BAW-2359
Topical Report
July 2000

THE B&W **OWNERS GROUP**

Risk-Informed Applications Committee

Demonstration Project
to Apply
Risk-Informed Inservice Testing
to
Air-Operated Valves

FRAMATOME
TECHNOLOGIES

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Demonstration Project to Apply Risk-Informed Inservice Testing to Air-Operated Valves

Prepared for the
B&W Owners Group
Risk-Informed Applications Committee

by
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EXECUTIVE SUMMARY

This is a demonstration project for the B&W Owners Group (B&WOG). The objective of this project is to apply the American Society of Mechanical Engineers (ASME) risk-informed inservice testing (RI-IST) methodology to air-operated valves (AOVs) at Davis-Besse, the B&WOG lead plant for RI-IST. This report documents the application of the ASME OMN-3 Code Case to AOVs for the inservice testing (IST) program at Davis-Besse. Since the B&WOG has also been participating in development of the Joint Owners Group (JOG) AOV Program, a secondary objective is to create some synergy between the RI-IST Program and the JOG AOV Program.

A comparison has been made of AOV risk and safety significance between participating B&WOG plants. The comparison information is based upon rigorous application of the ASME OMN-3 Code Case for Davis-Besse, and upon best-available data for the other B&WOG plants. The comparison is provided for perspective, and is not intended to commit any B&WOG plant other than Davis-Besse to a RI-IST program at this time. With this in mind, the tabulation of the overall AOV safety categorization for the B&WOG plants is shown in the table below:

Plant	Davis-Besse	Crystal River-3	TMI-1	Oconee-3
Total AOVs in Plant	766	715	910	385
Safety Related AOVs	105	73	193	65
AOVs Reviewed for AOV Program	180	85	193	40
AOVs in IST Program	83	70	70	67
AOVs that are HSSC*	15	12	4	6

* "High Safety Significance Component" determination for Davis-Besse is based upon rigorous application of Code Case OMN-3. For the other B&WOG plants the determination is based upon best available information and is subject to change.

By applying this methodology at Davis-Besse, several insights became apparent. First, the number of AOVs in the IST Program that are high safety significance components (HSSC) is small (18% for Davis-Besse). Second, no AOVs outside the Davis-Besse IST Program were identified as being HSSCs. Comparison of AOV application and PRA data across the B&WOG plants produces expectations that the other B&WOG plants will have similar small numbers of HSSC AOVs, once the methodology has been completely implemented.

In addition to applying the ASME RI-IST methodology to IST program AOVs at Davis-Besse, the methodology was also applied to the safety categorization of AOVs for the overall Davis-Besse AOV Program. Thus, the RI-IST Program and the JOG AOV Program have been synergistically linked to create the Davis-Besse AOV Program.

The Davis-Besse AOV program ensures operational readiness of AOV assemblies at Davis-Besse. Testing strategies have been developed for AOVs in proportion to component safety significance. The Davis-Besse AOV test strategies are a coupling of design verification, response time testing, diagnostic testing, setpoint control, periodic exercising, and preventive maintenance to provide assurance that AOV assemblies will perform their intended safety function.

With the conclusion of this demonstration project, Davis-Besse has a solid technical basis to apply RI-IST in support of a licensing request to the NRC for alternative testing requirements for IST AOVs. This project also creates a RI-IST template that can be used for other IST components, and can be used at other B&WOG plants.

ACKNOWLEDGEMENTS

This demonstration project has provided useful technical results for the B&WOG because of the support and active participation of the IST engineers, the PRA engineers, the AOV engineers, and the Davis-Besse Expert Panel. In particular the following individuals are thanked for their support and effort in collecting the information provided in this report:

Organization	Individuals
FirstEnergy / Davis-Besse	Greg Estep, AOV Engineer Ken Byrd, Senior PRA Engineer Tim Thompson, IST Engineer Scott Brinkman, PRA Engineer Allen McAllister, Engineering Manager Davis-Besse Expert Panel Members
Florida Power Corp / Crystal River	Tim Howard, IST Engineer Larry Ganstine, AOV Engineer Dave Miskiewicz, PRA Engineer
GPU Nuclear / TMI-1	Bob Masoero, IST Engineer Jim Gilles, AOV Engineer Hassan Elrada, PRA Engineer
Duke Power Corporation / Oconee	Ken Beasley, AOV Engineer Duncan Brewer, PRA Engineer/Manager Rob Boyer, PRA Engineer Jason Patterson, IST Engineer
Framatome Technologies / Lynchburg	Bob Enzinna, Principal Engineer Mike Epling, Project Manager Bob Schomaker, Project Manager (JOG/AOV)
The Wesley Corporation / Tulsa	Wes Rowley, Consulting Engineer

In addition the ASME OM-18/19/AOV Working Group and the JOG-AOV Committee were helpful in their indirect support of this demonstration project.

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1.1 Purpose

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This demonstration project creates a RI-IST template that can be used for other IST components, and for other B&WOG plants. Its use at the B&WOG plants other than Davis-Besse is optional.

Entergy Operations is developing its own RI-IST program for the ANO-1 nuclear plant and did not participate in this B&WOG project.

1.2 IST Program

Every nuclear power plant is required to have an IST Program by their plant Technical Specifications. The requirements for these IST Programs are mandated by the NRC in 10 CFR 50.55a, which references an ASME code for the specific technical requirements. Periodically the NRC revises 10 CFR 50.55a to reference a later version of the ASME code. A survey of the B&WOG plants show that they are currently on the IST Code of Records as shown in Table 1-1.

Table 1-1 IST Code of Record for B&WOG Plants

ASME IST Code	Davis-Besse	Crystal River-3	TMI-1	Oconee-1,2,3
B&PV Code 1989		X	X	X
B&PV Code 1986	X			

There are two major IST codes for IST Programs. Prior to 1990, the ASME published its IST requirements for pumps, valves, and snubbers in the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI (Sub-sections IWF, IWP, and IWV). Starting in 1990 the ASME has published its IST requirements for pumps, valves, and snubbers in the ASME Operations & Maintenance (OM) Code, Section IST (Sub-sections ISTA, ISTB, ISTC, and ISTD).

The NRC has decided to update 10 CFR 50.55a to endorse the ASME OM Code (1995 Edition and 1996 Addenda) for IST. This decision became final when the NRC published the change in the Federal Register on September 22, 1999.

1.3 AOV Program

Now that the MOV Program (mandated by NRC Generic Letters 89-10 and 96-05) has been mostly implemented by the nuclear power industry, attention has been turned to AOVs. The industry has developed a voluntary JOG AOV Program. The JOG AOV Committee has been created to coordinate the industry AOV effort, and the committee includes representatives from each of the Owners Groups. The lessons learned from the recent MOV effort are being fed into this committee. The intent of the JOG AOV Program is to specify industry AOV Program minimum requirements (including design, setup, testing, and maintenance) to ensure that AOVs are capable of performing their intended risk significant safety functions. By implementing the JOG AOV guidelines, utilities will focus resources on the most critical AOVs in the plant.

Representing the B&WOG utility interests, three members of the B&WOG's Valve Working Group are voting participants on the JOG AOV committee. In a supporting role to the B&WOG Valve Working Group, the B&WOG Risk Informed Applications Committee (RIAC) has been available to provide risk-based expertise.

This JOG AOV Program provides two categories for its active safety-significant AOVs and allows risk informed safety categorization to affect the implementation requirements. Thus, there is potential synergy to be realized by coupling, in some fashion, the IST Program requirements and the JOG AOV Program requirements.

2. BACKGROUND FOR RI-IST

2.1 RI-IST Methodology

The RI-IST methodology was developed by a Research Task Force of the ASME Center for Research and Technology Development, under joint funding from the four NSSS-owners groups, NRC, EPRI, Industrial Risk Insurers, and Japan Atomic Power Company. This methodology is described in ASME CRTD Vol. 40-2 publication [1].

2.2 ASME RI-IST Requirements

The RI-IST requirements have been developed by the ASME O&M Committee over the past several years via a series of code cases as alternatives to the ASME OM Code:

- OMN-3 Code Case, "Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants" [2, 3];
- OMN-4 Code Case, "Alternative Requirements for Inservice Testing Using Risk Insights for Check Valves in LWR Power Plants" [4];
- OMN-7 Code Case, "Alternative Requirements for Inservice Testing Using Risk Insights for Pumps in LWR Power Plants" [5];
- OMN-xx (AOV) Code Case, "Alternative Requirements for Inservice Testing Using Risk Insights for Pneumatically- and Hydraulically-Operated Valve Assemblies in LWR Power Plants" [6]; and,
- OMN-11 (MOV) Code Case, "Alternative Requirements for Inservice Testing Using Risk Insights for Motor-Operated Valve Assemblies in LWR Power Plants" [7].

The OMN-3 Code Case provides the requirements for the probabilistic risk assessment (PRA) risk ranking and the Expert Panel safety categorization process. The OMN-3 process organizes components into two bins: high safety significance components

(HSSCs) and low safety significance components (LSSCs). The OMN-3 Code Case also defines the entire RI-IST process, including determination of aggregate risk, corrective action, and records. The other four code cases provide testing strategies for that particularly defined group of IST components.

2.3 NRC RI-IST Requirements

The NRC has heavily participated in both the ASME research process and the ASME code case development process. In 1998 they issued two applicable Regulatory Guides:

- Regulatory Guide 1.174, "An Approach For Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes To The Current Licensing Basis" [8],
- Regulatory Guide 1.175, "An Approach For Plant-Specific, Risk-Informed Decisionmaking: Inservice Testing" [9].

RG 1.174 is a regulatory guide applicable to all risk-informed applications. RG 1.175 is an application-specific regulatory guide for RI-IST.

2.4 NRC RI-IST Licensing Actions

When the NRC was ready for some RI-IST pilots, Comanche Peak and Palo Verde were selected. After almost three years of licensing effort, Comanche Peak received a Safety Evaluation Report (SER) in August 1998. Palo Verde withdrew their licensing application. In December 1998, San Onofre submitted a "second generation" RI-IST Program for NRC review. The NRC has stated that they expect to issue the San Onofre SER in February 2000.

South Texas submitted a partial scope RI-IST Program for twelve containment isolation valve check valves per unit in 1998. They received an SER from the NRC in August 1999 approving their submittal for an interval extension from 18 months (their refueling interval) to five years."

2.5 Industry Pilot and Demonstration Projects

Over the past six years, there have been two EPRI pilot projects, including a ten-plant pilot for RI-IST pumps and valves and a seven-plant pilot for RI-IST snubbers. (See Table 2-1 for a summary of the AOVs identified in the IST programs for the original ten EPRI RI-IST pilot plants in 1995 (excerpt from reference 10).) There have been two Westinghouse Owners group (WOG) demonstration projects, including emergency core cooling system (ECCS) check valves at Vogtle and IST pumps at Shearon Harris. The Combustion Engineering Owners Group (CEOG) performed an ECCS check valve demonstration project at six stations. These pilots and demonstration projects have provided a substantial amount of technical information to the ASME (and the NRC) for the development of these code cases.

Table 2-1 Summary of Risk Categorization of AOVs from EPRI Study

Pilot Plant	Total Valves in IST	Total AOVs in IST	High Risk AOVs in IST	Low Risk AOVs in IST
St Lucie 1	537	33	1	32
St Lucie 2	513	33	4	29
Palo Verde	501	40	4	36
Comanche Peak	619	155	3	152
Seabrook	515	102	7	95
Wolf Creek	620	96	6	90
South Texas	564	103	22	81
Point Beach 1 & 2	683	136	26	110
TMI 1	345	77	4	73
Peach Bottom	1477	469	400	69

2.6 RI-IST Program for AOVs at Comanche Peak

When Comanche Peak was granted their SER [11] for their licensing submittal to the NRC as a pilot, the IST commitment for AOVs was:

- test 17 HSSC AOVs per ASME IST code of record (OM Part 10)
- test 108 LSSC AOVs per ASME IST code of record, except extend intervals up to six years
- exercise all IST AOVs at least once per operating cycle
- work with EPRI to develop an enhanced AOV program similar to the MOV program established in response to NRC Generic Letter 89-10 and 96-05 to ensure adequate margin

- additional monitoring for AOVs to include diagnostic testing, elastomer replacement, and response time testing

Table 2-2 Summary of Current IST Intervals for Comanche Peak AOVs

Safety Categorization	Quarterly	Cold Shutdown	Refueling
HSSC AOVs	11	6	0
LSSC AOVs	96	12	0

Comanche Peak is currently in the process of implementing their RI-IST Program and expects to be fully implemented over two refueling intervals. From Table 2-2, there are 108 AOV surveillance tests to move from quarterly (96) and cold shutdown (12) to every six years.

2.7 RI-IST Program for AOVs at San Onofre

Southern California Edison (SCE) submitted a RI-IST licensing proposal to the NRC in December 1998. This proposal includes most IST pumps and valves, including AOVs. The SCE commitment is that AOVs will be tested in accordance with the Code of Record (OM Part 10) with the exception that the test frequency will be in accordance with the component risk categorization defined below:

- HSSC testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a(f).

- Quad B [1] testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a(f) except based on evaluation of design, service condition, performance history, and compensatory actions, the test frequency may be extended not to exceed 6 years plus a 25% margin. Additionally Quad B AOVs will be stroked at least once during each operating cycle.

- LSSC testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a(f)) except based on evaluation of design, service condition, and performance, the test frequency may be extended not to exceed 6 years plus a 25% margin. Additionally, LSSC AOVs will be stroked at least once during each operating cycle.

- In addition, all AOVs will be exercised at least once during each operating cycle.

SCE has committed to work with the Joint Owners Group for Air Operated Valves (JOG AOV) to develop an enhanced AOV testing program similar to the MOV test program established in response to GL 89-10 and GL 96-05 (described above). The intent of this program is to specify AOV Program requirements to provide assurance that AOVs are capable of performing their intended safety-significant or risk-significant functions. Elements of the proposed program include establishing a scope of applicability, a categorization methodology, validation of safety significant functions by performing design basis reviews, performing baseline testing, and identifying the types of periodic testing necessary to identify potential degradation in a timely manner. SCE's current testing program meets or exceeds the current JOG AOV testing requirements for components within the IST program. As of December 1998, the design basis evaluations of all AOVs had not been performed. These evaluations will check the actuator capability versus the required design-bases conditions to ensure adequate margin does indeed exist.

The AOV program is assessed on a biennial frequency, updated as appropriate with new design and operational information, and incorporates any applicable site or industry lessons learned.

The proposed AOV testing program and planned test activities described above are consistent with the guidance provided in Sections 3.1 and 3.2 of RG1.175.

The maintenance and test strategies for the AOVs at San Onofre are:

- Static diagnostic testing performed following valve or actuator overhaul or corrective maintenance that could impact valve function or as requested.

- Routine overhauls: disassembly, cleaning, inspection; replacement of elastomers; and re-assembly and testing.

- Response time testing.

- Valves exposed to extreme environmental conditions will have repetitive maintenance orders for actuator replacement.

- Positioner preventive maintenance (PM) consists of the following: removal disassembly, cleaning, inspection; parts replacement as required; reassembly and test.

- Dynamic testing (the following testing parameters as applicable): bench set, maximum pneumatic pressure, seat load, spring rate, stroke time, actual travel, total friction.

- Setpoint of pressure switch(s) relief valve, regulator, etc.

- Minimum pneumatic pressure to accomplish safety function of valve assembly.

- Pneumatic pressure at appropriate point in operation.
- Others as applicable.

3. RI-IST PROGRAM DESCRIPTION FOR AOVs

3.1 Relation between IST AOVs and JOG AOVs

Since all plants have IST programs for their AOVs, and the JOG was developing a voluntary program similar to a "Generic Letter 96-05" type of AOV periodic verification, the B&WOG decided that a pro-active AOV testing program was wise. In parallel with the industry's JOG AOV initiative, the B&WOG has funded a RI-IST Project for AOVs. These two programs have many common elements, such as risk-informed component categorization, testing strategies, and performance / condition monitoring. This parallel approach is pro-active and will create some economic efficiencies for AOV testing, when a RI-IST program for AOVs is developed that bundles the proposed IST program changes with the improvements initiated by the JOG program.

3.2 AOV Scoping

The scope of AOVs within the RI-IST program was determined. For initial consideration, the existing IST AOVs were included, as well as AOVs outside of the current IST program that may be risk-significant.

3.3 PRA Risk-Ranking

One of the principal activities in the application of RI-IST is the categorization of the applicable systems, structures or components (SSCs) according to safety significance. A major input to this categorization process involves the use of risk-importance measures derived from the plant-specific PRA. The Fussell-Vesely Importance (F-V) and the Risk Achievement Worth (RAW) are the most common measures used in the relative risk ranking of SSCs:

- Fussell-Vesely (F-V) importance - for a specified SSC, Fussell-Vesely importance is the fractional contribution to core damage frequency (CDF) or large early release frequency (LERF) of all accident sequences from the PRA containing that SSC.

- Risk Achievement Worth (RAW) - for a specified SSC, Risk Achievement Worth reflects the increase in CDF or LERF when that SSC is assumed to be out-of-service due to testing, maintenance, or failure. It is the ratio of the increased CDF or LERF when that SSC's basic event probability is unity to the baseline CDF or LERF.

The use and limitations of these risk importance measures are described more fully in the references [2,3,8].

The PRA analyst provided a listing of AOVs modeled in the PRA. This list showed the Fussell-Vesely (F-V) and Risk Achievement Worth (RAW) importance measures for each of those AOVs to the CDF end state and the LERF end state, if available. Those AOVs that are also within the IST Program are identified. This information is arranged in a spreadsheet or database listing.

3.4 PRA Sensitivity Studies

PRAs vary in their modeling assumptions. To better understand the effects of modeling for the selected AOVs, the six PRA sensitivity studies shown in Figure 3-1 were performed per the OMN-3 Code Case [3].

Figure 3-1 First Excerpt from ASME OMN-3 Code Case

"(a) The following sensitivity studies shall be performed:"

"(1) Data and Uncertainties - Failure probabilities of components within the PRA models for those IST components that have initially very high or very low safety significance shall be selectively increased and/or decreased to determine if the results are sensitive to changes in the failure data. If sensitivities are indicated, steps shall be taken to determine if uncertainty ranges can be reduced and to validate the failure probabilities included in the models."

"(2) Human Factors - The PRA shall be requantified, and the F-V and RAW importance measures recalculated, after human actions modeled in the PRA to recover from specific component failures are removed from the models (i.e., the probability of successful recovery due to human intervention is set to zero)."

"(3) Test and Maintenance Unavailabilities - The models shall be requantified with test and maintenance unavailabilities minimized or removed, and importance measures recalculated."

"(4) LSSC Failure Rates - Failure rates for initially ranked LSSC components shall be increased by a factor representing the upper bound (95%) of the failure rate and the PRA models requantified. The importance measures shall then be recalculated.

"(5) Truncation Limits - If the PRA has not been quantified with a truncation limit in accordance with Ref 1 (EPRI "PSA Applications Guide"), the PRA model shall be requantified with the truncation limit lowered to this value. The importance measures shall then be recalculated."

"(6) Common Cause - Sensitivity studies shall determine the impact of increased or decreased common cause failure rates. Importance measures shall then be recalculated

"(b) The results of these sensitivity studies and any others that are performed, shall be documented. In addition to the magnitude of changes to the CDF or LERF, all insights obtained from the results shall be described."

"(c) The results and insights of these sensitivity studies shall be provided to the Expert Panel for their consideration in the final categorization of the components."

3.5 Deterministic Studies

The ASME OMN-3 Code Case provides specific requirements for qualitative assessments for each AOV, both modeled and not modeled in the PRA. Figure 3-2 shows the specific requirements.

Figure 3-2 Second Excerpt from ASME OMN-3 Code Case

"(a) The following qualitative assessments shall be performed:
(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);
(2) potential consequences of shutdown (outage) conditions; and
(3) response to external initiating events (e.g., seismic, fire, high winds / tornadoes, flooding, etc.)"

"(b) Qualitative assessments shall be performed for plant-specific design bases conditions and events not modeled in a PRA."

"(c) Qualitative assessments shall consider the impacts upon the plant to:
(1) prevent or mitigate accident conditions;
(2) reach and/or maintain shutdown conditions;
(3) preserve the reactor primary coolant pressure integrity; and
(4) maintain containment integrity."

"(d) Qualitative assessments shall also consider:
(1) safety function being satisfied by the component's operation;
(2) level of redundancy existing at the plant to fulfill the component's function;
(3) ability to recover from a failure of the component;
(4) performance history of the component;
(5) plant Technical Specifications requirements applicable to the component;
(6) Emergency Operating Procedure instructions that use the component(s); and
(7) design and licensing basis information relevant to IST component function."

"(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multi-train impacts) or critical safety function (e.g., multi-system impacts), shall also be considered."

"(f) These qualitative assessments and the Expert Panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result."

"(g) These qualitative assessments shall be available to the Expert Panel for their decision of component safety categorization."

3.6 Expert Panel Makeup

Expert Panel requirements are defined in the ASME OMN-3 Code Case. First, the Expert Panel must have at least five members. In most cases plants use between six and ten members (the more knowledgeable and senior the members are, the less the total number of members can be).

Three of those members must represent plant expertise in PRA, operations, and safety analysis engineering areas. This is because the bases for these three areas are important for overall plant safety and these three bases are likely to be somewhat different. Thus, during Expert Panel deliberations the bases for the PRA, the emergency operating procedures (EOPs), and the Safety Analysis Report (SAR) will be explored, especially the differences in these bases. This is ideal information to factor into the integrated decision-making process.

The remaining panel members should be selected from among system performance, maintenance, licensing, component performance, IST, or quality assurance (QA). Ideal members are those with experience in multiple areas and who are knowledgeable of the AOVs being discussed (including the AOV's system function and / or performance).

Frequently plants will invite visitors into the Expert Panel sessions, such as the responsible System Engineer when discussing the AOVs in his / her systems.

The Chairman of the Expert Panel should typically not be the "boss", since the whole idea of the Expert Panel performing the integrated decision-making is for everyone to offer their knowledge, experience, and perspective so that the final HSSC / LSSC determination is correct and not likely to be changed with a different Expert Panel. The Chairman should be someone who can make decisions with respect to guiding the discussions, asking for a vote, using Robert's Rules of Order if appropriate, assigning a member to gather more information for a later discussion if needed, etc. Specifically the Chairman has to be quite familiar with the provisions of the ASME OMN-3 Code Case.

The ASME O&M Committee white paper that supported the OMN-3 Code Case during its development may be particularly helpful for the Chairman.

If members of the Expert Panel are likely to be absent from the scheduled meetings from time to time, then alternates to those members should be identified. Note that alternates should receive the same PRA training and be relatively knowledgeable on the process of Expert Panel deliberations.

