APPLICATION OF THE EPRI RISK-INFORMED ISI METHODOLOGY TO:

VC SUMMER
(Class 1 and 2)

Binder 1 of 2

APPLICATION OF THE EPRI RISK-INFORMED ISI METHODOLOGY TO VC SUMMER (Class 1 and 2)

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INTRODUCTION

The enclosed binders contained the evaluations and associated documents that support the application of the EPRI risk-informed inservice inspection (RI-ISI) methodology to the Class 1 and 2 piping at VC Summer. The EPRI RI-ISI methodology was approved for generic use by the USNRC in November 1999. That approval allows licensees to implement the RI-ISI methodology as an alternative to existing ASME Section XI requirements. The implementation process consist of conducting the RI-ISI evaluation consistent with the methodology describe in EPRI TR-112657, Rev. B-A and individual licensees submitting a relief request using the RI-ISI template.

As part of implementing the RI-ISI methodology, a number of project specific documents were generated. The purpose of this report is to consolidate these documents into one location for ease of reference. The major components of the RI-ISI project were the degradation mechanism evaluation, consequence evaluation, delta risk evaluation and the template submittal. These documents are described below and included as Appendices to this report.

PROJECT DOCUMENTS

The project documents that support the risk-informed selections for Class 1 and 2 piping welds at VC Summer are described below and included in the specified appendices.

CONSEQUENCE EVALUATION

An evaluation was prepared which documented the pipe rupture consequence evaluation, and indicated the consequence effect and category assigned to each piping weld, as well as the technical basis for those assignments. The consequence evaluation used insights from the VC Summer PRA and other supporting documents (e.g. Tech Spec). The postulated pipe breaks that could result in an initiating event (e.g. LOCA), disable mitigating equipment or effect containment performance were evaluated. Any combination of the above effects were also considered. In addition, the evaluation considered the potential impact of spatial effects for each postulated break. The resultant consequence rank was based upon each postulated break's impact on core damage frequency (CDF) and large early release frequency (LERF). The results of the consequence evaluation were used as input into the risk ranking evaluation. The consequence evaluation is contained in Appendix 1.

DEGRADATION MECHANISM EVALUATION

An evaluation was prepared which documented each piping welds' susceptibility to a spectrum of potential degradation mechanisms in accordance with the EPRI RI-ISI methodology. The degradation mechanism criteria that were evaluated are presented in the form of checklists, which are included in the degradation mechanism evaluation. These checklists were completed for each system (Class 1 and 2) and the results are documented in the evaluation. As with the consequence evaluation results, the results of the degradation mechanism evaluation were used as input into the risk ranking evaluation. The degradation mechanism evaluation is contained in Appendices 2 (Class 1) and 3 (Class 2).

RISK RANKING

Once the consequence and degradation mechanism evaluations were completed, the results were used to perform a risk ranking of in-scope piping. The piping welds are classified in accordance with the EPRI RI-ISI risk matrix with the highest risk piping welds listed in the upper right hand corner and lowest risk welds in the lower left hand corner. The results of this effort is documented in Appendix 4.

ELEMENT SELECTION

Element selection and incorporation of plant specific service history (previous failures, indication, ISI results) were conducted by plant staff. This effort identified the new set of inspection locations that will be used as an alternative to the existing Section XI inspection locations.

DELTA RISK EVALUATION

Once the element selection was completed, the new set of locations that will be inspected under the RI-ISI program was compared to the locations that were inspected prior to the implementation of RI-ISI. A risk comparison was performed to ensure that the changes due to implementation of the RI-ISI program result in acceptable risk changes. The evaluation contained in Appendix 5 documents this evaluation and shows that the VC Summer RI-ISI program is in conformance with the acceptance criteria for RI-ISI programs.

RI-ISI Submittal Template

Utilizing the results of the RI-ISI process, a plant specific request for acceptable alternative inspections has been developed. This is provided in Appendix 6. This 'template submittal' is based upon the generic 'template submittal' developed by industry, NEI and NRC to streamline the RI-ISI submittal and NRC review process. It has been updated to incorporate lesson learned from previous RI-ISI submittals.

Risk-Informed Inservice Inspection

Consequence Evaluation of Class 1 & 2 Piping

V. C. Summer Nuclear Station,Rev 01

FRAMATOME ANP

FRAMATOME ANP DE&S

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1.0 Objective and Scope

1.1 Objective

This analysis is conducted to support the application of ASME Code Case N-578 (Reference 1) at the V. C. Summer Nuclear Station (VCSNS). The objectives of the overall evaluation process are to identify risk important piping segments, to define the elements that are to be inspected within this risk important piping, and to identify appropriate inspection methods. As part of the determination of the risk significance of the piping segments, the consequence evaluation focuses on evaluating the impact of a pipe failure. The goal of the consequence analysis is to evaluate and rank the consequences of pipe failures in a consistent manner, based on their impact on the plant's safety.

1.2 Scope

The analysis performed in this calculation applies to Class 1 and Class 2 piping within the ASME Inservice Inspection Program, more specifically to B-J, B-F, C-F-1, and C-F-2 welds. The systems included in the analysis are described below.

- REACTOR COOLANT SYSTEM (RCS)

  The Reactor Coolant System (RCS) transfers heat generated to the steam generators, where steam is produced to drive the turbine generators. It consists of 3 similar heat transfer loops connected in parallel to the reactor vessel. Each loop contains a reactor coolant pump, steam generator, and associated piping and valves. In addition, the system includes a pressurizer, pressurizer relief tank, interconnecting piping, and instrumentation necessary for operational control.

  The RCS piping under consideration consists of all hot leg, cold leg and crossover leg piping, pressurizer surge, pressurizer spray, auxiliary spray, relief, safety and vent lines. It also includes branch piping to the CVCS, SIS, and RHR. All piping attached to the hot legs, cold legs, crossover legs or pressurizer vessel is considered Class 1 out to the second valve.

  Reactor Coolant System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-1 in Appendix A.

- EMERGENCY CORE COOLING SYSTEM (ECCS)

  Emergency Core Cooling System (ECCS) is designed to cool the reactor core as well as provide additional shutdown capability following initiation of the accident conditions:

  1. Pipe breaks in the reactor coolant system (RCS) which cause a discharge larger than that which can be made up by the normal makeup system, up to and including the instantaneous circumferential rupture of the largest pipe in the RCS.

2. Rupture of a control rod drive mechanism causing a rod cluster control assembly ejection accident.
3. Pipe breaks in the steam system, up to the and including the instantaneous circumferential rupture of the largest pipe in the steam system.
4. A steam generator tube rupture.

The operation of the ECCS system following a LOCA can be divided into two distinct phases:

1. The injection phase, in which any reactivity increase following the postulated accident is terminated, initial cooling of the core is accomplished, and coolant lost from the primary system is replenished ; and
2. The recirculation phase, in which long-term core cooling is provided during the accident recovery period.

The ECCS is normally aligned to automatically inject water into the reactor upon receiving a safety injection signal.

Emergency cooling for small ruptures is provided primarily by high pressure injection. Small ruptures are those which do not immediately depressurize the RCS below the accumulator discharge pressure. The centrifugal charging pumps deliver borated water at the prevailing RCS pressure to the cold legs of the RCS. The charging pumps take suction from the Refueling Water Storage Tank (RWST) during the injection mode of operation. During the recirculation mode, the charging pumps receive suction flow from the RHR pumps.

For large pipe ruptures, the RCS is depressurized and voided of coolant rapidly, and a high flow rate of emergency coolant is required to quickly cover the exposed fuel rods and limit possible core damage. This high flow is provided by the passive accumulators, followed by the RHR pumps discharging into the cold legs of the RCS. The RHR pumps take suction from the RWST and deliver borated water to the RCS only after the pressure has fallen below the RHR pump shutoff head (160 psig).

During the injection phase, pumps take suction from the RWST until a low-low level signal from the RWST aligns the RHR pumps to take suction from the containment sump. The signal also alerts the operators to initiate additional manual actions to complete the alignment to the recirculation mode. After the injection operation, water collected in the sump is cooled by the RHR heat exchangers and returned to the RCS via the low or high head recirculation flow paths. The RHR pumps are aligned to take suction from the sump and directly to the RCS, or to supply suction to the centrifugal charging pumps, depending upon RCS pressure.

Charging System

During normal operation the charging system operates as the Chemical and me Control System. During ECCS actuation, the suction and discharge paths of the charging pumps are realigned allowing the charging pumps to provide high pressure injection to the RPV.

Chemical and Volume Control System

The Chemical Volume Control System performs the following functions:

- Control of Reactivity in the Reactor Core
- Purification of the Reactor Coolant
- Control of RCS Chemistry
- Maintaining Reactor Coolant Inventory

Maintaining reactor coolant inventory is necessary to compensate for changes in volume due to coolant temperature changes, and also due to RCP shaft seal leakage. The CVCS also provides core reactivity control by adjusting RCS boron concentration. In addition, the purity of the Reactor Coolant System is maintained by continuous purification of a letdown stream of reactor coolant.

