not a measure of risk coverage that can be used to assure that all the dominant risk contributors are included. For example, defining risk significant components to be greater than 0.001 does not assure that 99.9% of the dominant contributors are covered. All components could have FV importance values that are less than 0.001. This can occur when each minimal cutset has a small contribution and all components are equally distributed among the minimal cutsets. The fact that all components have small FV importance does not mean that nothing is important. It only means that there are no outlying components that have an abnormally high risk contribution.

Impact On CPSES Study:

This issue has been adequately addressed in the CPSES risk-based IST study through various sensitivity studies and the use of a thorough technical approach.

It should be pointed out that if risk is uniformly distributed among all plant components with FV importances of less than 0.001, all components will have small contributions to total plant risk. Therefore, all components should be considered as "small contributors" and not "significant" or "dominant contributors" as referred to by Dr. Vesely. Furthermore, this hypothetical example is a highly ideal case. All published IPEs in the industry and the actual performance of operating plants have shown that risk contributions of various plant components vary noticeably and, therefore, contain different FV importance values. In fact, a practically designed and operated plant cannot have such results. Such a plant would have to have numerous and redundant trains for every function, made up of components with similar reliabilities for each failure mode. This academic outcome is not worth considering.

In the CPSES Risk-Based IST Program, it was never attempted to claim that the FV importance measure is a complete measure of risk coverage nor was it needed. Although the IPE results for CPSES demonstrated that there are no severe accident vulnerabilities, some variations in risk contributions from various components were observed. That is , the FV and RAW importance measures, which were both used in the CPSES risk-based IST study, contain a wide range of values. For example, FV importance values ranged from truncated (e.g., less than 1.0E-5) to as high as 0.24 for turbine-driven AWF Pump.

In the CPSES study, the RAW importance measure was utilized to ensure that other potential dominant risk contributors are included that would otherwise be masked due to their high reliability and low CDF of the cutsets containing the components. The RAW measure distinguishes among components ranked low due to high reliability and those ranked low due to additional redundancies.

In addition, as described in the following pages, CPSES currently has other programs such as the Maintenance Rule, preventive maintenance, root cause analysis and component reliability/performance monitoring programs to ensure that plant and component performance are maintained at a level consistent with the established goals. Any deterioration in the performance of IST components is, therefore, expected to be identified through these programs and the feedback process of the risk based IST program. If the

performance deterioration is due to the revised IST test frequencies, then appropriate changes to the test frequencies will be made to correct the performance problem. The RAW measure provides additional focus to the components most important to monitor.

The sensitivity studies and other completeness issues included in the CPSES risk-based IST study are discussed in the following pages as part of the responses to other issues.

- Issue #2: The FV importance utilizations as defined in the ASME paper have additional deficiencies and sensitivities that can lead to erroneous conclusions. The sensitivities arise because the FV importance of a component depends on the assessed contributions of other components and other basics events in the PRA. If one or more of these other contributors are conservatively evaluated and are not in the minimal cutsets containing the component, then the FV importance of the given component will be underestimated. One also has to pay attention to nonconservatisms in the minimal cutsets that contain the component, which will also cause underestimation of the FV importance values. These conservatisms do occur in PRAs and can be large, especially for CCF and human error assessments.

  Impact On CPSES Study:

  This issue has been adequately addressed in the CPSES risk-based IST study through various sensitivity studies and the use of a thorough technical approach.

  In general, IPE studies have limitations and assumptions that could impact the final results. As long as these limitations and assumptions are well understood and properly accounted for, risk-based applications can greatly benefit from the IPE insights. If all different elements of the IPE studies are not accurately estimated to the best of TU Electric's knowledge, then other contributors to risk could be either underestimated or overestimated, both of which could produce undesirable or misleading results.

  The CPSES study indicated that the most vulnerable areas are Common Cause Failure (CCF) analysis and Human Reliability Analysis (HRA), both of which are usually treated and quantified differently in the IPE studies.

  The CPSES IPE study was reviewed to determine whether or not biases in the study could change the ranking results. It has been well established in the literature that dominating sequences or cutsets could "mask" the importance of some components. NEI's training for

the risk ranking portion of the Maintenance Rule covers this topic and was used to assist the evaluation. A review of the accident sequence results indicated that most sequence types at CPSES are represented in the top cutsets. The cutsets also indicate, however, that a significant number of top cutsets include dynamic human errors. Hence, it was concluded that the sensitivity of the ranking to human errors, especially dynamic human errors, should be evaluated. That sensitivity study is described below.

Regarding the impact of other potential masking effects, the selection of a natural break point in the results tends to compensate for biases, especially when the core damage contributors are evenly distributed as they tend to be at CPSES. The expert panel selected a break point in the results based originally on the IPE-based results. The panel found that when a few components with both FV and RAW importances near the threshold (~0.0009 and ~1.94 respectively) were moved to the more safety significant componeent (MSSC) category, the results were more naturally grouped.

After completion of the ranking and in response to questions from the NRC staff, the natural break point was again reviewed for the final results, i.e., after fire, outage, and LERF contributors were evaluated and sensitivity studies were performed. The expert panel set the cutoff at 0.0009. The next highest FV importance in the final results is about 0.0005, nearly a factor of two lower. This would imply that a bias of a factor of two would be required to numerically change the ranking results. However, the highest FV importance without a compensatory action assigned is 0.00025, nearly a factor of four lower. In conclusion, we should be concerned primarily about biases of a factor of four.

The potential for bias in the results can be indicated by the FV importances of the top contributors. The significant contributors are presented in the following table.

Significant Contributor	Approximate Percentage Contribution
Operator Actions	90
Assumed Probability of Various Pump Failures After Loss of Room Cooling	50
Diesel Generator	35
Assumed Probability of A Large RCP Seal LOCA	30
Sum of All Significant CCFs	20
Battery Depletion Occurs At 4 Hrs	20
Service Water Mechanical	15
AFW Turbine Driven Pump	15
Rods Fail to Insert - Mechanical and Electrical	10
AFW Motor Driven Pump	10
ECCS Pump Failure After Loss of Lube Oil Cooling	10

Significant contributors include contributions from basic events with FV importances greater than 1%, but whose total is less than 10%. The approximate contribution is represented by a sum of the FV importances.

As indicated by the table, only human reliability appears to be a contributor with the potential to be "conservatively evaluated" such that it would mask a component enough to move it from below to above the numerical threshold.

TU Electric's evaluation of the CPSES results indicated that a possibly more important area of bias in a risk ranking study is not explicitly addressed by Dr. Vesely's comments. This bias can result when basic events are combined to form a total importance measure for the component. That is, the importance of various failure modes is "summed" to obtain the importance of the component. In this process, the analyst must decide, for example, whether the importance of a CCF failure mode for that component should be added to the importance

of other failure modes. If it should be added, the analyst must determine what fraction of it to add. Often, it was noticed that CCF was the most significant contribution to a component's total FV importance. In particular, many of those components with FV importances between 0.001 and 0.005 had FVs greater than 0.001 solely because of CCF. A sensitivity study was performed and is described below.

In the risk-based IST study for CPSES, the CCF and HRA treatments in the IPE study were carefully reviewed to ensure that the sensitivity of the component importance measures to these treatments were identified, and the final risk importance results made sense. This was done by performing various sensitivity analyses. A total of four sensitivity cases were analyzed. Two of them on CCF, one with no CCF contribution assigned to the component and the other with the full CCF contribution assigned to the component. The other two sensitivity cases assumed perfect required dynamic human actions or guaranteed human failure (i.e., HRA failure probabilities for dynamic human actions and recovery actions were all set to zero and one). Then, for each of the four cases, component risk importances were recalculated, and both FV and RAW importance measures were obtained. The results of the sensitivity runs were reviewed and compared with the base case results. Consequently, the final components risk rankings were adjusted as appropriate to account for the effects of the CCF and HRA contributions on individual IPE components. While no change in risk ranking was observed due to the HRA sensitivity study, the CCF sensitivity study resulted in the inclusion of approximately 20 components in the final list of MSSCs.

- Issue #3: Grouping the FV importance values as described in the ASME paper is not a sufficient way to address the sensitivities since large enough shifts can occur in the FV importance values to change the group. Using other risk importance measures such as RAW to supplement the FV importance is also not an assured way to cover these sensitivities since other importance measures evaluate different risk effects.

Impact on CPSES Study:

This issue has been adequately addressed in the CPSES risk-based IST study through various sensitivity studies, deterministic evaluations and the use of a thorough technical approach.

This issue is somewhat related to the previous issue. Again, the most important point to remember when using the IPE results and insights for other applications is to fully understand the entire IPE study and its associated assumptions and limitations. One cannot and should not make a decision based solely on quantitative criteria derived from the IPE results. First of all, no matter how accurate and consistent the IPE numerical insights are, one has to review the component risk importance measures to ensure that the results make sense with respect to common engineering practices and other deterministic insights. Secondly, the available risk importance techniques, such as FV and RAW, should be well understood so that the results derived from these techniques are properly utilized. In addition, adequate sensitivity studies should be conducted to compensate for the limitations and weaknesses of these tools. Finally, the overall results need to be reviewed and validated by a group of people who are experts in various areas of a nuclear power plant.

The CPSES risk-based IST study included all these important factors. The FV importance measure was utilized along with the RAW importance measure to ensure that the strength of each method would complement the weakness of the other one. The RAW importance measure provided a good sensitivity study for those components that were highly reliable (i.e., low F-V) but, if failed, would have significant consequences. Since this method would only assume one component failing at a time, other sensitivity studies were conducted to evaluate the impact of more than one component failing simultaneously. In the CPSES study, inter-system dependency and intra-system dependency were addressed through a number of sensitivity studies. The intra-system dependencies were addressed by setting the CCF terms within a given system to 1.0 and recalculating the system risk rankings. The inter-system dependencies were addressed by setting the failure probabilities of two components and three components to 1.0 simultaneously. For two-component failures, many combinations were selected and evaluated, to some degree, by the computer. For three-

component failures, a selected number of combinations were analyzed based on a review of the final CDF cutsets and their contributions to total CDF. As mentioned earlier, other sensitivity studies were conducted to address uncertainties associated with CCF and HRA values. Other issues were also considered and analyzed for completeness which would not otherwise be included if CDF was the only end-state of interest. The final results and risk categories for each component were reviewed in detail by the expert panel for validation and any necessary adjustments.

Finally, additional sensitivity studies were performed to estimate the cumulative impact of test interval changes on total plant risk. The cumulative impact evaluation and the above-mentioned sensitivity studies, taken together, ensured that the dominant contributors were sufficiently considered in the risk-based IST study.

In conclusion, it is apparent that the grouping of the IST components requires a series of considerations. It may start with initial criteria based on some numerical criteria using FV and RAW importance values. However, other considerations such as sensitivity studies and deterministic evaluations need to be added to the process to ensure that the final results and grouping of the IST components based on their risk significance are meaningful and consistent. This is exactly what was done in the CPSES risk-based IST study.

- Issue # 4: The criteria in the ASME paper do not preserve the defense-in-depth approach to safety as practiced by the NRC. The defense-in-depth approach to safety requires that multiple lines of defense, involving different components and protections, fail before significant consequences can occur. In using the FV importance to categorize risk contributors, as defined in the ASME paper, components that provide defense-in-depth protection against accidents can be classified as being unimportant. For example, a motor-operated valve that is important for defense-in-depth can be declared to be unimportant because an unrelated human error probability in the same minimal cutset is assessed to be small.

Impact on CPSES Study:

The defense-in-depth philosophy was always followed in the CPSES Risk-Based IST Program. Adequate defense-in-depth capabilities were always maintained for accident mitigation.

The defense-in-depth concept has been interpreted differently in the industry. The traditional defense-in-depth concept as used in the FSAR is to maintain multiple barriers that restrict or limit the transport of radioactive material from the nuclear fuel to the public. These barriers are:

- Fuel pellet matrix
- Clad
- Reactor Coolant System
- Containment building

The IPEs mainly analyze the integrity of all these barriers, although the first two tend to be implicitly modeled and the last two explicitly modeled. Core damage frequency (CDF) is a measure of the first three barriers. When core damage occurs (as defined and assumed in IPEs), the fuel pellet matrix and clad integrity quickly fail, within generally an hour following the RCS failure. The containment building integrity is measured in terms of large, early releases frequency (LERF). As long as these two parameters (i.e., CDF and LERF) are maintained at reasonably low frequencies, then it should be concluded that these two barriers are most likely capable of performing their functions, when needed. This, in turn, means that the defense-in-depth capabilities are well controlled and maintained.

In the CPSES Risk-Based IST Program, the defense-in-depth philosophy was always followed. The robust process used in the CPSES IST study ensured that changes to the current IST program would not have any significant impact on CDF and LERF. This was

accomplished as summarized below:

<u>CDF:</u>

As described earlier, CPSES used FV and RAW importance measures to initially prioritize the IST components based on their risk significance. Since these two importance measures may have some limitations, various sensitivity studies were conducted along with other considerations to ensure the completeness of the approach. Furthermore, a study was performed to evaluate the cumulative impact of requested changes to the current IST program on total CDF. The results of this sensitivity study for CPSES demonstrated that modifying the test frequencies of the IST components in the less safety significance category to every 6 years is reasonable and, at worst, would result in an insignificant and acceptable increase in total CDF.

When a nuclear plant has an acceptable CDF, it means that plant components are reliable and/or there are enough redundant equipment available to perform the required accident mitigating function, when needed. However, the redundancy could be at the component level, train level, system level, or function level. For example, at the function level, if both trains of Service Water (SW) system fail, the ultimate heat sink will be lost. All components necessary to provide this SW function are included in the MSSC category. For other functions with more redundancy, less components are included in the MSSC category but an equal or greater measure of safety is maintained. Therefore, the CPSES ranking results demonstrate that, in effect, defense-in-depth is inherently assured. Again, if the risk importance values of the IST components have been properly evaluated, and sufficient sensitivity studies have been performed, and their cumulative impact on total CDF has been calculated to be low, and the resulting CDF is still low, then it is obvious that there are still adequate redundancies at different levels available to mitigate the consequences of a severe accident. This, in turn, leads to the fact that the "defense-in-depth" capabilities are adequately maintained even with all the proposed changes to the test intervals of the LSSCs.