3.7 PRA Training of Expert Panel

The ASME OMN-3 Code Case specifies that the Expert Panel shall be "trained and indoctrinated in the specific requirements to be used for this Code Case..." including "...application of risk analysis methods and techniques..." The minimum training is identified in the Code Case by the six areas described in Figure 3-3:

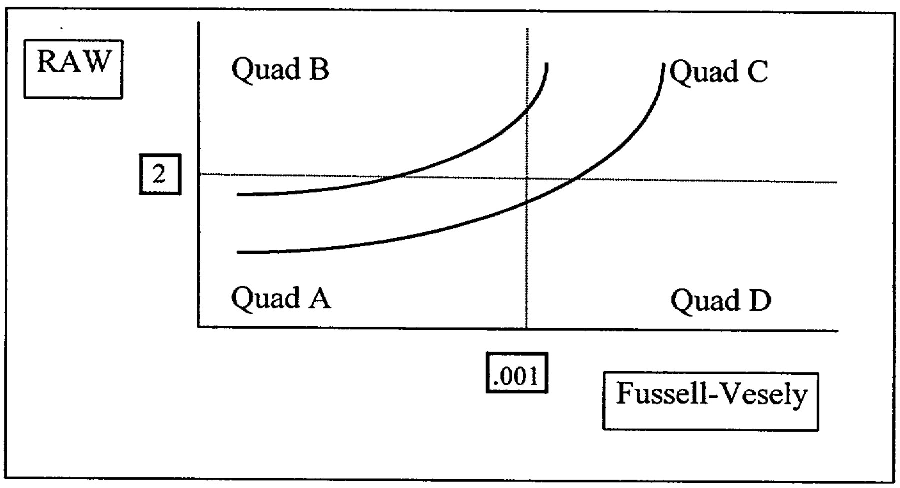
Figure 3-3 Third Excerpt from ASME OMN-3 Code Case

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty)
(2) use of risk importance measures
(3) assessment of failure modes
(4) reliability versus availability
(5) risk thresholds
(6) expert judgment elicitation

3.8 Expert Panel Decision-Making Criteria

The initial decision-making criteria of the Expert Panel should be similar to that identified in the ASME OMN-3 Code Case [3]. Then the AOVs modeled by the PRA can be placed on an ASME "quad chart" (originally suggested by reference 1) such as Figure 3-4 (using log-log paper). Almost all AOVs in the plant will fall on this "quad chart" between the two arcs shown below and most will be in Quad A.

Figure 3-4 Quadrant Chart



The following plant decision criteria should be used to determine placement of AOVs in the four Quads:

- Quad A - For F-V < .001 and RAW < 2: These are the least important AOVs in the IST Program, thus they should be classified LSSCs, as long as the Expert Panel does not find sufficient cause from the deterministic or sensitivity studies for HSSC classification. This will likely be the largest category of AOVs.

- Quad B - For F-V < .001 and RAW > 2: These are relatively unimportant AOVs in the IST Program, however, when they are out of service their RAW represents the "multiple" of their impact on their F-V risk importance. These AOVs should be categorized HSSC, unless there is some known compensatory measure that assures the plant that they are not out of service (e.g., they are periodically checked by operators on shift, in the plant Preventive Maintenance (PM) Program, or exercised periodically by normal plant evolutions). If the IST Program is the only attention this AOV receives, then conservatively it should be categorized as HSSC (especially if the RAW multiple is high like 20 or 200). More importantly, these AOVs should be managed by the plant to ensure they are available.

- Quad C - For F-V > .001 and RAW > 2: These are the most important AOVs in the plant and they become even more important when they are out of service. These AOVs need to be monitored for degradation and maintained to prevent inservice failure. Clearly, these AOVs are HSSCs.

- Quad D - For F-V > .001 and RAW < 2: These are important AOVs in the plant but for some reason have a minimal impact on the plant when out of service (perhaps they are assumed by the PRA to be relatively unreliable). Few, if any, AOVs will end up in this category. The Expert Panel should understand why an AOV ended up in this category. These AOVs are HSSCs.

For the modeled and unmodeled AOVs in the plant, a deterministic understanding of how that particular AOV would likely impact the plant for Containment Integrity or Shutdown Cooling needs to be made. For Containment Integrity, the containment isolation valves (CIVs) are relatively important and the bigger diameter CIVs are likely the most important. For Shutdown Cooling, the AOVs in the Decay Heat Removal (DHR) System and Service Water Systems are relatively important and the AOVs that can disable a train are likely the most important.

It is possible for a modeled AOV to show up as unimportant using a Level 1 PRA for the CDF end state, but to become important with a Level 2 PRA for the LERF end state or a Shutdown PRA for core cooling end state.

3.8.1 Preservation of Defense in Depth

The Expert Panel must ensure that defense-in-depth is maintained by the RI-IST program. Defense-in-depth is maintained by ensuring that the proposed changes do not cause strong reliance to be placed on any particular plant feature, human action, or programmatic activity. Nor should the RI-IST program place excessive reliance upon components with low levels of redundancy or diversity. A review should be done to ensure that components are not ranked low solely because of low initiating event frequency. Performance of the PRA sensitivity studies (see Section 3-4) provides assurance that components are not ranked low solely because of the high reliability of a component, a group of similar components (i.e., common cause failure rate), or human action. The deterministic studies (see Section 3-5) ensure that balance is maintained between PRA metrics and other factors that the PRA may not explicitly model such as components or functions (e.g., containment performance), alternate modes of operation, and external events.

3.8.2 Preservation of Safety Margin

Sufficient safety margin must be maintained when compared to the existing IST program. The proposed changes to test intervals and/or test methods should not cause significant degradation such that safety margins are reduced over the IST interval. The Expert Panel should identify the compensatory measures that are effective for ensuring component operability. In addition, testing strategies that stagger the extended IST intervals for groups of similar components, along with tracking and trending, provide assurance that the safety margin will be maintained.

3.9 Expert Panel Work Sheet

The Expert Panel has to make HSSC / LSSC determinations on about 50 to 200 AOVs. To ensure that the Expert Panel does not ignore a potentially important aspect of a particular AOV being considered, but efficiently uses available time, a work sheet for each AOV or group of AOVs is to be used.

Figure 3-5 was the initially suggested format for the work sheet. This format was to be modified to include any parameters or data that the plant felt was important, perhaps based on experience with the Maintenance Rule integrated decision-making process by the Expert Panel. The final work sheet for each AOV (or group of AOVs) is to be preserved in the plant records so that the basis for the actual HSSC / LSSC determination can be easily retrieved later (perhaps several years later).

Section 6 contains the modified work sheet that was used by Davis-Besse. Improvements were made to the work sheet by the plant in order to document information that was important to Davis-Besse. The work sheet also contains additional information because the same Davis-Besse Expert Panel also categorized AOVs for implementation of the JOG AOV initiative (see Section 5).

Figure 3-5 Suggested Work Sheet for Expert Panel

AOV Plant ID No. ______________ Size & Type _______ Valve Operator ☐ Diaphram ☐ Piston Plant System __________

Functional Description ____

Current IST Strategy __________________________ Relief Request ___________________________

F-V/CDF ________ RAW/CDF ________ F-V/LERF ________ RAW/LERF _______

Results of PRA ____
Sensitivity Studies: ____

Quad Chart PRA Location of AOV: ☐ A ☐ B ☐ C ☐ D

Impact on: ☐ Containment Integrity? ☐ Shutdown Cooling?

IST Basis: ____

____

EOP Basis: ____

____

Other Basis: ____

____

Performance History of AOV ____

Quad Chart Deterministic Location of AOV: ☐ A ☐ B ☐ C ☐ D

Compensatory Actions for AOV ____

Expert Panel Decision on Categorization: ☐ HSSC ☐ LSSC Key Decision Basis ____________________________

3.10 Testing Strategy

The program for managing the degradation of the AOVs was designed to be a combination of the JOG AOV Program, the preventive maintenance program, and the IST Program.

The B&WOG is participating in a project with the JOG to develop an AOV program similar to the motor-operated valve (MOV) Program mandated by generic letter (GL) 89-10 and 96-05. This program is applicable to the AOVs in the IST program. In accordance with the JOG program, the AOVs that are HSSC will be evaluated to ensure that they are capable of performing their safety function under the appropriate design basis conditions.

The preventive maintenance program will address elastomer replacement and other tasks appropriate for the type of AOV. In addition, plant performance monitoring will perform diagnostic testing and response time testing, both of which provide an indicator of the degradation of the AOV.

See Table 3-1 below for the RI-IST Program requirements.

Table 3-1 RI-IST Program Requirements

Category	Requirements
HSSC AOVs	Testing will be performed in accordance with the Code of Record as defined by 10CFR50.55a and ASME OMN-xx (AOV) Code Case.
LSSC AOVs	Testing will be performed in accordance with the Code of Record as defined by 10CFR50.55a and ASME OMN-xx (AOV) Code Case.
All AOVs	All AOVs will be stroked at least once during the operating cycle.

Implementation of the RI-IST to LSSCs will consist of grouping components and then staggering the testing of the group over the test frequency.

Components will be grouped based on:

- manufacturer
- model
- service condition
- size

The population of the group will be dependent on:

- total population available
- maintaining current testing schedule

Grouping components in this manner and testing on a staggered basis over the test frequency will reduce the importance of common cause failure modes as components in the same staggering failure mode group are continually being tested. This ensures that the component capability will be maintained over the test interval.

Testing of components within the defined group will be staggered over the test interval, typically 6 to 10 years. Testing will be scheduled on regular intervals over the extended period to ensure that all components in the group are tested at least once during the test interval and not all components are tested at one time. The staggering allows the trending of components in the group to ensure the test frequency selected is appropriate.

Testing will be scheduled / planned such that there is no more than one cycle between tests of components in a group.

3.11 Aggregate Risk

The cumulative impact of the test frequency changes on total plant risk (i.e., CDF and LERF) will be evaluated to ensure that any change in plant safety is within the acceptable range.

This will be done by performing sensitivity studies to determine the potential risk impact of increasing inservice testing intervals simultaneously on all the affected components.

The unavailabilities of any IST components will be increased by a factor proportional to the proposed increase in the component test interval (a conservative approach that provides little credit for AOV periodic exercise and preventive maintenance). For each sensitivity case, the PRA cut set results will be requantified using the adjusted component unavailabilities due to the proposed test intervals. The new total CDF and LERF for each case will be obtained. These new values will then be compared with the CDF and LERF of the base case to assess the net change in total plant risk due to proposed IST test frequencies.

In addition, component risk importances will be re-evaluated for the groups of IST components in Table 3-2 to identify any components that may move up from low safety significant components to high safety significant components:

Table 3-2 Sensitivity Studies for Quad B and Quad A AOVs

Quad B	Low F-V, high RAW with credit taken for compensatory measures identified by the expert panel
Quad A	Low F-V, low RAW with no credit taken for compensatory measures because this category implies that increases in component unavailabilities are not expected to impact risk significantly

Due to uncertainty in how test interval changes will actually affect the component unavailabilities, a number of conservative assumptions are made as summarized below:

- It is assumed that any increase in test intervals would simultaneously impact the reliability of all IST components in the low safety-significant component (LSSC) category.

- Consistent with the PRA techniques, the component unavailability required to change state, is assumed to be:

$$Q = \lambda_{OD} + \lambda(T/2)$$

Q = total component unavailability

Where:	λ_{OD}	=	Component unavailability on demand
	λ	=	Component failure rate per hour
	T	=	Interval between tests that verify operability of the component

- The component unavailability is 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 semi-annually is assumed to increase the total component unavailability by a factor of two. This is a very conservative assumption because it assumes that not only the $\lambda(T/2)$ term would be increased by a factor of two, but also the failure on demand term (λ_{OD}) is assumed to be directly impacted by the change in the test interval.

- An alternative (less conservative) method is to examine the component failure history and sort the failure modes into those that appear to be demand related (i.e., failure due to cyclic stressors) and those that are time related (i.e., failure due to time-in-service related stressors).

- Decrease in wearout due to less frequent testing is assumed to be negligible although frequent testing has been seen to cause components to be less available due to wearout.

- It is conservatively assumed that all IST tests are fully effective in finding the causes of component unavailability.

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

3.12 Monitoring and Corrective Action

Trending of test results in each AOV group will ensure that the IST frequency is appropriate.

When a component fails to meet established test criteria, corrective actions will be taken in accordance with the plant's corrective action program (CAP) as described below for the RI-IST.

For components not meeting the acceptance criteria, a CAP form will be generated. This document initiates the corrective action process. Also, the initiation of a CAP form may be from causes other than an unacceptable IST test. Programs exist that provide timely information to the IST coordinator that the performance of a reliable component has degraded. The recorded information will 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.

The initiating event could be any other indication that the component is in a non-conforming condition. The unsatisfactory condition will be evaluated to:

a) Determine the impact on system operability and take appropriate action.

b) Review the previous test data for the component and all components in the group.

c) Perform a cause analysis.

d) Determine if this is a generic failure. If it is a generic failure whose implications affect a group of components, initiate corrective action for all components in the affected group.

e) Initiate corrective action for failed IST components.

f) Evaluate the adequacy of the test strategy. If a change is required, review the IST test schedule and change as appropriate.

The results of component testing will be provided to the PRA group for input to PRA model evaluation. (see Section 3.13)

For an emergent plant modification, any new IST component added will initially be included at the current Code of Record test frequency. Only after evaluation of the component through the RI-IST Program (i.e., PRA model evaluation if applicable and plant expert panel review) will this be considered LSSC.

3.13 Periodic Reassessment

As a living process, components will be reassessed at a frequency not to exceed every other refueling outage to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process.

The RI-IST reassessment will be completed within 9 months of end of the outage.

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 reassessment, number and type of tests, number of failures, corrective actions taken including generic implication and changed test frequencies. Once the PRA has been reassessed, the information will be brought back to the plant expert panel for deliberation and confirmation of the existing lists of HSSCs and LCCSs or modification of these lists based on the new data. As part of the plant expert panel, compensatory measures previously utilized to categorize components as LSSC will be validated. Additionally, the maximum test interval will be verified or modified as dictated by the expert panel.

3.14 Changes to RI-IST after Initial NRC Approval

Changes to the process described above will require prior NRC approval. Changes to the categorization of components and associated testing strategies using the above process will not require prior NRC approval. As changes to component categorization are made, the plant will periodically submit them to the NRC for their information.

4. AOV RISK COMPARISONS

This section provides a comparison of AOV risk and safety significance between B&WOG plants. Since Davis-Besse is the lead B&WOG plant for RI-IST, the information in this section for Davis-Besse is fairly complete and is based upon rigorous application of the ASME OMN-3 Code Case. However, the other B&WOG plants have not convened expert panels specifically for this project. Their AOV data is based upon the best-available risk data and/or previous expert panels that have met for other purposes. Therefore, the information for these plants is provided for purposes of comparison only.

4.1 Scope of AOVs

The scope of AOVs for the B&WOG plants is shown in Table 4-1 below. This scoping table shows total numbers of AOVs in the plant, number of AOVs in the Maintenance Rule Program, number of Safety-Related AOVs, number of AOVs in the AOV Program (implementation of JOG initiative), and the number of AOVs in the IST Program.

Table 4-1 Comparison of AOVs for B&WOG Plants

Plant	Davis-Besse	Crystal River	TMI-1	Oconee-3
Total AOVs in Plant	766	715	910	385
AOVs in Maintenance Rule Program	366	144	630 (note 1)	(note 2)
Safety Related AOVs	105	73	193	65
AOVs Reviewed for AOV Program	180	85	193	40 (note 3)
AOVs in IST Program	83	70	70	67

Table 4-1 Notes:

1. Since Maintenance Rule program is at system level, this represents AOVs within in-scope systems.
2. Maintenance Rule program is at system level.
3. Preliminary.

4.2 Generic Plant Systems in B&WOG Plants

Although the B&WOG stations all have similar Nuclear Steam Systems (NSS) including the once-through steam generator (OTSG), because of vintage and architect-engineer decisions during the original design phase of each plant, there is little consistency in the application of AOVs for these stations (i.e., even the systems have different names in many cases). So a conceptual drawing was created to provide a "standard" B&WOG plant to assist in the AOV comparisons (see Figure 4-1). Table 4-2 compares the number of IST AOVs grouped according to these "generic" system categories.

Figure 4-1 Conceptual B&WOG "Generic" Plant Systems

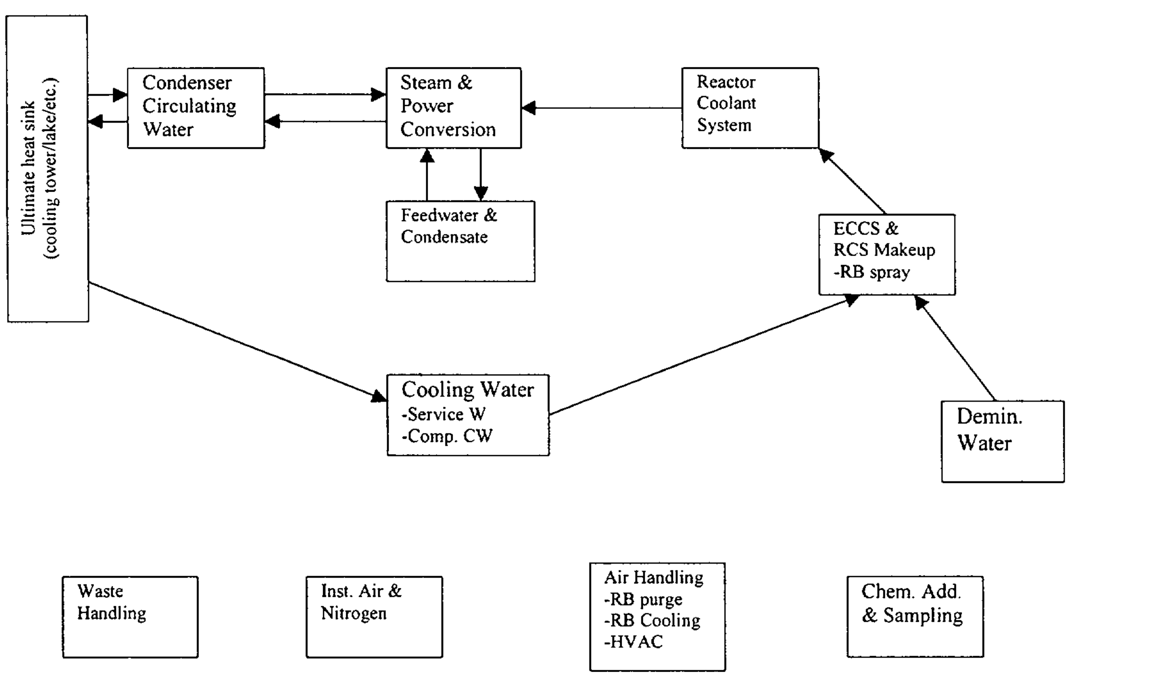


*Table 4-2 IST Program AOVs by Generic System**

Generic System Category	Davis-Besse	Crystal River	TMI-1	Oconee-3
Condenser Circulating Water				6
Cooling Water	14	34	17	10
ECCS & RCS Makeup	17	9	10	6
Feedwater & Condensate	4		8	13
Steam & Power Conversion	10	12	5	8
Air Handling	8	2	7	9
Inst. Air & N2	3	4	4	4
Waste Handling	12	3	11	4
Reactor Coolant System	7			2
Chemical Add. & Sampling	4	6	8	4
Demin. Water	4			
Other				1
Total	**83**	**70**	**70**	**67**

* See Appendix A for complete listing. AOVs of similar function may appear in different systems due to plant-specific delineation of system boundaries.

4.3 PRA Risk Ranking

Table 4-3 shows the number of AOVs that were modeled in the PRA and the number of IST AOVs that are modeled in the PRAs for the B&WOG plants. This tends to be a small number because of the typical design application for AOVs in the plant.

Table 4-3 Comparison of PRA-Modeled AOVs

Plant	Davis-Besse	Crystal River	TMI-1	Oconee-3
AOVs Modeled in PRA	46	38		24
AOVs in IST Program and Modeled in PRA	28	14	30	23

The PRA analysts at each plant provided a listing of AOVs modeled in the PRA for core damage frequency (i.e., Level 1). The risk importance measures for these AOVs were compared against risk thresholds for Fussell-Vesely and Risk Achievement Worth. The AOVs that were identified to be substantially above the PRA risk thresholds (F-V > 0.01 or RAW > 10), or just above the risk thresholds (F-V > 0.001 or RAW > 2) are shown in Table 4-4. A comparison listing of AOV importance measures by system is given in Table 4-5. Table 4-5 includes all of the AOVs modeled in each PRA. A notation in the table that the component was "truncated" is an indication that the risk-significance was so small that (even with a small truncation limit) it did not appear in any cut sets, and hence can be considered negligible.

Table 4-4a Identification of Highest Risk AOVs (F-V > 0.01 or RAW > 10)

Plant	Description	Plant ID	RAW	F-V
Davis-Besse	CCW Hx Temperature Control Valve	SW1424	10.2	0.012
		SW1429	10.2	0.012
		SW1434	10.2	0.012
Crystal River	Decay Heat Cooler Bypass and Outlet Flow Control Valves	DCV-177	17	0.01
		DCV-178	15.7	0.01
		DCV-17	17	0.01
		DCV-18	15.7	0.01
TMI-1		none		
Oconee-3		none		

Table 4-4b Other High-Ranking AOVs
(F-V > 0.001 or RAW > 2)

Plant	Description	Plant ID	RAW	F-V
Davis-Besse	Decay Heat Cooler CCW Isolation	CC1467 CC1469	2.23 2.15	0.002 0.001
	Decay Heat Cooler Flow Control	DH13A DH13B DH14A DH14B	2.21 2.37 3.23 4.86	0.002 0.003 0.004 0.006
	Reactor Coolant Pump Seal Injection Return	MU38	2.57	0
	Auxiliary Feed Pump Steam Admission	MS5889A MS5889B	2.80 2.14	0.003 0.001
	Main Steam Isolation	MS100 MS101	1.78 1.40	0.001 0.001
Crystal River	Main Steam Isolation	MSV-411 MSV-412 MSV-413 MSV-414	1.6	0.00143
	Main Steam Atmospheric Vent Valve	MSV-25 MSV-26	8.1 5.3	0.00 0.00
TMI-1	CCW Nonessential Supply isolation	IC-V-0003 IC-V-0004	2.42	0.00116
	Main Steam Atmospheric Vent Valve	MS-V-0004A MS-V-0004B	1.14	0.00136
Oconee-3	Condenser Circulating Water Outlet Valves	CCW-20 CCW-21 CCW-22 CCW-23 CCW-24 CCW-25	1.62	0.00137

Table 4-5 Importance Measures for PRA-Modeled AOVs by Generic System

Table 4-5a Condenser Circulating Water System

	Description	ID	RAW	F-V
Davis-Besse	Condenser Circulating Water Supply to turbine plant cooling water (TPCW) Hx Isolation Valve	CT2955	1.23	0.062 *
	TPCW High Level Cooling Water Tank Level Control Valve	CW620	1.75	0
Crystal River	None			
TMI-1	None			
Oconee-3	Condenser Circulating Water Outlet Valves (close for flood)	CCW-20 CCW-21 CCW-22 CCW-23 CCW-24 CCW-25	1.62	0.00137

* This component had a high F-V because of poor assumed reliability due to lack of a test or PM program. Because of this project, a periodic test was added, and the subsequent F-V is no longer significant.

Table 4-5b Cooling Water Systems

	Description	ID	RAW	F-V
Davis-Besse	CCW Hx Temperature Control Valve	SW1434 SW1424* SW1429*	10.2	0.012
	CCW Nonessential Supply Isolation valve (safety function is to close)	CC1460	1.03	0
	Decay Heat Cooler CCW Discharge Line Isolation Valve	CC1467 CC1469	2.23 2.15	0.002 0.001
	Emergency Diesel Generator Jacket Cooling Water Hx CCW Discharge Line Isolation Valve	CC1471 CC1474	1.59 1.78	0 0
Crystal River	Chilled Water Control	CHV-100 CHV-56 CHV-57 CHV-68 CHV-113	1.06 truncated truncated 1.05 truncated	0 truncated truncated 0 truncated
TMI-1	Coolant Supply and Return Valves for RB Fan Motor Coolers	NS-V-0052A NS-V-0052B NS-V-0052C NS-V-0053A NS-V-0053B NS-V-0053C	1.00	3.13E-7 2.32E-6 2.37E-6 3.13E-7 2.32E-6 2.37E-6
	CCW Nonessential Supply isolation valve (safety function is to close)	IC-V-0003 IC-V-0004	2.42	0.00116
Oconee-3	Emergency feedwater pump motor cooling valves	HPSW-184 LPSW-138 LPSW-516 LPSW-525	truncated	truncated
	Component cooling return valve from LD coolers and RCP thermal barrier HXs	CC-8	truncated	truncated

*SW1434 is modeled as the standby train in the PRA. SW1424 and SW1429 are included because any of the three valves can be operated as the standby train.