The Class 1 portion of the CVCS piping under consideration consists of the letdown, excess letdown, charging, alternate charging and pump seal lines, as well as the auxiliary spray line to the pressurizer.

The Class 2 portion of the CVCS piping under consideration consists of a section of CVCS piping that is aligned to the RWST to provide Safety Injection .

Chemical Volume Control System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-2a and Figure 1-2b in Appendix A.

High Pressure Injection (HPI)

The high pressure injection portion of the charging system consists of the three centrifugal charging pumps (XPP-43A, B&C), remotely controlled motor-operated valves, and associated piping, instrumentation and controls.

During normal operation, one charging pump is operating, one is in backup, and one is designated a spare and has its circuit breakers racked out. During the injection phase, the two operable charging pumps are started automatically and take suction from the RWST. The output of each of the three pumps discharges to a common header, which then branches to three individual lines leading to each of the three reactor coolant loops.

During the recirculation phase, the charging pumps are aligned to take suction form the discharge of the RH pumps, which are receiving suction from the containment sumps.

Accumulator Subsystem

The accumulator system includes three accumulators filled with borated water and pressurized with nitrogen gas. The design pressure of the accumulators is 700 psig, with a normal operating pressure of 600-655 psig.

There are two in-series swing check valves in each accumulator discharge line. In addition, there is a normally open motor-operated isolation valve in each discharge line.

These valves are locked open during normal operation. During startup these valves are opened when system pressure reaches 900-950 psig. During cooldown, they are closed prior to system pressure dropping to normal accumulator operating pressure.

Residual Heat Removal Subsystem (RH system)

Low Pressure Injection (LPCI)

The low pressure injection and RH subsystem consists of two redundant trains including an RH pump (31A/ 31B), heat exchanger (149A/5B), associated piping, valves and instrumentation. The discharge of the two trains flows to a common header that, in turn, supplies three lines, each of which supplies one of the three RCS cold legs. Each supply line includes two in-series check valves and one normally open motor operated valve to isolate the RH system from the RCS at high RCS pressure.

During the injection phase the RH pumps take suction from the RWST and inject to the RCS cold legs. Borated water from the RWST is supplied through a common line which, in turn supplies two lines providing the RH pump suction.

During the recirculation phase, the RH pumps are automatically aligned to take suction from the containment sump. Suction to each RH pump is supplied by a separate line from the containment sump. During the recirculation phase the RH pumps deliver flow to the RCS cold legs and the suction lines for the charging pumps.

RH pump flow can also be aligned to the RCS hot legs. This alignment is initiated approximately 8 hours after a loss of coolant accident to prevent boron precipitation in the core and to terminate boiling.

Low Pressure Injection piping in scope of the RI ISI Evaluation is illustrated on Figure 1-3 and Figure 1-2a in Appendix A.

Shutdown Operation

In the shutdown cooling mode of operation, the Safety Injection System is used to remove heat from the RCS during plant cooldown below 350°F and to maintain RCS temperature while the plant is in a cold shutdown or refueling condition. Decay heat is transferred to the component cooling water system flowing through the shell side of the RH heat exchangers.

Suction for each RH pump is supplied from one of the three RCS hot legs (A and C). One RCS hot leg does not supplying RH suction. The RH suction lines are isolated from the RCS by two in-series motor operated valves and a relief valve. RH pump discharge may be directed to any of the three RCS cold legs.

The Class 1 portion of the ECCS piping under consideration consists of all piping connecting the ECCS to the RCS hot and cold legs out to the second valve beyond the RCS.

The Class 2 portion of the ECCS piping under consideration consists of the ECCS pumps suction and discharge (up to the loop ECCS injection check valves), the ECCS pumps miniflow recirculation header to the RWST, and the suction and discharge piping used for the shutdown cooling.

- **REACTOR BUILDING SPRAY SYSTEM (SP)**

The Reactor Building Spray System (SP) functions to remove thermal energy released to the containment by a LOCA at a rate sufficient to limit the resulting pressurization to a level below the containment design, and subsequently to reduce the pressure to a low level to minimize the pressure differential that induces leakage out of containment.

An alternate function of the spray system is to reduce the concentration of airborne iodine in the containment atmosphere and limit the pH level in the sump. Sodium hydroxide is added to the spray water to induce the formation of water-soluble, non-volatile iodine compounds.

The spray system consists of two independent systems plus a tank for supplying an sodium hydroxide to the spray. Each subsystem includes a pump, three spray headers with spray nozzle assemblies and the associated piping and valves.

Reactor Building Spray System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-4 and Figure 1-2a in Appendix A.

- **MAIN FEEDWATER SYSTEM (MFW)**

The Main Feedwater System (MFW) provides heated and deaerated water to maintain the required feedwater level in the steam generators during normal operation and during transients. At 100-percent plant load, all main feedwater pumps and booster pumps are normally in operation.

The MFW system includes three 33.3-percent capacity turbine-driven feedwater pumps and four 33.3-percent capacity motor-driven feedwater booster pumps supplying suction to the feedwater pumps. Supply to each main feedwater pump passes through a suction MOV. The discharge of each main feedwater pump spring-assisted check valve and an isolation valve. The flow from each feedwater pump briefly flows through a common header, then splits into two paths supplying two trains of feedwater heaters. This flow recombines before splitting into three individual lines, each supplying one of the three steam generators. Each of these three supply lines contains a flow control valve, check valve and and isloation valve.

The Class 2 MFW piping under consideration consists of piping downstream of the MFW isolation valves up to the steam generators. In addition to the MFW pipng, a small portion of the emergency feedwater system consisting of the 6" piping inside containment attached to the steam generators is within scope.

Main Feedwater System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-5 in Appendix A.

- MAIN STEAM SYSTEM (MS)

The main Steam (MS) system conveys saturated steam for the three steam generators to the turbine generator, and provides for the release of energy from the turbine cycle through the steam generator power relief valves and/or the safety valves if an inadvertent mismatch occurs between the steam requirements of the turbine generator and the steam generated by the NSSS.

The MS system consists of three steam lines, each containing a steam generator, a flow restrictor, five safety valves, one power relief valve, moisture collectors, a main steam isolation valve and a main steam isolation bypass valve.

The Class 2 MS piping under consideration consists of the MS lines from the steam generators out to the MSIVs.

Main Steam System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-6 in Appendix A.

- SERVICE WATER SYSTEM

The Service Water (SW) System provides water from the service water pond for the cooling of plant components during both normal operation and emergency operation. The components provided cooling include the emergency diesel generators, component cooling heat exchangers, chilled water HVAC condensers, and the Service Water Pumphouse cooling coils. During post-accident conditions, LOSP or testing, the Reactor Building Cooling Units (RBCUs) are also provided with cooling water.

The SW System consists of two independent full-capacity pump loops (A&B), with the additional capability of valving a third SW pump to either loop. Normally both SW trains are operating to supply water to the cooling loads of both trains. The third SW pump (C) is normally raked out, and would be manually aligned in case of maintenance or failure of one of the operating pumps.

The Class 2 SW piping under consideration consists of the containment penetration boundary of the SW supply to the containment coolers.

Service Water System piping in scope of the RI ISI Evaluation is illustrated on Figure 1-7 in Appendix A.

2.0 Basic Principles of Methodology

2.1 Basis for Consequence Ranking

The methodology principles used in the consequence evaluation are explained in detail in Reference 2. The same principles are summarized in Reference 1. The goal of the consequence evaluation is to establish a process that consistently ranks consequences caused by a pipe failure, based on their safety significance. In order to assure a consistent ranking of consequences, four consequence importance categories have been defined based upon PRA (Probabilistic Risk Assessment) evaluation. They are: High, Medium, Low, and None. The "High" category represents events with a significant impact on plant safety, while the "Low" category represents events with a minor impact on plant safety. The "None" category defines those locations that are typified by "abandoned in place" piping.

The consequence ranking philosophy used in this evaluation can be summarized as follows:

High Consequence: Pressure boundary failures resulting in events that are important contributors to plant risk and/or pressure boundary failures that significantly degrade the plant's mitigative ability.

Low Consequence: Pressure boundary failures resulting in anticipated operational events and/or pressure boundary failures that do not significantly impact the plant's mitigative ability.

Medium Consequence: This category is included to accommodate pressure boundary failures that do not obviously belong to the "High" or "Low" rank.

Each consequence category has an assigned range of Conditional Core Damage Probability (CCDP) or Conditional Large Early Release Probability (CLERP), associated with the impact of specific Pressure Boundary Failure (PBF). The ranges used to define each category numerically are shown in Table 2.1.

The process of conducting a consequence evaluation is organized into four steps, as defined below:

Step 1: Plant PRA models, systems, and initiators are evaluated. The initial consequence rank is established, based on the PBFs impact on Core Damage Frequency (CDF).