In addition, testing and maintenance strategies that assure the reliability of components will still be maintained with the proposed Risk-Based IST Program.

LERF:

The same risk importance approach used for CDF was applied to LERF. Similar sensitivity studies were conducted to compensate for the limitations of FV and RAW importance measure techniques. In addition, in order to ensure that the containment integrity is always maintained, the following issues were also considered in the study:

- Containment isolation features that may not directly impact the value of LERF.
- Interfacing systems LOCA (i.e., V sequence) that provides a direct release path to the outside containment.

Furthermore, similar to the CDF impact evaluation, another study was performed to evaluate the cumulative impact of the requested changes to the current IST program on total LERF. The results of this study for CPSES demonstrated that modifying the test frequencies of the IST components in the less safety significance category to every 6 years is reasonable, and at worst, would result in an insignificant and acceptable increase in total LERF. Again, when total LERF is low, it means that containment safeguards features are reliable and/or there are enough redundant components available to perform similar function, when required. This leads to the fact that the "defense-in-depth" capabilities are adequately maintained with the proposed changes to the test intervals of the LSSCs.

- Issue # 5: How one calculated the failure probabilities of components can have significant impact on what the FV importance values will be for the components. The ASME paper states that the component failure probability should initially be determined assuming no

Inservice Inspection (ISI) is performed in order to maintain the validity of the risk importance measures. This is an applicable approach; however, the failure probabilities (unavailabilities) will then depend on the age of the Plant, even if constant failure rates are assumed. The ASME paper does not address this plant age consideration which can cause large variations in the failure probabilities when plants are categorized according to their age.

Impact on CPSES Study:

This issue has no impact on risk-based IST study for CPSES.

In PRAs, the component failure probability is usually assumed to be constant. This is based on the assumption that the changes in failure probabilities of the nuclear power plant components with time follow the bath-tub curve. That is, the failure probabilities are constant for the majority of the plant life before they start deteriorating due to aging. This is a reasonable assumption for the PRA studies considering the difficulties associated with time-dependent failure calculations and the uncertainty associated with the actual behavior of a piece of equipment over a long period of time (e.g., 40 years). However, for a specific risk-based application, adequate sensitivity studies should be performed to ensure that the potential aging effect is reasonably accounted for if deemed necessary.

For the CPSES Risk-Based IST Program, the aging effect has been carefully considered. However, no major evaluation was judged to be necessary due to the following reasons:

- CPSES Unit 1 has less than seven years of operation and Unit 2 has been operating for less than 4 years. Therefore, even if different failure probabilities were to be used, the lower bound of the age-dependent failure probability distribution would be applicable to CPSES.

- In general, the concern of aging effect is not as important to the Risk-Based

IST Program as it might be to other risk-based applications. This is due to the fact that one of the major elements of the Risk-Based IST Program is the performance feedback concept. That is, if any changes to the IST program lead to a gradual equipment degradation and performance problem, the problem will be quickly identified through root cause analysis and the corrective action program. In other words, the performance problem will not remain undetected. The Risk-Based IST Program is a dynamic process that requires periodic updates and necessary modification to correct any performance problems due to either aging or any other plant-specific operating practices. Therefore, even if no considerations were given to the aging of the plant in determining the risk importance of the components, the program itself would identify any potential age-related performance degradation.

- The CPSES Risk-Based IST Program recommends that the test intervals of the IST components in the low risk significance category to be extended to once every 6 years. A study was done by Dr. Vesely to show the unavailability changes for check valves versus IST intervals for various valve aging rates. The results collectively showed that, up to approximately a 10 year test interval, the unavailabilities stayed at or below the component unavailability at the test interval of once per quarter. This study seems to well support the test interval of 6 years for check valves.

- A review of the generic reliability database documented in NUREG/CR-2815 was performed to examine the mean time between failures (MTBF) for various IST components. In general, the majority of valve types were found to have a MTBF of greater than 10 years with the exception of safety valves. For example, the failure rate of motor-operated valves is 1.0E-5 per hour which corresponds to a MTBF of 11 years. Although there is some

uncertainty associated with component failure rates and MTBFs, it is a good practice, as a sanity check, to review the proposed test interval extensions for the IST components and compare them against their corresponding MTBFs.

Review of the CPSES IPE for Applicability to Risk-Based IST

1. Purpose

The purpose of this document is to provide the results of the review of the CPSES IPE for the Risk-Based IST application. Part 1 of this document describes the review done considering the questions posed in various sections of the PSA Applications Guide. Part 2 describes the review considering the questions of Appendix B of the PSA Applications Guide.

2. Part 1- Evaluation Considering Sections 2, 3, and 4 of the PSA Applications Guide

This part provides in a tabular format (see Tables 1 and 2) the results of the evaluation of the CPSES IPE for use in the Risk-Based IST program using the questions provided in the sections 2, 3 and 4 of the PSA Applications Guide. To do this evaluation, the specific questions identified in the PSA Applications Guide were answered based on a review of the CPSES IPE and the IST program considerations. These questions included problem definition, scope, figures of merit, analysis, decision criteria, initiating events, success criteria, event trees, system reliability models, parameter databases, dependent failure analysis, human reliability analysis, quantification, analysis of results, plant damage state classification, containment analysis, external events PSA hazards analysis, and shutdown PSA considerations. The results of this evaluation show that the CPSES IPE is appropriate for use in the CPSES Risk-Based IST program.

3. Part 2- Evaluation Considering Appendix B of the PSA Applications Guide

This part describes the results of the review of the CPSES IPE against Appendix B of the PSA Applications Guide. This appendix entitled, "Checklist for Technical Consistency in a PSA Model", discusses several issues that have been found in various PSAs to be significant in determining the risk profile. This checklist was used to demonstrate that the CPSES IPE conforms to the state-of-the-art with regard to completeness of coverage of PSA/PRA methodology. The results of his review are presented in the sections that follow.

Quality and Technical Adequacy of CPSES IPE

In general, the IPE study for CPSES fully satisfies the requirements of a full-scope Level-I and Level-II PRA. One of the main objectives of the IPE development was to be able to utilize its results and insights toward the enhancement of plant safety through risk-based applications. With this objective in mind, the IPE elements were developed in detail and integrated in a manner sufficient to satisfy both the NRC Generic Letter 88-20 requirements and support future plant applications. The CPSES IPE study was performed by developing large fault trees and small event trees. The large fault trees were then linked together according to the event tree logics for quantifying accident sequences. The major elements of the IPE study were developed and reviewed in a manner consistent with and in excess of the good practices of the time. In general, it is believed that the CPSES IPE meets or exceeds the quality standards subsequently suggested by the EPRI PSA Applications Guide. These major elements are briefly described below.

Initiating Event Analysis

A detailed review of plant equipment and operating procedures was performed to identify all the potential plant-specific initiating events as well as those initiating events that were identified in the industry. The loss of support system initiators such as service water, component cooling water, safety chilled water, HVAC, instrument air, electrical power subsystems were also identified and evaluated in the IPE study. In addition, other special initiators including interfacing systems LOCA, SGTR, ATWS, internal flooding and station blackout were analyzed in detail and documented in the IPE.

Accident Sequence Analysis

A detailed accident sequence analysis was performed and resulted in the development of functional event trees for all the initiating events identified in the IPE study. This also included induced LOCA initiating events such as stuck open primary side safety valves, stuck open PORVs, and most importantly, reactor coolant pump seal LOCA.

The accident sequences were quantified using the fault tree linking methodology. The common concern in the industry is the truncation limit which could potentially impact the importance evaluation. The total core damage frequency for CPSES was estimated to be 5.72 E-05. The truncation limit chosen for the CPSES accident sequence quantification was set at 1.0E-09 which

is approximately 2.0E-05 below the total core damage frequency. The recommended truncation limit in the EPRI PSA Application Guide document is 10^{-4} below the baseline IPE core damage frequency. The analysis of truncation limits for this application is described in section 4.2.1 of Enclosure 4 TXX-95260. Most assumptions related to IST components were in effect validated by the treatment of not-modeled IST components as described in section 4.1.5 of Enclosure 4 of TXX-95260. In addition, ATWS mitigating IST components have been ranked appropriately.

Systems Analysis

One of the major elements of the CPSES IPE study was the system analysis task. A total of 15 systems including support systems and front-line systems required for accident mitigation were analyzed. For all 15 systems, detailed system notebooks were developed which are found to be excellent documents for plant support activities. The impact of the loss of room cooling on equipment operability was carefully evaluated by the plant-specific room heat-up calculations and other available information in the industry. As part of this effort, the impact of loss of room cooling on the control room and switchgear room were also evaluated.

Common Cause Failure Analysis

Common Cause Failures (CCF) impacting two or more components in a system were carefully examined and appropriately placed in the system fault tree models. The Multiple Greek Letter (MGL) method described in NUREG/CR-4780, "Procedures for Treating Common Cause Failures in Safety and Reliability Studies," was used to quantify the effect of common cause failure events. The evaluation process is consistent with the NRC and EPRI guidelines. The typical IST-related component types are included in the CCF analysis. These are:

- Motor operated valves
- Air operated valves
- Check valves
- Electro-hydraulic valves
- Solenoid valves
- Operating pumps
- Standby pumps
- Turbine-driven pumps
- Positive displacement pumps

Human Reliability Analysis

TU Electric spent extensive amount of time to review, analyze and document human interactions that were modeled in the IPE study. This analysis is consistent with the guidelines of SHARP methodology developed by EPRI. This analysis included an evaluation of operator timing and emergency operating procedures that might create more demands on the operator. In general, three groups of human interactions were considered, namely, latent human errors, human errors associated with initiating events, and dynamic human errors. In addition, a detailed recovery analysis was performed to properly account for the possible recovery actions. The approach adopted for the CPSES IPE follows the guidelines in the EPRI recovery analysis (EPRI RP 3206-03, "Modeling of Recovery Actions in PRAs"). The recovery analysis included the interview of operations staff with extensive plant experience, development of decision trees, review of related procedures and drawings, and consideration of the available time for each critical recovery action. The human reliability analysis process and results were all documented in a separate notebook.

IPE Review Process

To ensure a high-quality IPE and to provide quality control to the IPE process, two types of independent reviews were conducted. One was done internally by TU Electric staff, and the other was done externally by outside PSA experts. Both reviews were applied to the entire examination process except when it was not possible due to the availability of resources or required skills. In those few cases, as a minimum, each task was reviewed thoroughly by either an internal or external independent reviewer. Furthermore, a final independent review was performed after the IPE study was completed. A team of PRA experts was selected from the industry to independently review the entire IPE study and its supporting analyses. The review team spent one week at the TU Electric offices where documents, procedures and supporting calculations and analyses were available for use. The results of all independent review activities performed by internal and external reviewers were well documented as part of the IPE documentation requirements.

4. Conclusions

The results of this evaluation show that the CPSES IPE meets or exceeds the quality standards suggested by the PSA Applications Guide and is appropriate for use in the CPSES Risk-Based IST Program.

Table 1
PSA APPLICABILITY/QUESTIONS FOR IST PROGRAM EVALUATION
COMANCHE PEAK

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Problem Definition	Can PSA effectively evaluate the change?	Yes, for those component functions considered in the scope of the PSA	YES
	What kind of application is involved?	Risk significance.	N/A
	What is the role of the PSA application in the decision-making process?	It is a central but not sole basis. Deterministic methods including expert panel review will supplement the PSA.	N/A
	Is the change permanent or temporary?	Permanent. It is intended to be a permanent change to the IST program.	N/A
	Does PSA address the spectrum of issues associated with the change?	Yes. However, deterministic methods including expert panel review will supplement the PSA.	YES

Table 1
PSA APPLICABILITY/QUESTIONS FOR IST PROGRAM EVALUATION
COMANCHE PEAK

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Scope Assessment	Does the change involve SSCs or procedures involved in external event scenarios?	Yes. However, the expert panel will specifically address this issue. The PSA review will identify any areas which may have increased importance in external events based on insights from the IPEEE for the plant.	YES
	Does the change involve SSCs or procedures involved in shutdown or low power operations?	Yes. However, the expert panel will specifically address this issue. The PSA review will identify any areas which may have increased importance in external events based on insights from the shutdown defense in-depth requirements for the plant.	Used ORAM model to supplement PSA
	Does the change involve procedures or resources involved in emergency planning?	No. Therefore, the offsite consequences for specific containment failure modes associated with the proposed changes are not changed.	N/A

Table 1
PSA APPLICABILITY/QUESTIONS FOR IST PROGRAM EVALUATION
COMANCHE PEAK

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Figures of Merit	What figures of merit best characterize the change being evaluated?	CDF and LERF	YES
	How will the figure of merit be used?	The SSCs in the IST program will be ranked using the Fussell-Vesely and Risk Achievement Worth importance measures. The combined impact of the extended test frequencies for low importance components will be compared to the permanent change screening criteria in the PSA Applications Guide.	YES
	Can the PSA reflect changes in IST frequencies for each figure of merit?	Yes	YES

Table 1
PSA APPLICABILITY/QUESTIONS FOR IST PROGRAM EVALUATION
COMANCHE PEAK

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Analysis	Is the PSA adequate to support the application?	Yes. A technical adequacy checklist was completed and is attached.	See Attached Table 2
	Which portions of the PSA model are affected by the change being evaluated?	The IST frequency may impact the failure rate of the component.	See Attached Table 2
	What supplemental tools may be necessary to support this application?	An expert review panel will be utilized to consider other elements of the operations, maintenance and design of the plant, especially operational problems with components.	N/A
	What general approach will be utilized?	Once the basic events which reflect SSC ISTs have been identified, a ranking will be done based on the Fussell-Vesely importance of the event. This ranking will be used to identify components with potentially low risk significance. The cumulative impact of changing the IST frequency will be evaluated. Compensatory measures were selected for components with high RAW and low FV.	YES
	What deterministic approaches will be blended with the PSA?	The expert review panel will be used to validate PSA rankings and to rank components not considered in the PSA.	Alternatives