Table 4-5c ECCS & Makeup Systems

	Description	ID	RAW	F-V
Davis-Besse	Decay Heat Cooler Bypass and Outlet Flow Control Valves	DH13A DH13B DH14A DH14B	2.21 2.37 3.23 4.86	0.002 0.003 0.004 0.006
	Reactor Coolant Pump Seal Injection Flow Control or Isolation Valve	MU19 MU66A MU66B MU66C MU66D MU38	1.00 1.00 1.00 1.00 1.00 2.57	0
	Normal Makeup to the Reactor Coolant System Flow Control Valve	MU32	1.00	0
	Reactor Coolant Letdown Isolation Valve	MU3	1.00	0
	Makeup Pump Recirculation Valve	MU6406 MU6407	1.00 1.30	0 0
Crystal River	Decay Heat Cooler Bypass and Outlet Flow Control Valves	DCV-177 DCV-178 DCV-17 DCV-18	17 15.7 17 15.7	0.01 0.01 0.01 0.01
	Reactor Coolant Pump Seal Injection and Aux. Pressurizer Spray isolation/Flow Control Valves	MUV-116 MUV-124 MUV-144 MUV-244 MUV-245 MUV-49 MUV-50 MUV-90 MUV-97	truncated	truncated
TMI-1	Reactor Coolant Pump Seal Injection Isolation Valve	MU-V-0020 MU-V-0026	1.58 1.00	2.32E-4 2.93E-5
	Reactor Coolant Letdown Isolation Valve	MU-V-0003	1.00	4.73E-5
Oconee-3	Aux. Pressurizer Spray Flow Control Valve	HP-355	truncated	truncated
	Reactor Coolant Letdown Isolation Valve	HP-5	truncated	truncated

Table 4-5d Feedwater & Condensate Systems

	Description	ID	RAW	F-V
Davis-Besse	Startup Feedwater Control Valve	SP7A SP7B	1.00 1.02	0 0
	Deaerator Storage Tank Crossover Valve	FW423	1.00	0
Crystal River	Main Feedwater Control Valve	FWV-39 FWV-40	truncated	truncated
	Emergency Feedwater Flow Control Valve	FWV-216 FWV-217	1.00	0
TMI-1	Startup Feedwater Control Valve	FW-V-0016A	1.00	6.37E-9
	Emergency Feedwater Flow Control Valve	EF-V-0030A EF-V-0030B EF-V-0030C EF-V-0030D	1.00 1.01 1.00 1.00	2.13E-7 2.46E-5 2.01E-7 8.59E-7
Oconee-3	Auxiliary Feedwater Flow Control Valve	FDW-315 FDW-316	truncated	truncated
	Condenser Emergency Makeup	C-187 C-128	truncated	truncated

Table 4-5e Steam & Power Conversion System

	Description	ID	RAW	F-V
Davis-Besse	Auxiliary Feed Pump Steam Admission Valve	MS5889A MS5889B	2.80 2.14	0.003 0.001
	Auxiliary Boiler Feedwater Control Valve	AS1678	1.00	0
	Main Steam Isolation Valve	MS100 MS101	1.78 1.40	0.001 0.001
	Main Steam Atmospheric Vent Valve	ICS11A ICS11B	1.06	0
	Turbine Bypass Valve	SP13A1 SP13A2 SP13A3 SP13B1 SP13B2 SP13B3	1.00	0
	Turbine Bypass Valves Desuperheating Valve	CD430	1.00	0
Crystal River	MFW Pump Turbine Steam Control Valve	SCV-69 SCV-70	truncated	truncated
	Main Steam Isolation Valve	MSV-411 MSV-412 MSV-413 MSV-414	1.6	0.00143
	Main Steam Atmospheric Vent Valve	MSV-25 MSV-26	8.1 5.3	0.00 0.00
	Turbine Bypass Valve	MSV-9 MSV-10 MSV-11 MSV-14	truncated	truncated
TMI-1	Emergency Feed Pump Steam Admission Valve	MS-V-0006 MS-V-0013A MS-V-0013B	1.67 1.00 1.00	5.38E-4 1.62E-5 5.07E-4
	Main Steam Atmospheric Vent Valve	MS-V-0004A MS-V-0004B	1.14	0.00136
Oconee-3	Auxiliary Feed Pump Steam Admission Valve	MS-93	truncated	truncated
	Turbine Bypass Valve	MS-19 MS-22 MS-28 MS-31	truncated	truncated

Table 4-5f Other Systems

	Description	ID	RAW	F-V
Davis-Besse	Instrument Air Valves	IA931 IA962	1.00	0
	Waste System Valves	WC1761 WC1751 WC1752	1.00 1.01 1.01	0 0 0
Crystal River	Instrument Air Valves	SAV-402 SAV-6	truncated	truncated
	BWST Refill from Demin. Water	DWV-325 DWV-346	truncated	truncated
TMI-1	Pressurizer Pilot Operated Relief Valve (PORV)	RC-RV-0002	1.13	5.27E-04
	Instrument Air Valves	IA-V-1625A IA-V-1626A IA-V-1625B IA-V-1626B	1.01 1.01 1.10 1.10	2.01E-5 2.01E-5 2.23E-4 2.23E-4
	Waste System Valves	WDL-V-0304 WDL-V-0534 WDL-V-0535	1.00 truncated truncated	0 truncated truncated
	RB Emergency Cooling Regulator Valve	RR-V-0006	1.00	7.77E-6
	RB Purge Outlet isolation Valve	AH-V-0001A	truncated	truncated
Oconee-3	Waste System Valve	GWD-13	truncated	truncated

4.4 Safety Categorization

The safety categorization process is performed by the Expert Panel, using a blend of PRA and deterministic information as discussed in Section 3. The results of the Expert Panel integrated decision-making for the B&WOG plants are shown in Table 4-6 and Table 4-7. Only the lead plant, Davis-Besse, has convened an Expert Panel specifically for this RI-IST project. The others were performed previously and may or may not represent the latest information; they are provided here for information only.

*Table 4-6 Comparison of Safety Significant AOVs**

	Davis-Besse	Crystal River	TMI-1	Oconee-3
HSSC AOVs	15	12	4	6

* Only Davis-Besse has convened an Expert Panel specifically for this RI-IST project. The others were performed previously and may not represent the latest information; they are provided here for information only.

*Table 4-7 Comparison of HSSC AOVs**

Plant	Description	Plant ID	In IST Program
Davis-Besse	CCW Hx Temperature Control	SW1424	Yes
		SW1429	Yes
		SW1434	Yes
	Decay Heat Cooler CCW Isolation	CC1467	Yes
		CC1469	Yes
	CCW to Emergency Diesel Generator Jacket Cooling Water Hx	CC1471	Yes
		CC1474	Yes
	Decay Heat Cooler Flow Control	DH13A	Yes
		DH13B	Yes
		DH14A	Yes
		DH14B	Yes
	Auxiliary Feed Pump Steam Admission	MS5889A	Yes
		MS5889B	Yes
	Main Steam Isolation	MS100	Yes
		MS101	Yes
Crystal River	Main Steam Isolation	MSV-411	Yes
		MSV-412	Yes
		MSV-413	Yes
		MSV-414	Yes
	Main Steam Atmospheric Vent Valve	MSV-25	Yes
		MSV-26	Yes
	Decay Heat Cooler Bypass and Outlet Flow Control Valves	DCV-177	No
		DCV-178	No
		DCV-17	No
		DCV-18	No
	Chilled Water Control	CHV-100	Yes
		CHV-68	Yes
TMI-1	CCW Nonessential Supply isolation	IC-V-0003	Yes
		IC-V-0004	Yes
	Main Steam Atmospheric Vent Valve	MS-V-0004A	Yes
		MS-V-0004B	Yes
Oconee-3	Condenser Circulating Water Outlet Valves	CCW-20	Yes
		CCW-21	Yes
		CCW-22	Yes
		CCW-23	Yes
		CCW-24	Yes
		CCW-25	Yes

* At this time only Davis-Besse has convened an Expert Panel specifically for this RI-IST project. The others were performed previously and may not represent the latest information; they are provided here for information only.

5. JOG AOV PROGRAM DESCRIPTION

The AOV program developed by the Joint Owners Group (JOG) [12] provides the basis and guidance associated with the development of a nuclear industry AOV Program. The intent is to specify the minimum program elements required to assure that AOVs are capable of performing their intended safety-significant, i.e., risk-significant, functions. This JOG document recommends the use of risk-informed tools in establishing the AOV categorization criteria. Specific guidance is also provided for the basic elements of an AOV program including design, setup, testing and maintenance. Meeting the JOG AOV Program requirements is one acceptable method to establish an effective plant AOV program. It is expected that utilities, by developing plant-specific programs to implement elements of the JOG guidance, will focus station resources on the most critical AOVs in the plant.

5.1 JOG AOV Program Elements

Nine key elements for an JOG AOV Program are identified as follows:

- Scoping and Categorization
- Setpoint Control
- Design Basis Reviews
- Testing
- Preventive Maintenance
- Training
- Feedback

- Documentation/Data Management
- Tracking and Trending of AOV Performance.

The first step in establishing an AOV program is to identify and categorize the plant AOVs for evaluation. AOVs are screened for inclusion or exclusion from the JOG AOV Program. Those included in the program are placed in one of two categories (Categories 1 and 2) based on their contribution to safe plant operation and or accident mitigation. The requirements of the JOG AOV Program are dependent on the category in which each AOV falls. These categories determine the extent of design review and testing activities to be performed.

Training, Feedback, Tracking and Trending, and Documentation/Data Management are general program requirements. In addition, all program AOVs require setpoint control and shall be included in a maintenance program. Setpoint control ensures that for each AOV, setpoints, (e.g., preload, regulator setting, etc.) are maintained. For AOVs that are safety-related, active and have high safety significance (Category 1), additional requirements are stipulated to provide added confidence in the functional capability of these AOVs. These requirements include Design Basis Reviews (DBR), Baseline Testing, Periodic Testing and Post Maintenance Testing. The JOG program document [12] provides detailed guidance on these elements.

Table 5-1 summarizes the program elements associated with each category of valves.

Table 5-1 JOG AOV Program Requirements

Program Element	Category 1 Valves[1]	Category 2 Valves[2]
Setpoint Control	Yes	Yes
Design Basis Reviews	Yes	No[3]
Baseline Testing	Yes	No[4]
Periodic Testing	Yes[5]	No[5]
Post Maintenance Testing	Yes	No[6]
Preventive Maintenance	Yes	Yes
Training	Yes	Yes
Feedback	Yes	Yes
Documentation/Data Management	Yes	Yes
Tracking and Trending	Yes	Yes

Table 5-1 Notes:

1. Category 1 includes AOVs that are safety-related, active and have high safety-significance.
2. Category 2 includes all other active AOVs that are safety-related or have high safety-significance.
3. Although a DBR is not required for Category 2 valves, any generic issues identified through Category 1 DBRs or industry feedback mechanisms that could affect Category 2 valves shall be considered. For example, if a given vendor's effective diaphragm area is found to be less than stated in the original sizing, similar Category 2 AOV actuators shall be evaluated for impact.
4. Baseline testing is not required on Category 2 AOVs unless a DBR is required due to a generic issue identified through the Category 1 DBR process.
5. Testing may be required by existing plant programs such as inservice inspection/testing (ISI/IST), Maintenance Rule, ASME code, local leak rate testing (LLRT), licensing commitments, etc. For Category 2 AOVs, the JOG AOV Program does not specifically require additional testing beyond these.
6. This program does not require additional post maintenance testing for Category 2 AOVs beyond verification of the affected setpoints.

5.2 AOV Program Scope for B&WOG

The summary of the AOVs identified to be in the scope of the JOG AOV Program are shown in Table 5-2.

Table 5-2 Summary of JOG AOV Scope

Plant	Valves Reviewed for JOG AOV Program	Category 1 AOVs (note 1)	Category 2 AOVs (note 2)
Davis-Besse	180	15	46
Crystal River	85	12 (note 3)	73
TMI-1	193	54 (note 4)	14
Oconee-3	40 (note 5)	(note 5)	(note 5)

Table 5-2 Notes:

1. Category 1 includes AOVs that are safety-related, active and have high safety-significance.
2. Category 2 includes all other active AOVs that are safety-related or have high safety-significance.
3. Preliminary; level 2 PRA results have not yet been considered.
4. TMI-1 has not yet convened an expert panel for JOG AOV program implementation. Therefore, initial categorization uses AOVs that support a Maintenance Rule risk-significant system function, rather than "HSSC".
5. Still under review.

5.3 Davis-Besse Implementation of JOG AOV Program

One premise for the B&WOG RI-IST Program for AOVs is to synergistically link it with the JOG AOV Program. Thus, all of the AOVs that were considered by the expert panel as candidates for the RI-IST program were also reviewed for inclusion in the Davis-Besse AOV program utilizing the JOG scoping criteria.

The JOG AOV Program defines the minimum elements needed for an effective plant AOV program. For plant-specific implementation, Davis-Besse plans to meet the minimum JOG program requirements outlined above.

The JOG program and RI-IST program implementations will share overlapping programmatic elements such as preventive maintenance, documentation and data management, tracking and trending, and feedback. Testing strategies where applicable will serve the needs of JOG program periodic testing, as well as RI-IST. Other existing test programs (such as technical specifications surveillance and local leak rate tests) may serve as compensatory measures for both programs.

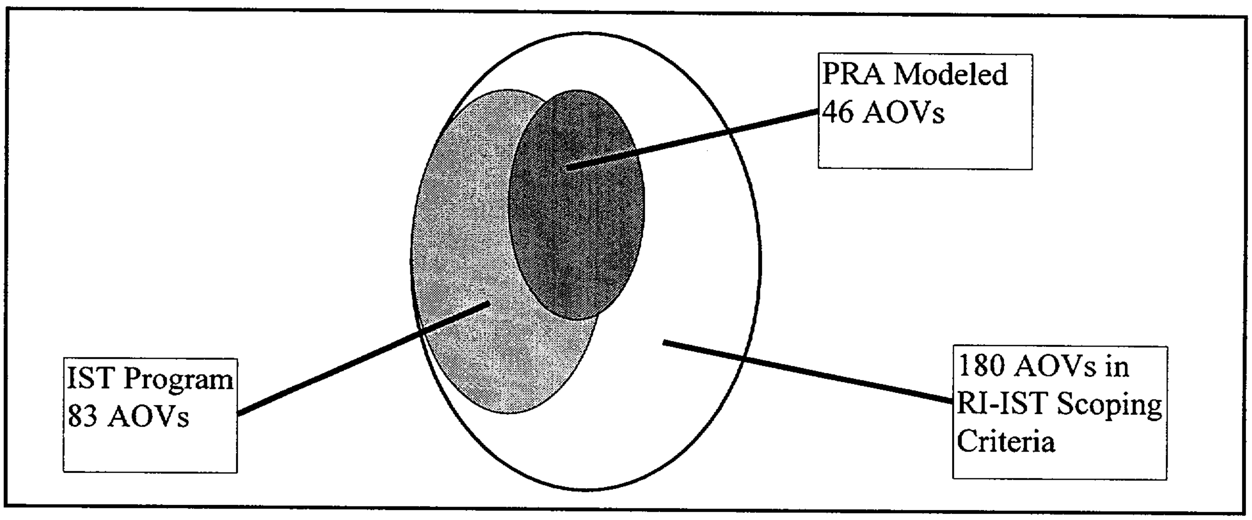
6. DISCUSSION OF DAVIS-BESSE RI-IST PROGRAM

Davis-Besse is the lead plant for the B&WOG RI-IST program for AOVs. This section briefly describes Davis-Besse's implementation of the RI-IST Program Description contained in Section 3, and the insights gained from that experience.

6.1 Scope of AOVs

As Table 4-1 depicts, Davis-Besse has a population of 766 AOVs. Based on the RI-IST scope inclusion criteria at the plant, 180 AOVs were deemed to be candidates for the HSSC / LSSC determination by the expert panel. See Figure 6-1 below.

Figure 6-1 Davis-Besse Population of AOVs for Expert Panel



6.2 PRA Risk Ranking of AOVs

Davis-Besse has recently completed a major update to their PRA. The update represents an improvement in the PRA tools, PRA models, and data (operating experience) since completion of the individual plant examination (IPE) in 1993. The methods, scope, data usage, and results of the Davis-Besse PRA are consistent with those of other state-of-the-art PRAs. The model uses the fault tree linking method and was built and quantified using the CAFTA PRA software. To keep the PRA current, Davis-Besse has a procedure for control, maintenance and update of the PRA. In 1999, the Davis-Besse PRA underwent a thorough peer review using the peer review process originally developed by the Boiling Water Reactor Owners Group (BWROG) [13], and adapted for use by the B&WOG [14], Westinghouse Owners Group, and Combustion Engineering Owners Group.

As Figure 6-1 shows, the PRA models 46 AOVs. Note that 28 of those 46 AOVs are in the IST Program. A full listing of the AOVs modeled in PRA, showing F-V and RAW importance measures, was included in Table 4-5.

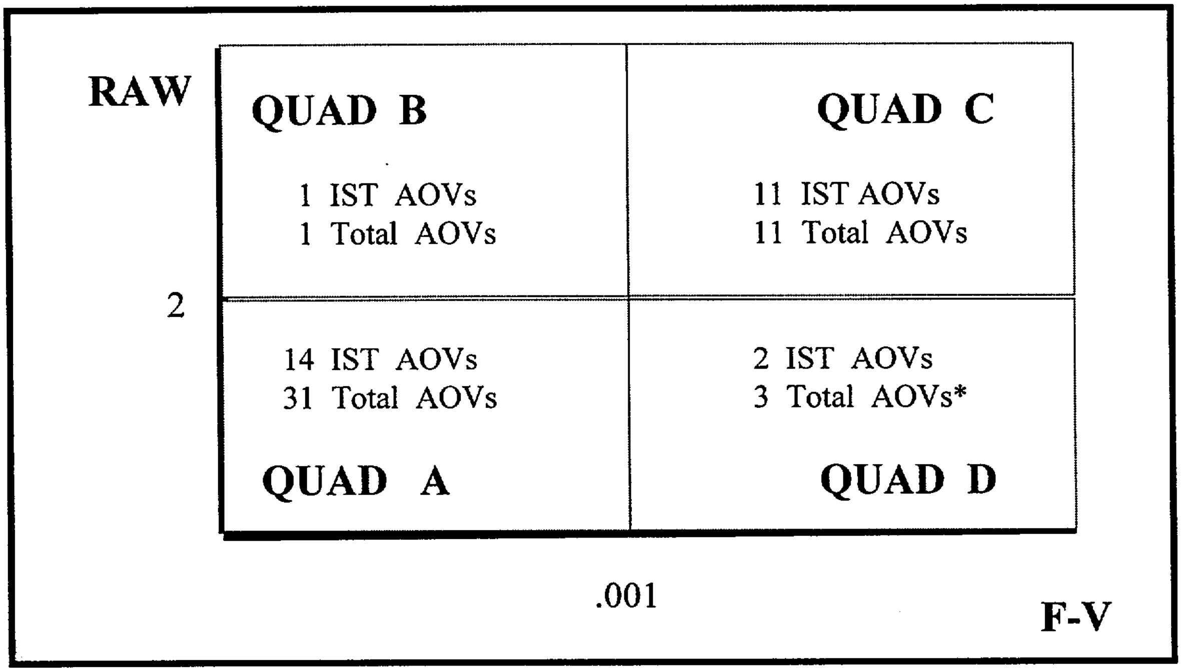
For the initial consideration of risk, the AOVs modeled by the PRA were placed on the CDF "quad chart" as illustrated in Figure 6-2. For Davis-Besse, risk thresholds of RAW > 2 and F-V > 0.001 were chosen. These thresholds are more conservative than required by the OMN-3 Code Case (RAW > 2, F-V > .005). Graphically depicting those modeled AOVs on the Quad Chart using the Davis-Besse risk thresholds, provides some interesting risk insights.

- All of the Quad B and C AOVs (1 and 11 respectively) are in the IST Program.

- One Quad D AOV was not in the IST Program. The reason that this AOV was in Quad D is it did not have a preventive maintenance (PM) program and its assumed reliability in the PRA was low. The plant created a PM for the particular AOV, factored that into the PRA, and the AOV then moved into Quad A.

- Of the 31 AOVs in Quad A, 14 were in the IST Program.

Figure 6-2 Quad Chart for Davis-Besse AOVs



*One AOV was in Quad D because it had no PM or test, which resulted in poor assumed reliability in the PRA. A test/PM program was added for this valve, which reduced the F-V to < 0.001 and subsequently caused the valve to move into Quad A.

6.2.1 Summary of Level 2 (LERF) Results

The level 2 results do not necessitate the re-classification of any valve to a new quadrant. For most valves the F-V and RAW were lower when calculated based on LERF. This is because a large fraction of the LERF comes from steam generator tube rupture and interfacing systems LOCA sequences. The outcomes of these sequences are not highly dependent on any air-operated valves.

The following summarizes the significant differences between the importance measures calculated based on LERF (level 2 PRA) versus CDF (level 1 PRA):

- Feedwater systems are even more risk significant in the level 2 analysis than in the level 1 analysis, because feedwater flow can prevent induced steam generator tube ruptures and provides scrubbing for fission products if tube ruptures have occurred.

This results in increased importance of MS5889A, MS5889B and CT2955 when calculated based on LERF.

- Importance measures for individual components in LPI, HPI and Containment Spray systems are lower in the level 2 analysis. This is because core damage, followed by a release, is not likely to occur as the result of a series of independent component failures. Support systems including water and electrical distribution tend to be more important. Thus the RAW and FV of the decay heat cooler valves are much less when calculated based on LERF.

- Component cooling water malfunctions are the largest contributor to CDF, but do not contribute appreciably to LERF. Although CCW is a support system for makeup, HPI and LPI, it is not required for containment spray or containment air cooling. Therefore, CCW is less important in the LERF analysis. This results in lower importance of SW1434 when calculated based on LERF.

6.3 PRA Sensitivity Studies

The six PRA sensitivity studies were performed on the AOVs per the requirements of the OMN-3 Code Case. This included sensitivity to (1) data and uncertainties, (2) human factors, (3) test and maintenance unavailability, (4) LSSC failure rates, (5) truncation limits, and (6) common cause. Two AOVs in Quad A that provide emergency diesel generator cooling (CC1471, CC1474) had an increase in F-V importance from 0.000 to 0.001 in the maintenance and human action sensitivity studies. No other AOVs changed location in the Quad Chart because of the sensitivity studies.

6.4 Expert Panel for AOVs

The Maintenance Rule Expert Panel at Davis-Besse is also the AOV Expert Panel. The Expert Panel consisted of six individuals and brought in the AOV Engineer and the IST Engineer as "visiting experts". The Expert Panel consisted of senior-level plant personnel with expertise in the required areas including plant operations, PRA, safety analysis engineering, maintenance, and component performance. The Expert Panel was chaired by the Maintenance Rule Engineer.