Step 2: Containment performance is evaluated. The CDF consequence rank is reviewed and adjusted to reflect the PBFs impact on containment performance, by evaluating CLERP or by evaluating the likelihood of containment bypass.

Step 3: Shutdown operation is evaluated. The consequence rank is reviewed and adjusted to reflect the PBFs impact on plant operation during shutdown.

Step 4: External events are evaluated. The consequence rank is reviewed and adjusted to reflect the PBFs impact on the mitigation of external events.

2.2 *Evaluated Impacts and Operating Configurations*

The consequence evaluation is conducted assuming a pipe failure (loss of pressure boundary integrity). A pipe failure can occur at any time. Occurrences during operation, standby, periodic testing, or an accident demand are evaluated. The configuration can influence the probability of PBF and the probability of detecting and isolating the failure. If failure were to occur during operation, it would probably be promptly detected, while failures in standby could be undetected until a test or demand. The analyzed failures also can have different impacts: they can cause an initiating event and/or affect the mitigating ability of the plant. The containment performance can also be affected.

In the EPRI Methodology, the consequence evaluation and ranking is organized into four basic consequence impact groups, with three corresponding operating configurations. Those consequence impact groups and configurations are defined in Table 2.2.

2.3 *Failure Modes and Effects Analysis (FMEA)*

The core of every consequence evaluation is a Failure Modes and Effects Analysis (FMEA), which evaluates the impact of each pipe break. These impacts can be direct, indirect, or a combination of both:

- **Direct Impacts**: Failure results in a diversion of flow and a loss of the train/system or an initiating event (such as a LOCA).

- **Indirect Impacts**: Failure results in a flood, spray, or jet impingement, spatially affecting neighboring equipment or results in depletion of a tank and loss of the systems supplied by the tank.

FMEA documents the evaluation of pipe break impacts. Information included in the FMEA is listed below:

(a) Break Size
(b) Isolability of the Break
(c) Spatial Effects
(d) Initiating Events
(e) System Impact/Recovery
(f) System Redundancy

More details on information provided in the FMEA are given below.

(a) <u>Break Size</u>: The consequence analysis is performed assuming a spectrum of break sizes. Typically, the most critical size is based on pipe diameter, unless a smaller break could be more limiting. No credit is given for leak-before-break.

(b) Isolability of Break: The possibility of isolating a break is also identified and accounted for as part of the consequence analysis. A break could be isolated by a protective check valve, a closed isolation valve, or it could be automatically isolated by an isolation valve that closes on a given signal. If not automatically isolated, a break can be isolated by an operator action, given successful diagnosis. The likelihood of isolating a break depends on the availability of isolation equipment, a means of detecting the break, the amount of time available to prevent specific consequences (e.g., flooding of the room or draining of the tank), and human performance. Operator recovery actions are evaluated as part of the analysis.

(c) Spatial Effects: Spatial effects are an example of indirect effects caused by pressure boundary failures. These include the effects of flood, spray, and pipe whip on equipment located in the vicinity of the break. Spatial consequences of the break are determined based on the location of the analyzed break and the relative position of important equipment. Analyzed locations of the break should be consistent with locations analyzed in other spatial analyses performed for the plant (e.g., internal flood analysis or fire analysis).

(d) Initiating Events: Pipe breaks could cause an initiating event. In the analysis of Class 1 piping, loss of coolant accident (LOCA) initiating events are prevalent. Beyond the first normally closed isolation valve in the reactor coolant pressure boundary, potential LOCAs (that include a passive valve failure) are evaluated. Often, if the analyzed pipe break does not cause an initiating event, and the demand configuration is analyzed, it is necessary to identify and assume a "critical" initiator to challenge this piping in the evaluation.

(e) System Impact/Recovery: The impact on systems, including the potential for recovery, is described. The total impact includes both direct and indirect impacts. The possibility of isolating the break and preventing multiple system loss, tank depletion, or flooding is also evaluated.

Where applicable, the impact of both isolation success and isolation failure should also be considered. Recovery of the train containing the pipe failure is usually not credited in the evaluation, because even successful isolation will render that train unavailable.

(f) System Redundancy: Given the total impact described above, the remaining available trains are identified for each critical safety function (i.e., redundancy). This is an important input in the determination of the consequence ranking. The critical failure combinations and the success paths are analyzed for each safety function.

Table 2.1 Correspondence of Consequence Categories to Numerical Estimates of Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP)

Consequence Category	Corresponding CCDP Range	Corresponding CLERP Range
High	CCDP > 1E-4	CLERP > 1E-5
Medium	1E-6 < CCDP ≤ 1E-4	1E-7 < CLERP ≤ 1E-5
Low	CCDP ≤ 1E-6	CLERP ≤ 1E-7

Table 2.2 **Definition of Consequence Impact Groups and Configurations**

Consequences		
Impact Group	**Configuration**	**Description**
Initiating Event	Operating	A PBF occurs in an operating (pressurized system) resulting in an initiating event
Loss of Mitigating Ability	Standby	A PBF occurs in a standby system and does not result in an initiating event, but degrades the mitigating capabilities of a system or train. After failure is discovered, the plant enters the Allowed Outage Time defined in the Technical Specification
	Demand	A PBF occurs when system/train operation is required by an independent demand
Combination	Operating	A PBF causes an initiating event with an additional loss of mitigating ability (in addition to the expected mitigating degradation due to the initiator)
Containment	Any	A PBF, in addition to the above impacts, also affects containment performance

3.0 Plant-Specific Application

3.1 *Summary of PRA Insights*

Level 1 PRA

The VCSNS IPE (Reference 3) was performed by conducting a Level 2 PRA, and including an analysis of internal flooding. In performing the IPE, standard PRA systems analysis practices, such as those outlined in the PRA Procedures Guide (NUREG/CR-2300), were used. The specific PRA approach used was a variation of the large event tree modeling technique. Integration between the Level 1 analysis and the containment analysis was accomplished by through the development of plant response trees (PRT). A PRT for a given initiator combines both the key Level 1 events relative to core damage with the subsequent key events impacting containment response and fission product release. Included in the PRTs was the ability to transfer to other PRTs in response to failures that resulted in altered plant response.

The Westinghouse TREAT code and the EPRI MAAP 3.0 code were used to develop success criteria, including timing requirements, for plant response to accident sequences. The MAAP code was used to predict both core damage and containment failure.

Each sequence terminates in either a success or a core damage state. Two success states are defined: 1) no core damage has occurred and 2) no core damage has occurred within 24 hours, but the plant is still not in a stable condition. Each core damage state is defined by a combination of five characteristics: 1) initiating event, 2) timing of core damage, 3) SI and heat removal condition, 4) containment response and 5) RCS pressure at the time of core damage. Accident sequences within a given core damage state were grouped to assess accident progression, containment response and fission product release.

The internal flooding analysis (Reference 4) for VCSNS was performed consistent with the requirements of NUREG-1335. For the analysis, the plant was subdivided initially into 157 areas. These areas were reviewed for the following items: 1) equipment that, if failed, could result in a reactor trip, 2) equipment required for safe shutdown, 3) flooding source(s) and 4) spray source(s). Areas that contained both items 1 and 2 above and also 3 and/or 4 were analyzed either qualitatively or quantitatively as potential contributors to plant CDF.

Peer Review of PRA Model

The VCSNS IPE was produced by a team of SCE&G, Westinghouse and FAI personnel, and completed in June 1993. Work performed by Westinghouse and FAI was performed in accordance with the Westinghouse quality assurance program and meets the requirements of 10CFR 50, Appendix B. Independent reviews of each notebook were performed by selected members of Westinghouse and/or FAI before submittal to SCE&G. Comments from all reviews were included, as appropriate, into the work packages and, if necessary into the final report.

The SCE&G review process was established early in the IPE project, with continuous feedback used to capture the plant as-operated in the modeling. Four different independent reviews were performed during the IPE study. The first two (Phase 1 and Phase 2) were structured to meet the Independent Review (IR) requirements of GL 88-20. Phase 1 concentrated on the Level 1 analysis, while Phase 2 addressed the Containment System Performance Analysis. In addition to the Phases 1 and 2 reviews, a review of the human reliability analysis was performed by a human error analyst from Science Applications International Corporation (SAIC). Also, SCE&G employed a PRA analyst from SAIC to review all aspects of the Level 1 analysis.

Summary of PRA Level 1 Results

The VC Summer PRA calculated a core damage frequency (CDF) for internal events of 5.59E-5/year. The contributors to the VCSNS CDF, by initiating event, are shown in Table 3.1 (Reference 5 &22).

The largest contributor to CDF, with a 70.5% contribution, is loss-of -offsite-power/station blackout events. The PRA credited recovery of off-site power for these events, but did not take credit for any recovery of on-site power sources.

Transient events contribute approximately 10% of the CDF, primarily due to loss of support systems leading to an RCP seal failure LOCA. Containment bypass, steam generator tube rupture, and interfacing systems LOCAs contribute less than 1 percent to total CDF.