Table 1
PSA APPLICABILITY/QUESTIONS FOR IST PROGRAM EVALUATION
COMANCHE PEAK

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Decision Criteria	How will the quantitative results be evaluated?	The change in baseline CDF and LERF will be evaluated against the permanent change criteria.	YES
	How will the PSA results be reviewed qualitatively?	The revised baseline PSA result will be reviewed to determine whether the revised component ranking and test frequency sensitivities requires IST program changes.	N/A

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Initiating Events	Does the application introduce consideration of new initiating events?	No	YES
	Does the application address changes that lead to a modification of the initiating event groups?	No	YES
	Does the application require a reassessment of the frequencies of the initiating event groups?	The ISLOCA and safety chilled water, component cooling water, and station service water support systems initiators.	YES
	Does the application increase the likelihood of a system failure that was bounded by an initiating event group to the extent that it needs to be considered explicitly?	No	YES
Success Criteria	Does the application require modification of the success criteria?	No	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Event Trees	Does the application address an issue that can be associated with a particular branch, or branches on the event trees, and if so, is the branching structure adequate?	Yes	YES
	Does the application require the introduction of new branches or top events to represent concerns not addressed in the event trees?	No	YES
	Does the application require consideration of re-ordering branch points?	No	YES
	Are the end states of the event trees adequate to distinguish changes caused by the application?	No	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
System Reliability Models	Does the application impact system design?	No	YES
	Does the application impact the support functions of the system in such a way as to alter the dependencies in the model?	No	YES
	Does the application impact the system performance, and, if so, is that impact on the function obscured by conservative modeling techniques?	Occasional conservatisms were identified by expert panel process.	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Parameter Database	Can the application be clearly associated with one or more of the basic event definitions, or does it require new basic events?	Yes	YES
	Does the application require a specific probability model (i.e., time dependent model, etc.)?	A model for relating component reliability to IST test frequency and compensatory actions was developed and conservatisms were documented.	YES
	Does the application require modifications to specific parameter values?	Yes	YES
	Does the application require that the plant-specific (historical) data be taken into account, and can this be achieved easily by an update of the previous parameters?	Application does not require plant specific data. However it is used by the expert panel in their deliberations.	NO
	Does the application involve a change which may impact parameter values, and do the present estimates reflect the current status of the plant with respect to what is to be changed?	Yes. The test frequencies are not always explicitly related to the failure probability, but were considered in the analysis.	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Dependent Failure Analysis	Does the application introduce or suggest new common cause failure (CCF) contributions?	No	YES
	Is the application likely to affect CCF probabilities?	Possibly	YES
Human Reliability Analysis	Does the application involve a guideline change?	No	N/A
	Does the application involve a new human action?	No	YES
	Does the application eliminate an existing human action?	No	YES
	Is the application concerned with events that have been screened from the model, either in whole or in part?	No	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Human Reliability Analysis (cont'd)	Does the application impact a particular performance shaping factor (PSF), or a group of PSFs, and are they explicitly addressed in the estimation approach? For example, if the issue is to address training, is training one of the PSFs used in the HRA?	No	YES
	Does success in the application hinge on incorporating the impact of changes in PSFs, and if so, do the current estimates reflect the current status of the PSFs?	No	YES
	Is it possible that the particular group of human error events that is affected by the change being analyzed has been truncated?	No	YES
	Does the change address new recovery actions?	No	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Quantification	Does the application change any of the basic event probabilities?	Yes	YES
	Does the application change relative magnitudes of probabilities?	Yes	YES
	Does the application only make probabilities smaller?	No	YES
	Does the application require a change in the truncation limits for the model?	No	YES
Analysis of Results	Does the application require an assessment of uncertainty, and is it to be qualitative and quantitative?	Probably not, but the RAW was used for uncertainties in component reliability that might result from changes in IST testing frequency.	N/A
	Are there uncertainties in the definition of the application that could be clarified by the application of sensitivity studies?	No	N/A
	Does the application strategy require an importance analysis to rank contributions?	Yes	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Analysis of Results (cont'd)	Does the application require that an importance, uncertainty, or sensitivity analysis of the base case PSA be performed?	Yes	YES
Plant Damage State Classification	Does the application impact the choice of parameters used to define plant damage states?	No	YES
	Do the Plant Damage States utilized adequately represent the results of the Level 1?	Yes	YES
Containment Analysis (Level 2 PSA)	Are new containment failure modes identified by the application addressed in the PSA? Are potential changes accounted for?	No	YES
	Are any dependencies among containment failure modes being changed?	No	YES
	Does the application involve mechanisms that could lead to containment bypass?	Yes	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Containment Analysis (Level 2 PSA)	Does the application involve mechanisms that could cause failure of the containment to isolate?	Yes	YES
	Does the application directly affect the occurrence of any severe accident phenomena?	No	YES
	Does the application require use of risk measures other than CDF and large, early release?	No	YES
External Events PSA Hazard Analysis	Will the changes introduce or remove additional external hazards?	No	YES
	Will the requested changes increase or decrease the intensity of existing hazards significantly?	No	YES
	Are design changes modifying the structural response of the plant being considered?	No	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
External Events PSA Hazard Analysis (cont'd)	Does the requested change significantly change the vulnerability of equipment to an external event?	No	YES
	Does the change impact the availability and performance of necessary mitigation systems for an external hazard?	Yes	YES
	Are changes being requested for systems designed to mitigate against specific external events?	No	N/A
	Will the requested changes to systems impact their vulnerability to external events?	No	YES
	Does the application involve availability and performance of containment systems under the external hazard?	Yes	YES

Table 2
SPECIFIC PSA APPLICABILITY/QUESTIONS RELATED TO IST EVALUATION

Topic	Specific Question	Response and Additional Information	Currently Addressed in PSA
Shutdown PSA	Will the changes affect the manner in which outage activities are scheduled?	Yes	NO
	Will the application affect the reliability of equipment used for shutdown conditions?	Yes	YES
	Will the changes affect the availability of equipment or instrumentation used for contingency plans?	Yes	YES

1. Purpose

The purpose of this document is to provide the methodology and decision criteria that can be used by the expert panel in the CPSES Risk-Based IST Program. This information is fairly comprehensive and is intended to supplement information in the CPSES Risk-Based In-Service Testing Program Expert Panel Guidance Document, Attachment 6 to TXX-96371.

2. Expert Panel Methodology/Decision Criteria

In the sections that follow, the Risk-Based IST methodology and decision criteria are summarized in a checklist. A decision tree, shown as Figure 1, depicts how the methodology and decision criteria feed the decision points. Figure 2 depicts an overview of the expert panel process exemplifying the decision process that is internal to each of the decision blocks shown on Figure 1. The overview process is discussed further in Section 3.

The evaluation process shown in Figure 1 begins with a determination of the applicability of the IPE to the ranking activities. (The evaluation of the CPSES IPE is presented in Attachment 3 of TXX-96371.) This is followed by development of importance criteria for the IST ranking that are consistent with the work done previously in the Maintenance Rule. For the CPSES Risk-Based IST Program, the following ranking criteria for the various categories were be used:

Category	Criterion
High:	FV > 0.001
Potentially High:	FV < 0.001 and RAW > 2
Low:	FV < 0.001 and RAW < 2

The components were then evaluated according to the methods and criteria listed below. Figure 1 shows these methods and criteria as blocks to the left that feed into the decision block. The end result of this process is the list of less safety significant components (LSSCs).

2.1 Apply Importance Criteria to IPE and Review

Review FV and RAW importance measures for pumps and valves considered in the IPE against the criteria and determine if the grouping of components is logical.

Review component importance measures to make sure that their bases are well understood.

- locate the component on the simplified P&ID,
- review the IPE modeled function, i.e., component failure mode and accident scenario,
- determine if that function is an IST function,
- if not, document the result, evaluate the IST function with the not modeled components,
- identify similar components and validate the consistency of ranking,
- understand the ranking in the context of other components in the flowpath, train, or system,
- determine whether or not mitigating operator actions are included in the IPE and if they affect the ranking,

<u>IPE Limitations</u>

Consider a range of limitations in the IPE, examples of which are described below.

- Evaluate the importance of unmodeled/low probability failures modes assumed in the IPE, e.g., reverse flow in each check valve and unmodeled components that might degrade the performance of a system or train.
- Address the sensitivity of the results to common cause failures, assuming all/none of the CCF importance is assigned to the associated component.
- Evaluate the sensitivity due to human action modeling. Identify/evaluate operator actions omitted by the IPE that can change the ranking of a component. The omitted recovery actions are those not credited because they are not important to the CDF.
- Check similar components in the system to ensure that assumed alignments of systems in the IPE did not affect the ranking, and assign both components the higher ranking.
- Consider plant specific performance for each low ranked component to compensate for use of generic data. Components with low FV / high RAW solely due to

inapplicable generic reliability data may be ranked low.

- Consider industry history for particular IST components. Review such sources as NRC Generic Letters, SOERs, IOERs and Technical Bulletins and rank accordingly.

- For components with low FV/ high RAW ensure that other compensatory measures are available to maintain the reliability of the component.

- Identify and evaluate components whose performance shows a history of causing entry into LCO conditions. To ensure that safety margins are maintained, consider retaining the ASME test frequency for these components.

- Ensure that truncated components have been eliminated due to redundancy of function rather than solely due to reliability.

- Determine whether IST components are modeled as part of another component and if so, extrapolate the results to determine the ranking, if possible.

Validate or change the IPE-based ranking. If the validated IPE ranking is high, rank the component high; if the IPE ranking is low and the other factors such as the operating performance of the component validate the ranking, rank as low.

2.2 Fire, Tornado and Seismic Considerations

Consider the following for risk ranking components for fire and tornado.

- Calculate risk importance measures for components in the fire and tornado cutsets. Compare these calculated values and the IPE values to identify those components that are less risk significant for the IPE but more risk significant for fire and tornado.

- Review component importance measures and the IPE limitations for fire and tornado in a manner similar to that described for internal events discussed above and adjust the rankings of the components accordingly.

- Confirm that the rankings are reasonable (e.g., does the risk importance increase for components in one train because the fire damages components in the opposite train).

Consider the following for risk ranking components based on the seismic IPEEE.

- For those components on the SSEL and the containment systems list, evaluate whether the risk ranking is consistent with the seismic risk and adjust the ranking accordingly. Review the seismic initiating event frequency and compare it to the initiating event frequency for VSBLOCA, LOOP and MSLB as a measure of relative importance of these events and the systems and components required to mitigate the events.

2.3 Outage Criteria

Consider the following for risk ranking components for outage modes:

- If a component performs the same function and is in the same initial state as at power, the at power ranking is assumed to bound the outage ranking.
- If a component performs a different function or is in a different initial state than at power, then the outage ranking must be evaluated.

Additionally the following rules are a guide to risk ranking for shutdown.

High Components- Category 1- High FV:

- Pumps that must start to perform function (assume all pumps in systems that cycle operating trains)(High FV)
- Motor Operated Valve (MOV) or Air Operated Valve (AOV) that must change state to perform function (but not portions with redundant paths, e.g. two supply sources to one pump)(High FV)
- MOV or AOV that must change state to prevent flow diversion that can fail redundant trains (high FV, extremely high RAW)
- Pressure relief valves (safety or power operated) needed to control pressure so that redundant trains of systems can perform function (high FV or low FV with a high RAW)

Potentially High Components- Category 2- Low FV, Moderate to High RAW:

- Pumps that must continue running (low FV, moderate RAW)
- Valves in single path portions of redundant systems that are not required to change state (RHR outlet valves)(low FV, moderate or high RA
- Check valve and MOV or AOV in series that must remain as is, if they are in the trains only flow path (low FV, moderate RAW)
- Check valves for which reverse flow can fail redundant trains simultaneously (low FV, extremely high RAW)
- MOV or AOV which if they change state can cause flow diversion that can fail redundant trains (low FV, extremely high RAW)
- Control components that need to function to prevent system degradation (e.g. AFW flow control valves to the steam generators that can fail the Turbine Driven AFW pump)(low FV, moderate RAW)

Category 3 - Low Importance:

- All other Components that do not fall into category 1 or 2 are ranked low.

2.4 Backend Importance

Consider components/systems that are potential contributors to large, early release. The sources are:

- containment cooling systems
- containment isolation valves
- high-low pressure interface valves
- safety systems uniquely important to preventing high pressure core melt scenarios

- steam generator tube rupture

Determine FV LERF for components

- For components with FV LERF greater than 0.001, rank as more safety significant component (MSSC).

- Review each set of CIVs to determine which would have the equivalent of a high FV with respect to LERF and rank as MSSC.

- For those valves not explicitly modeled in the IPE consider ranking less safety significant (LSSC).

- Consider compensatory measures for large but late releases involving components not already ranked MSSC.

- Identify specific operator actions to isolate the leak path that are not fully credited in the IPE and evaluate the impact on ranking for LERF and the need for compensatory actions.

- Review Interfacing Systems LOCA (ISLOCA) sequences to determine which would have the equivalent of a high FV with respect to LERF and rank as MSSC.

2.5 IST Components Not in IPE

Review scenarios not explicitly modeled by the IPE to ensure an IST component is in fact low risk.

- Check the functions of each IST component (e.g., flowpath boundary) that are not explicitly or implicitly modeled in the IPE.

- Compare the typical IPE "safety functions" to typical IST component functions.

- Compare the IPE function to the design basis function to integrate an understanding of probabilistic and deterministic insights.

- Review the IPE system notebook documentation of why certain components are not

modeled, e.g., primarily flowpath boundary components.

- Review deterministic calculations that supported the IPE bases, e.g. thermal-hydraulic calculations.

- Using the expert panel knowledge of plant operations and design, rank components not modeled.

  - Consider systems integral to operator actions, e.g., surge tank emergency makeup. Frequency of use of the system is a factor to be considered in the ranking.

  - Verify the component failure modes that would have to occur and redundant components required to fail for the IST function to be needed.

  - Consider component performance history.

  - If failure scenarios are such that the probability of the system and/or train failure is obviously lower than other sources, rank the component LSSC. In general, the scenarios should involve additional redundancy or failure modes of very low probability, e.g., passive failures or spurious operation.