The Expert Panel deliberations followed the requirements of the ASME OMN-3 Code Case, as well as the Davis-Besse plant procedure covering expert panels. The expert panel process at Davis-Besse is proceduralized to ensure that it complies with all the applicable requirements for both the Maintenance Rule and RI-IST. Appendix C contains a sample expert panel procedure similar to the one used by Davis-Besse.

Following a one-day training session, the expert panel met for three half-days over a two calendar week period to categorize the 180 AOVs. The Expert Panel is discussed further in the following sections.

6.5 PRA Training of Expert Panel

As required by the ASME OMN-3 Code Case, the Davis-Besse Expert Panel received training and indoctrination in the specific requirements of the Code Case. An ASME consultant familiar with the OMN-3 Code Case provided the Expert Panel with a one-day training and indoctrination session. The Expert Panel was trained in the application of risk analysis to expert judgment elicitation. Topics included PRA fundamentals, PRA limitations, use of risk importance measures, reliability versus availability, risk thresholds, deterministic risk analysis, the role of defense-in-depth and safety margins, and other topics.

6.6 Deterministic Studies

Qualitative assessments were made for each AOV, both modeled and not modeled in the PRA, per the requirements of the OMN-3 Code Case. All of the qualitative assessments and considerations (see Figure 3-2) required by the Code Case were included in the Expert Panel deliberations.

For each AOV, the Expert Panel examined whether the AOV is considered in design basis analysis, the Safety Analysis Report, or the Technical Specifications. The Expert Panel also assessed whether valve failure would be a breach of an engineered safety barrier or could result in releases in excess of 10 CFR 100 limits. The Expert Panel discussed each AOV's importance for maintaining system reliability, including consideration of the failure and maintenance history. The importance of each AOV failure to system availability and operational readiness was assessed including whether there is component redundancy and/or defense-in depth via other systems. Other deterministic considerations by the Expert Panel included whether the valve is used to mitigate the consequences of an external event, and whether the AOV is important to safe shutdown. The Expert Panel also examined the completeness of the PRA with respect to whether other failure modes exist that the PRA did not include or should have included.

In addition, industry AOV experience [15, 16] was reviewed by the participants prior to the Expert Panel meetings, and incorporated into the discussions as applicable.

To ensure completeness, the deterministic questions from Appendix A of OMN-3 were used as a checklist by the Expert Panel, and were discussed for each of the180 AOVs reviewed. All findings related to these qualitative assessments were documented on the individual Expert Panel work sheets.

6.7 Expert Panel Decision-Making Criteria

The Davis-Besse Expert Panel discussed the initial risk thresholds (see Figure 6-2) and reached a consensus that these would be the quantitative criteria used by the Expert Panel. They decided to use these quantitative criteria although they are more conservative than suggested by the OMN-3 code case. Using the integrated decision-making process, each AOV was assigned to the HSSC or LSSC category based upon a combination of the quantitative criteria and subjective consideration of the qualitative assessments. The Expert Panel had the prerogative to assign an AOV to the HSSC category if deterministic assessments justified it.

The following decision criteria were used to guide the HSSC/LSSC categorization:

- For F-V < .001 and RAW < 2 (Quad A): These were LSSC candidates. They became LSSC only after determination by the Expert Panel that there was not qualitative justification for categorization as HSSC.

- For F-V < .001 and RAW > 2 (Quad B): These AOVs were categorized as LSSC if the Expert Panel identified sufficient compensatory measures to justify the LSSC categorization. Otherwise they were categorized HSSC.

- For F-V > .001 and RAW > 2 (Quad C): These AOVs were categorized HSSC.

- For F-V > .001 and RAW < 2 (Quad D): The Expert Panel examined why these AOVs had a significant impact on CDF yet a minimal impact when taken out of service (probably assumed by the PRA to be unreliable). If they stayed in Quad D, then they were categorized HSSC.

AOVs that were not modeled in the PRA were categorized by the Expert Panel based upon their integrated assessment of the entire body of deterministic and qualitative information.

6.7.1 Preservation of Defense in Depth

The Expert Panel ensured that defense-in-depth would be maintained in the RI-IST program. The PRA sensitivity studies provided assurance to the Expert Panel that components were not ranked low solely because of high assumed reliability for components, component common cause failure rates, or human actions. In addition, the

Expert Panel's deterministic assessments ensured that the HSSC/LSSC decisions appropriately blended PRA insights with factors that the PRA did not explicitly model.

6.7.2 Preservation of Safety Margin

The Davis-Besse RI-IST program ensures that safety margins will be maintained with respect to the proposed changes, such as extension of LSSC IST frequencies. The Expert Panel identified compensatory measures where appropriate to provide assurance of component availability between IST. In addition, testing strategies that include staggered testing, and tracking and trending of AOVs (see Sections 6-10 through 6-13) will provide additional assurance that safety margins will not be reduced through undiscovered component failures.

6.8 Expert Panel Work Sheet

The Expert Panel made the HSSC / LSSC determination on 180 AOVs. To ensure that the Expert Panel did not ignore a potentially important aspect of the particular AOV being considered, and to efficiently use the available time of the Expert Panel, a work sheet for each AOV was used.

Figure 6-3 is the work sheet used for the Davis-Besse AOV categorization. The finished work sheets document the complete basis for the HSSC/LSSC determination, including valve description and function, PRA data, the qualitative factors affecting the determination, and key decision bases. The work sheet used for Davis-Besse is an improvement on the basic work sheet (Figure 3-5) and documents information that is important for the RI-IST program basis as well information needed as for implementation of the JOG AOV initiative (see Section 5).

The work sheets were completed "on-line" during the Expert Panel meeting using an overhead computer projector. The overhead projection showed the work sheet for each AOV being categorized. The basis for the determination was annotated on the work sheet for all members of the expert panel to see. Frequently the basis for the determination was modified so that all members agreed. This ensured unanimous agreement with the content and language of the entries, and prevented miscommunication and documentation errors. The final work sheet for each AOV is preserved in the plant records in an electronic database.

A sampling of the completed work sheets for Davis-Besse are included in Appendix D. Complete documentation of the integrated decision-making process (Expert Panel) is available for review at the Davis-Besse plant site.

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Figure 6-3 Davis-Besse Expert Panel Work Sheet

Air Operated Valve Categorization

VALVE INFORMATION

ASSET NUMBER	**EQUIP GROUP**
SUBSYSTEM	**DWG NO**
VALVE MANUF	**VALVE TYPE**
ACTUATOR MANUF	**ACTUATOR TYPE**
QUAL CLASS	**VALVE SIZE**
NORMAL POSITION	**FAILURE POSITION**
IST PROGRAM	**CONT INTEGRITY**

VALVE FUNCTION

NORMAL FUNC

SAFETY FUNC

MR FUNCTION

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC **PSA RAW** **PSA F-V**

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

Figure 6-3 Davis-Besse Expert Panel Work Sheet (continued)

Air Operated Valve Categorization

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

OTHER CONSIDERATIONS

COMPENSATORY ACTIONS

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

10 CFR 100 RELEASE LIMITS?

MAINTENANCE RELIABILITY?

SYSTEM AVAILABILITY?

OTHER DETERMINISTIC CONSIDERATIONS?

6.9 Results from Integrated Decision-making (Expert Panel)

The scope of the deliberations included the 180 AOVs identified by the RI-IST scope inclusion criteria, which includes the 83 AOVs already in the IST Program as well as safety-related and non-safety-related valves currently outside of the IST program. These were reviewed by the Expert Panel for consideration and categorization with respect to both the RI-IST program and Davis-Besse AOV program. The ASME OMN-3 Code Case [2, 3] was used as the guidance for the HSSC/LSSC designation, which is used by both RI-IST and Davis-Besse AOV program categorization.

Upon the completion of the Expert Panel sessions, the 180 AOVs were categorized into 15 HSSCs, 68 LSSCs, and 97 determined to be out of the scope of a RI-IST program. In addition, the Expert Panel placed 119 of the subject AOVs in the Davis-Besse AOV program (based upon the JOG scoping criteria) as follows:

- Category 1 – 15 AOVs
- Category 2 – 46 AOVs
- Category 3 – 58 AOVs

All 15 of the HSSCs were already in the IST Program. The 15 Davis-Besse HSSCs are listed in Table 6-1.

Table 6-1 Davis-Besse HSSC AOVs

AOV Identifier	Quad Chart Location	AOV Description
SW1424	C	Component Cooling Water 1-1 Service Water Outlet Isolation Valve
SW1429	C	Component Cooling Water 1-3 Service Water Outlet Isolation Valve
SW1434	C	Component Cooling Water 1-2 Service Water Outlet Isolation Valve
CC1467	C	Decay Heat Removal Heat Exchanger 1-1 CCW Discharge Line Isolation Valve
CC1469	C	Decay Heat Removal Heat Exchanger 1-2 CCW Discharge Line Isolation Valve
CC1471	A	Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-1 CCW Discharge Line Isolation Valve
CC1474	A	Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-2 CCW Discharge Line Isolation Valve
DH13A	C	Decay Heat Cooler 1-2 Bypass Flow Control Valve
DH13B	C	Decay Heat Cooler 1-1 Bypass Flow Control Valve
DH14A	C	Decay Heat Cooler 1-2 Outlet Flow Control Valve
DH14B	C	Decay Heat Cooler 1-1 Outlet Flow Control Valve
MS5889A	C	Auxiliary Feed Pump 1-1 Steam Admission Valve
MS5889B	C	Auxiliary Feed Pump 1-2 Steam Admission Valve
MS100	D	Main Steam Line 2 Isolation Valve
MS101	D	Main Steam Line 1 Isolation Valve

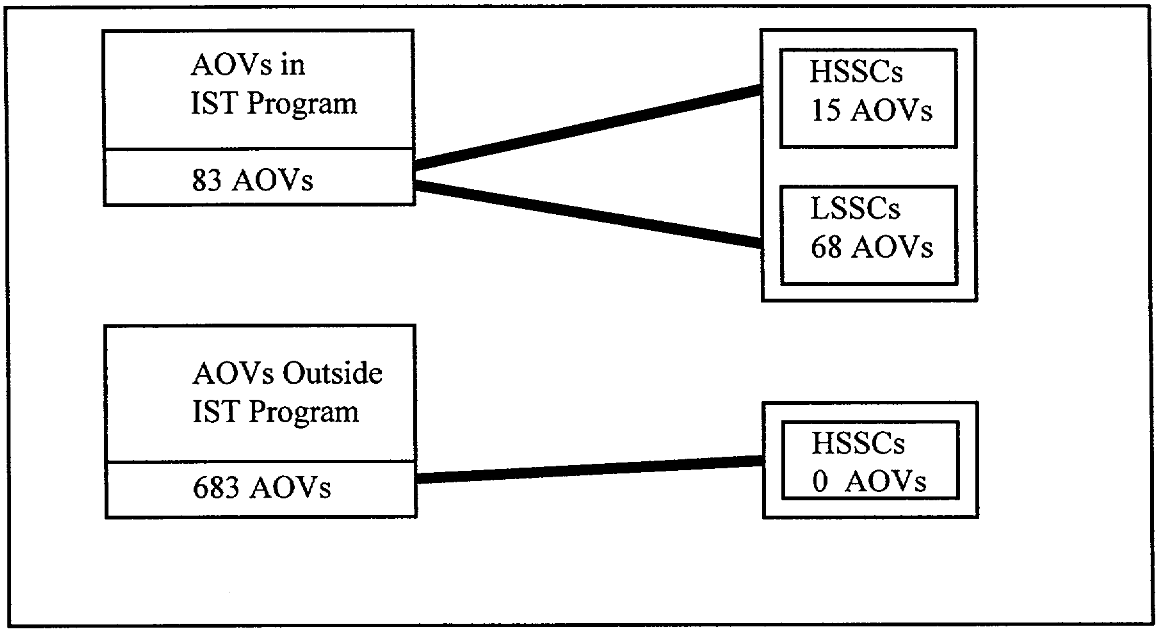
Thirteen of the 15 HSSC AOVs were ranked high by the PRA using the selected risk thresholds. Of these 13, only three AOVs in the service water system (that serve the component cooling water heat exchangers) were substantially above the risk criteria, all three having RAW scores of 10.2 and F-V scores of 0.012.

Nine of those 13 AOVs were designated HSSC based on a blend of deterministic factors and PRA. These nine AOVs had F-V importance between 0.001 and 0.005, and thus were “captured” in the HSSC category by use of the more conservative risk criteria (F-V > 0.001). Seven of these 13 also had high RAW scores (RAW > 2). Even so, these AOVs would have been categorized HSSC on deterministic grounds as well. One compelling reason why the Expert Panel decided to use more conservative risk criteria than recommended by OMN-3 (F-V > 0.005) was that they felt these AOVs should have been risk significant. The AOVs involved include the decay heat removal (DHR) heat exchanger flow control valves, the DHR heat exchanger component cooling water supply, the auxiliary feedwater (AFW) pump steam admission valves (Davis-Besse has two turbine-driven AFW pumps), and the main steam isolation valves.

Two of the 15 HSSC AOVs were not risk significant, but were categorized HSSC by the expert panel based on the deterministic and sensitivity studies. These two HSSCs were in Quad A (RAW < 2, F-V < 0.001) and their function is to provide emergency diesel generator cooling. They were designated HSSC because of their function and because the F-V importance increased to 0.001 in the maintenance and human action sensitivity studies.

Thus, all of the 13 AOVs that had F-V importance greater than 0.001 (Quads C and D) were categorized HSSC. All except one of the 12 AOVs with RAW > 2 (Quads B and C) were designated HSSC. The lone AOV from Quad B (RAW > 2, F-V < 0.001) was categorized LSSC by the expert panel because there were sufficient compensatory measures to ensure that the component would be reliable. This valve (makeup flow to the reactor coolant pump seals) does not have to change position to perform its safety function.

Figure 6-4 HSSC / LSSC Determinations at Davis-Besse



6.10 Operational Readiness Strategy for AOVs

6.10.1 AOV Program Goal

The overall goal of the AOV program is to ensure that AOVs will perform their intended design function. Therefore, the test strategies for Davis-Besse AOVs will be a coupling of design verification, response time testing, diagnostic testing, setpoint control, periodic exercising, and preventive maintenance to provide assurance that AOV assemblies will perform their intended safety function.

The following demonstrates how the AOV program, the RI-IST program and other site programs are synergistically linked to ensure operational readiness of AOV assemblies at Davis-Besse

AOV Program

- Grouping
- Design Basis Capability (DBC)
- Diagnostic Testing

RI-IST Program

- Baseline Testing
- Periodic Testing
- Periodic Exercising

Plant Programs

- Appendix J Local Leak Rate Test (LLRT)
- Preventive Maintenance
- Setpoint Control

Synergistically linking these programs will ensure that AOV reference parameters are identified, maintained, and monitored to ensure operational readiness of air operated valves.

6.10.2 Operational Readiness Strategies

Grouping

All AOV assemblies in the Davis-Besse AOV Program will be grouped. Grouping AOV assemblies and testing on a staggered basis over the test interval will lessen the importance of common cause failures as AOV assemblies in the same failure mode group are continually being tested. The specific grouping strategies are outlined in the three distinct AOV categories.

Design Basis Capability

Design verification of an AOV assembly includes the system level calculation, the valve required thrust or torque, the actuator capability evaluation and the margin evaluation. The results of the design basis capability will be used to establish important parameters for valve/actuator setup, and to monitor for potential degradation. For those AOV assemblies that do not receive a design basis capability review, vendor supplied parameters will be used.

Diagnostic Testing

Davis-Besse has a well-established, diagnostic testing program that is used to assess the overall health of the AOV assembly. Parameters that are monitored using the diagnostic test equipment are bench set, spring rate, valve travel, seating/unseating load, valve/actuator friction, and calibration. Test fittings have been permanently installed to allow non-intrusive testing of the AOV assembly under static or dynamic conditions. Diagnostic testing will be used to baseline, and periodically monitor reference parameters established during the design basis capability evaluation.

Baseline Testing

Baseline testing will be performed, or credit will be taken for existing baseline testing to establish the reference stroke times and reference parameters used to monitor potential degradation of the AOV assembly.

Periodic Testing

Periodic testing will be performed at the frequency established by the design basis and maintenance history evaluation for each group of AOV assemblies. The periodic test results will be used to monitor potential degradation in the AOV assembly via a combination of stroke time testing and diagnostic testing compared against the baseline test results.

Periodic Exercising

All AOV assemblies will be periodically exercised to verify that the AOV assembly is fully capable of cycling between the open and closed position. Periodic exercising will verify that there is no binding of the valve/actuator combination, and that local valve position agrees with indicated valve position.

Seat Leakage

Seat leakage requirements established under the Appendix J program or IST Program are not superceded by these operational readiness strategies. Seat leakage requirements will still be performed per the applicable ASME Code requirement to further justify operational readiness of the AOV assembly. Seat leakage testing will be used to effectively compliment the other test strategies, ensuring that all failure mechanisms are comprehensively monitored.

Preventive Maintenance

Preventive Maintenance strategies have been developed using the guidance provided in EPRI Report TR-106857-V1, "Preventive Maintenance Basis Volume 1: Air Operated Valves" [17]. These strategies are aligned to apply a graded maintenance approach to AOV assemblies based upon the valve/actuator service and environmental conditions. The recommended replacement intervals and component maintenance replacement recommendations are evaluated against plant/industry operating experience (OE) to arrive at the overall preventive maintenance strategy.

Setpoint Control

Reference parameters defined during the design basis capability evaluation and monitored during the periodic testing phase will be controlled using existing site processes. These setpoints will be controlled by issuance of the I&C Data Package through the Records Management system to the associated preventive maintenance or corrective work order. These data packages will be used as the official record of valve setup and calibration. Additionally, those parameters important to assure the design basis capability of the AOV assembly will be documented in the associated diagnostic testing procedure. This procedure will clearly define the acceptance criteria as well as actions that must be performed if the acceptance criteria are not met.

6.10.3 Davis-Besse AOV Categories

All AOVs determined by the Expert Panel to be within the scope of the AOV Program were placed into three distinct categories. The three categories are defined as follows:

Category 1: AOV is safety-related, active and has high safety significance.

Category 2: AOV is safety-related, active and does not have high safety significance, or AOV is non safety-related, active and has high safety significance.

Category 3: AOV was determined to be within the scope of the AOV Program, but is not in Category 1 or Category 2

Table 6-2 identifies which Category the 180 air operated valves considered by the Expert Panel were placed. Table 6-3 identifies the operational readiness strategies for each AOV Assembly.

Table 6-2 Davis-Besse AOV Categorization for Operational Readiness Strategies

	Number of AOV Assemblies	RI-IST AOV Assemblies	HSSC AOV Assemblies	LSSC AOV Assemblies
Category 1	15	15	15	0
Category 2	46	37	0	37
Category 3	58	31	0	31
Out of Program Scope	61	0	0	0
Totals	180	83	15	68

Table 6-3 Davis-Besse Operational Readiness Strategies for AOVs

	Category 1	Category 2	Category 3
Grouping	Based on valve, actuator and service conditions	Based on valve, actuator and service conditions	Based on actuator
Design Basis Capability	DBC for each AOV Group based upon vendor supplied data	DBC for each AOV Group based upon best available information	DBC only based upon issue identified during DBC of Cat. 1&2
Diagnostic Testing	Yes	Yes	Yes
Baseline Testing	Stroke Time & Diagnostic	Diagnostic	Diagnostic
Periodic Testing	Stroke Time & Diagnostic once per cycle going to once per two cycles max	Diagnostic once per three cycles going to once per five cycles max	Diagnostic for Post-Maintenance Test only, max of once per five cycles for IST
Periodic Exercising	Once per cycle	Once per cycle	Once per cycle
Seat Leakage	Per Code of Record	Per Code of Record	Per Code of Record
Preventive Maintenance	Based upon EPRI Report [17] and OE	Based upon EPRI Report and OE	Based upon EPRI Report and OE
Setpoint Control	Based upon DBC	Based upon DBC	Based upon vendor data

6.10.4 Strategies for Category 1 AOV Assemblies

AOV Program Strategy

Grouping

Category 1 AOVs will be grouped based upon the following parameters:

- AOV Assembly Manufacturer
- Valve Size

- Valve Type
- Actuator Type
- Service Conditions

The grouping will be justified with a documented engineering evaluation.

Design Basis Capability

The design basis capability of the AOV assembly will be performed for each Category 1 AOV in the group. The design basis capability will be based upon vendor supplied design data under a 10CFR50 Appendix B Program. In addition, test or calculational methods will be utilized to verify the design basis capability.

RI-IST Strategy

Baseline Testing

Baseline testing will be performed to establish reference stroke times and reference parameters to monitor any degradation that may occur between maintenance intervals. Credit may be taken for existing reference values and reference parameters established under existing testing programs.

Periodic Testing

Periodic testing will be performed and compared to baseline testing for acceptability. The initial frequency for this testing will be 1 cycle. Based upon a documented acceptable performance history, this frequency may be extended to a maximum of 2 cycles.

Periodic Exercising

Periodic exercising will be performed at least once per fuel cycle to stroke the AOV through one complete open and closed cycle to verify that there is no binding in the AOV assembly and that local valve position and remote position indication agree.

Plant Program Strategy

Preventive Maintenance

All Category 1 AOV assemblies will have elastomer sensitive components rebuilt or replaced at regular intervals based upon a combination of operating experience, environmental conditions and manufacturers recommended changeout intervals to obtain a high level of confidence that the AOV assembly will not degrade or fail between maintenance intervals.

Setpoint Control

Important parameters to ensure the Category 1 AOV will perform its safety related function will be established and monitored via diagnostic testing.

6.10.5 Strategies for Category 2 AOV Assemblies

<u>AOV Program Strategy</u>

Grouping

Category 2 AOVs will be grouped based upon the following parameters:

- AOV Assembly Manufacturer
- Valve Size
- Valve Type
- Actuator Type
- Service Conditions

The grouping will be justified with a documented engineering evaluation.

Design Verification

The design basis capability of the AOV assembly will be performed for each Category 2 AOV. The design basis capability will be based upon best available information. Any Category 2 AOV assembly with a demonstrated low margin may have a design basis capability based upon vendor supplied design data under a 10CFR50 Appendix B Program. In addition, any Category 2 AOV assembly with a demonstrated low margin may have a test or calculational method utilized to verify the design basis capability.

RI-IST Strategy

Baseline Testing

Baseline testing will be performed to obtain reference parameters to monitor any degradation that may occur between maintenance intervals. Credit may be taken for existing reference parameters established under existing testing programs.

Periodic Testing

Periodic testing which will include both as-found and post maintenance testing will be performed and compared to baseline testing for acceptability. The initial frequency for this testing will be three cycles based upon a documented acceptable performance history. In addition, this frequency may be extended based upon an improved performance history in increments not to exceed one cycle. In no case shall the maximum interval exceed 10 years between evaluations.

Periodic Exercising

Periodic exercising will be performed at least once per fuel cycle to stroke the AOV through one complete open and closed cycle to verify that there is no binding in the AOV assembly and that local valve position and remote position indication agree.

Plant Program Strategy

Preventive Maintenance

All Category 2 AOV assemblies will have elastomer sensitive components rebuilt or replaced at regular intervals based upon a combination of operating experience, environmental conditions and manufacturers recommended changeout intervals to obtain a high level of confidence that the AOV assembly will not degrade or fail between maintenance intervals.