All LOCAs contribute approximately 3% to the total CDF. The primary LOCA contributors to CDF are SLOCAs (13.4%) and MLOCAs (3.7%). The dominant failure contributors for these events include failure of low pressure recirculation and failure of the chilled water system.

Special initiators (loss of support systems) contribute approximately 10 percent to CDF, primarily due to loss of service water and loss of chilled water. Both of these lead to RCP seal failure LOCAs.

Summary of Level 2 PRA Results

The Level 2 analysis calculated that given core damage, the conditional probability of containment failure within 48 hours is 21 percent. No containment overpressure failures were found to occur within the first 24 hours. The frequency of containment failure and uncontrolled fission product release within the first 24 hours was calculated to be 1.4E-6/yr. (Reference 3)

Containment overpressurization failures occur only when containment heat removal is unavailable. The VCSNS containment is not susceptible to failure modes and mechanisms that lead to early containment failures. If the containment is isolated and not bypassed, containment failure will not occur for many hours after vessel failure, due to the gradual increase in containment pressure that occurs if containment heat removal is failed.

The frequency of uncontrolled release is dominated by sequences where an early, high-pressure vessel failure occurs, containment heat removal is unavailable, containment sprays are unavailable and the containment is isolated. Substantial fission product release results only from steam generator tube rupture or interfacing systems LOCA sequences that bypass containment.

3.2 Initiating Events Impact Group

In this impact group, pipe breaks that result in an initiating event are evaluated.

A list of all initiating events analyzed in the VCSNS PRA, with corresponding CCDPs and CLERPs is given in Table 3.2 (References 5, 6 and 22). SSBO and SSBI were updated per Reference 23.

As can be seen from Table 3.2, all LOCAs, Loss of Offsite Power, the steam line breaks inside and outside of containment and ISLOCAs would result in a "High" consequence rank (CCDP > 1E-4). All other initiating events, except an inadvertent opening of a PORV, result in a "Medium" consequence rank.

LOCA sizes (Reference 5 & 22), corresponding CCDPs and ranks are separately summarized in Table 3.3.

Potential LOCAs are LOCAs that are isolated by a normally closed valve. The initiator would occur if a passive valve failure occurs during a year of operation. Isolable LOCAs are LOCAs that could be isolated by a closure on demand of a normally open valve (MOV or AOV). The initiator would occur if the valve fails to close on demand.

Potential and isolable LOCAs are evaluated in Table 3.4, which also includes plant-specific valve failure rates (Reference 7) used in the analysis.

3.3 Loss of Mitigating Ability Impact Group

In this impact group, the pressure boundary failures (PBFs) that degrade the plant mitigating ability are evaluated. This evaluation should identify those pipe failures that can result in a loss or degradation of a system/train or multiple systems/trains.

A system/train can be lost either due to diversion of flow or due to secondary effects caused by the pipe break. Both direct and indirect effects of pipe failure need to be evaluated to determine the affected systems. During this analysis, the system safety function, the means of detecting a failure, test and maintenance practice, and technical specifications associated with the system are identified. Possible automatic or operator actions to prevent or to recover from the loss of systems should also be identified and evaluated.

USING LOOKUP TABLES TO EVALUATE THE IMPACT ON MITIGATING ABILITY

In the EPRI TR (Reference 2) simplified lookup tables were designed to be used in evaluating consequence ranks. One of the tables, Table 3.5, provides guidance in assigning the consequence categories to pipe failures that affect the plant mitigating ability, but do not cause an initiating event. This table is designed to simplify determining the CCDP range (defined in Table 2.1), based on three factors. Those factors are the frequency of challenge, the number of back-up trains unaffected, and the exposure time to the conditions created by the pipe failure. Each of these factors is addressed separately below:

1. **Frequency of the challenge** determines how often the mitigating function of the systems/trains is anticipated to be called upon. Since this evaluation deals with PBFs that do not cause initiating events, but do impact mitigation capabilities, the challenge referred to here is assumed to come from other independent initiating events.

   In Table 3.5, the frequency of the challenge is grouped into design basis event categories (II, III, and IV): anticipated events, infrequent events, and accidents (unexpected events). All other factors being equal, systems that are called upon to mitigate an anticipated event would be more important than systems called upon to mitigate an unexpected event.

2. **Number of backup systems/trains available** determines how many unaffected systems or trains are available to perform the same mitigating function. The availability of multiple backup trains would make the effect of the loss of one system/train less significant. Backup systems should be evaluated for each plant safety function.

   As shown in Table 3.5, the number of backup trains is given in "one-half" increments. In this methodology a train "worth" concept has been introduced to standardize crediting backup trains. A mitigating train "worth" does not necessarily correspond to an actual plant train. A train "worth" is defined as having an unavailability value of approximately 1E-2 (range between 3E-3 and 3E-2). The mean value for a half train is 1E-1, and for 2 trains, the value is 1E-4. For example, a train with an unavailability of 2E-2 can be credited as a full "train," while a train with an unavailability of 8E-2 can be credited only as a half "train."

   The number of backup trains is determined based on the success criteria for each **safety function**. VCSNS PRA success criteria are defined in Table 3.6 (Reference 3), for the following functions:

   - Feedwater
   - MS Isolation
   - Feed and Bleed
   - Seal Cooling
   - Accumulator Injection
   - Low Pressure Injection and Recirculation
   - High Pressure Injection and Recirculation
   - Cooldown and Depressurization
   - Containment Air Recirculation

3. **Exposure time** determines the downtime for the failed system/train, or the time the system/train would be unavailable before the plant is shutdown.

   Examples of exposure time are discussed below:

   - If a pipe failure is discovered immediately, the exposure time is equal to the applicable Allowed Outage Time (AOT), plus the time it took to detect the failure.
   - If the pipe failure goes undetected, it is assumed that the exposure time is equal either to the test period (if the equipment is tested) or to all year if the equipment is not tested.

   Four different exposure times are included in Table 3.5:

i) All Year, which applies to standby systems and parts of systems in which pipe segments are not "tested" or exposed to an operating load during the year;

ii) Time Between Tests, applies to the standby systems, which are regularly tested (monthly or quarterly). It is assumed that, for those systems, an actual exposure time is equal to the test interval because, if a degraded pipe condition is present, it will be discovered during the test.

iii) Long AOT, applies to operating or standby systems in which a pipe failure will be detected within a short time after its occurrence, but could result in a plant shutdown if the failure is not recovered from during the AOT. The exposure time is, therefore, equal to the AOT plus the detection time. A "long AOT" exposure time is typically one to two weeks.

iv) Short AOT, applies to the same systems as does the "long AOT," except that the exposure time is less than 72 hours.

v) Other Exposure Times: Sometimes, in addition to the time to detect pipe break and applicable AOT after the plant is shutdown, there is a time necessary to repair the break, during which a train or equipment is unavailable. This situation applies only to equipment necessary for a shutdown operation. An example of such equipment, RWST and specific exposure times used in the VCSNS analysis, are defined below:

(a) Breaks in RWST discharge lines under the tank pressure, ISOLABLE: A 24 hr. exposure time is used. It is assumed that this time is equal to time to detect the problem along with the time before a controllable shutdown (LCO equal to 1 hour) which is half the normal plant shift, 6 hrs, plus time to solve the problem and refill RWST (time assumed to be equal to a shift and one-half, or 18 hours).

(b) Breaks in RWST discharge lines under the tank pressure, UNISOLABLE: A 36 hr. exposure time is used. The times for detection and LCO are the same as for (a), above. Time to solve the problem is assumed to be much longer (assumed to be equal to 2 and one-half shifts), 30 hrs, 12 hrs longer than in the case of (a), above. This is because the break is not isolable, and the broken pipe needs to be replaced before refilling the RWST.

USING PRA RESULTS TO EVALUATE AN IMPACT ON MITIGATING ABILITY

When PRA Risk Ranking results are available (RAWs), CCDP values can be determined based on the RAW values (with some additional runs). A summary of these results, provided in References 5 and 6, is given in Table 3.7. The trains/systems analyzed in the table correspond to the systems in the scope of this analysis. CCDP values are determined based on the following equation:

CCDP (given loss of a system) = [CDF (given loss of a system) – CDF(Base)] * [Exposure Time]

$$= [RAW-1] * CDF (Base) * [Exposure Time]$$

where

- [CDF(given loss of a system) – CDF(Base)] = Risk Increase
- RAW is Risk Achievement Worth:
  RAW (system) = CDF (given loss of system)/CDF(Base)
- Exposure time is defined in the previous subsection, and it is equal to 1 year for non-tested lines, and to 3 months for tested lines

  (Two different exposure times are used for a loss of RWST, during operation: 24 hours (2.7E-3) and 36 hours (4.1E-3), confirming the risk rankings which were based on the PRA results)

As described in the EPRI RI ISI Evaluation Procedure, the lookup tables can be used as a reality check for the risk rankings based on the PRA results. This reality check is based on the requirements specific for lookup tables: to determine which safety functions are affected, as well as the effects on plant mitigative functions. These insights are not always obvious from PSA quantifications, without a detailed analysis of resultant CDF and LERF sequences.