  - Assume that not modeled components may be subject to the same types of limitations as modeled components and evaluate accordingly.

- Using the outage criteria as a guide, determine whether an LSSC component would have the equivalent of a high RAW. If so, ensure a compensatory action is available or rank the component as MSSC.

2.6 High-Risk IPE Components Not in the IST Program

Identify other high risk pumps and valves that are not in the IST program but should be tested commensurate with their importance.

- evaluate the IPE modeling assumptions and conservatisms, component failure modes, operator action, recoveries and any other effects that could substantiate the rankings.

- Determine whether current plant testing is commensurate with the importance of these valves. If not, determine what test, e.g., the IST test, would be the most appropriate.

  - Does in-service testing apply to the failure modes that are risk significant?

  - What testing is currently being done?

2.7 Other Considerations

Review the IPE to determine that the following issues have been adequately addressed in the determination of component importances.

Sensitivity studies for cumulative effects
Defense in depth

3. Overview of Expert Panel Deliberation Process (Refer to Figure 2)

Once the Expert Panel (EP) is seated, they are provided a discussion on the goals and objectives of the program. They are also provided a discussion of the existing program and its requirements. Next, the EP is briefed on PRA, what it is, what's involved, what's not and why, and how PRA can be used to help rank the components. The EP is briefed on the limitation of the PRA model.

The EP deliberations begin with those components that are modeled. For modeled components/functions, if the components FV ≥ 0.001, the EP either confirms the component is MSSC or justification of the conservatism of the PRA model must be developed and agreed upon by the EP.

For modeled components/functions with a FV < 0.001 but a RAW ≥ 2.0, the expert panel must concur that the component can be final ranked LSSC and identify a compensatory measure that ensure operational readiness. For these components, the EP discusses the design basis function, the PRA modeled function and why the model determined FV was low and RAW and high. Next the EP considers site specific performance history, any known industry history associated with that particular model (NRC Generic Letter, SOER, IOER, Technical Bulletin, etc.), service condition, and the ASME Section XI test requirements. Next the EP determines that a compensatory measure is available to ensure operational readiness. Typically this is associated with a pump run or a Technical Specification required Surveillance. Once the component reliability is ensured and a

compensatory measure is available, the component is final ranked LSSC. If both these items are not acceptable the component is ranked MSSC.

For modeled components/functions with FV $\leq$ 0.001 and RAW < 2.0, the EP discusses those items above associated with component reliability. If the reliability is acceptable, the component is ranked LSSC. If the reliability is unacceptable, the EP tries to identify a compensatory measure, if one is located the component is final ranked LSSC, if not the component is final ranked MSSC.

For a component not modeled or the IST function is not modeled, the following is the course of action for the EP.

If the sister train is modeled then the component takes that final ranking. If the component is implicitly modeled, the FV and RAW are estimated and the deliberation is as previously discussed.

If the component is not implicitly modeled, the EP confirms the system ranking associated with the Maintenance Rule. If the EP finds disagreement, then the PRA model requires revision (however, this was not the case for CPSES). Once the EP confirms the system ranking, the component performance history, service-condition, etc. are reviewed to ensure component reliability, and if so, the component is final ranked LSSC. If not, but compensatory measures are available, the final rank is LSSC. If compensatory measures are not available the component is ranked MSSC, and the PRA model is reviewed for a necessary update.

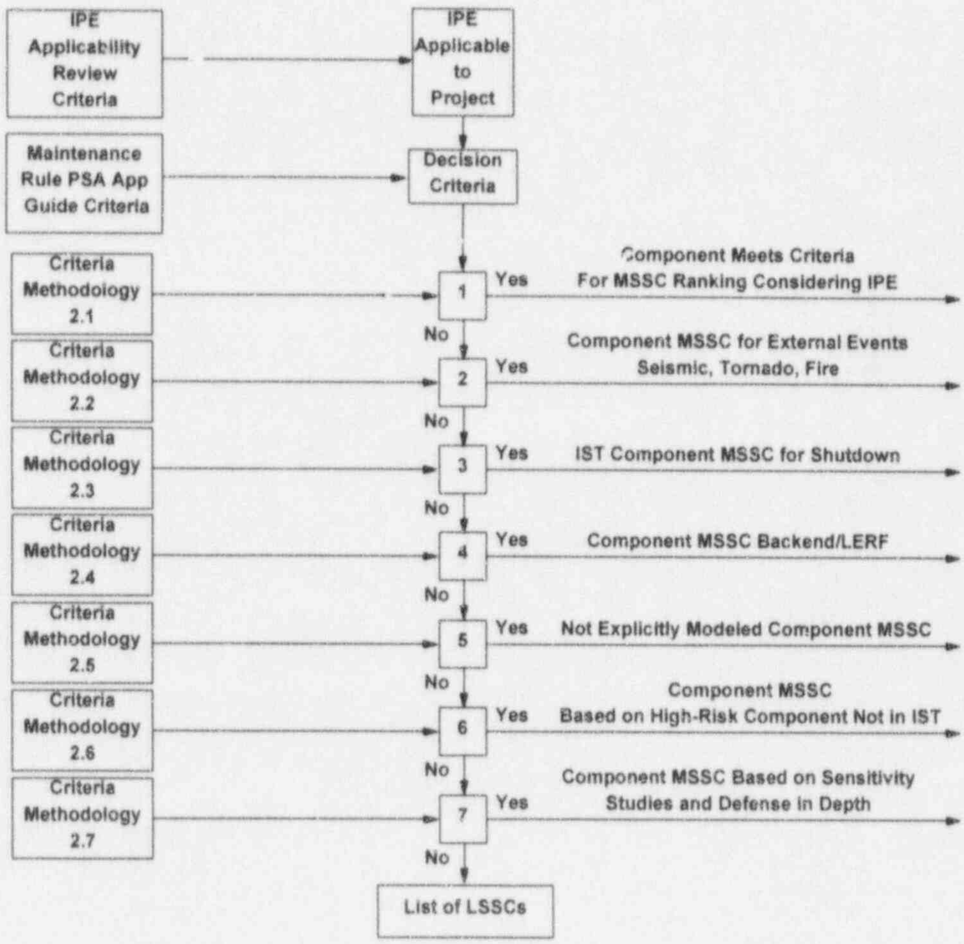

Figure 1
CPSES Risk-Based IST
Decision Tree

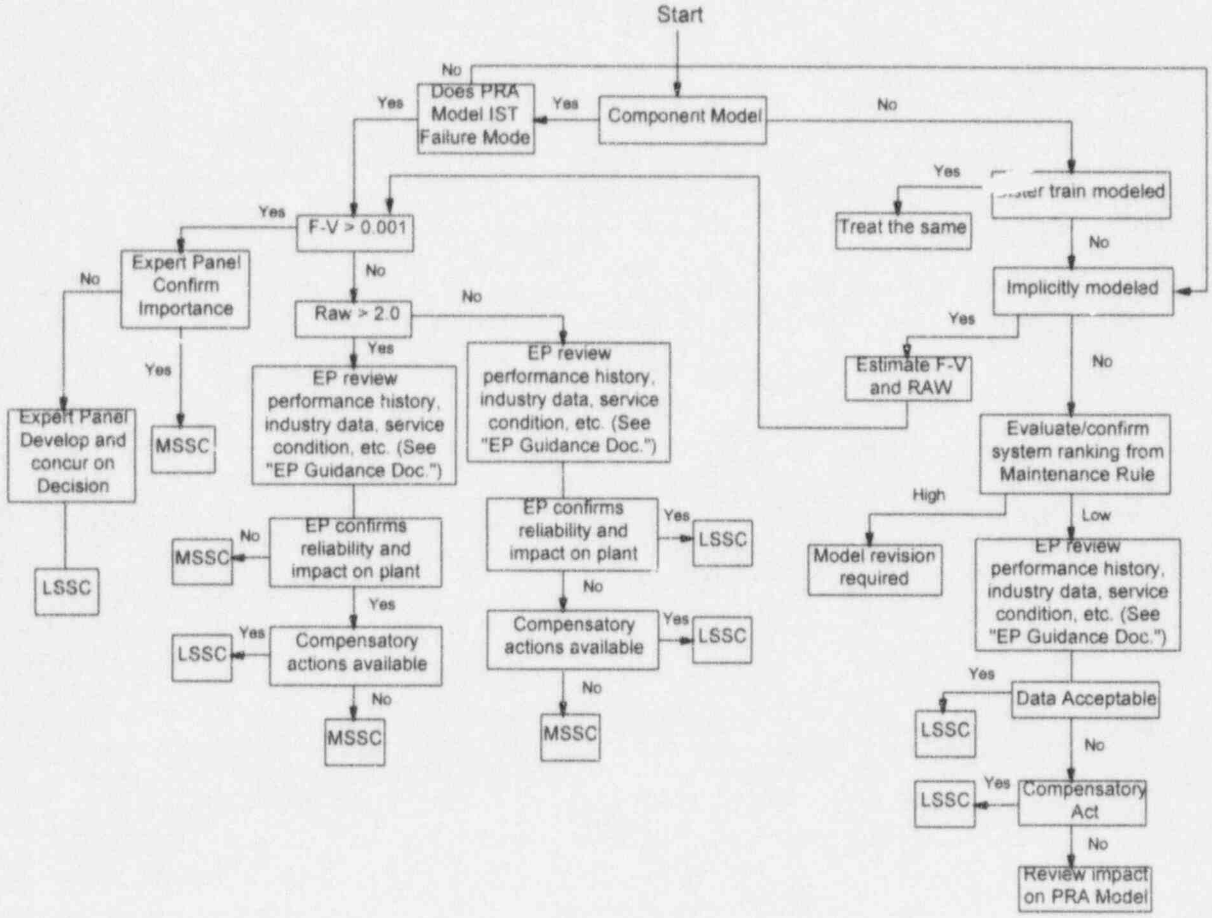

Figure 2
Expert Panel Deliberation
(for Base Model and Sensitivity Studies)

CORRECTIVE ACTION FOR LSSCs IN THE RISK BASED IST PROGRAM

1. Purpose

The purpose of this document is to describe the corrective actions that will be taken for less safety significant components in the Risk-Based IST Program that fail to meet the acceptance criteria or that are otherwise determined to have nonconforming conditions.

2. Discussion

Less safety significant components (LSSCs) that do not meet the acceptance criteria or that are otherwise determined to have nonconforming conditions will be handled in accordance with the CPSES corrective action program. (Refer to the attached Figure 1 for a flow chart of the process.) Currently at CPSES the corrective action program is referred to as the ONE Form Process. The ONE Form Process was developed to provide a single form to document all conditions that require some form of resolution, including but not limited to nonconforming conditions associated with ASME Section XI Inservice Testing of pumps and valves.

As such, when tests of LSSC are not satisfactory, a ONE Form will be generated. This ONE Form will be routed to the IST Coordinator for resolution. The IST Coordinator will review the current test data and evaluate the impact on system operability since the previous test. Next, a determination of the cause of the failure will be made along with a review of the LSSC's test history (including all component in that group). From this review, a determination will be made on generic implications to other components. If it is determined not to be generic, corrective action will be initiated for that component. However, if the evaluation indicates a generic problem, the IST coordinator will initiate testing/corrective action for the components in the affected group. As part of this corrective action, the IST Coordinator will evaluate the necessity of reducing the testing frequency of the group if the cause of failure is determined to be age related.

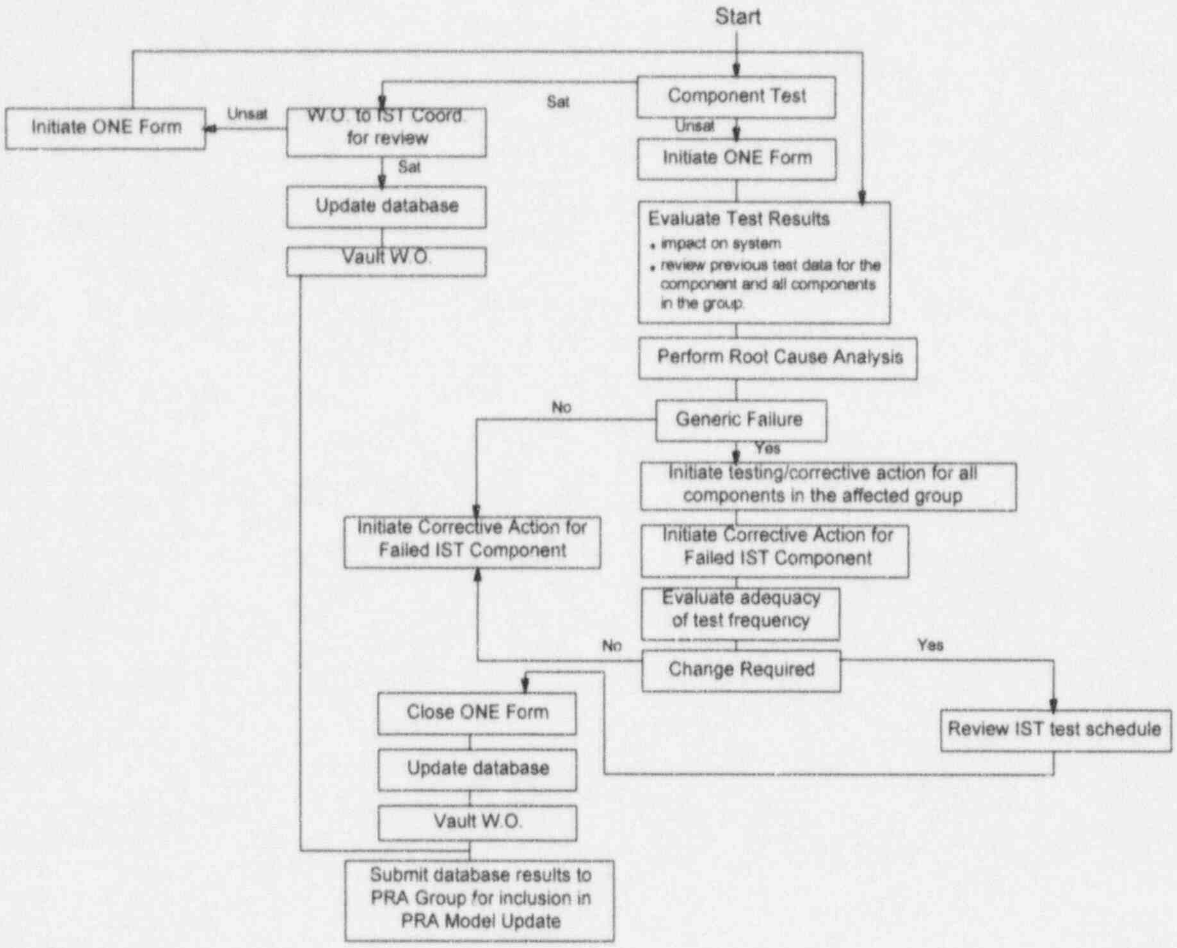

Figure 1
Corrective Action for LSSC
In the Risk-Based IST Program

Comanche Peak Steam Electric Station

Risk-Based In-Service Testing Program

Expert Panel Guidance Document

November 22, 1995

Revision 1

Prepared By: [See original for signature] Date: ____________

Reviewed By: [See original for signature] Date: ____________

Approved By: [See orignial for signature] Date: ____________

CPSES Risk-Based In-Service Testing Program
Expert Panel Guidance Document

1.0 Purpose and Scope

The purpose of utilizing an expert panel (EP) for the CPSES Risk-Based In-Service Testing (RBIST) Program is to confirm or adjust the risk importance measures developed using the individual plant examination (IPE) results and insights and to provide a qualitative assessment where necessary based on the engineering judgement of the EP. This qualitative assessment compensates for limitations of the IPE Study, including those cases where adequate quantitative risk information is not available.