Setpoint Control

Important parameters to ensure the active LSSC AOV will perform its safety related function will be established and monitored via diagnostic testing.

6.10.6 Strategies for Category 3 AOV Assemblies

<u>AOV Program Strategy</u>

Grouping

Category 3 AOVs will be grouped based upon the following parameters:

- AOV Assembly Manufacturer
- Actuator Type

The grouping will be justified with a documented engineering evaluation.

Design Basis Capability

In general, no design basis capability will be performed for this category of AOVs unless an issue is identified during the design basis capability phase of the Category 1/Category 2 AOV assemblies that would affect an AOV assembly in this class.

RI-IST Strategy

Baseline Testing

If degradation or failure of an AOV assembly in this category occurs, important parameters to ensure the Category 3 AOV will perform it safety related function will be established and monitored via diagnostic testing. Baseline testing will be performed to obtain reference parameters to monitor any degradation that may occur between maintenance intervals. Credit may be taken for existing reference parameters established under existing testing programs.

Periodic Testing

Diagnostic testing will be performed for post-maintenance testing only. The maximum interval for IST periodic testing shall not exceed 10 years between evaluations.

Periodic Exercising

Periodic exercising will be performed at least once per fuel cycle to stroke the AOV through one complete open and closed cycle to verify that there is no binding in the AOV assembly and that local valve position and remote position indication agree.

Plant Program Strategy

Preventive Maintenance

All Category 3 AOV assemblies will have elastomer sensitive components rebuilt or replaced at regular intervals based upon a combination of operating experience, environmental conditions and manufacturers recommended changeout intervals to obtain a high level of confidence that the AOV assembly will not degrade or fail between maintenance intervals.

Setpoint Control

If during the course of the monitoring interval, degradation or failure of an AOV assembly in this category occurs, important parameters to ensure the Category 3 AOV will perform it safety related function will be established and monitored via diagnostic testing. The interval will be established based upon a documented engineering evaluation.

6.11 Aggregate Risk

After the AOV testing strategies were identified, their impact was measured using the Davis-Besse PRA. All of the LSSC and HSSC IST frequencies were changed to once per the maximum interval indicated in the RI-IST Strategies outlined above. If the work sheets indicated a compensatory action (such as another test) that demonstrates valve operability on a more frequent basis than the proposed IST interval, then that was credited in the PRA as well. As indicated in Table 6-4 this resulted in no impact upon the core damage frequency for Davis-Besse.

Table 6-4 Change in Aggregate Risk

Plant	CDF (before)	CDF (after)
Davis-Besse	1.6E-05 /yr.	1.6E-05 /yr.

The "delta CDF" and the base CDF (before) were plotted on the figure in Appendix B to the OMN-3 Code Case (same as Figure 3 from Reg. Guide 1.174, reference 8) to determine acceptability. The delta CDF in this case is zero, which indicates a negligible change in risk due to the proposed IST program changes.

Based upon the analysis discussed in Section 6.2.1, it was determined that the delta-LERF for the proposed IST change is also negligible.

6.12 Monitoring and Corrective Action

The results of the testing strategies will be trended for each AOV group to ensure that the IST frequency is appropriate.

When a component fails to meet established test criteria, corrective actions will be taken in accordance with Davis-Besse's corrective action program (CAP).

For components not meeting the acceptance criteria, a Condition Report form will be generated, initiating the corrective action process. The unsatisfactory condition will be evaluated to:

a) Determine the impact on system operability and take appropriate action,

b) Review the previous test data for the component and all components in the group,

c) Perform a cause analysis,

d) Determine if this is a generic failure that may affect a group of components,

e) Initiate corrective action for failed IST components,

f) Evaluate the adequacy of the test strategy, and if a change is required, review the IST test schedule and change as appropriate.

6.13 Periodic Reassessment

The Davis-Besse Expert Panel will meet to reassess the RI-IST program and AOV grouping at a frequency not to exceed every other refueling outage. The RI-IST reassessment will be completed within 9 months of the end of every other outage. The reassessment will consider and make appropriate changes to reflect changes in plant configuration, component performance, industry experience, and other inputs to the process. The Expert Panel will validate the RI-IST program outputs including HSSC/LSSC grouping, compensatory measures and maximum IST interval for AOVs.

7. CONCLUSIONS

The ASME risk-informed inservice testing methodology was applied to AOVs at the Davis-Besse nuclear power plant in a B&WOG-sponsored demonstration project. The RI-IST process was also applied by the Davis-Besse team to implementation of their AOV program. Synergy was created between the RI-IST Program and the JOG AOV Program to create the Davis-Besse AOV Program.

The Davis-Besse AOV program ensures operational readiness of AOV assemblies at Davis-Besse. Testing strategies have been developed in proportion to AOV safety significance for both IST Program AOVs and non-IST Program AOVs. AOV test strategies are a coupling of design verification, response time testing, diagnostic testing, setpoint control, periodic exercising, and preventive maintenance to provide assurance that AOV assemblies will perform their intended safety function.

By applying the RI-IST methodology at Davis-Besse, several insights became apparent with respect to AOVs and their risk significance. First, the number of AOVs in the IST Program that are HSSC is small (18% for Davis-Besse). Second, no AOVs outside the Davis-Besse IST Program were identified as HSSC. Comparison of AOV application and PRA data across the B&WOG plants is tentative since the OMN-3 Code Case methodology has not been completely implemented at all the plants. However, the comparison produces expectations that the other B&WOG plants will have similar small numbers of HSSC AOVs, although all may not be within the current IST programs.

Although each B&WOG plant has 400 to 900 total AOVs (less than 200 in safety-related programs, and 60 to 80 in the IST Program), the population of HSSC or risk-significant AOVs is rather low. The system location of risk-significant or HSSC AOVs varies from plant to plant, as valve application varies depending upon the particular architect-engineer. However, with transient initiators being relatively important at most B&WOG plants (see Appendix B), a few AOVs located in the cooling water and steam systems are likely to be HSSC.

With the conclusion of this demonstration project, Davis-Besse has a solid technical basis to apply RI-IST in support of a licensing request to the NRC for alternative testing requirements for IST AOVs. The Davis-Besse RI-IST program can be used as a template for application to other IST components and for use by other B&WOG plants. In addition, this methodology can be applied to the safety categorization of AOVs for the JOG AOV initiative.

8. REFERENCES

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APPENDIX A

PLANT SPECIFIC LISTS OF AOVs IN IST PROGRAM

Appendix A.1 - Davis-Besse

Table A-1 Complete List of AOVs in Davis-Besse IST Program			
Valve Identifier	**HSSC**	**LSSC**	**Description**
CC1460		X	CCW Nonessential Supply to Makeup Pump Lube Oil Coolers
CC1467	X		Decay Heat Removal Heat Exchanger 1-1 CCW Discharge Line Isolation Valve
CC1469	X		Decay Heat Removal Heat Exchanger 1-2 CCW Discharge Line Isolation Valve
CC1471	X		Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-1 CCW Discharge Line Isolation Valve
CC1474	X		Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-2 CCW Discharge Line Isolation Valve
CC1495		X	CCW to Nonessential Loads Isolation Valve
CF1541		X	Core Flood Tank 1-2 Pressurization Isolation Valve
CF1542		X	Core Flood Tank 1-1 and 1-2 Vent Isolation to Waste Gas System
CF1544		X	Core Flood Tank 1-1 Pressurization Isolation Valve
CF1545		X	Core Flood Tank 1-1 and 1-2 Bleed and Sample Isolation to Reactor Coolant Drain Tank
CV5004		X	Mechanical Penetration Room/Shield Building Annulus Supply Purge Valve
CV5005		X	Containment Supply Purge Valve
CV5006		X	Containment Supply Purge Valve
CV5007		X	Containment Exhaust Purge Valve
CV5008		X	Containment Exhaust Purge Valve
CV5009		X	Mechanical Penetration Room/Shield Building Annulus Exhaust Purge Valve
CV5016		X	Mechanical Penetration Room/Shield Building Annulus Supply Purge Valve
CV5021		X	Mechanical Penetration Room/Shield Building Annulus Exhaust Purge Valve
DH13A	X		Decay Heat Cooler 1-2 Bypass Flow Control Valve
DH13B	X		Decay Heat Cooler 1-1 Bypass Flow Control Valve
DH14A	X		Decay Heat Cooler 1-2 Outlet Flow Control Valve
DH14B	X		Decay Heat Cooler 1-1 Outlet Flow Control Valve
DW2643		X	Component Cooling Water Surge Tank Demin Water Makeup Valve
DW6831A		X	Demin Water Service Inside Containment Isolation Valve
DW6831B		X	Demin Water Service Outside Containment Isolation Valve
DW6880		X	Demin Water Transfer Pumps Pressure Control Valve
IA2011		X	Instrument Air to Containment Outside Isolation Valve
ICS11A		X	Main Steam Line 2 Atmospheric Vent Valve
ICS11B		X	Main Steam Line 1 Atmospheric Vent Valve
MS100	X		Main Steam Line 2 Isolation Valve
MS100-1		X	Main Steam Line 2 Isolation Valve Bypass
MS101	X		Main Steam Line 1 Isolation Valve
MS101-1		X	Main Steam Line 1 Isolation Valve Bypass
MS375		X	Main Steam Line 2 Warmup Drain Isolation Valve

Table A-1 Complete List of AOVs in Davis-Besse IST Program

Valve Identifier	HSSC	LSSC	Description
MS394		X	Main Steam Line 1 Warmup Drain Isolation Valve
MS5889A	X		Auxiliary Feed Pump 1-1 Steam Admission Valve
MS5889B	X		Auxiliary Feed Pump 1-2 Steam Admission Valve
MU23		X	Boris Acid Pumps Discharge Control Valve
MU3		X	Reactor Coolant Letdown Outlet Isolation Valve
MU38		X	Reactor Coolant Pump Seal Return Isolation Valve
MU6406		X	Makeup Pump 1-2 Recirculation Valve
MU6407		X	Makeup Pump 1-1 Recirculation Valve
MU66A		X	Reactor Coolant Pump 2-1 Seal Injection Isolation Valve
MU66B		X	Reactor Coolant Pump 2-2 Seal Injection Isolation Valve
MU66C		X	Reactor Coolant Pump 1-1 Seal Injection Isolation Valve
MU66D		X	Reactor Coolant Pump 1-2 Seal Injection Isolation Valve
NN236		X	Nitrogen Supply to Containment Header Isolation Valve
RC1719A		X	Pressurizer Quench Tank Vent to Gaseous Radwaste System Containment Isolation Valve
RC1719B		X	Pressurizer Quench Tank Vent to Gaseous Radwaste System Containment Isolation Valve
RC1773A		X	Reactor Coolant Drain Tank Header Containment Isolation Valve
RC1773B		X	Reactor Coolant Drain Tank Header Containment Isolation Valve
RC229A		X	Pressurizer Quench Tank Recirculation Containment Isolation Valve
RC229B		X	Pressurizer Quench Tank Recirculation Containment Isolation Valve
RC232		X	Pressurizer Quench Tank Cooler Return Containment Isolation Valve
SA2010		X	Station Air to Containment Isolation Valve
SP6A		X	Main Feedwater Control Valve to Steam Generator 1-2
SP6B		X	Main Feedwater Control Valve to Steam Generator 1-1
SP7A		X	Startup Feedwater Control Valve to Steam Generator 1-2
SP7B		X	Startup Feedwater Control Valve to Steam Generator 1-1
SS235A		X	Pressurizer Quench Tank Sample Containment Isolation Valve
SS235B		X	Pressurizer Quench Tank Sample Containment Isolation Valve
SS598		X	Steam Generator 1-2 Sample Containment Isolation Valve
SS607		X	Steam Generator 1-1 Sample Containment Isolation Valve
SW1356		X	Containment Air Cooler 1-1 Service Water Outlet Isolation Valve
SW1357		X	Containment Air Cooler 1-2 Service Water Outlet Isolation Valve
SW1358		X	Containment Air Cooler 1-3 Service Water Outlet Isolation Valve
SW1424	X		Component Cooling Water 1-1 Service Water Outlet Isolation Valve
SW1429	X		Component Cooling Water 1-3 Service Water Outlet Isolation Valve
SW1434	X		Component Cooling Water 1-2 Service Water Outlet Isolation Valve
SW2944		X	Service Water Strainer Blowdown Valve to Collection Basin
SW2945		X	Service Water Strainer Blowdown Valve to Intake Structure Forebay
WG1823		X	Waste Gas Decay Tank 1-1 Inlet from Waste Gas Compressor 1-1
WG1824		X	Waste Gas Decay Tank 1-1 Inlet from Waste Gas Compressor 1-2
WG1825		X	Waste Gas Decay Tank 1-2 Inlet from Waste Gas Compressor 1-1
WG1826		X	Waste Gas Decay Tank 1-2 Inlet from Waste Gas Compressor 1-2
WG1827		X	Waste Gas Decay Tank 1-3 Inlet from Waste Gas Compressor 1-1
WG1828		X	Waste Gas Decay Tank 1-3 Inlet from Waste Gas Compressor 1-2
WG1835		X	Waste Gas Decay Tank 1-1 Outlet Valve to Clean Waste Receiver Tank

Table A-1 Complete List of AOVs in Davis-Besse IST Program			
Valve Identifier	**HSSC**	**LSSC**	**Description**
WG1836		X	Waste Gas Decay Tank 1-1 Outlet Valve to Waste Gas Absolute Filter
WG1837		X	Waste Gas Decay Tank 1-2 Outlet Valve to Clean Waste Receiver Tank
WG1838		X	Waste Gas Decay Tank 1-2 Outlet Valve to Waste Gas Absolute Filter
WG1839		X	Waste Gas Decay Tank 1-3 Outlet Valve to Clean Waste Receiver Tank
WG1840		X	Waste Gas Decay Tank 1-3 Outlet Valve to Waste Gas Absolute Filter

Appendix A.2 - Crystal River

Table A-2 Complete List of AOVs in Crystal River 3 IST Program	
Valve Identifier	**Description**
AHV-001A	Reactor Building Purge Isolation
AHV-001D	Reactor Building Purge Isolation
CAV-006	OTSG 3A Sample RB Isolation
CAV-007	OTSG 3B Sample RB Isolation
CFV-025	CFT-1A Fill Control Valve
CFV-026	CFT-1B Fill Control Valve
CFV-027	CFT-1B Nitrogen Supply Control Valve
CFV-028	CFT-1A Nitrogen Supply Control Valve
CFV-029	Vent Control Valve to WD System
CFV-042	Sample Control Valve Sample System and RB Sump
CHV-068	CHHE-1A Return Control Valve
CHV-069	CHHE-1B Return Control Valve
CHV-100	Temp Controller
CHV-113	Temp Controller
CIV-034	Cavity Cooling System "A" Supply POV Isolation
CIV-035	Cavity Cooling System "A" Return POV Isolation.
CIV-040	Cavity Cooling System "B" Return POV Isolation
CIV-041	Cavity Cooling System "B" Supply POV Isolation.
EGV-056	EDG 3A Air Start Valve
EGV-057	EDG 3A Air Start Valve
EGV-058	EDG 3B Air Start Valve
EGV-059	EDG 3B Air Start Valve
MSV-009	OTSG 3A Turbine Bypass Control Valve
MSV-010	OTSG 3A Turbine Bypass Control Valve
MSV-011	OTSG 3B Turbine Bypass Control Valve
MSV-014	OTSG 3B Turbine Bypass Control Valve
MSV-025	"A" OTSG Atmospheric Dump Valve
MSV-026	"B" OTSG Atmospheric Dump Valve
MSV-130	"A" OTSG Drain Header Isolation
MSV-148	"B" OTSG Drain Header Isolation
MSV-411	MS Line A-2 Isolation Valve
MSV-412	MS Line A-1 Isolation Valve
MSV-413	MS Line B-1 Isolation Valve
MSV-414	MS Line B-2 Isolation Valve
MUV-049	L/D Coolers Outlet Isolation
MUV-253	RCP's Cont. Bleedoff Isolation
MUV-541	MU&P System Feed

Table A-2 Complete List of AOVs in Crystal River 3 IST Program	
Valve Identifier	**Description**
SWV-012	Evap., Seal Return Coolers, & Waste Gas Compressor Isolation
SWV-035	RB Fan Assembly 1A Supply Line RB Isolation Valve
SWV-037	RB Fan Assembly 1B Supply Line RB Isolation Valve
SWV-039	RB Fan Assembly 1C Supply Line RB Isolation Valve
SWV-041	RB Fan Assembly 1A Return Line RB Isolation Valve
SWV-043	RB Fan Assembly 1B Return Line RB Isolation Valve
SWV-045	RB Fan Assembly 1C Return Line RB Isolation Valve
SWV-047	A/C LD Cooler Supply RB Isolation Valve
SWV-048	LD Cooler B Supply RB Isolation Valve
SWV-049	B LD Cooler Return Line RB Isolation Valve
SWV-050	A/C LD Cooler Return RB Isolation Valve
SWV-079	RC Pump 1B Supply Line RB Isolation Valve
SWV-080	RC Pump 1A Supply Line RB Isolation Valve
SWV-081	RC Pump 1D Supply Line RB Isolation Valve
SWV-082	RC Pump 1C Supply Line RB Isolation Valve
SWV-083	RC Pump 1B Return Line RB Isolation Valve
SWV-084	RC Pump 1A Return Line RB Isolation Valve
SWV-085	RC Pump 1D Return Line RB Isolation Valve
SWV-086	RC Pump 1C Return Line RB Isolation Valve
SWV-109	CRD Cooling Water Supply Line RB Isolation Valve
SWV-110	CRD Cooling Water Supply Line RB Isolation Valve
SWV-151	Industrial Cooling Return from RB Fan Assemblies
SWV-152	Industrial Cooling Water Supply to RB Fan Assemblies
SWV-353	NS Supply to RB Fan Assemblies
SWV-354	NS Return from RB Fan Assemblies
SWV-355	Industrial Cooling Return from RB Fan Assemblies
WDV-004	RB Sump Discharge Header Isolation
WDV-061	RC Drain Tank Vent Line Outside Isolation Valve
WDV-062	RC Drain Tank Discharge Header Isolation Valve
WSV-003	Normal Containment Air Sample RB Isolation
WSV-004	Normal Containment Air Sample RB Isolation
WSV-005	Normal Containment Air Sample RB Isolation
WSV-006	Normal Containment Air Sample RB Isolation

Appendix A.3 - Three Mile Island 1

Table A-3 Complete List of AOVs in TMI-1 IST Program	
Valve Identifier	**Description**
AH-V-0001A	CONTAINMENT ISOLATION - RB PURGE OUTLET ISOL VALVE
AH-V-0001D	CONTAINMENT ISOLATION - RB PURGE INLET ISOL VALVE
AH-V-0011A	CONTROL BLDG VENT UNIT "A" COOLING COIL DISCH VLV
AH-V-0011B	CONTROL BLDG VENT UNIT "B" COOLING COIL DISCH VLV
CA-V-0002	CONTAINMENT ISOLATION - RC SAMPLE ISOLATION VALVE
CA-V-0005A	CONTAINMENT ISOLATION - OTSG "A" FW SAMPLE VALVE
CA-V-0005B	CONTAINMENT ISOLATION - OTSG "B" FW SAMPLE VALVE
CA-V-0189	CONTAINMENT INTEGRITY - RECLAIMED WATER TO RB VLV
CF-V-0019A	CONTAINMENT ISOLATION - MU TO CF-T1A
CF-V-0019B	CONTAINMENT ISOLATION - MU TO CF-T1B
CF-V-0020A	CONTAINMENT ISOLATION - CF-T1A SAMPLE ISOL VLV
CF-V-0020B	CONTAINMENT ISOLATION - CF-T1B SAMPLE ISOL VLV
CM-V-0001	CONTAINMENT ISOLATION - RB ATMOSPHERE SAMPLE VALVE
CM-V-0002	CONTAINMENT ISOLATION - RB ATMOS SAMPLE RETURN VLV
CM-V-0003	CONTAINMENT ISOLATION - RB ATMOSPHERE SAMPLE VALVE
CM-V-0004	CONTAINMENT ISOLATION - RB ATMOS SAMPLE ISOL VALVE
EF-V-0030A	EFW TO OTSG "A" FLOW CONTROL VALVE
EF-V-0030B	EFW TO OTSG "B" FLOW CONTROL VALVE
EF-V-0030C	EFW TO OTSG "A" FLOW CONTROL VALVE
EF-V-0030D	EFW TO OTSG "B" FLOW CONTROL VALVE
FW-V-0016A	MAIN FEEDWATER STARTUP FLOW CONTROL VALVE
FW-V-0016B	MAIN FEEDWATER STARTUP FLOW CONTROL VALVE
FW-V-0017A	MAIN FEEDWATER CONTROL VALVES
FW-V-0017B	MAIN FEEDWATER CONTROL VALVE
IA-V-1625A	2-HR BACKUP AIR SYSTEM "A" HEADER VENT VALVE
IA-V-1625B	2-HR BACKUP AIR SYSTEM "B" HEADER VENT VALVE
IA-V-1626A	2-HR BACKUP AIR SYSTEM HEADER SUPPLY VALVE
IA-V-1626B	2-HR BACKUP AIR SYSTEM HEADER SUPPLY VALVE
IC-V-0003	CONTAINMENT ISOLATION - ICCW COOLANT RETURN VALVE
IC-V-0004	CONTAINMENT ISOLATION - IC ISOL COOLANT SUPPLY
IC-V-0006	CONTAINMENT ISOLATION - IC COOLANT SUPPLY TO CRDM
MS-V-0004A	ATMOSPHERIC DUMP VALVE FOR OTSG "A"
MS-V-0004B	ATMOSPHERIC DUMP VALVE FOR OTSG "B"
MS-V-0006	EF-P1 MS PRESSURE REGULATOR CONTROL VALVE
MS-V-0013A	MAIN STEAM SUPPLY TO EF-P1 FROM OTSG "A"
MS-V-0013B	MAIN STEAM SUPPLY TO EF-P1 FROM OTSG "B"
MU-V-0003	CONTAINMENT ISOLATION - LETDOWN COOLER ISOL VALVE
MU-V-0010	WDL ADDITION TO LETDOWN ISOLATION VALVE
MU-V-0018	CONTAINMENT ISOLATION - CHARGE LINE ISOL VALVE
MU-V-0020	CONTAINMENT ISOLATION - RCP SEAL WATER ISOL VLV
MU-V-0026	CONTAINMENT ISOLATION RCP SEAL RETURN LETDOWN ISOL

Table A-3 Complete List of AOVs in TMI-1 IST Program	
Valve Identifier	**Description**
MU-V-0051	EMERGENCY BORIC ACID ADD VALVE TO MAKEUP TANK
NS-V-0052A	CONTAINMENT ISOLATION - AH-E1A MOTOR COOLER SUPPLY
NS-V-0052B	CONTAINMENT ISOLATION - AH-E1B MTR COOLER SUPPLY
NS-V-0052C	CONTAINMENT ISOLATION - AH-E1C MTR COOLER SUPPLY
NS-V-0053A	CONTAINMENT ISOLATION - AH-E1A MTR COOLER RETURN
NS-V-0053B	CONTAINMENT ISOLATION - AH-E1B MTR COOLER RETURN
NS-V-0053C	CONTAINMENT ISOLATION - AH-E1C MTR COOLER RETURN
NS-V-0054A	SPENT FUEL PUMP ROOM COOLING COIL FLOW CONTROL
NS-V-0054B	SPENT FUEL PUMP ROOM COOLING COIL FLOW CONTROL VLV
NS-V-0055A	EFW PUMP ROOMS & IA COMPRESSOR FLOW CONTROL VLV
NS-V-0055B	EFW PUMP ROOMS & IA COMPRESSOR FLOW CONTROL VLV
NS-V-0056A	NS-P1 & DC-P1 PUMP AREA VENT EQ FLOW CONTROL VLV
NS-V-0056B	NS-P1 & DC-P1 PUMP AREA VENT EQ FLOW CONTROL VLV
NS-V-0108A	CONTROL ROOM HVAC COOLER OUTLET CONTROL VALVE
NS-V-0108B	CONTROL ROOM HVAC COOLER OUTLET CONTROL VALV
RR-V-0006	RB EMERG COOLING COIL BACK PRESSURE REGULATOR
RR-V-0010A	RR-P1A RECIRCULATION MINIMUM FLOW BYPASS VALVE
RR-V-0010B	RR-P1B RECIRCULATION MINIMUM FLOW BYPASS VALVE
WDL-V-0049	WDL-P13A OUTLET SUPPLY TO RCBT
WDL-V-0050	WDL-P13B OUTLET SUPPLY TO RCBT
WDL-V-0061	BORIC ACID MIX TANK OUTLET TO PRIMARY SYSTEM
WDL-V-0062	OUTLET BORIC ACID MIX TANK TO RCBT
WDL-V-0089	OUTLET RBAT (WDL-T7A) TO WDL-P13A
WDL-V-0090	OUTLET RBAT (WDL-T7A) TO WDL-P13B
WDL-V-0091	OUTLET RBAT (WDL-T7B) TO WDL-P13A
WDL-V-0092	OUTLET WDL-T7B TO WDL-P13B
WDL-V-0304	CONTAINMENT ISOLATION - RC DRAIN PUMP DISCH ISOL
WDL-V-0534	CONTAINMENT ISOLATION - RB SUMP DRAIN TO AUX BLDG
WDL-V-0535	CONTAINMENT ISOLATION - RB SUMP DRAIN TO AUX BLDG

A.3.1 TMI-1 Risk-Informed IST Pilot Study

TMI-1 participated in a previous RI-IST project as part of an EPRI pilot study [10]. The following information was derived from that study. This information may change after completion of the TMI-1 PRA update that is currently underway. The data provided here is for information purposes only, and has not been used to create a RI-IST program at TMI-1.