Results of using lookup tables to confirm rankings based on the PRA/RAW results (presented in Table 3.7) are summarized in Table 3.7a. As seen from the table, there is only one instance where the lookup tables did not confirm the PRA results (see shaded areas in the table). In this instance, the PRA result is conservative. It is connected with LERF values, and it was not changed.

3.4 Combinations Impact Group

Guidelines for determining consequence categories for the combination consequence group are given in Table 3.8. This table applies to the evaluation of pipe failures that both cause an initiating event and affect the plant's mitigating ability beyond the expected and modeled effects of the initiator. For example, when a loss of an injection leg occurs with a LOCA, that is an expected LOCA effect on mitigating ability, and it is typically analyzed as a simple initiating event. If in addition to the loss of an injection leg, the injection system operation is affected, that combination should be evaluated using Table 3.8. If the category recommended in Table 3.8 is lower than one recommended in Table 3.2, the worst case category should be used.

3.5 Containment Performance Impact Group

In addition to consequences affecting CDF, PBFs must also be evaluated for their impact on containment performance in order to determine their effects on Large Early Release Frequency (LERF).

Because of the many terms introduced in this chapter, some basic definitions are given below:

LERF – Large Early Release Frequency
LERP – Large Early Release Probability or Probability of Large Early Release, given that core damage has occurred
CLERP – Conditional Large Early Release Probability, or Probability of Large Early Release, given a pipe break.

The general philosophy for addressing containment performance is to ensure a 0.1 Large Early Release Probability (LERP). If this criterion is not satisfied, then consequence categories determined by CCDP values may have to be increased. This relationship has already been defined by the CCDP and CLERP numerical criteria given in Table 2.1.

In the EPRI Methodology LERF is evaluated in three ways:

1. PBF's impact on containment isolation
2. PBF's impact on LOCA outside containment
3. PBF's impact on early core melt and containment failure

PBF impact on containment isolation is evaluated for each specific break. Some breaks could lead to a direct containment bypass. General guidance for evaluation of pipe breaks which could lead to LOCAs outside containment is provided in Table 3.9. If the impact of a pipe break leads to a loss of containment isolation, or containment bypass, LERP is assumed to be one.

The pipe break impact on early core melt and containment failure is more difficult to evaluate. In the latest VCSNS model, LERF is evaluated to be 7.E-7/yr. (Reference 6). Given a CDF of 5.6E-5E/year, the resulting LERP for VCSNS is 1.25E-2. This value provides enough of a margin to guarantee that LERF consideration would not affect the consequence rank based on CDF.

The LERP values used in this evaluation are summarized below.

Analyzed Event	Probability of Large Early Release Given Core Damage (LERP)
Containment Bypass, IS-LOCA	1
Any other event	0.1
Any Initiating Event	The specific plant values from Table 3.2
LOCAs, potential or isolable	The specific plant values from Table 3.2 and Table 3.4
Loss of any mitigating ability	The specific plant values from Table 3.7

The 0.1 value is used to simplify the evaluation, since it is a minimum value that does not affect ranking due to CCDP values.

3.6 Summary of Other Modes of Operation

The initial consequence evaluation is performed assuming operation at power. In order to assure that the total risk from PBFs is evaluated, it is necessary to perform an additional review of other modes of operation.

In general, the at-power plant operation is expected to result in more critical consequences when piping failures are analyzed. This is because operation at power requires immediate responses to control reactivity, ensure heat removal, and coordinate inventory control, and because the plant is also at higher pressures and temperatures when operating. From a risk perspective, shutdown operation is characterized by the following:

- During shutdown, unavailability of mitigating trains is higher due to planned maintenance scheduled during outages.

- During shutdown, safety injection is not automatic, but instead requires manual action.

- For the majority of piping, the exposure time associated with operation in a shutdown configuration is on the order of 0.1/yr. The frequency of being in a more risk significant configuration could be even lower, depending on the events and functions being evaluated.

- During shutdown, the operating conditions are much less severe than during power operation. The reactor is shutdown and depressurized and decay heat is low. The reactor coolant system and connected piping are not pressurized, nor are they at high temperatures. The likelihood of PBF is expected to be lower.

- Since decay heat is lower during shutdown, the available time for recovery of DHR or inventory makeup is longer.

- The system that needs special attention in the shutdown evaluation is the RHR System, which is aligned to the reactor coolant system in the Shutdown mode (RHR connection to RCS is isolated during at-power operation). The most critical events during shutdown are expected to be a loss of Shutdown Cooling and LOCA.

Even though the actuation of makeup systems during shutdown is not automatic, outage risk management and procedures provide guidelines to ensure that a loss of shutdown cooling or a LOCA will be detected and mitigated in a timely manner (References 8 and 9). The same procedures and guidelines ensure sufficient redundancy in the mitigating equipment and systems, especially during the higher risk configurations.

Plant-Specific Analysis:

The lines analyzed for consequences during shutdown operation are RHR suction from Hot Legs, RHR pumps and discharge:

The analyzed break in those lines is assumed to occur on demand, after the system is aligned for shutdown operation or during operation in shutdown. Consequences of the break are as follows:

- Unisolated Breaks, LOCA, inside, or for the majority of the piping, outside of the Containment
- Isolated Breaks, Loss of Shutdown Cooling

Based on the shutdown guidelines (Reference 9), at least two backup trains have to be available for RCS heat removal and one train for RCS makeup. The more critical path is a LOCA outside of containment, and, therefore, isolation is required.

In order to prevent a LOCA outside containment, during a shutdown operation, either one of the

RHR suction valves from hot leg needs to close. In order to prevent boiling, the operator needs to recognize the problem, isolate the break and establish a primary makeup. Multiple means of detecting the problem will be available: low RCS level and high temperatures, area sump alarms, and radiation monitors. It is assumed that the operator has an error probability of 1E-2 for early problem detection and isolation of the break. If this isolation fails, later in the event, after RHR pumps are flooded, operators are assumed to have another opportunity to isolate and establish core cooling. (Also note that flooding of RHR pumps would significantly slow the rate of a reactor coolant loss through the break.) This late isolation is credited as 1E-3. Total operator failure to isolate a break is estimated to be 1E-5.

If isolation fails, and a LOCA outside containment occurs (containment bypass), no credit was given for a primary makeup.

Given that a successful isolation of the break occurs, it would result in a loss of the RHR System. There are two cases considered: (1) Shutdown Start: At least two trains should be available for decay heat removal and (2) Shutdown Operation: During the time when both S/Gs are not available, and the refueling cavity is not full, only one train of decay heat removal may be available (given a loss of RHR). We consider this configuration to occur approximately 10% of the Shutdown time.

Based on the above analysis, breaks in the RHR piping during shutdown are evaluated to result in "Medium" consequences, as presented in Appendix D, and Tables 4.3 and 4.4.

3.7 Summary of External Events

The VCSNS IPEEE assessments address the external events identified in Supplement 4 of Generic Letter 88-20: earthquakes (seismic activity), internal fires, high winds, floods, and other credible external events. The seismic investigation was conducted by using an IPEEE focused scope SMA and consisted of a walkdown that concentrated on potential seismic vulnerabilities for equipment, large tanks, distribution systems, and structures. The internal fire assessment was done with the EPRI Fire Induced Vulnerabilities Evaluation (FIVE) Methodology. The evaluation of the other events was performed using combination of probabilistic and deterministic techniques. The results are summarized below:

External Event	Analysis and Result
Seismic	Seismic Margins Assessment
Fire	CDF = 8.52E-5/yr in combination with FIVE Analysis
High Winds and Tornadoes	Screening performed and documented in IPEEE
External Flooding and Probable Maximum Precipitation	Screening performed and documented in IPEEE
Transportation and Nearby Facility Accidents	Screening performed and documented in IPEEE

Pipe breaks in Class 1 and Class 2 piping are not considered to have a major impact on the CDF contribution from external events. Given their low frequency, external events do not present a significant challenge to those piping systems. The high majority of class 1 and 2 piping is evaluated to have "HIGH" or "MEDIUM" consequence. In order to effect those rating (for example, to update a "MEDIUM" to a "HIGH"), an external event should have a frequency higher than 1E-4/year and cause a significant effect on mitigation ability. This is a highly unlikely situation. Therefore, the external events are excluded from further evaluation.