The expert panel evaluation is based on deterministic insights, engineering judgement and regulatory requirements. The EP will review the IPE component risk ranking, analyze applicable deterministic information, and determine the final safety significance categorizations for all the IST Components. These EP considerations should be well documented for each individual component to allow for future repeatability of the risk ranking process of the IST components.

The panel will be a living panel and will participate in periodic updates to the ranking at intervals corresponding to the periodic IPE/PRA updates planned by TU Electric.

The scope of the expert panel activities includes both risk ranking and application. The panel's principal responsibility is to provide deterministic insights that might influence ranking. The EP should identify cases where a component's poor performance justifies changing its ranking from low to high.

The expert panel should determine the appropriate changes to testing. The panel should identify compensatory measures for potentially important components and also select the test interval for less-safety significant components. The panel should determine the test strategies for more safety significant components not currently in the IST program.

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2.0 Membership

The members of the expert panel are selected based on their nuclear power plant experience in systems engineering, risk analysis, operations, maintenance and plant specific operating history. Facilitation of the EP discussion is contained in NUREG/CR-5424, NUREG/CR-4962, NUREG/CR-5695, NUMARC 93-02, and NUMARC 93-01. The EP shall consist of six to ten members with a qualified chairperson. The EP chairperson shall have technical experience as well as project management skills in order to facilitate the discussion and obtain end results.

Members of the RBIST expert panel should be drawn as much as possible from the Maintenance Rule (MR) expert panel. The required functional disciplines for the panel are:

- Codes and Standards
- Operations with a Senior Reactor Operator background
- Maintenance Engineering
- System Engineering/ In-Service Test Engineering
- Probabilistic Risk Assessment
- Design Engineering

The minimal education and experience requirements for panel members are a BS in an engineering discipline and eight years in nuclear power. It is desirable that the operations representative holds a current USNRC Senior Reactor Operator License and has held it for at least two years. Alternate individuals shall be presented to the EP for consideration and approval.

3.0 Determining Risk Significance

The panel will be given an initial criteria for risk ranking and develop additional criteria as necessary. The initial criteria establish less-safety significant components as those with a Risk

Achievement Worth (RAW) of less than or equal to two (2) and a Fussell-Vesely (FV) of less than one-tenth of one percent (0.001). Components with an FV of less than 0.001 and a RAW of greater than 2 will be considered potentially important.

The panel's additional criteria should be objective, except in the case of plant-specific performance data which, due to its current sparseness at CPSES, can be based on the judgement of the panel members.

The deterministic sources that the expert panel should utilize include the IST plan information which contains component functions from the design basis documents and references to relevant plant licensing commitments for IST. At the discretion of the panel, design issues generic to Westinghouse plants should be discussed by the cognizant EP member. Plant procedures should be referenced when considering operator actions not modeled in the IPE and in identifying tests that could serve as compensatory actions. The operating experience insights should be used to complement the validated generic database upon which the IPE is based for both functional failures and in-service testing performance.

The panel should consider a range of limitations in the IPE, examples of which are described below:

- The panel should evaluate potentially important failure modes that were not modeled in the IPE. For example, because the IPE assumes the failure mode to be insignificant, the panel should evaluate reverse flow in each check valve.

- The panel should evaluate the risk ranking measures two ways, one assuming all CCF importance assigned to the basic event and the other assuming none.

- The panel should evaluate the sensitivity due to human action modeling. The panel should also identify operator actions or recovery actions not credited in the IPE if they could significantly alter the ranking of a component.

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- The panel should check similar components train-to-train to ensure assumed alignments of systems in the IPE do not affect the ranking.

- To compensate for the use of generic data, the panel should consider plant specific performance of each low ranked component. For those that are potentially important, the panel should ensure a compensatory measure is available to confirm adequate reliability of the component.

In summary, to blend deterministic and probabilistic information, the panel should deliberate on the limitations of IPE when it applies and use both plant specific and generic information and operating experience.

The process for reviewing the modeled components should be performed as follows. The panel should:

- locate the component on the simplified P&ID,
- review the IPE modeled function, i.e., component failure mode and accident scenario,
- determine if that function is an IST function,
- if not, document the result, but evaluate the IST function with the not modeled components,
- identify similar components and validate the consistency of ranking,
- understand the ranking in the context of other components in the flowpath, train, or system,
- determine if practical mitigating operator actions were omitted by the IPE,
- validate or change the IPE based ranking,
- if the validated IPE ranking is high, the component will be ranked high,
- if the validated IPE ranking is low, the operating performance of the component should be checked to validate the ranking.

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Where applicable IPEEE, outage risk management, and the large early release evaluations should also be considered along with the IPE information. For components in the IPE and not in the IST program and for IST components not explicitly modeled by the IPE, a similar process should be used. In the case of unmodeled components, however, the risk significance snould be based on the consequences and likelihood of component failures for unmodeled failure modes and accident scenarios addressed by the IST program but not addressed by the IPE.

4.0 Duties of Members

The members should be meet on an as-needed basis to address issues related to RBIST activities. Issues should be identified and resolved as described in this guidance document. The proceedings of the meeting should be documented in a 'minutes of the meeting' by a member designated by the chairperson.

The deliberations of the expert panel are generally application independent, although the attendance of the plant IST engineer will help the panel to integrate the current IST practices. Since the expert panel needs to be generally familiar with the IPE model as an engineering tool, each member of the expert panel should have some familiarity with the CPSES IPE study and its application to ranking. For example, the members should be familiar with the importance measures, specifically FV and RAW, including what each importance measure indicates and how it will be utilized in the risk-ranking process for the CPSES RBIST program.

5.0 Quorum

The quorum necessary for the expert panel to conduct business is four (4) members, or their alternates, consisting of representatives from operations, probabilistic risk assessment, mechanical engineering, and maintenance engineering.

CPSES Risk-Based In- rvice Testing Program
Expert Panel Guidance Document

6.0 Current Members

Listed below are the current memb ers, their area of expertise and their current positions.

- Codes and Standards - Ben Mays, Supervisor
- Operations - Jim Brau, Supervisor
- Design Engineering - Bob Cockrel, Consulting Mechanical Engineer
- Maintenance Engineering - Russ Green, Senior Engineer
- Probabilistic Risk Assessment - Hossein Hamzehee, Risk & Reliability Supervisor
- Probabilistic Risk Assessment - Steven Karpyak, Consulting Engineer
- System Engineering - Gary McGee, Senior Engineer

Study of Dynamic Ranking Effects for CPSES IST Components

1. Background and Discussion

As part of the CPSES risk-based IST program, a study of the dynamic ranking effects for IST components was performed. This paper provides a discussion of the overall approach used in the study and the results and the conclusions of the study. This study is based in part on joint work done by the NRC and its contractors, Brookhaven National Labs, and TU Electric to review the risk profile for various equipment outage configurations for CPSES Unit 1. The configurations referred to in the current study are those developed as part of that joint work.

2. Overall Approach and Results

A study of the dynamic ranking effects for IST components was performed for CPSES using the following steps:

- Select representative configurations
- Adjust the cutset model to reflect components removed from service
- Calculate the FV and RAW importances for IST components for each configuration
- Calculate integrated FV and RAW importances for the IST components
- Interpret the results

In the sections that follow, the implementation of each of these steps is described and the results are presented.

Select Representative Configurations

The study looked at the contribution from four risk peaks in a six month period. These peaks were selected from roughly two hundred configurations that occurred during the period. To select the peaks, about 15 significant and unique configurations were identified. In general, the configurations involved removal from service of a train in a risk significant system. Four configurations selected from these 15 were deemed representative because the cases with both peak risk and significant duration were represented, and the trains removed represented the types of trains removed in the 15

configurations.

The configurations selected were: removal of an EDG from service (Configuration 12), removal of a SI pump from service (Configuration 92), removal of a CCW pump from service (Configuration 144), and removal of the AFW turbine driven pump train from service (Configuration 205).

The types of trains removed were judged to be representative because:

- the most risk significant trains were included (i.e., the diesel generators and the AFW turbine driven pump),
- one train represented removing mechanical support systems from service, i.e., CCW, and
- one train represented reducing the redundancy of ECCS capability for LOCAs and feed and bleed, i.e., safety injection.

<u>Adjust the Cutset Model to Reflect Components Removed from Service</u>

For each of these configurations, the CPSES cutset file was modified by setting to 1.0 the probabilities for the applicable failure modes of the equipment being removed from service, e.g., fails to operate and continue to operate. The changes made for each configuration are summarized below:

Configuration Name and Representative Number	Component Removed From Service	Basic Events Set to 1.0
Emergency Diesel Generator - Configuration 12	CP1-MEDGEE-02	EPBDGGEE02FN EPBDGGEE02NN EPBDGGEE02NX
Safety Injection - Configuration 92	1-8923B	SIBVM8923BFN SIBVM8923BFX
Safety Injection - Configuration 92	1-HV-2321	FWAVMV2321FN
Safety Injection - Configuration 92	1-HV-2323	FWAVMV2323FN

Configuration Name and Representative Number	Component Removed From Service	Basic Events Set to 1.0
Safety Injection - Configuration 92	1-PV-2325	MSXVAV2325FF MSXVPV2325FF MSXVPV2325FN MSXVPV2325NF MSXVPV2325NN
Safety Injection - Configuration 92	CPX-CICACO-02	CIXPAACO02FN CIXPAACO02NN CIXPAACO02NX CIYPAACO02FN
Safety Injection - Configuration 92	CPX-SWTSTS-02	SWXTSSTS02FN SWXTSSTS02NN
Safety Injection - Configuration 92	TBX-SIAPSI-02	SIBPMPSI02FN SIBPMPSI02FN
Component Cooling Water - Configuration 144	CP1-CCAPCC-01	CCAPOPCC01FN CCAPOPCC01NN CCAPOPCC01NX
Auxiliary Feedwater (Turbine Driven Pump Train) - Configuration 205	1-HV-2452-1	AFCVA24521FN AFCVA24521NN AFCVA24521NX
Auxiliary Feedwater (Turbine Driven Pump Train) - Configuration 205	1-HV-2452-2	AFCVA24522FN AFCVA24522NN AFCVA24522NX
Auxiliary Feedwater (Turbine Driven Pump Train) - Configuration 205	1-HV-2493B	AFCVM2493BFN
Auxiliary Feedwater (Turbine Driven Pump Train) - Configuration 205	1-HV-2494B	AFCVM2494BFN
Auxiliary Feedwater (Turbine Driven Pump Train) - Configuration 205	CP1-AFAPTD-01	AFCPTPTD01FN AFCPTPTD01FX AFCPTPTD01NN

Calculate the FV and RAW Importances for IST Components for Each Configuration

Using the cutset files generated accordingly, the RAW and FV risk measures were calculated in the same manner as in the original study, i.e., using the EQUIMP code and the same assignment of basic events to component tag numbers. Table 1 lists the component tag number, the IPE FV and the four configuration FVs. Table 2 lists the component tag number, the IPE RAW and the four configuration RAWs. The implication of these values to changes in ranking are discussed in the results section.

Calculate Integrated FV and RAW Importances for the IST Components

A measure of the integrated importance was obtained by taking the four representative configurations and weighting their impact on the importance by the duration and the CDF of the corresponding configuration. The duration was obtained by summing all the outage times over the six month interval for the corresponding trains and using the limiting value. In other words, the total outage time of each EDG, SI pump train, and CCW train was summed and the larger value was used. For AFW, the turbine driven pump train outage time was used. Then it was assumed that the remainder of the time is spent in the nominal case. For CDF, we use the value from the cutset results for each configuration and the nominal value. Those values are:

Configuration Number	Core Damage Frequency
Nominal Case (all T&M set to 0)	3.53E-5
Configuration 12	1.92E-4
Configuration 92	6.69E-5
Configuration 144	1.22E-4
Configuration 205	3.66E-4

Table 3 lists the component tag number, the nominal (IPE FV), the integrated FV and the percentage change followed by the nominal, integrated and percent change for the RAW. The implication of these results is described in the next section.

Interpret the Results

Changes from below the FV criteria (i.e., LOW ranking) to above it (i.e., HIGH ranking) were observed to occur in 13 of the approximately 140 components in the cutset model. In each case, the

changes occurred during only one of the four peaks. These changes are noted in Table 4.