The ASME "quad chart" was applied to 27 of the 30 AOVs modeled in the TMI-1 PRA (3 were truncated). The Quad Chart shown in Figure A-1 provides a pictorial perspective of AOV risk significance.

The two AOVs in Quad C (F-V > .001 and RAW > 2) are:

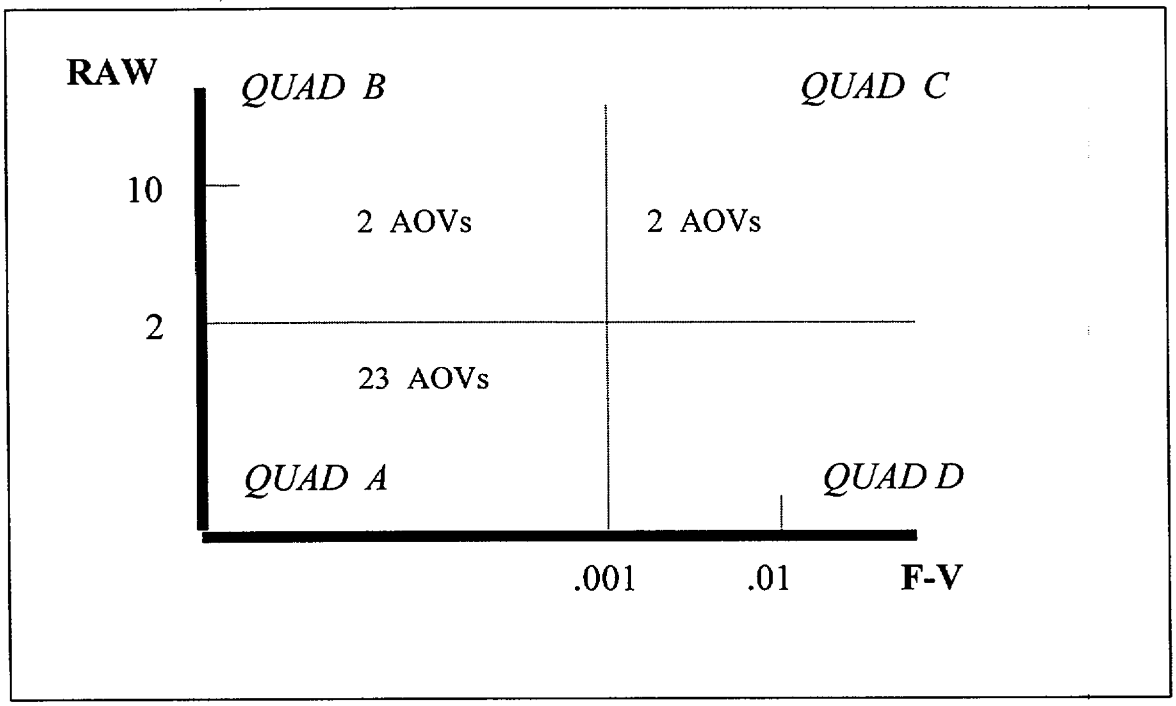
- Containment Isolation ICCW Coolant Return Valves (ICV-3 and ICV-4)

The two AOVs in Quad B (F-V < .001 and RAW > 2) are:

- Atmospheric Dump Valves for "A" and "B" OTSG (MSV-4A and MSV-4B)

The two AOVs in Quad C are clearly risk significant with respect to CDF. The two AOVs in Quad B could be risk significant if they are out of service.

Figure A-1 AOVs on Quad Chart for TMI-1



The Inservice Testing Expert Panel consisted of eight members with most members having served on the Maintenance Rule Expert Panel. The members included the PRA Engineer, Senior Reactor Operator, Safety Analysis Engineer, Maintenance Engineer, System Engineer, plant engineers (two), and Mechanical Design Engineer (chairman).

The Inservice Testing Expert Panel placed the 4 AOVs from Quads C and B into HSSC category and 73 AOVs into the LSSC category (including the 23 AOVs from Quad A).

Appendix A.4 - Oconee

Table A-4 Complete List of AOVs in Oconee IST Program		
Unit	**Valve Identifier**	**Description**
0	0DA0025	Inlet to Diesel "A" Air Start Motor
0	0DA0031	Diesel "A" Air Start Motor "B" Inlet
0	0DA0037	Engine B-C Air Starter Relay
0	0DA0043	Engine B-D Air Starter Relay
1	1C0176	Emergency Make-up to Condenser from UST
1	1C0187	Emergency Make-up to Condenser from UST
1	1C0192	Normal Make-up to Condenser from UST
1	1CC0008	CC Return
1	1CC0008	CC Return
1	1CCW0020	Condenser "1A1" Outlet
1	1CCW0021	Condenser "1A2" Outlet
1	1CCW0022	Condenser "1B1" Outlet
1	1CCW0023	Condenser "1B2" Outlet
1	1CCW0024	Condenser "1C1" Outlet
1	1CCW0025	Condenser "1C2" Outlet
1	1CS0006	QT RB Isolation
1	1CS0006	QT RB Isolation
1	1CS0046	Bleed Transfer Pump A Discharge Control
1	1CS0056	Bleed Transfer Pump B Discharge Control
1	1FDW0032	"A" OTSG Main Flow Control Valve
1	1FDW0035	EFDW to OTSG "A"
1	1FDW0041	"B" OTSG Main Flow Control Valve
1	1FDW0044	EFDW to OTSG "B"
1	1FDW0106	OTSG "1A" Sample
1	1FDW0106	OTSG "1A" Sample
1	1FDW0108	OTSG "1B" Sample
1	1FDW0108	OTSG "1B" Sample
1	1FDW0315	EFDW to OTSG "A"
1	1FDW0316	EFDW to OTSG "B"
1	1GWD0013	GWD Penetration 18 Cont. Isolation
1	1GWD0013	GWD Penetration 18 Cont. Isolation
1	1HP0005	LD Isolation
1	1HP0005	LD Isolation
1	1HP0016	Makeup to LDST
1	1HP0021	RC Pump Seal Return
1	1HP0021	RC Pump Seal Return
1	1HP0355	Aux Pressurizer Spray Flow Control
1	1HPS0184	TDEFDWP Oil Cooler Backup Cooling Water Isolation
1	1LPS0138	Bypass around Vlv to Cooling Jacket
1	1LPS0251	DH Cooler Outlet
1	1LPS0251	DH Cooler Outlet
1	1LPS0252	DH Cooler Outlet
1	1LPS0252	DH Cooler Outlet
1	1LPS0516	Auto Valve from "A" MDEFWP Motor

Table A-4 Complete List of AOVs in Oconee IST Program		
Unit	**Valve Identifier**	**Description**
1	1LPS0525	Auto Valve from "B" MDEFWP Motor
1	1LRT0017	Pressurization Block
1	1LWD0002	Normal Pump Suction
1	1LWD0002	Normal Pump Suction
1	1MS0019	Turbine Bypass Control "A"
1	1MS0022	Turbine Bypass Control "B"
1	1MS0028	Turbine Bypass Control "C"
1	1MS0031	Turbine Bypass Control "D"
1	1MS0087	MS to Emerg FDW Turbine Control
1	1MS0093	EFPT Supply Trip Valve
1	1MS0126	AUXILIARY STEAM PRESSURE CONTROL VALVE
1	1MS0129	AUXILIARY STEAM PRESSURE CONTROL VALVE
1	1PR0002	RB Purge Outlet
1	1PR0002	RB Purge Outlet
1	1PR0005	RB Purge Inlet
1	1PR0005	RB Purge Inlet
1	1PR0008	RB Radiation Monitor
1	1PR0008	RB Radiation Monitor
1	1PR0010	RB Radiation Monitor
1	1PR0010	RB Radiation Monitor
1	1PR0020	PR Fan Suction Tie
1	1RC0007	Pressure Sample
1	1RC0007	Pressure Sample
1	1WL0011	Unit Cooling Water Control Valve
2	2C0176	Emergency Make-up to Condenser from UST
2	2C0187	Emergency Make-up to Condenser from UST
2	2C0192	Normal Make-up to Condenser from UST
2	2CC0008	CC Return
2	2CC0008	CC Return
2	2CCW0020	Condenser "2A1" Outlet
2	2CCW0021	Condenser "2A2" Outlet
2	2CCW0022	Condenser "2B1" Outlet
2	2CCW0023	Condenser "2B2" Outlet
2	2CCW0024	Condenser "2C1" Outlet
2	2CCW0025	Condenser "2C2" Outlet
2	2CS0006	QT RB Isolation
2	2CS0006	QT RB Isolation
2	2CS0046	Bleed Transfer Pump A Discharge Control
2	2CS0056	Bleed Transfer Pump B Discharge Control
2	2FDW0032	"A" OTSG Main Flow Control Valve
2	2FDW0035	EFDW to OTSG "A"
2	2FDW0041	"B" OTSG Main Flow Control Valve
2	2FDW0044	EFDW to OTSG "B"
2	2FDW0106	OTSG "2A" Sample
2	2FDW0106	OTSG "2A" Sample
2	2FDW0108	OTSG "2B" Sample
2	2FDW0108	OTSG "2B" Sample
2	2FDW0315	EFDW to OTSG "A"
2	2FDW0316	EFDW to OTSG "B"

Table A-4 Complete List of AOVs in Oconee IST Program		
Unit	**Valve Identifier**	**Description**
2	2GWD0013	GWD Penetration. 18 Cont. Isolation Valve
2	2GWD0013	GWD Penetration. 18 Cont. Isolation Valve
2	2HP0005	LD Isolation
2	2HP0005	LD Isolation
2	2HP0016	Makeup to LDST
2	2HP0021	RC Pump Seal Return
2	2HP0021	RC Pump Seal Return
2	2HP0355	Aux Pressurizer Spray Flow Control
2	2HPS0184	TDEFDWP Oil Cooler Backup Cooling Water Isolation
2	2LPS0138	Bypass around Vlv to Cooling Jacket
2	2LPS0251	DH Cooler Outlet
2	2LPS0251	DH Cooler Outlet
2	2LPS0252	DH Cooler Outlet
2	2LPS0252	DH Cooler Outlet
2	2LPS0516	Auto Valve from "A" MDEFWP Motor
2	2LPS0525	Auto Valve from "B" MDEFWP Motor
2	2LRT0017	Pressurization Block
2	2LWD0002	Normal Pump Suction
2	2LWD0002	Normal Pump Suction
2	2MS0019	Turbine Bypass Control "A"
2	2MS0022	Turbine Bypass Control "B"
2	2MS0028	Turbine Bypass Control "C"
2	2MS0031	Turbine Bypass Control "D"
2	2MS0087	MS to Emerg FDW Turbine Control
2	2MS0093	EFPT Supply Trip Valve
2	2MS0126	AUXILIARY STEAM PRESSURE CONTROL VALVE
2	2MS0129	AUXILIARY STEAM PRESSURE CONTROL VALVE
2	2PR0002	RB Purge Outlet
2	2PR0002	RB Purge Outlet
2	2PR0005	RB Purge Inlet
2	2PR0005	RB Purge Inlet
2	2PR0008	RB Radiation Monitor
2	2PR0008	RB Radiation Monitor
2	2PR0010	RB Radiation Monitor
2	2PR0010	RB Radiation Monitor
2	2PR0020	PR Fan Suction Tie
2	2RC0007	Pressurizer Sample
2	2RC0007	Pressurizer Sample
2	2WL0011	Unit Cooling Water Control Valve
3	3C0176	Emergency Make-up to Condenser from UST
3	3C0187	Emergency Make-up to Condenser from UST
3	3C0192	Normal Make-up to Condenser from UST
3	3CC0008	CC Return
3	3CC0008	CC Return
3	3CCW0020	Condenser "3A1" Outlet
3	3CCW0021	Condenser "3A2" Outlet
3	3CCW0022	Condenser "3B1" Outlet
3	3CCW0023	Condenser "3B2" Outlet
3	3CCW0024	Condenser "3C1" Outlet

Table A-4 Complete List of AOVs in Oconee IST Program		
Unit	**Valve Identifier**	**Description**
3	3CCW0025	Condenser "3C2" Outlet
3	3CS0006	QT RB Isolation
3	3CS0006	QT RB Isolation
3	3CS0046	Bleed Transfer Pump A Discharge Control
3	3CS0056	Bleed Transfer Pump B Discharge Control
3	3FDW0032	"A" OTSG Main Flow Control Valve
3	3FDW0035	EFDW to OTSG "A"
3	3FDW0041	"B" OTSG Main Flow Control Valve
3	3FDW0044	EFDW to OTSG "B"
3	3FDW0106	OTSG "3A" Sample
3	3FDW0106	OTSG "3A" Sample
3	3FDW0108	OTSG "3B" Sample
3	3FDW0108	OTSG "3B" Sample
3	3FDW0315	EFDW to OTSG "A"
3	3FDW0316	EFDW to OTSG "B"
3	3GWD0013	GWD Penetration 18 Cont. Isolation Valve
3	3GWD0013	GWD Penetration 18 Cont. Isolation Valve
3	3HP0005	LD Isolation
3	3HP0005	LD Isolation
3	3HP0016	Makeup to LDST
3	3HP0021	RC Pump Seal Return
3	3HP0021	RC Pump Seal Return
3	3HP0355	Aux Pressurizer Spray Flow Control
3	3HPS0184	TDEFDWP Oil Cooler Backup Cooling Water Isolation
3	3LPS0138	Bypass around Vlv to Cooling Jacket
3	3LPS0404	LPSW DH Cooler Outlet
3	3LPS0404	LPSW DH Cooler Outlet
3	3LPS0405	LPSW DH Cooler Outlet
3	3LPS0405	LPSW DH Cooler Outlet
3	3LPS0516	Auto Valve from "A" MDEFWP Motor
3	3LPS0525	Auto Valve from "B" MDEFWP Motor
3	3LRT0017	Pressurization Block
3	3LWD0002	Normal Pump Suction
3	3LWD0002	Normal Pump Suction
3	3MS0019	Turbine Bypass Control "A"
3	3MS0022	Turbine Bypass Control "B"
3	3MS0028	Turbine Bypass Control "C"
3	3MS0031	Turbine Bypass Control "D"
3	3MS0087	MS to Emerg FDW Turbine Control
3	3MS0093	EFPT Supply Trip Valve
3	3MS0126	AUXILIARY STEAM PRESSURE CONTROL VALVE
3	3MS0129	AUXILIARY STEAM PRESSURE CONTROL VALVE
3	3PR0002	RB Purge Outlet
3	3PR0002	RB Purge Outlet
3	3PR0005	RB Purge Inlet
3	3PR0005	RB Purge Inlet
3	3PR0008	RB Radiation Monitor
3	3PR0008	RB Radiation Monitor
3	3PR0010	RB Radiation Monitor

Table A-4 Complete List of AOVs in Oconee IST Program		
Unit	**Valve Identifier**	**Description**
3	3PR0010	RB Radiation Monitor
3	3PR0020	PR Fan Suction Tie
3	3RC0007	Pressurizer Sample
3	3RC0007	Pressurizer Sample

APPENDIX B

PLANT SPECIFIC PRA COMPARISON

B.1 Davis-Besse

B.2 Crystal River-3

B.3 Three Mile Island-1

B.4 Oconee-3

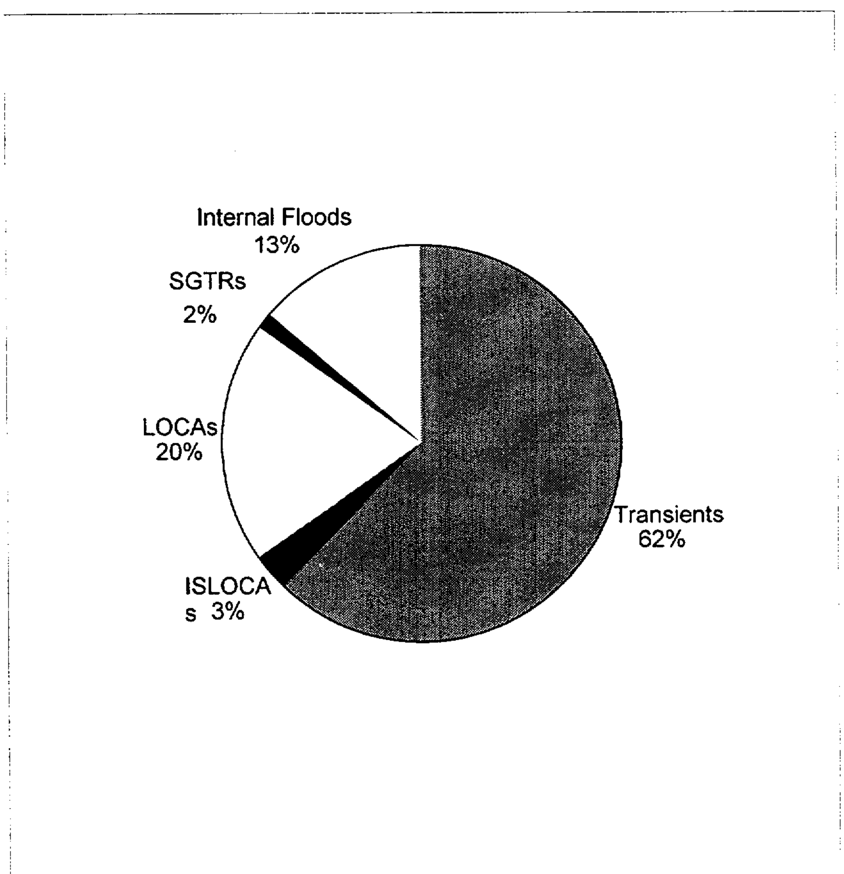
NOTE: The material in this appendix is high-level and based upon a "snapshot" of the PRAs at a certain point in time. Since the B&WOG PRAs are constantly being maintained and updated, the information presented here may already be out of date. As such, it is presented here for information purposes only.

Appendix B.1 - Davis-Besse

Davis-Besse is a Babcock and Wilcox PWR with a rated power of 2772 MWt housed in a large dry reinforced concrete containment. The site is located on the southwest shore of Lake Erie in northwestern Ohio. Condenser cooling is provided via natural draft cooling tower, while cooling water for various auxiliaries is drawn from Lake Erie. The plant was placed into commercial operation in 1978.

The Davis-Besse PRA uses the linked fault tree approach and the CAFTA computer code. The CDF mean value for Davis-Besse full power operations is 1.6E-05 per year. The major contributors by general event categories are shown on Figure B-1.

Figure B-1 Contributions to Core Damage Frequency for Davis-Besse

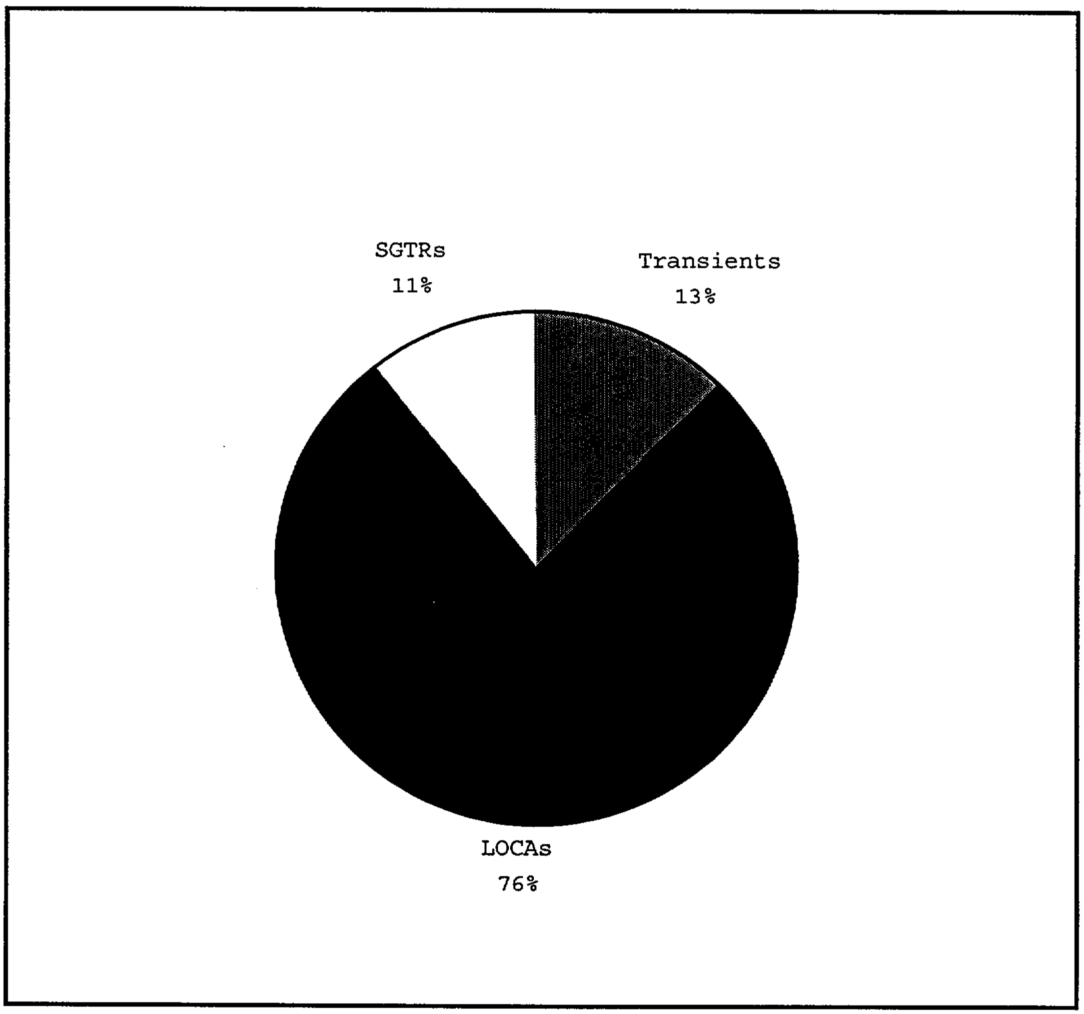


Appendix B.2 - Crystal River

Crystal River is a Babcock and Wilcox PWR with a rated power of 2544 MWt housed in a large dry reinforced concrete containment. The site is located on Gulf Coast of Florida just north of Tampa. Condenser cooling is provided via saltwater from the Gulf of Mexico. The cooling water for various auxiliaries is also drawn from the Gulf. The plant was placed into commercial operation in 1977.