Table 3.1 Summary of VCSNS PRA Contributors

Initiator	Initiator ID	IE Frequency [1/yr]	Total CDF [1/yr]	Percent
Transients				
Reactor Trip	RT	4.91E-01	9.10E-07	1.72%
Turbine Trip	TT	1.63E-01	3.47E-07	0.66%
Loss of Main FW Flow	LMF	6.60E-01	1.64E-06	3.1%
Partial Loss MFW Flow	PMF	6.00E-01	1.49E-06	2.82%
Loss of Condenser	LOC	1.03E-01	2.54E-07	0.48%
Loss Reac. Coolant Flow	RCS	1.15E-01	2.46E-07	0.47%
Primary Sys. Transient	PST	1.92E-01	4.11E-07	0.78%
Inadv. SI Signal	SIS	1.18E-01	2.52E-07	0.48%
Inadv. Open. of Stm Vlv	ISOV	2.80E-02	8.56E-09	0.01%
Pos. Reactivity Insertion	PRI	9.38E-02	2.00E-07	0.38%
Loss of Electrical Support				
LOSP	LSP	3.38E-02	3.94E-05	74.6%
LOCAs				
Large LOCA	LLO	5.00E-6	1.91E-08	0.04%
Medium LOCA	MLO	4.00E-5	1.44E-07	0.27%
Small LOCA	SLO	5.00E-4	1.71E-06	3.24%
SGTR	SGR	4.78E-03	1.14E-07	0.22%
Reactor Vessel Rupture	VRP	1.00E-7	-	-
ISLOCA	ISL	1.54E-06	1.77E-07	0.34%
Secondary Line Breaks				
SLB in Cont.	SSBI	1.80E-03	1.76E-07	0.33%
SLB out Cont.	SSBO	1.80E-03	1.77E-07	0.33%
Special Initiating Events				
Loss of Service Water	LSW1	-	1.62E-07	0.31%
Total Loss of CCW	LCC1	-	3.86E-06	6.82%
Loss Inst. Air	LIA1	-	6.2E-07	1.17%
Loss of DC Bus A	LDCA1	-	5.76E-08	0.11%
Loss of DC Bus B	LDCB1	-	5.92E-08	0.11%
LO APN5901APN5904	LACA1	-	2.0E-08	0.036%
Flooding Events				
Loss of CCW Train	FLD1	9.90E-04	2.55E-08	0.05%
Loss of SW Train A	FLD2	1.10E-04	2.65E-09	0.005%
Loss of SW Train B	FLD3	1.00E-04	2.94E-10	0.0005%
Total:			5.28E-5	

Table 3.2 Initiating Events Table

Initiator	Initiator ID	IE Freq. [1/yr]	Total CDF [1/yr]	Total LERF [1/yr]	IE CCDP	IE CLERP	RANK
Transients							
Reactor Trip	RT	4.91E-01	9.10E-07	6.49E-09	1.85E-06	1.32E-08	MEDIUM
Turbine Trip	TT	1.63E-01	3.47E-07	2.45E-09	2.13E-06	1.50E-08	MEDIUM
Loss of Main FW	LMF	6 60E-01	1.64E-06	1.17E-08	2.48E-06	1.77E-08	MEDIUM
Part. Loss MFW	PMF	6.00E-01	1.49E-06	1.06E-08	2.48E-06	1.77E-08	MEDIUM
Loss of Conden.	LOC	1.03E-01	2.54E-07	1.79E-09	2.47E-06	1.74E-08	MEDIUM
Loss RC Flow	RCS	1.15E-01	2.46E-07	1.73E-09	2.14E-06	1.50E-08	MEDIUM
Pri. System Tran.	PST	1.92E-01	4.11E-07	2.91E-09	2.14E-06	1.52E-08	MEDIUM
Inadv. SI Sig.	SIS	1.18E-01	2.52E-07	1.78E-09	2.14E-06	1.51E-08	MEDIUM
I/O of Stm Vlv	ISOV	2.80E-02	8.56E-09	5.81E-11	3.06E-07	2.08E-09	LOW
Pos. React. Insert.	PRI	9.38E-02	2.00E-07	1.41E-09	2.13E-06	1.50E-08	MEDIUM
Loss of Electrical Support							
LOSP	LSP	3.38E-02	3.94E-05	2.81E-07	1.17E-03	8.31E-06	HIGH
LOCAs							
Large LOCA	LLO	5.00E-6	1.91E-08	1.76E-10	3.82E-03	3.52E-05	HIGH
Medium LOCA	MLO	4.00E-5	1.44E-07	1.39E-09	3.60E-03	3.48E-05	HIGH
Small LOCA	SLO	5.00E-4	1.71E-06	1.69E-08	3.42E-03	3.38E-05	HIGH
SGTR	SGR	4.78E-03	1.14E-07	1.18E-07	2.38E-05	2.47E-05	HIGH
RV Rupture	VRP	1.00E-7	-	-	-	-	-
ISLOCA	ISL	1.54E-06	1.77E-07	1.78E-07	1.15E-01	1.15E-01	HIGH
Secondary Line Breaks							
SLB in Cont.	SSBI	1.80E-03	1.76E-07	1.31E-09	9.78E-05	7.28E-07	MEDIUM
SLB out Cont.	SSBO	1.80E-03	1.77E-07	1.34E-09	9.83E-05	7.44E-07	MEDIUM
Special Initiating Events							
Loss of SW	LSW1	-	1.62E-07	1.17E-09	-	-	-
Total Loss of CCW	LCC1	-	3.86E-06	2.87E-08	-	-	-
Loss Inst. Air	LIA1	-	6.2E-07	4.02E-09	-	-	-
Loss of DC Bus A	LDCA1	-	4.29E-07	3.04E-09	-	-	-
Loss of DC Bus B	LDCB1	-	5.92E-08	4.01E-10	-	-	-
APN5901 APN5904	LACA1	-	2.0E-08	1.4E-10	-	-	-
Flooding Events							
Loss of CCW Trn.	FLD1	9.90E-04	2.55E-08	1.83E-10	2.58E-05	1.85E-07	MEDIUM
Loss of SW Trn. A	FLD2	1.10E-04	2.65E-09	1.82E-11	2.41E-05	1.65E-07	MEDIUM
Loss of SW Trn. B	FLD3	1.00E-04	2.94E-10	1.87E-12	2.94E-06	1.87E-08	MEDIUM
Total:			**5.28E-5**	**6.74E-7**			

Table 3.3 LOCA Sizes and Corresponding CCDPs

	SIZE	FREQUENCY	CCDP	RANK
LLOCA	D>6"	5E-6	3.82E-3	HIGH
MLOCA	2"<D≤6"	4.0E-5	3.60E-3	HIGH
SLOCA	3/8"<D≤2"	5.0E-4	3.42E-3	HIGH

Table 3.4 Potential and Isolable LOCAs CCDPs/CLERPS

EVENT	Corresponding LOCA CCDP	Corresponding LOCA CLERP	Isolation Valve (Normal position)	Valve Failure Rate [1/hr]	Valve Failure Likelihood [for a year]	CCDP	CLERP	RANK
PSLOC(MV)	3.42E-03	3.38E-05	MANUAL (CLOSED)	5.00E-07	4.4E-03	1.5E-05	1.5E-07	MED
PLLO(CV)	3.82E-03	3.52E-05	CHECK (CLOSED)	5.00E-07	4.4E-03	1.7E-05	1.5E-07	MED
PMLO(CV)	3.60E-03	3.48E-05	CHECK (CLOSED)	5.00E-07	4.4E-03	1.6E-05	1.5E-07	MED
PSLOC(CV)	3.42E-03	3.38E-05	CHECK (CLOSED)	5.00E-07	4.4E-03	1.5E-05	1.5E-07	MED
PLLO(MOV)	3.82E-03	3.52E-05	MOV (CLOSED)	5.00E-07	4.4E-03	1.7E-05	1.5E-07	MED
PMLO(MOV)	3.60E-03	3.48E-05	MOV (CLOSED)	5.00E-07	4.4E-03	1.6E-05	1.5E-07	MED
PSLOC(MOV)	3.42E-03	3.38E-05	MOV (CLOSED)	5.00E-07	4.4E-03	1.5E-05	1.5E-07	MED
IMLO(AOV)	3.60E-03	3.48E-05	AOV (OPEN)	2.00E-03	2.0E-03	7.2E-06	7.0E-08	MED
IS-LOCA (2MOVS)	N/A	N/A	2 MOVs (CLOSED)	5.00E-07	1.2E-06[1]	1.2E-06	1.2E-06	MED

(1) Common Cause was not considered for all year (equivalent to considering common cause factor < 0.01). The pipe was regularly tested, so exposure time is equal to three months (not a year).