When the integrated FV is considered, that is the FV weighted by both risk level and exposure time, the sensitivity of the FV measure is even smaller. A sensitivity study was used to estimate the potential change in the integrated FV among the ~140 components in the cutset model. Nearly three quarters of the modeled components had increases of less than 5%. None of the components with increases greater than 5% even approached the ranking threshold. The factor of four difference in FV between less safety significant components (LSSCs) without compensatory measures and more safety significant components (MSSCs) discussed in Issue 2 of Attachment 2 to TXX-96371 was preserved.

Changes to plant configuration also were reviewed and it was determined that the basis for truncation of the other modeled components was not affected. Hence, the conclusion applies to truncated and unmodeled cutsets as well.

In reviewing the results for the 13 components that experienced temporary ranking changes, i.e., FV > 0.001 during one of the four peaks, seven had already been addressed by other aspects of the ranking analysis. Three components were high for fire risk (two of which were also high for LERF risk). Four components had high RAWs and consequently have compensatory measures implemented.

Of the remaining six components, the measured increases were small. The instantaneous FV increased less than or equal to an order of magnitude. In no case was the peak FV greater than 0.003. But most importantly, the percentage increase in the FV integrated over the operating period was less than or equal to about 12%.

The CPSES risk ranking results have shown that ranking is determined primarily by the degree of redundancy. When reliability determines ranking, large changes in the perceived reliability must occur to change a component from LSSC to MSSC. Based on the findings of the study and these sensitivity studies, it appears that configuration changes will change risk ranking only if sustained unavailability occurs in important system recovery paths, e.g., service water backup to the CST, or in components with high RAW values. Components with high RAW values are in risk significant trains which in turn are subject to Maintenance Rule monitoring and to compensatory measures in the RB-IST Program. Hence, adequate plant controls are in place to ensure configuration changes (i.e., dynamic risk) does not pose a problem.

3. Conclusion

In conclusion, this study shows that the magnitude of the ranking change considering configurations changes was low whether it was considered in an instantaneous or an integrated manner. The effect on all components was low in general and, in particular, the effect was low for those components that temporarily experienced a ranking threshold change. On this basis, it was concluded that the existing RB-IST Program results adequately address both temporary and integrated effects that are likely to result from plant configuration changes.

Table 1
Component Dynamic FV Importance for Various Configurations

TAG Number	IPE FV	FV for configuration 12	FV for configuration 92	FV for configuration 144	FV for configuration 205
1-8000A	2.800e-03	6.920e-04	1.990e-03	1.100e-03	9.960e-04
1-8000B	1.100e-02	2.560e-03	7.360e-03	4.050e-03	2.130e-02
1-8010A	5.710e-03	1.010e-02	3.100e-03	3.680e-03	5.660e-04
1-8010B	5.710e-03	1.010e-02	3.100e-03	3.680e-03	5.660e-04
1-8010C	5.710e-03	1.010e-02	3.100e-03	3.680e-03	5.660e-04
1-8105	2.140e-04	5.290e-05	2.800e-03	8.380e-05	2.780e-05
1-8106	2.140e-04	5.290e-05	2.800e-03	8.380e-05	2.780e-05
1-8110	2.140e-04	5.290e-05	2.800e-03	8.380e-05	2.780e-05
1-8111	9.130e-04	2.260e-04	3.290e-03	3.580e-04	1.430e-03
1-8481A	1.360e-04	3.020e-04	1.320e-04	1.540e-04	7.630e-06
1-8481B	2.940e-04	4.120e-05	1.380e-03	1.820e-04	2.160e-05
1-8511A	1.160e-03	2.860e-04	8.230e-04	4.530e-04	1.500e-04
1-8511B	1.160e-03	2.860e-04	8.230e-04	4.530e-04	1.500e-04
1-8512A	1.160e-03	2.860e-04	8.230e-04	4.530e-04	1.500e-04
1-8512B	1.160e-03	2.860e-04	8.230e-04	4.530e-04	1.500e-04
1-8546	2.110e-04	5.220e-05	2.760e-03	8.260e-05	2.740e-05
1-8716A	3.390e-03	1.220e-03	3.520e-03	1.940e-03	6.430e-04
1-8716B	3.700e-03	1.300e-03	3.740e-03	2.060e-03	6.830e-04
1-8717	2.130e-04	5.280e-05	1.520e-04	8.350e-05	2.770e-05
1-8801A	2.140e-04	5.290e-05	2.800e-03	8.380e-05	2.780e-05
1-8801B	2.140e-04	5.290e-05	2.800e-03	8.380e-05	2.780e-05
1-8804B	1.080e-03	2.670e-04	7.680e-04	4.220e-04	1.400e-04
1-8806	5.000e-04	1.240e-04	3.560e-04	1.960e-04	6.500e-05
1-8809A	3.390e-03	8.390e-04	2.410e-03	1.330e-03	4.410e-04
1-8809B	3.700e-03	9.150e-04	2.630e-03	1.450e-03	4.810e-04
1-8811A	4.490e-03	6.990e-04	5.390e-03	2.970e-03	9.860e-04
1-8811B	7.220e-03	1.710e-03	4.920e-03	2.710e-03	8.990e-04
1-8812A	2.820e-03	6.990e-04	2.010e-03	1.110e-03	3.670e-04
1-8812B	3.080e-03	7.610e-04	2.190e-03	1.200e-03	4.000e-04
1-8813	2.080e-03	5.090e-04	1.460e-03	8.050e-04	2.670e-04
1-8814A	1.550e-03	3.850e-04	1.110e-03	6.090e-04	2.020e-04
1-8814B	1.550e-03	3.850e-04	1.110e-03	6.090e-04	2.020e-04
1-8815	2.120e-04	5.240e-05	2.760e-03	8.300e-05	2.760e-05
1-8835	5.660e-04	1.400e-04	4.030e-04	2.220e-04	7.370e-05
1-8840	2.470e-02	5.570e-03	1.600e-02	8.810e-03	2.930e-03
1-8922A	6.890e-05	1.700e-04	2.220e-04	3.940e-05	7.080e-06
1-8922B	1.210e-04	1.790e-05	6.370e-05	2.840e-05	1.390e-05
1-8923A	1.730e-05	4.230e-06	1.520e-05	6.700e-06	2.230e-06
1-8923B	1.730e-05	4.230e-06	1.520e-05	6.760e-06	2.230e-06

Table 1
Component Dynamic FV Importance for Various Configurations

TAG Number	IPE FV	FV for configuration 12	FV for configuration 92	FV for configuration 144	FV for configuration 205
1-8924	9.160e-07	2.270e-07	8.090e-07	3.590e-07	7.950e-08
1-8926	1.280e-04	3.180e-05	1.130e-04	5.030e-05	1.670e-05
1-8969B	3.100e-05	7.640e-06	2.740e-05	1.210e-05	3.970e-06
1-FCV-0610	3.600e-05	8.920e-06	3.180e-05	1.410e-05	4.690e-06
1-FCV-0611	6.700e-05	1.440e-05	5.130e-05	2.280e-05	7.550e-06
1-HV-2333A	4.490e-04	1.110e-04	3.960e-04	1.760e-04	5.840e-05
1-HV-2334A	4.490e-04	1.110e-04	3.960e-04	1.760e-04	5.840e-05
1-HV-2335A	4.490e-04	1.110e-04	3.960e-04	1.760e-04	5.840e-05
1-HV-2336A	4.490e-04	1.110e-04	3.960e-04	1.760e-04	5.840e-05
1-HV-2452-1	2.110e-05	0.000e+00	0.000e+00	0.000e+00	0.000e+00
1-HV-2452-2	2.110e-05	0.000e+00	0.000e+00	0.000e+00	0.000e+00
1-HV-2462	5.950e-06	1.210e-06	1.730e-05	1.970e-06	6.360e-07
1-HV-4286	6.070e-03	2.020e-02	5.130e-03	2.200e-03	5.140e-03
1-HV-4287	8.040e-05	1.190e-05	5.730e-05	3.370e-04	8.590e-05
1-HV-4512	2.770e-03	3.890e-04	1.860e-03	8.670e-04	5.330e-03
1-HV-4513	1.840e-03	3.120e-04	1.490e-03	6.940e-04	5.280e-03
1-HV-4514	5.010e-03	7.680e-04	4.870e-03	1.710e-03	5.600e-03
1-HV-4515	1.840e-03	3.120e-04	1.490e-03	6.940e-04	5.280e-03
1-HV-4524	1.860e-03	3.150e-04	1.510e-03	7.030e-04	5.280e-03
1-HV-4525	1.860e-03	3.150e-04	1.510e-03	7.030e-04	5.280e-03
1-HV-4527	1.860e-03	3.150e-04	1.510e-03	7.030e-04	5.280e-03
1-HV-4572	4.450e-03	7.550e-04	3.610e-03	1.680e-03	5.320e-04
1-HV-4573	4.770e-03	8.090e-04	3.870e-03	1.800e-03	5.710e-04
1-HV-4696	1.110e-05	1.870e-06	1.760e-05	4.160e-06	1.320e-06
1-HV-4699	4.040e-05	6.840e-06	3.280e-05	1.520e-05	4.830e-06
1-HV-4700	4.040e-05	6.840e-06	3.280e-05	1.520e-05	4.830e-06
1-HV-4709	1.100e-05	1.870e-06	1.750e-05	4.040e-06	1.320e-06
1-LCV-0112B	2.140e-04	3.630e-05	1.740e-04	8.080e-05	2.560e-05
1-LCV-0112C	9.130e-04	1.550e-04	7.410e-04	3.450e-04	1.320e-03
1-LCV-0112D	2.140e-04	3.630e-05	1.730e-04	8.080e-05	2.560e-05
1-LCV-0112E	9.130e-04	1.550e-04	7.410e-04	3.450e-04	1.320e-03
1-PCV-0456	1.670e-02	3.030e-02	1.150e-02	5.340e-03	1.050e-02
1-PV-2325	8.430e-04	1.210e-04	1.750e-03	2.700e-04	8.540e-05
1-PV-2328	6.350e-04	8.570e-05	1.580e-03	1.910e-04	6.050e-05
1-PV-2454B	1.200e-05	1.660e-06	3.180e-05	3.700e-06	1.170e-06
1-PV-4553	7.640e-07	1.040e-07	6.820e-07	3.460e-07	1.460e-07
1AF-0032	2.850e-04	4.040e-05	1.940e-04	2.180e-03	2.860e-05
1AF-0038	2.850e-04	4.040e-05	1.940e-04	2.180e-03	2.860e-05
1AF-0041	1.960e-04	2.780e-05	1.330e-04	1.500e-03	1.970e-05

Table 1
Component Dynamic FV Importance for Various Configurations

TAG Number	IPE FV	FV for configuration 12	FV for configuration 92	FV for configuration 144	FV for configuration 205
1AF-0051	3.970e-04	6.290e-05	4.490e-04	2.790e-04	9.130e-04
1AF-0054	2.730e-04	4.320e-05	3.090e-04	1.920e-04	6.280e-04
1AF-0065	2.750e-04	4.360e-05	3.870e-04	1.750e-04	6.450e-04
1AF-0066	1.890e-04	3.000e-05	2.660e-04	1.210e-04	4.430e-04
1AF-0215	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0216	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0221	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0222	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0223	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0224	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0230	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1AF-0231	2.520e-04	3.490e-05	6.670e-04	7.780e-05	2.460e-05
1CC-0031	5.440e-04	8.270e-05	4.970e-04	5.840e-04	9.760e-04
1CC-0061	9.390e-06	1.140e-06	5.580e-06	8.330e-06	1.780e-05
1CC-0646	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-0657	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-0687	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-0694	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-0713	4.580e-06	7.260e-07	3.660e-06	5.490e-06	5.850e-07
1CC-1075	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-1076	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-1077	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1CC-1078	1.300e-06	2.070e-07	1.050e-06	1.560e-06	1.460e-07
1DO-0049	2.640e-04	0.000e+00	0.000e+00	0.000e+00	0.000e+00
1DO-0050	5.460e-04	4.800e-05	2.290e-04	3.390e-04	3.390e-05
1MS-0142	2.210e-06	4.150e-07	1.800e-06	2.750e-06	2.930e-07
1MS-0143	2.210e-06	4.150e-07	1.800e-06	2.750e-06	2.930e-07
1SW-0016	5.460e-04	4.800e-05	2.290e-04	3.390e-04	3.390e-05
1SW-0017	2.640e-04	0.000e+00	0.000e+00	0.000e+00	0.000e+00
1SW-0084		1.040e-07	3.100e-07	4.580e-07	6.580e-07
1SW-0085		2.070e-06	9.660e-06	1.430e-05	1.560e-05
1SW-0374	1.210e-03	3.930e-03	7.650e-04	1.130e-03	1.130e-04
CP1-AFAPMD-01	2.820e-02	3.980e-03	3.540e-02	2.810e-02	5.900e-02
CP1-AFAPMD-02	3.940e-02	5.760e-03	4.110e-02	4.070e-02	8.350e-02
CP1-AFAPTD-01	2.351e-01	1.107e-01	3.599e-01	2.324e-01	9.234e-01
CP1-CCAPCC-01	3.660e-02	4.090e-03	2.450e-02	2.890e-02	4.820e-02
CP1-CHAPCP-05	7.970e-03	1.070e-03	5.120e-03	7.560e-03	7.550e-04
CP1-CHAPCP-06	2.840e-04	4.170e-05	1.990e-04	2.940e-04	2.940e-05
CP1-DOAPFT-02	4.780e-02	7.840e-03	3.750e-02	5.540e-02	5.780e-02