The Crystal River-3 PRA uses the linked fault tree approach and the CAFTA computer code. The CDF mean value for Crystal River full power operations is 6.4E-06 per year. The major contributors are shown in Figure B-2.

Figure B-2 Contributions to Core Damage Frequency for Crystal River

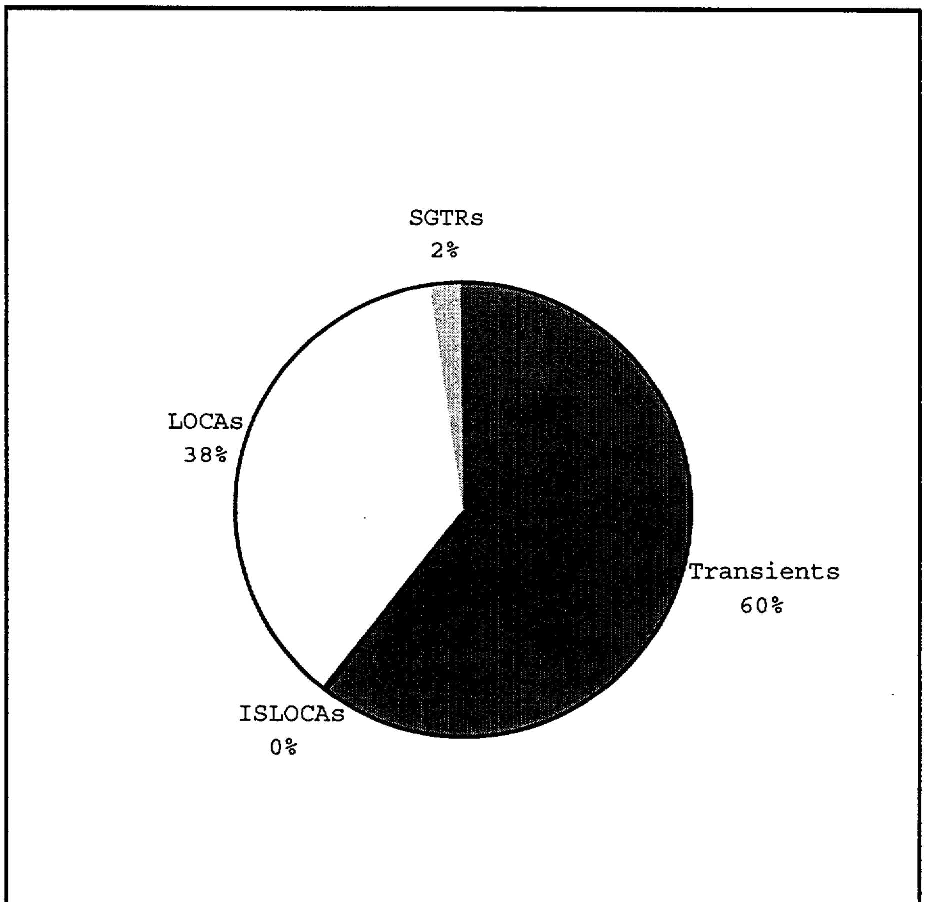


Appendix B.3 - Three Mile Island 1

TMI-1 is a Babcock and Wilcox PWR with a rated power of 2568 MWt housed in a large dry reinforced concrete containment. The site is located on Three Mile Island in the Susquehanna River in southeastern Pennsylvania. Condenser cooling is provided via natural draft cooling towers, while cooling water for various auxiliaries is drawn from the Susquehanna River. The plant was placed into commercial operation in 1974.

The TMI-1 PRA uses the large event tree method and the RISKMAN computer code. The CDF mean value for TMI-1 full power operations is 4.2E-05 per year, based upon internal initiating events. A breakdown of major contributors is shown in Figure B-3. TMI-1 is currently in the process of updating their PRA, so these results may change.

Figure B-3 Contributions to Core Damage Frequency for TMI-1

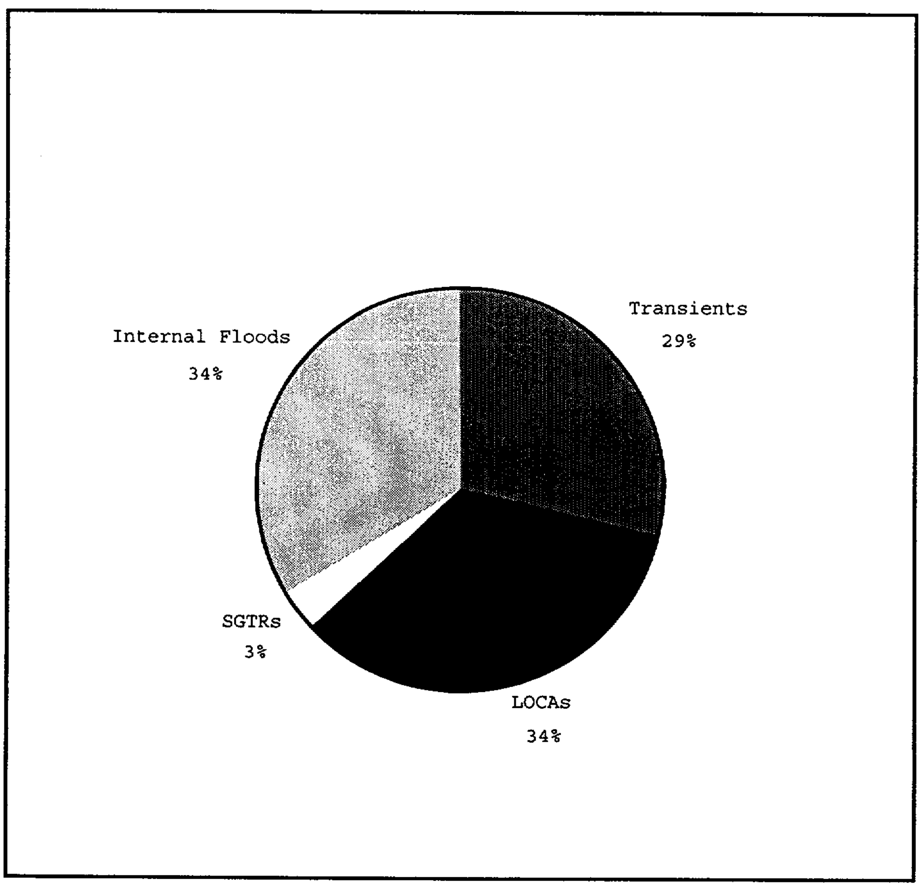


Appendix B.4 - Oconee

Oconee 1, 2, and 3 are three Babcock & Wilcox PWRs housed in large dry concrete containments, each with a power rating of 2568 MWt. The plant is located on Lake Keowee in western South Carolina, near Greenville. Condenser and cooling water is provided by the Lake. The three units were placed into operation in 1973, 1974, and 1974.

The Oconee PRA uses the linked fault tree approach and the CAFTA computer code. The PRA models Oconee 3 and common systems. The Oconee PRA is Level 1/2/3 with both internal and external initiating events. Figure B-4 shows major contributors to CDF for internal events only. The Oconee CDF is about 3E-5 per year for internal events and 9E-5 per year for internal plus external events.

Figure B-4 Contributions to CDF for Oconee 3 (internal events)



APPENDIX C

SAMPLE EXPERT PANEL PROCEDURE

The following is an example of a section of a procedure applicable to Expert Panels. It covers both Maintenance Rule and RI-IST applications.

C.1 Expert Panel

C.1.1 Expert Panel Designation - The Supervisor - Test/Performance shall designate members and alternates of the following Expert Panels by name, including the chairman. These Expert Panels shall be composed of individuals who collectively possess a comprehensive knowledge base in the identified areas:

a. Maintenance Rule Expert Panel - minimum of four individuals representing comprehensive knowledge in Maintenance Rule, Plant Operations, Maintenance, Scheduling, equipment reliability, and the PRA.

b. RI-IST Expert Panel - minimum of five individuals representing comprehensive knowledge in Plant Operations, safety analysis engineering, the PRA, Maintenance, equipment reliability, and component engineering.

c. Each Expert Panel should be an interdisciplinary group composed of individuals who have expertise in at least one of the following areas:

c.1 Operations

c.2 Senior Reactor Operator qualifications

c.3 Plant Engineering

c.4 Maintenance

c.5 Planning or Scheduling

c.6 Probability Risk Assessment (PRA)

c.7 Design Engineering

c.8 Regulatory Affairs

c.9 Quality Assurance

d. The indoctrination and training of the Expert Panel members in risk analysis should include the following:

d.1 PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty),

d.2 Use of risk importance measures,

d.3 Assessment of failure modes,

d.4 Reliability verses availability,

d.5 Risk thresholds,

d.6 Expert judgment elicitation.

C.1.2 Expert Panel Chairman

a. The Maintenance Rule Coordinator shall serve as the chairman of the expert panels.

b. The expert panel chairman is responsible for the preparation of the meeting agenda.

c. The expert panel chairman is responsible for the preparation of the meeting minutes, which should contain the following:

c.1 List of attendees of the meeting

c.2 Discussion of decisions reached

c.3 Basis of decisions reached

c.4 Dissenting opinions.

d. For the RI-IST Expert Panel, the Chairman shall be familiar with the ASME OMN-3 Code Case, especially the requirements relating to the expert panel.

C.1.3 Expert Panel Meeting Requirements

a. The expert panel shall not meet unless a quorum is present.

a.1 For the Maintenance Rule Expert Panel, a quorum shall consist of four member (including the Chairman) with no more than half being alternates, at least one member who holds or has held an SRO license, and representatives from Operations and Plant Engineering.

a.2 For the RI-IST Expert Panel, a quorum shall consist of five members (including the Chairman and experts from Plant Operations, safety analysis engineering, and the PRA). Alternate members may fulfill these requirements, but the alternates must have been trained and fill the same requirements as the member.

b. Visitors may be invited to the expert panel sessions. Their technical expertise may be utilized, but they have no vote in expert panel decision-making.

c. Decisions of the expert panel shall be formally recorded.

c.1 For the Maintenance Rule Expert Panel, the decisions reached will be made by simple majority vote. Any dissenting opinions can be appealed by submitting the dissenting opinion to the Manager - Plant Engineering and then to the Director Engineering and Services.

c.2 For the RI-IST Expert Panel, the decisions reached will be arrived at by consensus. Differing opinions shall be documented and resolved, if possible. If a resolution cannot be achieved concerning the safety significance of a component, then the component shall be classified as HSSC. If components have a high initial ranking from the PRA, but are ultimately classified as LSSC, then the Expert Panel shall provide written justification of their decision.

C.1.4 Periodic Monitoring of Categorized Components by Expert Panel

a. For the Maintenance Rule Expert Panel:

a.1 The Expert Panel should review the quarterly equipment windows and the Periodic Maintenance Effectiveness Assessment Reports, to ensure performance monitoring and goal setting activities are proceeding as desired.

a.2 The Expert Panel should meet at least quarterly to perform these reviews.

a.3 The Expert Panel should review and approve all changes to the SSC scoping, risk significance determination, establishment of performance criteria, Periodic Maintenance Effectiveness Assessment Report, categorization of SSCs as (a)(2) or (a)(1), and the establishment of goals.

a.4 For decisions that alter the implementation of the rule (i.e., scoping, risk significance, etc), all of the organizations represented on the expert panel should be present. As necessary the expert panel should be supplemented by subject matter experts.

b. For the RI-IST Expert Panel, the Expert Panel should meet at least once every other refueling cycle, and no later than nine months after the end of the refueling outage, to review the RI-IST program and verify HSSC/LSSC categorization.

APPENDIX D

SAMPLE WORK SHEETS

FROM DAVIS-BESSE AOV EXPERT PANEL SESSIONS

The following are samples of completed two-page work sheets from the Davis-Besse Expert Panel meetings for AOVs. The complete set is maintained in the database at the Davis-Besse site.

Air Operated Valve Categorization

CCW Nonessential Supply to Makeup Pump Lube Oil Coolers — CC1460

VALVE INFORMATION

ASSET NUMBER	HV1460	**EQUIP GROUP**	CC1460
SUBSYSTEM	016-04	**DWG NO**	M-036A
VALVE MANUF	ITT Hammel Dahl	**VALVE TYPE**	Globe
ACTUATOR MANUF	ITT Hammel Dahl	**ACTUATOR TYPE**	Spring & Diaphragm
QUAL CLASS	Q	**VALVE SIZE**	1 1/2"
NORMAL POSITION	Open	**FAILURE POSITION**	Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC

Normal Operation is open to allow nonessential CCW to the Makeup pump(s) bearing and gear oil coolers. Closure function is required to meet SFAS and surge tank low-low level interlock requirements.

Nonessential CC1460 supply line may be used in parallel with the essential line when the respective CCW and make-up pump are both in service.

SAFETY FUNC

Safety function is to close automatically upon SFAS Level 3 and low-low surge tank level.

MR FUNCTION

EOPs utilize CCW to provide cooling to non-essential loads. Non-risk significant function is for each train to be able to isolate non-essential loads when required.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	A	**PSA RAW**	1.03	**PSA F-V**	0

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

EXCELLENCE • QUALITY • TEAMWORK

Air Operated Valve Categorization

CCW Nonessential Supply to Makeup Pump Lube Oil Coolers — CC1460

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

If a loss of component cooling water to the makup pumps lube oil cooler would occur, the makeup pumps will operate for up to an hour without cooling water which provides ample time to start the redundant train cooling.

Additionally, the non essential supply to the makup pump is not risk significant due to the essential supply.

OTHER CONSIDERATIONS

The safety function of this valve is to mitigate breaks that are low probabilty events based on the frequency of the initiating events. A loss of CCW inventory due to recent rupture disk failures does not warrant the HSSC classification.

This valve/actuator combination receives no preventive maintenance.

COMPENSATORY ACTIONS

This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS?

This component is already in the IST Program.

MAINTENANCE RELIABILITY?

This component is already in the IST Program.

SYSTEM AVAILABILITY?

This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS?

This component is already in the IST Program.

DAVIS-BESSE NUCLEAR POWER STATION
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Air Operated Valve Categorization

Decay Heat Removal Heat Exchanger 1-1 CCW Discharge Line Isolation Valve — CC1467

VALVE INFORMATION

ASSET NUMBER	HV1467	**EQUIP GROUP**	CC1467
SUBSYSTEM	016-04	**DWG NO**	M-036B
VALVE MANUF	ITT Hammel Dahl	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	ITT Hammel Dahl	**ACTUATOR TYPE**	Piston
QUAL CLASS	Q	**VALVE SIZE**	18"
NORMAL POSITION	Closed	**FAILURE POSITION**	Open
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve is normally closed during operation and open during Mode 4, 5, or 6 for decay heat removal.

SAFETY FUNC The safety function is to open upon an SFAS Level 3 signal. This valve contains a detention device to ensure the valves remain in a failed safe open position upon loss of instrument air.

MR FUNCTION The risk significant function is for each train to provide cooling for safety related heat loads.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	C	**PSA RAW**	2.23	**PSA F-V**	0.002

RISK INFORMED CLASSIFICATION

HSSC	☑	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

EXCELLENCE • QUALITY • TEAMWORK

Air Operated Valve Categorization

Decay Heat Removal Heat Exchanger 1-1 CCW Discharge Line Isolation Valve

CC1467

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	This valve meets the criteria for high safety significant classification.
OTHER CONSIDERATIONS	This valve/actuator combination receives full preventive maintenance.
COMPENSATORY ACTIONS	This valve is being placed in Category 1 of the AOV Program to ensure that the design basis capability is demonstrated, timely maintenance is performed, and setpoint control is maintained.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

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Air Operated Valve Categorization

Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-1 CCW Discharge Line Isolation Valve

CC1471

VALVE INFORMATION

ASSET NUMBER	HV1471	**EQUIP GROUP**	CC1471
SUBSYSTEM	016-04	**DWG NO**	M-036B
VALVE MANUF	ITT Hammel Dahl	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	ITT Hammel Dahl	**ACTUATOR TYPE**	Spring & Diaphragm
QUAL CLASS	Q	**VALVE SIZE**	6"
NORMAL POSITION	Open/Closed	**FAILURE POSITION**	Open
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC

This valve will automatically open upon a closed valve differential pressure of 84 psid or EDG speed of 40 RPM or greater.

A modification has been initiated to fail this valve in the open position.

SAFETY FUNC

This valve opens automatically whenever EDG 1-1 is >40 RPM or delta P across the valve is > 84 psid.

MR FUNCTION

The risk significant function is for each train to provide cooling for safety related heat loads.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	A	**PSA RAW**	1.59	**PSA F-V**	0

RISK INFORMED CLASSIFICATION

HSSC	☑	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaualtion.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Emergency Diesel Generator Jacket Cooling Water Heat Exchanger 1-1 CCW Discharge Line Isolation Valve

CC1471

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

This valve meets the criteria for high safety significant classification based on Fussell-Vesely increasing from 0.000 to 0.001 in the Maintenance and Human Action Sensitivity Study.

OTHER CONSIDERATIONS

A cycle 13 modification to fail this valve in its open safety position will eliminate this component from the IST and JOG program requirement.

This valve is required for function of the emergency diesel generator. An operator work around is not feasible. This valve receives preventive maintenance.

COMPENSATORY ACTIONS

This valve is being placed in Category 1 of the AOV Program to ensure that the design basis capability is demonstrated, timely maintenance is performed, and setpoint control is maintained.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS?

This component is already in the IST Program.

MAINTENANCE RELIABILITY?

This component is already in the IST Program.

SYSTEM AVAILABILITY?

This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS?

This component is already in the IST Program.

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Air Operated Valve Categorization

Deareator Heater 1-2-3 Level Control Valve — CD420

VALVE INFORMATION

ASSET NUMBER	LV420	**EQUIP GROUP**	CD420
SUBSYSTEM	035-01	**DWG NO**	M-006F
VALVE MANUF	ITT Hammel Dahl	**VALVE TYPE**	Globe
ACTUATOR MANUF	ITT Hammel Dahl	**ACTUATOR TYPE**	Spring & Diaphragm
QUAL CLASS	NQ	**VALVE SIZE**	12"
NORMAL POSITION	Throttled	**FAILURE POSITION**	Closed
IST PROGRAM	No	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC Normal valve function is open for deareator level control.

SAFETY FUNC This valve has no safety related function. Valve will close automatically on hi-hi deaerator level as sensed by LSHH405.

MR FUNCTION The non risk significant functions are to supply the normal source to the Main Feedwater System and to not initiate a plant trip.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	N/A	**PSA RAW**	Not modeled	**PSA F-V**	Not modeled

RISK INFORMED CLASSIFICATION

HSSC ☐ High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.

LSSC ☐ Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.

OUT OF SCOPE ☑ AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Deareator Heater 1-2-3 Level Control Valve

CD420

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

This component does not have a risk significant function; however, based the poor performance history and potential importance to transient initiation, there is no added value to adding this component to the IST program.

This component does warrant increased attention and will be placed in Category 2 of the AOV Program.

OTHER CONSIDERATIONS

Currently, the PM strategy (PM 3301) calibrates the entire valve string every refuel outage. Components found defective during the calibration are replaced.

Need to ensure there is a PM to replace elastomer components. Also need to address the packing leakage.

COMPENSATORY ACTIONS

This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is not considered in the Design Basis Analysis, the Safety Analysis Report or any Technical Specifications.

10 CFR 100 RELEASE LIMITS?

Failure of this component is not a breach of any engineered safety barrier, nor will failure of this component contribute to an uncontained release of radioactive material.

MAINTENANCE RELIABILITY?

This component is important in maintaining system reliability. This component has had a poor maintenance history. Failure would be detected when this component initiated a transient.

SYSTEM AVAILABILITY?

This component is important to maintaining system availability.

OTHER DETERMINISTIC CONSIDERATIONS?

There are no other deterministic considerations that component failure would mitigate with regards to external events, or safe shutdown conditions.

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Air Operated Valve Categorization

Circulating Water Supply to TPCW Heat Exchanger Isolation Valve (Backup Service Water) — CT2955

VALVE INFORMATION

ASSET NUMBER	HV2955	**EQUIP GROUP**	CT2955
SUBSYSTEM	011-01	**DWG NO**	M-041A
VALVE MANUF	Neles-Jamesbury	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	Neles-Jamesbury	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	AQ	**VALVE SIZE**	20"
NORMAL POSITION	Closed	**FAILURE POSITION**	Closed
IST PROGRAM	No	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve provides a backup supply to the Service Water System to serve the TPCW System.

SAFETY FUNC This valve has no safety related function. Low pressure in the service water supply line as sensed by PSL2956 automatically opens CT2955 at <30 psig as long as PDS3886 senses >0.3 psid. This valve closes automatically is these conditions are cleared.

MR FUNCTION Not Risk Significant

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	D	**PSA RAW**	1.23	**PSA F-V**	0.062

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☑	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Circulating Water Supply to TPCW Heat Exchanger Isolation Valve (Backup Service Water) CT2955

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☑	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS This valve provides an important function as a backup to service water for Turbine Plant Cooling Water. This valve is categorized as out of scope for IST contingent upon compensatory actions.

OTHER CONSIDERATIONS With periodic testing, the function is not expected to be risk significant based upon a verification that the valve will in fact perform its function.

COMPENSATORY ACTIONS Develop a test for this valve to verify that it passes flow.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS? This component is not considered in the Design Basis Analysis, the Safety Analysis Report or any Technical Specifications.

10 CFR 100 RELEASE LIMITS? Failure of this component is not a breach of any engineered safety barrier, nor will failure of this component contribute to an uncontained release of radioactive material.

MAINTENANCE RELIABILITY? This component is used as a backup source of cooling flow to the TPCW Heat Exchangers. Currently, there is no method to detect component failure. This component has had an acceptable maintenance history.

SYSTEM AVAILABILITY? This component could cause failures in turbine plant cooling water cooling when used as a backup to service water.

OTHER DETERMINISTIC CONSIDERATIONS? This component could be used to mitigate accidents caused by loss of service water due to an external event.

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Air Operated Valve Categorization

Mechanical Penetration Room/Shield Building Annulus Supply Purge Valve — CV5004

VALVE INFORMATION

ASSET NUMBER	HV5004	EQUIP GROUP	CV5004
SUBSYSTEM	060-03	DWG NO	M-029E
VALVE MANUF	Fisher Controls	VALVE TYPE	Butterfly
ACTUATOR MANUF	Bettis	ACTUATOR TYPE	Spring Return Piston
QUAL CLASS	Q	VALVE SIZE	48"
NORMAL POSITION	Open	FAILURE POSITION	Closed
IST PROGRAM	Yes	CONT INTEGRITY	No

VALVE FUNCTION

NORMAL FUNC Open when the Purge Supply and Exhaust Fans are aligned to the penetration room. This valve is normally open during plant operation to supply and remove shield building and penetration room atmosphere.