Table 3.5 **Guidelines for Assigning Consequence Categories to Pipe Failures Resulting in System/Train Loss**

Affected Systems		Number of Unaffected Backup Trains							
Frequency of Challenge	Exposure Time to Challenge	0.0	0.5	1.0	1.5	2.0	2.5	3.0	>=3.5
Anticipated (DB Cat II) [>0.1/yr]	All Year	H	H	H	H	M*	M	L*	L
	Between tests (1-3 months)	H	H	H	M*	M	L*	L	L
	Long AOT (<=1 week)	H	H	M*	M	L*	L	L	L
	Short AOT (<=1 day)	H	M*	M	L*	L	L	L	L
Infrequent (DB Cat. III) [0.1/yr, 0.01/yr]	All Year	H	H	H	M*	M	L*	L	L
	Between tests (1-3 months)	H	H	M*	M	L*	L	L	L
	Long AOT (<=1 week)	H	M*	M	L*	L	L	L	L
	Short AOT (<=1 day)	H	M	L*	L	L	L	L	L
Unexpected (DB Cat. IV) [<0.01/yr]	All Year	H	H	M*	M	L*	L	L	L
	Between tests (1-3 months)	H	M*	M	L*	L	L	L	L
	Long AOT (<=1 week)	H	M	L*	L	L	L	L	L
	Short AOT (<=1 day)	H	L*	L	L	L	L	L	L

H = High Consequence Category

M = Medium Consequence Category

L = Low Consequence Category

*The final rank is based on the containment performance

Table 3.6 VCSNS Success Criteria

Functional/ System ID	Function/ System Description	Initiators	Success Criteria
MSI	MS Isolation	SGTR	Either (1) 1 of 1 MSIV on faulted SG or (2) 2 of 2MSIV's on the intact SG and EF terminated to the faulted SG
MSI	MS Isolation	SLB-Inside Cont.	Either (1) MSIV and FWIV closure to the faulted SG and emergency feedwater isolated to the faulted SG or (2) MSIV's and FWIV's closed on 2 of 2 intact SG and emergency feedwater isolated to the faulted SG.
MSI	MS Isolation	SLB-Outside Cont.	MSIV's and FWIV's closed on 2 of 3 SG's and emergency feedwater isolated to the faulted SG.
EF	Emergency Feedwater	Transients	1 of 3 EF pumps supplying 1 of 3 steam generators for 4 hours.
EF	Emergency Feedwater	SGTR	1 of 3 EF pumps delivering to 1 of 2 intact SG's for 4 hours.
EF	Emergency Feedwater	SLOCA	1 of 3 EF pumps delivering to 1of 3 SG's for 4 hours. This applies for short-term heat removal and also depressurization if required.
EF	Emergency Feedwater	MLOCA	1 of 3 EF pumps delivering to 1of 3 SG's for 4 hours for depressurization.
EF	Emergency Feedwater	ATWS	PWR level < 40%: 1 of 3 EF pumps supplying 1of 3 SG's. PWR level > 40%: 3of 3 EF pumps supplying 3of 3 SG's.
	Feed and Bleed	All but LLOCA and ATWS > 40% Power	1 OF 2 HPI pumps delivering to 2 of 3 cold legs and 2 of 3 SG PORVs opening.
CC	RCP Seal Cooling	Transient, SLOCA	RCP seal cooling continues (1 of 2 CC booster pumps for 24 hours)
SI	Accumulator Injection	MLOCA, SLOCA	2 of 2 accumulators and 1 of 2 RH pumps to 2 cold legs for 1 hour. Requires depressurization via the secondary side.

Functional/ System ID	Function/ System Description	Initiators	Success Criteria
SI	Accumulator Injection	LLOCA	Accumulators are not needed for LLOCA if 1 of 2 RH pumps delivers to the 2 intact cold legs. 2 of 2 accumulators and 1 of 2 HPI pumps delivering to the 2 intact cold legs for one hour will provide short-term inventory control, but will not prevent core damage.
SW	Service Water	LOSP SSM, TRAN SSM, LOCA SSM	2 of 2 trains (1 pump per train for 24 hours
SW	Service Water, Containment Integrity	LLOCA, MLOCA, SLOCA	1 of 2 RBCU run for 24 hours or 1 RHHX
RH	Low Pressure Injection	SLOCA	Short Term Inventory Control: 1 of 2 RH pumps delivering to the 2 of 3 cold legs for 1 hour. Long Term Inventory Control: 1 of 2 RH pumps delivering to 2 of 3 cold legs for 23 hours.
HPI	High Pressure Injection	MLOCA	Short Term Inventory Control: 1 of 2 HPI pumps delivering to the 2 intact cold legs for 1 hour. Long Term Inventory Control: 1 of 2 HPI pumps delivering to 2 intact cold legs for 10 hours followed by hot leg injection for hours 11-24.
CS	Reactor Building Spray	N/A	Reactor Building Spray was not credited in the PRA for any containment heat removal function, only credited for fission product removal. Thus it was consider an unimportant system in this review.
HPI	High Pressure Injection	SLOCA, SGTR, Transient, SLB and ATWS resulting in SLOCA.	Short Term Inventory Control: 1 of 2 HPI pumps delivering to the 2 intact cold legs for 1 hour. Long Term Inventory Control: 1 of 2 HPI pumps delivering to 2 intact cold legs for 23 hours.
RH	Residual Heat Removal	All Initiating Events	1 RH heat exchanger supplied by CC on the operating recirculation loop.

Table 3.7 CCDP Values for System/Train Loss

Base CDF[1/yr]= 5.6E-05 Base LERF [1/yr]= 7.0E-07

System	Component	Corresponding Basic Event	RAW CDF (1)	RAW LERF (1)	CDF [1/YR]	LERF [1/YR]	Exp. Time [YR]	CCDP	CLERP	RANK
RWST	TK 025	SYSTEM	23.001	350.95	1.2E-03	2.4E-04	0.25	3.1E-04	6.1E-05	HIGH
RWST	TK 025	SYSTEM	23.001	350.95	1.2E-03	2.4E-04	2.7E-03	3.4E-06	6.7E-07	MED
RWST	TK 025	SYSTEM	23.001	350.95	1.2E-03	2.4E-04	4.1E-03	5.1E-06	1.0E-06	MED
SI A	XPP-43A-CS	XPP0043A	1.418	5.63	2.3E-05	3.2E-06	0.25	5.8E-06	8.1E-07	MED
SI B	XPP-43B-CS	XPP0043B	1.593	2.07	3.3E-05	7.5E-07	0.25	8.3E-06	1.9E-07	MED
SI C	XPP-43C-CS	XPP0043C	1.031	1.03	1.7E-06	2.3E-08	0.25	4.3E-07	5.8E-09	MED
SI	SI	SYSTEM	26.200	248.04	1.4E-03	1.7E-04	0.25	3.5E-04	4.3E-05	HIGH
SI-NT	SI	SYSTEM	26.200	248.04	1.4E-03	1.7E-04	1	1.4E-03	1.7E-04	HIGH
RH A	XPP31A-RH	XPP0031A	1.916	4.55	5.1E-05	2.5E-06	0.25	1.3E-05	6.2E-07	MED
RH A-NT	XPP31A-RH	XPP0031A	1.916	4.55	5.1E-05	2.5E-06	1	5.1E-05	2.5E-06	HIGH
RH B	XPP31B-RH	XPP0031B	1.402	1.15	2.2E-05	1.0E-07	0.25	5.6E-06	2.6E-08	MED
RH B-NT	XPP31B-RH	XPP0031B	1.402	1.15	2.2E-05	1.0E-07	1	2.2E-05	1.0E-07	MED
RH	RH	SYSTEM	20.550	14.00	1.1E-03	9.1E-06	0.25	2.7E-04	2.3E-06	HIGH
RH-NT	RH	SYSTEM	20.550	14.00	1.1E-03	9.1E-06	1	1.1E-03	9.1E-06	HIGH
CCW	CC	SYSYEM	17817.040	28464.34	1.0E+00	2.0E-02	0.25	2.5E-01	5.0E-03	HIGH
SPA	XPP-38A-SP	XPP0038A	1.000	1.00	<1E-6	<1E-7	1	<1E-6	<1E-7	LOW
SPB	XPP-38B-SP	XPP0038B	1.000	1.00	<1E-6	<1E-7	1	<1E-6	<1E-7	LOW
SP	SP	SYSTEM	1.000	66.96	<1E-6	4.6E-05	0.25	<1E-6	1.2E-05	HIGH
SP-NT	SP	SYSTEM	1.000	66.96	<1E-6	4.6E-05	1	<1E-6	4.6E-05	HIGH
ACC1	MOV 1-8948A	XVC08948A	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED
ACC2	MOV 1-8948B	XVC08948B	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED
ACC3	MOV 1-8948C	XVC08948C	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED
SI CLA	XVC-8997A	F-CVXVC8897AFO	1.024	1.14	1.3E-06	1.0E-07	1	1.3E-06	1.0E-07	MED