Table 1
Component Dynamic FV Importance for Various Configurations

TAG Number	IPE FV	FV for configuration 12	FV for configuration 92	FV for configuration 144	FV for configuration 205
CP1-DOAPFT-03	4.780e-02	7.840e-03	3.750e-02	5.540e-02	5.780e-02
CP1-DOAPFT-04	4.780e-02	7.840e-03	3.750e-02	5.540e-02	5.780e-02
CP1-MEDGEE-01		7.790e-03	3.720e-02	5.500e-02	5.770e-02
CP1-MEDGEE-02		7.790e-03	3.720e-02	5.500e-02	5.770e-02
CP1-SWAPSW-01	9.690e-02	3.330e-01	7.920e-02	1.083e-01	7.570e-02
CP1-SWAPSW-02	3.860e-02	5.580e-03	2.670e-02	3.940e-02	3.210e-02
TBX-CSAPCH-01	1.250e-02	1.900e-02	4.660e-03	6.890e-03	6.880e-04
TBX-CSAPCH-02	2.710e-02	3.240e-03	1.550e-02	2.290e-02	2.290e-03
TBX-RHAPRH-01	4.950e-03	8.400e-04	4.010e-03	5.930e-03	5.920e-04
TBX-SIAPSI-01	1.460e-02	2.470e-02	6.430e-03	9.500e-03	1.390e-03
TBX-SIAPSI-02	2.570e-02	2.980e-03	1.430e-02	2.110e-02	2.990e-03
XCI-0645		1.040e-05	4.940e-05	7.320e-05	1.570e-04
XCI-0646		1.040e-05	4.940e-05	7.320e-05	1.570e-04

Table 2
Component RAW for Various Configurations

TAG Number	IPE RAW	RAW for configuration 12	RAW for configuration 92	RAW for configuration 144	RAW for configuration 205
1-8000A	1.3049	1.0755	1.2171	1.1195	1.1073
1-8000B	2.6299	1.3867	2.1119	1.6119	4.2082
1-8010A	3.8695	2.5703	2.9468	2.2674	1.3558
1-8010B	3.8695	2.5703	2.9468	2.2674	1.3558
1-8010C	3.8695	2.5703	2.9468	2.2674	1.3558
1-8105	1.784	1.1941	11.2483	1.3071	1.102
1-8106	1.784	1.1941	11.2483	1.3071	1.102
1-8110	1.784	1.1941	11.2483	1.3071	1.102
1-8111	1.9458	1.2341	11.3634	1.3705	1.4268
1-8481A	1.505	2.1207	1.492	1.5709	1.0283
1-8481B	2.0913	1.1531	6.1105	1.6751	1.0805
1-8511A	4.8723	1.9586	3.7567	2.5171	1.5039
1-8511B	4.8723	1.9586	3.7567	2.5171	1.5039
1-8512A	4.8723	1.9586	3.7567	2.5171	1.5039
1-8512B	4.8723	1.9586	3.7567	2.5171	1.5039
1-8546	1.784	1.1941	11.2483	1.3071	1.102
1-8716A	5.3279	3.1253	7.1119	4.3635	2.1171
1-8716B	5.3988	3.1429	7.1624	4.3913	2.1264
1-8717	5.2624	2.0552	4.0344	2.6699	1.5546
1-8801A	1.784	1.1941	11.2482	1.3071	1.102
1-8801B	1.784	1.1941	11.2482	1.3071	1.102
1-8804B	1.1151	1.0285	1.082	1.0451	1.015
1-8806	1.4773	1.1182	1.3398	1.187	1.0621
1-8809A	5.3279	2.0714	4.081	2.6956	1.5632
1-8809B	5.3988	2.0889	4.1315	2.7233	1.5724
1-8811A	5.0741	1.9692	6.9302	4.2635	2.0839
1-8811B	9.4595	3.0854	6.997	4.3003	2.0961
1-8812A	4.915	1.9692	3.7871	2.5338	1.5094
1-8812B	4.965	1.9816	3.8227	2.5534	1.5159
1-8813	5.3732	2.0767	4.0962	2.7039	1.5659
1-8814A	4.8719	1.9585	3.7564	2.5169	1.5038
1-8814B	4.8719	1.9585	3.7564	2.5169	1.5038
1-8815	1.787	1.1948	11.2491	1.3083	1.1024
1-8835	1.4773	1.1182	1.3398	1.187	1.0621
1-8840	13.9685	3.1569	7.2025	4.4134	2.1337
1-8922A	1.2558	1.6332	1.8265	1.1466	1.0264
1-8922B	1.4509	1.0666	1.2369	1.1054	1.0518
1-8923A	1.0061	1.0015	1.0054	1.0024	1.0008
1-8923B	1.0061	1.0015	1.0054	1.0024	1.0008

Table 2
Component RAW for Various Configurations

TAG Number	IPE RAW	RAW for configuration 12	RAW for configuration 92	RAW for configuration 144	RAW for configuration 205
1-8924	1.0002	1	1.0001	1.0001	1
1-8926	1.4773	1.1182	1.4214	1.187	1.0621
1-8969B	1.1151	1.0285	1.1016	1.0451	1.015
1-FCV-0610	1.3467	1.0858	1.3061	1.1358	1.0451
1-FCV-0611	1.62	1.1325	1.4727	1.2097	1.0697
1-HV-2333A	6.9592	2.4752	6.2613	3.3346	1.7754
1-HV-2334A	6.9592	2.4752	6.2613	3.3346	1.7754
1-HV-2335A	6.9592	2.4752	6.2613	3.3346	1.7754
1-HV-2336A	6.9592	2.4752	6.2613	3.3346	1.7754
1-HV-2452-1	1.0083	1	1	1	1
1-HV-2452-2	1.0083	1	1	1	1
1-HV-2462	1.9356	1.1893	3.698	1.2995	1.0995
1-HV-4286	9.0386	27.4536	7.1195	3.6685	6.4767
1-HV-4287	37.1754	6.3929	26.8051	152	39.4068
1-HV-4512	23.7844	4.8667	19.7228	9.6146	63.8436
1-HV-4513	30.9018	6.0661		12.2867	64.6692
1-HV-4514	23.7844	4.8667	19.7227	9.6146	63.8436
1-HV-4515	30.9018	6.0661	26.3245	12.2867	64.6692
1-HV-4524	40.9779	7.785	33.4354	16.116	65.8522
1-HV-4525	40.9779	7.785	33.4354	16.116	65.8522
1-HV-4527	40.9779	7.785	33.4354	16.116	65.8522
1-HV-4572	9.2011	2.3919	7.6538	4.1009	1.9815
1-HV-4573	9.2781	2.4044	7.7138	4.1289	1.9903
1-HV-4696	5.9646	1.828	8.9017	2.8446	1.5838
1-HV-4699	19.205	4.0897	15.7703	7.8835	3.1787
1-HV-4700	19.205	4.0897	15.7703	7.8835	3.1787
1-HV-4709	5.9646	1.828	8.9017	2.8446	1.5838
1-LCV-0112B	1.7841	1.1331	1.6361	1.2965	1.0938
1-LCV-0112C	1.9459	1.1605	1.7675	1.3577	1.3926
1-LCV-0112D	1.7841	1.1331	1.6361	1.2965	1.0938
1-LCV-0112E	1.9459	1.1605	1.7675	1.3577	1.3926
1-PCV-0456	2.6291	2.2831	1.9294	1.4331	2.8935
1-PV-2325	1.0329	1.0047	1.0682	1.0105	1.0033
1-PV-2328	1.0248	1.0033	1.0617	1.0074	1.0024
1-PV-2454B	2.8715	1.2596	5.9593	1.5783	1.183
1-PV-4553	1.1249	1.0212	1.1014	1.0472	1.0149
1AF-0032	2.0581	1.1505	1.7196	9.0913	1.1061
1AF-0038	2.0581	1.1505	1.7196	9.0916	1.1061
1AF-0041	2.0582	1.1505	1.7197	9.0922	1.1062

Table 2
Component RAW for Various Configurations

TAG Number	IPE RAW	RAW for configuration 12	RAW for configuration 92	RAW for configuration 144	RAW for configuration 205
1AF-0051	2.4741	1.2338	2.668	2.0378	4.391
1AF-0054	2.4741	1.2338	2.668	2.0378	4.391
1AF-0065	2.0232	1.1619	2.438	1.6518	3.3947
1AF-0066	2.0232	1.1619	2.438	1.6518	3.3947
1AF-0215	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0216	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0221	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0222	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0223	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0224	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0230	1.9358	1.1298	3.4798	1.2891	1.0915
1AF-0231	1.9358	1.1298	3.4798	1.2891	1.0915
1CC-0031	3.0208	1.3073	2.8459	3.1707	4.6256
1CC-0061	38.5415	5.6891	23.4164	34.1267	71.1568
1CC-0646	6.1735	1.878	5.1974	7.2029	1.6192
1CC-0657	6.1735	1.878	5.1974	7.2029	1.6192
1CC-0687	6.1735	1.878	5.1974	7.2029	1.6192
1CC-0694	6.1735	1.878	5.1974	7.2029	1.6192
1CC-0713	19.2052	4.0897	15.7704	22.8276	3.1788
1CC-1075	6.1735	1.878	5.1974	7.2029	1.6192
1CC-1076	6.1735	1.878	5.1974	7.2029	1.6192
1CC-1077	6.1735	1.878	5.1974	7.2029	1.6192
1CC-1078	6.1735	1.878	5.1974	7.2029	1.6192
1DO-0049	1.9795	1	1	1	1
1DO-0050	3.0296	1.1782	1.852	2.259	1.1257
1MS-0142	1.0083	1.0014	1.0068	1.01	1.001
1MS-0143	1.0083	1.0014	1.0068	1.01	1.001
1SW-0016	3.0296	1.1782	1.852	2.2591	1.1257
1SW-0017	1.9796	1	1		1
1SW-0084		1.2444	2.1682	2.7264	3.6118
1SW-0085		9.0979	39.7117	58.208	62.6387
1SW-0374	71.8633	33.5162	57.1015	83.9064	9.6447
CP1-AFAPMD-01	2.8296	1.1618	2.438	2.1434	3.3948
CP1-AFAPMD-02	3.302	1.2338	2.668	2.652	4.3911
CP1-AFAPTD-01	12.9035	5.3133	15.3263	10.9384	1.0922
CP1-CCAPCC-01	4.8323	1.3072	2.8457	3.1703	4.6247
CP1-CHAPCP-05	1.7278	1.075	1.3586	1.53	1.0529
CP1-CHAPCP-06	1.3459	1.0507	1.2424	1.3582	1.0358
CP1-DOAPFT-02	140	24.3534	113	166	52.2919

Table 2
Component RAW for Various Configurations

TAG Number	IPE RAW	RAW for configuration 12	RAW for configuration 92	RAW for configuration 144	RAW for configuration 205
CP1-DOAPFT-03	140	24.3534	113	166	52.2919
CP1-DOAPFT-04	140	24.3534	113	166	52.2919
CP1-MEDGEE-01		6.2416	26.0574	38.0296	39.6983
CP1-MEDGEE-02		6.2416	26.0574	38.0296	39.6983
CP1-SWAPSW-01	77.6709	52.6995	62.0057	90.5803	14.5571
CP1-SWAPSW-02	107	18.07	82.6032	122	47.5249
TBX-CSAPCH-01	1.5301	1.7711	1.1894	1.2799	1.0279
TBX-CSAPCH-02	2.1861	1.1316	1.6293	1.93	1.0928
TBX-RHAPRH-01	1.3468	1.0589	1.2814	1.4158	1.0415
TBX-SIAPSI-01	1.2559	1.4343	1.1128	1.1668	1.0244
TBX-SIAPSI-02	1.4509	1.0523	1.2502	1.3697	1.0524
XCI-0645		1.056	1.2675	1.3953	1.8494
XCI-0646		1.056	1.2675	1.3953	1.8494

Table 3
Nominal vs. Integrated FV and RAW Importances

TAG NO.	Nominal Importance FV	Integrated Importance FV	Percentage Change FV	Nominal Inportance RAW	Integrated Inportance RAW	Percentage Change RAW
1-8000A	3.350e-03	3.358e-03	0.227%	1.366e+00	1.395e+00	2.179%
1-8000B	1.240e-02	1.254e-02	1.165%	2.873e+00	2.924e+00	1.765%
1-8010A	5.850e-03	6.038e-03	3.216%	4.342e+00	4.393e+00	1.159%
1-8010B	5.850e-03	6.038e-03	3.216%	4.342e+00	4.393e+00	1.159%
1-8010C	5.850e-03	6.038e-03	3.216%	4.342e+00	4.393e+00	1.159%
1-8105	2.560e-04	2.632e-04	2.829%	1.940e+00	1.996e+00	2.858%
1-8106	2.560e-04	2.632e-04	2.829%	1.940e+00	1.996e+00	2.858%
1-8110	2.560e-04	2.632e-04	2.829%	1.940e+00	1.996e+00	2.858%
1-8111	1.090e-03	1.107e-03	1.539%	2.134e+00	2.192e+00	2.701%
1-8481A	7.540e-05	8.226e-05	9.101%	1.280e+00	1.334e+00	4.251%
1-8481B	2.500e-04	2.542e-04	1.662%	1.930e+00	1.974e+00	2.296%
1-8511A	1.390e-03	1.391e-03	0.097%	5.644e+00	5.678e+00	0.595%
1-8511B	1.390e-03	1.391e-03	0.097%	5.644e+00	5.678e+00	0.595%
1-8512A	1.390e-03	1.391e-03	0.097%	5.644e+00	5.678e+00	0.595%
1-8512B	1.390e-03	1.391e-03	0.097%	5.644e+00	5.678e+00	0.595%
1-8546	2.530e-04	2.601e-04	2.820%	1.940e+00	1.996e+00	2.858%
1-8716A	5.930e-03	5.936e-03	0.099%	1.130e+01	1.134e+01	0.347%
1-8716B	6.290e-03	6.296e-03	0.102%	1.138e+01	1.142e+01	0.346%
1-8717	2.560e-04	2.563e-04	0.099%	6.112e+00	6.146e+00	0.557%
1-8801A	2.560e-04	2.632e-04	2.829%	1.940e+00	1.996e+00	2.858%
1-8801B	2.560e-04	2.632e-04	2.829%	1.940e+00	1.996e+00	2.858%
1-8804B	1.290e-03	1.291e-03	0.102%	1.138e+00	1.167e+00	2.555%
1-8806	6.000e-04	6.006e-04	0.100%	1.572e+00	1.602e+00	1.877%
1-8809A	4.070e-03	4.074e-03	0.099%	6.190e+00	6.224e+00	0.552%
1-8809B	4.430e-03	4.434e-03	0.101%	6.275e+00	6.310e+00	0.545%
1-8811A	9.090e-03	9.077e-03	-0.145%	1.099e+01	1.101e+01	0.166%
1-8811B	8.290e-03	8.298e-03	0.100%	1.110e+01	1.114e+01	0.352%
1-8812A	3.390e-03	3.393e-03	0.100%	5.695e+00	5.729e+00	0.591%
1-8812B	3.690e-03	3.694e-03	0.098%	5.755e+00	5.789e+00	0.586%
1-8813	2.490e-03	2.492e-03	0.091%	6.245e+00	6.279e+00	0.543%
1-8814A	1.860e-03	1.862e-03	0.103%	5.644e+00	5.677e+00	0.595%
1-8814B	1.860e-03	1.862e-03	0.103%	5.644e+00	5.677e+00	0.595%
1-8815	2.540e-04	2.611e-04	2.809%	1.944e+00	1.999e+00	2.852%
1-8835	6.790e-04	6.797e-04	0.100%	1.573e+00	1.602e+00	1.877%
1-8840	2.700e-02	2.703e-02	0.099%	1.145e+01	1.149e+01	0.344%
1-8922A	4.490e-05	4.873e-05	8.532%	1.167e+00	1.210e+00	3.704%
1-8922B	9.950e-05	9.955e-05	0.046%	1.370e+00	1.399e+00	2.126%
1-8923A	2.070e-05	2.073e-05	0.130%	1.007e+00	1.036e+00	2.874%
1-8923B	2.070e-05	2.069e-05	-0.061%	1.007e+00	1.036e+00	2.873%