SAFETY FUNC Automatically close upon SFAS Level 1 to ensure shield building negative pressure boundary conditions.

MR FUNCTION Not Risk Significant

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	N/A	PSA RAW	Not modeled	PSA F-V	Not modeled

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Mechanical Penetration Room/Shield Building Annulus Supply Purge Valve

CV5004

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	This valve has no affect on initiation of accidents or core damage frequency. It can be used to mitigate releases; however, most significant releases are bypasses which will not be mitigated by this valve.
OTHER CONSIDERATIONS	Periodic draw down tests are performed to verify operability of this valve. Additionally, this valve has had a good performance history and receives preventive maintenance.
COMPENSATORY ACTIONS	This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

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Air Operated Valve Categorization

Containment Exhaust Purge Valve — CV5007

VALVE INFORMATION

ASSET NUMBER	HV5007	**EQUIP GROUP**	CV5007
SUBSYSTEM	060-03	**DWG NO**	M-029E
VALVE MANUF	Henry Pratt	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	Bettis	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	48"
NORMAL POSITION	Closed	**FAILURE POSITION**	Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	Yes

VALVE FUNCTION

NORMAL FUNC

Valves are maintained closed and de-energized during Modes 1, 2, 3, and 4 per Licensing Commitment with the NRC.

Technical Specification states this valve may be opened during normal operation to purge the Containment for personnel access.

SAFETY FUNC

Automatically close upon SFAS Level 1 to ensure shield building negative pressure boundary conditions.

MR FUNCTION

The risk significant function is to provide containment isolation to maintain dose less than 10CFR100 limits.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	N/A	**PSA RAW**	Not modeled	**PSA F-V**	Not modeled

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaualtion.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

Air Operated Valve Categorization

Containment Exhaust Purge Valve

CV5007

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	During normal operation, this valve is denergized, tagged out and closed in its safety related position per tech spec 3.6.1.7.
OTHER CONSIDERATIONS	This valve has local leak rate testing performed during refueling outages. Additionally, this valve has had a good performance history and receives preventive maintenance.
COMPENSATORY ACTIONS	This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

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Air Operated Valve Categorization

High Level Cooling Water Tank Level Control Valve — CW620

VALVE INFORMATION

ASSET NUMBER	LV620	**EQUIP GROUP**	CW620
SUBSYSTEM	014-01	**DWG NO**	M-009A
VALVE MANUF	Fisher Controls	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	Fisher Controls	**ACTUATOR TYPE**	Piston
QUAL CLASS	NQ	**VALVE SIZE**	12"
NORMAL POSITION	Open	**FAILURE POSITION**	Open
IST PROGRAM	No	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve modulates to control level in the High Level Cooling Water Tank in response to LC620.

This valve also opens to ensure minimum flow for the TPCW pumps regardless of tank level.

SAFETY FUNC This valve has no safety related function. This valve will fail open on a loss of instrument air.

MR FUNCTION Not Risk Significant

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	A	**PSA RAW**	1.75	**PSA F-V**	0

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☑	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

High Level Cooling Water Tank Level Control Valve — CW620

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	Failure of this valve affects numerous secondary systems which can initiate a plant transient and complicate a plant shutdown. However, this valve does not perform a safety significant function.
OTHER CONSIDERATIONS	Operator intervention can be used to mitigate conseqences of failure of this valve. Currently, this valve receives no preventive maintenance.
COMPENSATORY ACTIONS	This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is not considered in the Design Basis Analysis, the Safety Analysis Report or any Technical Specifications.
10 CFR 100 RELEASE LIMITS?	Failure of this component is not a breach of any engineered safety barrier, nor will failure of this component contribute to an uncontained release of radioactive material.
MAINTENANCE RELIABILITY?	This component is very important for maintaining system reliability. Failures are readily detected by operators. This component has had an acceptable maintenance history.
SYSTEM AVAILABILITY?	This component is important for maintaining system availability. This component affects many other systems. Defense in depth is a manual action.
OTHER DETERMINISTIC CONSIDERATIONS?	There are no other deterministic considerations that component failure would mitigate with regards to external events, or safe shutdown conditions.

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Air Operated Valve Categorization

Decay Heat Cooler 1-1 Outlet Flow Control Valve — DH14B

VALVE INFORMATION

ASSET NUMBER	HVDH14B	**EQUIP GROUP**	DH14B
SUBSYSTEM	049-02	**DWG NO**	M-033B
VALVE MANUF	Valtek	**VALVE TYPE**	Butterfly
ACTUATOR MANUF	Valtek	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	10"
NORMAL POSITION	Locked Open	**FAILURE POSITION**	Open
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve is normally used to control reactor coolant temperature during a normal cooldown from hot standby to cold shutdown condition and maintain the RCS in cold shutdown.

SAFETY FUNC This valve will receive an automatic open signal on SFAS Level 2 or 3.

MR FUNCTION This valve supports the following risk significant functions; To provide injection from the BWST and recirculation from the Containment Emergency Sump for long term decay heat removal.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	C	**PSA RAW**	4.86	**PSA F-V**	0.006

RISK INFORMED CLASSIFICATION

HSSC ☑ High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.

LSSC ☐ Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.

OUT OF SCOPE ☐ AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Decay Heat Cooler 1-1 Outlet Flow Control Valve DH14B

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS This valve is in Quadrant C, and by definition, is high safety significant.

OTHER CONSIDERATIONS This valve is stroked under flow conditions during shutdown operations. Additionally, the safety significant function is not an active function during low pressure injection operations.

This valve receives preventive maintenance.

COMPENSATORY ACTIONS This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS? This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS? This component is already in the IST Program.

MAINTENANCE RELIABILITY? This component is already in the IST Program.

SYSTEM AVAILABILITY? This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS? This component is already in the IST Program.

Air Operated Valve Categorization

Main Steam Line 2 Atmospheric Vent Valve — ICS11A

VALVE INFORMATION

ASSET NUMBER	PVICS11A	**EQUIP GROUP**	ICS11A
SUBSYSTEM	083-01	**DWG NO**	M-007A
VALVE MANUF	Control Components	**VALVE TYPE**	Angle Drag
ACTUATOR MANUF	Control Components	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	8"
NORMAL POSITION	Closed	**FAILURE POSITION**	Open/Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC

This valve provides a controlled path for venting main steam to atmosphere and is automatically regulated, according to demand, as determined by the Integrated Control System.

The normal position of this valve is closed during 100% power operation.

SAFETY FUNC

This valve automatically closes on an SFRCS trip.

MR FUNCTION

This valve performs USAR accident mitigation functions and isolation of the steam generators.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	A	**PSA RAW**	1.06	**PSA F-V**	0

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

Air Operated Valve Categorization

Main Steam Line 2 Atmospheric Vent Valve — ICS11A

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

This valve is safety related, has an active function, and is a quadrant A valve (low safety significant).

OTHER CONSIDERATIONS

This valve has stroke time tests, and can be manually operated. Technical Specification 3.3.3.2 applies. This valve has demonstrated good performance and reliability.

There is a modification to replace this valve in 12RFO.

COMPENSATORY ACTIONS

This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS?

This component is already in the IST Program.

MAINTENANCE RELIABILITY?

This component is already in the IST Program.

SYSTEM AVAILABILITY?

This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS?

This component is already in the IST Program.

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Air Operated Valve Categorization

Main Steam Line 2 Isolation Valve

MS100

VALVE INFORMATION

ASSET NUMBER	FV100	**EQUIP GROUP**	MS100
SUBSYSTEM	083-01	**DWG NO**	M-003A
VALVE MANUF	Rockwell International	**VALVE TYPE**	Y-Globe
ACTUATOR MANUF	Rockwell International	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	36"
NORMAL POSITION	Open	**FAILURE POSITION**	Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC The normal position of this valve is open for steam flow to the main turbine.

SAFETY FUNC This valve automatically closes on an SFRCS trip.

MR FUNCTION The risk significant function is to provide containment isolation to maintain dose less than 10CFR100 limits and isolation of the Steam Generator.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	D	**PSA RAW**	1.78	**PSA F-V**	0.001

RISK INFORMED CLASSIFICATION

HSSC	☑	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Main Steam Line 2 Isolation Valve — MS100

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	This valve meets the criteria for high safety significant classification based on Fussell-Vesely equal to 0.001.
OTHER CONSIDERATIONS	This component is considered in the design basis analysis and the USAR. Additionally, this valve also has a specific Tech Spec. This valve is used to mitigate consequences of a release.
COMPENSATORY ACTIONS	This valve is being placed in Category 1 of the AOV Program to ensure that the design basis capability is demonstrated, timely maintenance is performed, and setpoint control is maintained.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

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Air Operated Valve Categorization

Auxiliary Feed Pump 1-1 Steam Admission Valve — MS5889A

VALVE INFORMATION

ASSET NUMBER	HV5889A	**EQUIP GROUP**	MS5889A
SUBSYSTEM	050-01	**DWG NO**	M-003C
VALVE MANUF	Valtek	**VALVE TYPE**	Globe
ACTUATOR MANUF	Valtek	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	4"
NORMAL POSITION	Closed	**FAILURE POSITION**	Open
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve is normally closed during 100% power operation.

SAFETY FUNC This valve will automatically open on an SFRCS trip.

MR FUNCTION The risk significant function is to provide a steam supply to the AFW pump turbines.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	C	**PSA RAW**	2.80	**PSA F-V**	0.003

RISK INFORMED CLASSIFICATION

HSSC	☑	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaualtion.
LSSC	☐	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Auxiliary Feed Pump 1-1 Steam Admission Valve MS5889A

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	This valve is in Quadrant C; therefore, this valve is high safety significant.
OTHER CONSIDERATIONS	This valve receives preventive maintenance.
COMPENSATORY ACTIONS	This valve is being placed in Category 1 of the AOV Program to ensure that the design basis capability is demonstrated, timely maintenance is performed, and setpoint control is maintained.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

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Air Operated Valve Categorization

Reactor Coolant Pump Seal Return Isolation Valve MU38

VALVE INFORMATION

ASSET NUMBER	HVMU38	EQUIP GROUP	MU38
SUBSYSTEM	065-01	DWG NO	M-031B
VALVE MANUF	Velan	VALVE TYPE	Globe
ACTUATOR MANUF	Keiley & Mueller	ACTUATOR TYPE	Double Acting Piston
QUAL CLASS	Q	VALVE SIZE	1"
NORMAL POSITION	Open	FAILURE POSITION	Closed
IST PROGRAM	Yes	CONT INTEGRITY	Yes

VALVE FUNCTION

NORMAL FUNC MU38 is normally open to provide an RCP seal return flow path.

SAFETY FUNC This valve will automatically close on SFAS Level 3.

MR FUNCTION The risk significant function is to provide RCP seal injection.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	B	PSA RAW	2.57	PSA F-V	0

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Reactor Coolant Pump Seal Return Isolation Valve — MU38

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

This valve has high reliability and is not required to change position to perform its most risk significant function. Active containment isolation function is not risk significant and would not be expected to contribute to dose to the public.

OTHER CONSIDERATIONS

This valve receives local leak rate testing and stroke time testing. Additionally, this valve receives preventive maintenance.

COMPENSATORY ACTIONS

This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS?

This component is already in the IST Program.

MAINTENANCE RELIABILITY?

This component is already in the IST Program.

SYSTEM AVAILABILITY?

This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS?

This component is already in the IST Program.

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Air Operated Valve Categorization

Reactor Coolant Pump 2-1 Seal Injection Isolation Valve — MU66A

VALVE INFORMATION

ASSET NUMBER	HVMU66A	**EQUIP GROUP**	MU66A
SUBSYSTEM	064-03	**DWG NO**	M-031B
VALVE MANUF	Velan	**VALVE TYPE**	Globe
ACTUATOR MANUF	Keiley & Mueller	**ACTUATOR TYPE**	Double Acting Piston
QUAL CLASS	Q	**VALVE SIZE**	1 1/2"
NORMAL POSITION	Open	**FAILURE POSITION**	Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	Yes

VALVE FUNCTION

NORMAL FUNC This valve is open whenever any RCP is operating, or RCS temperature is above 150 F. and/or pressure is above 150 psig.

SAFETY FUNC This valve will automatically close on SFAS Level 3 or when accumulator pressure is < or = 75 psig as sensed by PSLLMU66A.

MR FUNCTION The risk significant functions are to provide RCP seal injection and to provide containment isolation to maintain dose less than 10CFR100 limits.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	A	**PSA RAW**	1.00	**PSA F-V**	0

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaualtion.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Reactor Coolant Pump 2-1 Seal Injection Isolation Valve MU66A

AOV PROGRAM CATEGORIZATION

CATEGORY 1 ☐ AOV is safety-related, active and has high safety-significance.

CATEGORY 2 ☑ AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.

CATEGORY 3 ☐ AOV is safety-related, but is not in Category 1 or Category 2.

OUT OF SCOPE ☐ AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS

This valve has high reliability and is not required to change position to perform its most risk significant function. Active containment isolation function is not risk significant and would not be expected to contribute to dose to the public.

OTHER CONSIDERATIONS

This valve receives local leat rate testing. The function of this valve has redundancy. Additionally, this valve receives preventive maintenance.

COMPENSATORY ACTIONS

This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?

This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS?

This component is already in the IST Program.

MAINTENANCE RELIABILITY?

This component is already in the IST Program.

SYSTEM AVAILABILITY?

This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS?

This component is already in the IST Program.

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Air Operated Valve Categorization

Main Feedwater Control Valve to Steam Generator 1-1 SP6B

VALVE INFORMATION

ASSET NUMBER	FVSP6B	**EQUIP GROUP**	SP6B
SUBSYSTEM	045-01	**DWG NO**	M-007B
VALVE MANUF	Fisher Controls	**VALVE TYPE**	Angle Globe
ACTUATOR MANUF	Fisher Controls	**ACTUATOR TYPE**	Double Acting Piston
QUAL CLASS	AQ	**VALVE SIZE**	16"
NORMAL POSITION	Open	**FAILURE POSITION**	Closed
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve will modulate to provide feedwater to the steam generator as demanded by FICICS35B.

SAFETY FUNC This valve has no safety related function. This valve will automatically close on an SFRCS signal.

MR FUNCTION The risk significant function is to provide sufficient feedwater to the steam generators and to isolate main feedwater on an SFRCS signal. This valve also has USAR accident mitigation functions.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC	N/A	**PSA RAW**	Not Modeled	**PSA F-V**	Not Modeled

RISK INFORMED CLASSIFICATION

HSSC	☐	High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
LSSC	☑	Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.
OUT OF SCOPE	☐	AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Main Feedwater Control Valve to Steam Generator 1-1 SP6B

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS This valve has some risk significance; however, not high enough to categorize as HSSC.

OTHER CONSIDERATIONS There are multiple valves in flow path that provide defense in depth for the SFRCS function. Additionally, this valve receives preventive maintenance.

COMPENSATORY ACTIONS This valve will be placed in Category 2 of the AOV Program due to its active function and the recognized risk significance of the valve. This will ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS? This component is already in the IST Program.

10 CFR 100 RELEASE LIMITS? This component is already in the IST Program.

MAINTENANCE RELIABILITY? This component is already in the IST Program.

SYSTEM AVAILABILITY? This component is already in the IST Program.

OTHER DETERMINISTIC CONSIDERATIONS? This component is already in the IST Program.

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Air Operated Valve Categorization

Turbine Bypass Valve 2-3 to Low Pressure Condenser — SP13A3

VALVE INFORMATION

ASSET NUMBER	PVSP13A3	**EQUIP GROUP**	SP13A3
SUBSYSTEM	083-01	**DWG NO**	M-003C
VALVE MANUF	CDC Valve Company	**VALVE TYPE**	Cage&Ball
ACTUATOR MANUF	Miller Fluid Power	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	PQ	**VALVE SIZE**	6"
NORMAL POSITION	Closed	**FAILURE POSITION**	Closed
IST PROGRAM	No	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve is normally closed during 100% power operation.

SAFETY FUNC This valve has no safety related function. This valve will automatically open to control steam generator pressure as sensed by PICICS12A.

MR FUNCTION The non-risk significant function is to control steam generator pressure when the main turbine is off-line.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC A **PSA RAW** 1.00 **PSA F-V** 0

RISK INFORMED CLASSIFICATION

HSSC ☐ High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.

LSSC ☐ Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.

OUT OF SCOPE ☑ AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Turbine Bypass Valve 2-3 to Low Pressure Condenser — SP13A3

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☐	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☑	AOV is safety-related, active and does not have high safety-significance, or AOV is non safety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	It is recognized that this valve is important in mitigating plant transients; however, this valve has no safety function. This will be placed in Category 2 of the AOV Program as a compensatory measure.
OTHER CONSIDERATIONS	This valve receives preventive maintenance and also receives a lot of oversight throughout the operating cycle.
COMPENSATORY ACTIONS	This valve is being placed in Category 2 of the AOV Program to ensure timely preventive maintenance and setpoint control.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is in the Safety Analysis Report.
10 CFR 100 RELEASE LIMITS?	This component can be used to mitigate secondary side releases.
MAINTENANCE RELIABILITY?	This component is important for matintaining system reliability. Additionally, this component has a poor maintenance history.
SYSTEM AVAILABILITY?	This component is important for maintiaing system operational readiness; however, there is redundancy. Loss of this component is not a significant operator burden.
OTHER DETERMINISTIC CONSIDERATIONS?	There are no other deterministic considerations that component failure would mitigate with regards to external events, or safe shutdown conditions.

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Air Operated Valve Categorization

Component Cooling Water 1-1 Service Water Outlet Isolation Valve SW1424

VALVE INFORMATION

ASSET NUMBER	TV1424	**EQUIP GROUP**	SW1424
SUBSYSTEM	011-02	**DWG NO**	M-041B
VALVE MANUF	Neles-Jamesbury	**VALVE TYPE**	Ball
ACTUATOR MANUF	Neles-Jamesbury	**ACTUATOR TYPE**	Spring Return Piston
QUAL CLASS	Q	**VALVE SIZE**	12"
NORMAL POSITION	Open/Closed	**FAILURE POSITION**	Open
IST PROGRAM	Yes	**CONT INTEGRITY**	No

VALVE FUNCTION

NORMAL FUNC This valve modulates to maintain CCW Hx outlet temperature at 95 F. as demanded by TIC1424.

SAFETY FUNC This valve will automatically open on SFAS Level 2.

MR FUNCTION The risk significant function is for each train to be able to cool safety related loads.

PROBABILISTIC SAFETY ANALYSIS RESULTS

PSA QUAD LOC C **PSA RAW** 10.2 **PSA F-V** 0.012

RISK INFORMED CLASSIFICATION

HSSC ☑ High Safety Significant Components (HSSCs): components that have been designated as more important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaulation.

LSSC ☐ Low Safety Significant Components (LSSCs): components that have been designated as less important to plant safety by a blended process of PSA risk ranking and Plant Expert Panel evaluation.

OUT OF SCOPE ☐ AOV is not HSSC or LSSC

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Air Operated Valve Categorization

Component Cooling Water 1-1 Service Water Outlet Isolation Valve SW1424

AOV PROGRAM CATEGORIZATION

CATEGORY 1	☑	AOV is safety-related, active and has high safety-significance.
CATEGORY 2	☐	AOV is safety-related, active and does not have high safety-significance, or AOV is non $afety-related, active and has high safety significance.
CATEGORY 3	☐	AOV is safety-related, but is not in Category 1 or Category 2.
OUT OF SCOPE	☐	AOV is not Category 1, Category 2 or Category 3

KEY DECISION BASIS

DECISION BASIS	This valve is in Quadrant C; therefore, this valve is high safety significant.
OTHER CONSIDERATIONS	This valve receives preventive maintence and surveillance testing.
COMPENSATORY ACTIONS	This valve is being placed in Category 1 of the AOV Program to ensure that the design basis capability is demonstrated, timely maintenance is performed, and setpoint control is maintained.

RISK INFORMED IST PROGRAM INCLUSION CONSIDERATIONS

DESIGN BASIS?	This component is already in the IST Program.
10 CFR 100 RELEASE LIMITS?	This component is already in the IST Program.
MAINTENANCE RELIABILITY?	This component is already in the IST Program.
SYSTEM AVAILABILITY?	This component is already in the IST Program.
OTHER DETERMINISTIC CONSIDERATIONS?	This component is already in the IST Program.

APPENDIX E

GLOSSARY OF TERMS AND ACROYNMS

E.1 Definitions

Air Operated Valve - an assembly of the valve, the operator (e.g., piston, diaphram), and control circuit.

Code Case - This is an approved and published alternative to an ASME code, which is temporary in nature and must be reaffirmed or modified every three years, otherwise it become null and void.

Code of Record - The applicable ASME code for a particular activity, e.g., design, construction, inservice inspection, inservice testing.

Expert Panel - A multi-disciplined panel of plant engineers from the PRA Group, the plant operations group, the safety analysis group, and others as appropriate.

Inservice Testing - Testing to determine the operational readiness of a component.

O&M Committee - The ASME nuclear codes and standard committee responsible for developing and maintaining the IST requirements.

Operational Readiness - The ability of a component to perform its intended design function when required.

E.2 Glossary of Terms

AFW	Auxiliary feedwater
AOV	Air Operated Valve
ASME	American Society of Mechanical Engineers
B&PV	(ASME) Boiler & Pressure Vessel (Code)
B&WOG	Babcock & Wilcox Owners Group
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners Group
CAP	corrective action program
CDF	Core Damage Frequency
CE	(ABB) Combustion Engineering
CEOG	CE Owners Group
CFR	Code of Federal Regulations
CIV	Containment Isolation Valve
CRTD	(ASME) Center for Research & Tech Development
DBC	Design Basis Capability
DBR	Design Basis Reviews
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling Systems
EOPs	Emergency Operating Procedures
EPRI	Electric Power Research Institute
FSAR	Final Safety Analysis Report
FTI	Framatome Technologies Incorporated
F-V	Fussell-Vesely (risk measure)
GL	Generic Letter
HSSC	High Safety Significant Component
IPE	Individual Plant Examination
ISI	Inservice Inspection
IST	Inservice Testing
JOG	Joint Owners Group

LERF	Large Early Release Frequency
LLRT	local leak rate testing
LSSC	Low Safety Significant Component
MOVs	Motor Operated Valves
NEI	Nuclear Energy Institute
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NRR	(NRC) Nuclear Reactor Regulation
NSS	Nuclear Steam Systems
NUREG	NRC Report
NUREG/CR	NRC Contractor Report
OE	operating experience
OM	(ASME) Operations & Maintenance (Code)
OMN	(ASME) O & M Nuclear (Code Case)
OTSG	Once-Through Steam Generator
PM	Preventive Maintenance
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PWR	Pressurized Water Reactor
QA	Quality Assurance
RAI	(NRC) Request for Additional Information
RAW	Risk Achievement Worth (risk measure)
RCS	Reactor Coolant System
RG	(NRC) Regulatory Guide
RI	Risk Informed
RIAC	Risk Informed Applications Committee
RI-IST	Risk-Informed Inservice Testing
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SCE	Southern California Edison
SSCs	Systems, Structures or Components

TWC	The Wesley Corporation
WOG	Westinghouse Owners Group