Table 3
Nominal vs. Integrated FV and RAW Importances

TAG NO.	Nominal Importance FV	Integrated Importance FV	Percentage Change FV	Nominal Inportance RAW	Integrated Inportance RAW	Percentage Change RAW
1-8924	1.100e-06	1.101e-06	0.113%	1.000e+00	1.029e+00	2.894%
1-8926	1.540e-04	1.542e-04	0.137%	1.572e+00	1.602e+00	1.891%
1-8969B	3.720e-05	3.725e-05	0.133%	1.138e+00	1.167e+00	2.560%
1-FCV-0610	4.330e-05	4.336e-05	0.135%	1.416e+00	1.445e+00	2.085%
1-FCV-0611	6.970e-05	6.980e-05	0.138%	1.642e+00	1.672e+00	1.816%
1-HV-2333A	5.380e-04	5.387e-04	0.138%	8.147e+00	8.185e+00	0.476%
1-HV-2334A	5.380e-04	5.387e-04	0.138%	8.147e+00	8.185e+00	0.476%
1-HV-2335A	5.380e-04	5.387e-04	0.138%	8.147e+00	8.185e+00	0.476%
1-HV-2336A	5.380e-04	5.387e-04	0.138%	8.147e+00	8.185e+00	0.476%
1-HV-2452-1	2.530e-05	2.510e-05	-0.808%	1.010e+00	1.039e+00	2.858%
1-HV-2452-2	2.530e-05	2.510e-05	-0.808%	1.010e+00	1.039e+00	2.858%
1-HV-2462	5.950e-06	5.992e-06	0.707%	1.917e+00	1.952e+00	1.854%
1-HV-4286	6.980e-03	7.372e-03	5.620%	9.457e+00	9.993e+00	5.673%
1-HV-4287	8.510e-05	8.835e-05	3.817%	3.932e+01	4.080e+01	3.774%
1-HV-4512	2.750e-03	2.783e-03	1.200%	2.832e+01	2.874e+01	1.493%
1-HV-4513	2.200e-03	2.233e-03	1.506%	3.679e+01	3.715e+01	0.963%
1-HV-4514	5.430e-03	5.466e-03	0.658%	2.832e+01	2.874e+01	1.493%
1-HV-4515	2.200e-03	2.233e-03	1.506%	3.679e+01	3.721e+01	1.152%
1-HV-4524	2.230e-03	2.263e-03	1.484%	4.894e+01	4.935e+01	0.855%
1-HV-4525	2.230e-03	2.263e-03	1.484%	4.894e+01	4.935e+01	0.855%
1-HV-4527	2.230e-03	2.263e-03	1.484%	4.894e+01	4.935e+01	0.855%
1-HV-4572	5.330e-03	5.329e-03	-0.016%	1.083e+01	1.086e+01	0.252%
1-HV-4573	5.720e-03	5.719e-03	-0.017%	1.092e+01	1.095e+01	0.250%
1-HV-4696	1.300e-05	1.302e-05	0.172%	6.849e+00	6.887e+00	0.561%
1-HV-4699	4.850e-05	4.849e-05	-0.019%	2.283e+01	2.285e+01	0.111%
1-HV-4700	4.850e-05	4.849e-05	-0.019%	2.283e+01	2.285e+01	0.111%
1-HV-4709	1.300e-05	1.302e-05	0.162%	6.849e+00	6.887e+00	0.561%
1-LCV-0112B	2.560e-04	2.560e-04	-0.015%	1.940e+00	1.969e+00	1.484%
1-LCV-0112C	1.090e-03	1.098e-03	0.722%	2.134e+00	2.165e+00	1.434%
1-LCV-0112D	2.560e-04	2.560e-04	-0.016%	1.940e+00	1.969e+00	1.484%
1-LCV-0112E	1.090e-03	1.098e-03	0.722%	2.134e+00	2.165e+00	1.434%
1-PCV-0456	1.690e-02	1.748e-02	3.450%	2.374e+00	2.434e+00	2.566%
1-PV-2325	8.550e-04	8.580e-04	0.345%	1.033e+00	1.062e+00	2.812%
1-PV-2328	6.060e-04	6.090e-04	0.492%	1.024e+00	1.053e+00	2.839%
1-PV-2454B	1.180e-05	1.186e-05	0.512%	2.833e+00	2.872e+00	1.357%
1-PV-4553	1.010e-06	1.010e-06	-0.036%	1.150e+00	1.179e+00	2.515%
1AF-0032	2.860e-04	3.045e-04	6.470%	2.063e+00	2.161e+00	4.731%
1AF-0038	2.860e-04	3.045e-04	6.470%	2.063e+00	2.161e+00	4.731%
1AF-0041	1.970e-04	2.097e-04	6.462%	2.063e+00	2.161e+00	4.731%

Table 3
Nominal vs. Integrated FV and RAW Importances

TAG NO.	Nominal Importance FV	Integrated Importance FV	Percentage Change FV	Nominal Inportance RAW	Integrated Inportance RAW	Percentage Change RAW
1AF-0051	4.450e-04	4.523e-04	1.639%	2.652e+00	2.708e+00	2.114%
1AF-0054	3.060e-04	3.110e-04	1.640%	2.652e+00	2.708e+00	2.114%
1AF-0065	3.080e-04	3.132e-04	1.681%	2.143e+00	2.191e+00	2.248%
1AF-0066	2.120e-04	2.156e-04	1.679%	2.143e+00	2.191e+00	2.248%
1AF-0215	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0216	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0221	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0222	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0223	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0224	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0230	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1AF-0231	2.470e-04	2.483e-04	0.516%	1.917e+00	1.950e+00	1.758%
1CC-0031	5.840e-04	5.938e-04	1.677%	3.170e+00	3.236e+00	2.061%
1CC-0061	8.330e-06	8.491e-06	1.929%	3.413e+01	3.480e+01	1.955%
1CC-0646	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-0657	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-0687	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-0694	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-0713	5.490e-06	5.522e-06	0.576%	2.283e+01	2.299e+01	0.692%
1CC-1075	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-1076	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-1077	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1CC-1078	1.560e-06	1.569e-06	0.570%	7.203e+00	7.269e+00	0.911%
1DO-0049	0.000e+00	0.000e+00	ERR	1.000e+00	1.029e+00	2.894%
1DO-0050	3.390e-04	3.410e-04	0.591%	2.259e+00	2.295e+00	1.611%
1MS-0142	2.750e-06	2.767e-06	0.608%	1.010e+00	1.039e+00	2.871%
1MS-0143	2.750e-06	2.767e-06	0.608%	1.010e+00	1.039e+00	2.871%
1SW-0016	3.390e-04	3.410e-04	0.591%	2.259e+00	2.295e+00	1.611%
1SW-0017	0.000e+00	0.000e+00	ERR	1.000e+00	1.020e+00	2.007%
1SW-0084	4.580e-07	4.655e-07	1.638%	2.727e+00	2.782e+00	2.028%
1SW-0085	1.440e-05	1.458e-05	1.239%	5.821e+01	5.895e+01	1.267%
1SW-0374	1.130e-03	1.208e-03	6.895%	8.391e+01	8.482e+01	1.090%
CP1-AFAPMD-01	2.810e-02	2.868e-02	2.069%	2.143e+00	2.196e+00	2.452%
CP1-AFAPMD-02	4.070e-02	4.150e-02	1.971%	2.652e+00	2.714e+00	2.319%
CP1-AFAPTD-01	2.324e-01	2.356e-01	1.388%	1.094e+01	1.109e+01	1.427%
CP1-CCAPCC-01	2.890e-02	2.913e-02	0.786%	3.170e+00	3.216e+00	1.453%
CP1-CHAPCP-05	7.560e-03	7.605e-03	0.592%	1.530e+00	1.562e+00	2.097%
CP1-CHAPCP-06	2.940e-04	2.957e-04	0.592%	1.358e+00	1.389e+00	2.287%
CP1-DOAPFT-02	5.540e-02	5.607e-02	1.216%	1.660e+02	1.672e+02	0.745%

Table 3
Nominal vs. Integrated FV and RAW Importances

TAG NO.	Nominal Importance FV	Integrated Importance FV	Percentage Change FV	Nominal Inportance RAW	Integrated Inportance RAW	Percentage Change RAW
CP1-DOAPFT-03	5.540e-02	5.607e-02	1.216%	1.660e+02	1.672e+02	0.745%
CP1-DOAPFT-04	5.540e-02	5.607e-02	1.216%	1.660e+02	1.672e+02	0.745%
CP1-MEDGEE-01	5.500e-02	5.567e-02	1.220%	3.803e+01	3.851e+01	1.261%
CP1-MEDGEE-02	5.500e-02	5.552e-02	0.952%	3.803e+01	3.841e+01	1.001%
CP1-SWAPSW-01	1.083e-01	1.154e-01	6.544%	9.058e+01	9.191e+01	1.465%
CP1-SWAPSW-02	3.940e-02	3.982e-02	1.065%	1.220e+02	1.230e+02	0.796%
TBX-CSAPCH-01	6.890e-03	7.271e-03	5.534%	1.280e+00	1.324e+00	3.470%
TBX-CSAPCH-02	2.290e-02	2.304e-02	0.591%	1.930e+00	1.964e+00	1.785%
TBX-RHAPRH-01	5.930e-03	5.965e-03	0.592%	1.416e+00	1.447e+00	2.218%
TBX-S!APSI-01	9.500e-03	1.000e-02	5.267%	1.167e+00	1.205e+00	3.234%
TBX-SIAPSI-02	2.110e-02	2.119e-02	0.440%	1.370e+00	1.400e+00	2.232%
XCI-0645	7.320e-05	7.462e-05	1.945%	1.395e+00	1.432e+00	2.626%
XCI-0646	7.320e-05	7.462e-05	1.945%	1.395e+00	1.432e+00	2.626%

Table 4
Matrix of Dynamic FV Importance

TAG NO.	Configuration 12	Configuration 92	Configuration 144	Configuration 205
1-8105		LOW2HIGH		
1-8106		LOW2HIGH		
1-8110		LOW2HIGH		
1-8481B		LOW2HIGH		
1-8546		LOW2HIGH		
1-8801A		LOW2HIGH		
1-8801B		LOW2HIGH		
1-8815		LOW2HIGH		
1-PV-2325		LOW2HIGH		
1-PV-2328		LOW2HIGH		
1AF-0032			LOW2HIGH	
1AF-0038			LOW2HIGH	
1AF-0041			LOW2HIGH	

PHASE-IN PHILOSOPHY
STAGGERING TECHNIQUE
(Refer to Figure 1 on page 2 of 2)

<u>Grouping</u>

Groups will be based on manufacturer/model, service condition and orientation. For this case four valves constitute the group. These valves are Safety Injection Accumulator motor operated valves (MOVs) - 1-8808A, B, C, D. These valves are manufactured by Westinghouse and their model number is 10000GM88FNH010, each valve is oriented the same, on a horizontal run of piping. The service medium is identical as well as the service environment (heat, humidity and radiation).

<u>Case 1</u>
Group of 4 MOV's
No Failures

Over the 6 yr. test interval one valve is tested at each refueling outage.

<u>Case 2</u>
Group of 4 MOV's
One failure occurs that is not generic and not age related.

Over the 6 yr. test interval one valve is tested at each refueling outage.

<u>Case 3</u>
Group of 4 MOV's
One failure occurs that is generic but not age related.

At the occurrence of the generic failure, all valves will be tested during the refueling outage and corrective action taken; at which time the valves will continue on the 6 yr. test frequency.

<u>Case 4</u>
Group of 4 MOV's
One failure occurs that is determined to be generic and age related.

At the occurrence of the failure, all valves in the group will be tested during the refueling outage and corrective action taken. Additionally, the test frequency will be reduced to a frequency based on the age related failure mechanism.

T = Test Results Satisfactory
F = Test Results Unsatisfactory

Figure 2

		CYCLE 1						CYCLE 2						CYCLE 3						CYCLE 4						CYCLE 5					
		YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				YEAR 6				YEAR 7					
		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	27	28	29	30
		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
CASE 1	1-8808A						T																								
	1-8808B												T																		
	1-8808C																		T												
	1-8808D																								T						
CASE 2	1-8808A						T																								
	1-8808B												F																		
	1-8808C																		T												
	1-8808D																								T						
CASE 3	1-8808A						T						T																		
	1-8808B												F																		
	1-8808C												T						T												
	1-8808D												T												T						
CASE 4	1-8808A						T						T						T												
	1-8808B												F						T												
	1-8808C												T												T						
	1-8808D												T												T						