Base CDF[1/yr]= 5.6E-05   Base LERF [1/yr]= 7.0E-07

System	Component	Corresponding Basic Event	RAW CDF (1)	RAW LERF (1)	CDF [1/YR]	LERF [1/YR]	Exp. Time [YR]	CCDP	CLERP	RANK
SI CLB	XVC-8997B	F-CVXVC8897BFO	1.024	1.14	1.3E-06	1.0E-07	1	1.3E-06	1.0E-07	MED
SI CLC	XVC-8997C	F-CVXVC8897CFO	1.004	1.13	2.2E-07	9.1E-08	1	1.3E-06 (2)	1.0E-07 (2)	MED
CL A	XVC-8998A	H-CVXVC8998AFO	1.843	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED
CL B	XVC-8998B	H-CVXVC8998BFO	1.843	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED
CL C	XVC-8998C	H-CVXVC8998CFO	1.843	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED
RHR HL	HLS	NO DATA	-	-	.	.	-	-	-	LOW
HLA	XVC 1-8993A	NO DATA		-	-	-	-	-	-	LOW
HLB	XVC 1-8993B	NO DATA	-	-	-	-	-	-	-	LOW
HLC	XVC 1-8993C	NO DATA	-	-	-	-	-	-	-	LOW
RH CLA	XVC-8973A	H-CVXVC8973AFO	1.839	-	4.7E-05	-	0.25	1.2E-05	-	MED
RH CLB	XVC-8973B	H-CVXVC8973BFO	1.839	-	4.7E-05	-	0.25	1.2E-05	-	MED
RH CLC	XVC-8973C	H-CVXVC8973CFO	1.004	-	2.2E-07	-	0.25	1.2E-05 (2)	-	MED
									-	
SUMP-RH A	XVG-8812A	IAMVXVG8812AFO	1.842	-	4.7E-05	-	0.25	1.2E-05	-	MED
SUMP-RH B	XVG-8812B	IAMVXVG8812BFO	1.401	-	2.2E-05	-	0.25	5.6E-06	-	MED
RH-CSA	XVG-8706A	GAMVXVG8706AFO	1.418	-	2.3E-05	-	0.25	5.8E-06	-	MED
RH-CSB	XVG-8706B	GAMVXVG8706BFO	1.224	-	1.3E-05	-	0.25	3.1E-06	-	MED

(1) RAW values for Basic Events Per Reference (6).
(2) Result affected by asymmetry in Model. LOCA events modeled with failing CLC causing lower RAW for CLC. Set CLC = CLB = CLA.

Table 3.7a Confirming CCDP Values for System/Train Loss, by Lookup Tables

							Risk Achievement Worth (RAW) Rank			LOOKUP Table Rank		
System	Exp. Time [YR]	RAW CDF	RAW LERF	CDF [1/YR]	LERF [1/YR]	Exp. Time [YR]	CCDP	CLERP	RANK	Frequency of Challenge	# of Backup Trains	Rank
RWST	0.25	23.001	350.95	1.2E-03	2.4E-04	0.25	3.1E-04	6.1E-05	HIGH	Unexpected	0	HIGH
RWST	2.7E-03	23.001	350.95	1.2E-03	2.4E-04	2.7E-03	3.4E-06	6.7E-07	MED	Unexpected	0.5(2)	MED
RWST	4.1E-03	23.001	350.95	1.2E-03	2.4E-04	4.1E-03	5.1E-06	1.0E-06	MED	Unexpected	0.5(2)	MED
SI A	0.25	1.418	5.63	2.3E-05	3.2E-06	0.25	5.8E-06	8.1E-07	MED	Unexpected	1	MED
SI B	0.25	1.593	2.07	3.3E-05	7.5E-07	0.25	8.3E-06	1.9E-07	MED	Unexpected	1	MED
SI C	0.25	1.031	1.03	1.7E-06	2.3E-08	0.25	4.3E-07	5.8E-09	MED	Unexpected	1	MED
SI	0.25	26.200	248.04	1.4E-03	1.7E-04	0.25	3.5E-04	4.3E-05	HIGH	Unexpected	0	HIGH
SI-NT	1	26.200	248.04	1.4E-03	1.7E-04	1	1.4E-03	1.7E-04	HIGH	Unexpected	0	HIGH
RH A	0.25	1.916	4.55	5.1E-05	2.5E-06	0.25	1.3E-05	6.2E-07	MED	Unexpected	1	MED
RH A-NT	1	1.916	4.55	5.1E-05	2.5E-06	1	5.1E-05	2.5E-06	MED	Unexpected	1	MED
RH B	0.25	1.402	1.15	2.2E-05	1.0E-07	0.25	5.6E-06	2.6E-08	MED	Unexpected	1	MED
RH B-NT	1	1.402	1.15	2.2E-05	1.0E-07	1	2.2E-05	1.0E-07	MED	Unexpected	1	MED
RH	0.25	20.550	14.00	1.1E-03	9.1E-06	0.25	2.7E-04	2.3E-06	HIGH	Unexpected	0	HIGH
RH-NT	1	20.550	14.00	1.1E-03	9.1E-06	1	1.1E-03	9.1E-06	HIGH	Unexpected	0	HIGH
CCW	0.25	17817.04	28464.34	1.0E+00	2.0E-02	0.25	2.5E-01	5.0E-03	HIGH	Anticipated	0	HIGH

							Risk Achievement Worth (RAW) Rank			LOOKUP Table Rank		
System	Exp. Time [YR]	RAW CDF	RAW LERF	CDF [1/YR]	LERF [1/YR]	Exp. Time [YR]	CCDP	CLERP	RANK	Frequency of Challenge	# of Backup Trains	Rank
		0										
SPA	1	1.000	1.00	<1E-6	<1E-7	1	<1E-6	<1E-7	LOW	Unexpected	2	LOW
SPB	1	1.000	1.00	<1E-6	<1E-7	1	<1E-6	<1E-7	LOW	Unexpected	2	LOW
SP	0.25	1.000	66.96	<1E-6	4.6E-05	0.25	<1E-6	1.2E-05	HIGH	Unexpected	1*	MED
SP-NT	1	1.000	66.96	<1E-6	4.6E-05	1	<1E-6	4.6E-05	HIGH	Unexpected	1*	HIGH
ACC1	1	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED	Unexpected	1	MED
ACC2	1	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED	Unexpected	1	MED
ACC3	1	1.368	1.21	2.1E-05	1.5E-07	1	2.1E-05	1.5E-07	MED	Unexpected	1	MED
SI CLA	1	1.024	1.14	1.3E-06	1.0E-07	1	1.3E-06	1.0E-07	MED	Unexpected	1	MED
SI CLB	1	1.024	1.14	1.3E-06	1.0E-07	1	1.3E-06	1.0E-07	MED	Unexpected	1	MED
SI CLC	1	1.024 (1)	1.14	1.3E-06	1.0E-07	1	1.3E-06	1.0E-07	MED	Unexpected	1	MED
CL A	1	1.843	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED	Unexpected	1	MED
CL B	1	1.843	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED	Unexpected	1	MED
CL C	1	1.843 (1)	1.77	4.7E-05	5.4E-07	1	4.7E-05	5.4E-07	MED	Unexpected	1	MED
RHR HL	-	-	-	-	-	-	-	-	LOW	Not used for mitigation	-	LOW
HLA	-		-	-	-	-	-	-	LOW	Unexpected	2	LOW
HLB	-	-	-	-	-	-	-	-	LOW	Unexpected	2	LOW

							Risk Achievement Worth (RAW) Rank			LOOKUP Table Rank		
System	Exp. Time [YR]	RAW CDF	RAW LERF	CDF [1/YR]	LERF [1/YR]	Exp. Time [YR]	CCDP	CLERP	RANK	Frequency of Challenge	# of Backup Trains	Rank
HLC	-	-	-	-	-	-	-	-	LOW	Unexpected	2	LOW
RH CLA	0.25	1.839	-	4.7E-05	-	0.25	1.2E-05	-	MED	Unexpected	1	MED
RH CLB	0.25	1.839	-	4.7E-05	-	0.25	1.2E-05	-	MED	Unexpected	1	MED
RH CLC	0.25	1.839 (1)	-	4.7E-05	-	0.25	1.2E-05	-	MED	Unexpected	1	MED
								-				
SUMP-RH A	0.25	1.842	-	4.7E-05	-	0.25	1.2E-05	-	MED	Unexpected	1	MED
SUMP-RH B	0.25	1.401	-	2.2E-05	-	0.25	5.6E-06	-	MED	Unexpected	1	MED
RH-CSA	0.25	1.418	-	2.3E-05	-	0.25	5.8E-06	-	MED	Unexpected	1	MED
RH-CSB	0.25	1.224	-	1.3E-05	-	0.25	3.1E-06	-	MED	Unexpected	1	MED

* Containment Performance Affected

(1) RAW affected by asymmetry in PRA Model. LOCA events were modeled with failing CLC causing lower RAW than CLA or CLB. Therefor set CLC RAW =CLA RAW=CLB RAW

(2) A very short exposure time at power, and a continuing exposure in shutdown to possible LOCA events, are considered to have a "Half" train worth (0.1). LOCA events likelihood in shutdown is considered to be at least one order of magnitude lower than at power.

Table 3.8: **Guidelines for Assigning Consequence Categories to Combinations of Consequence Impacts**

Combination Event	Consequence Category
Initiating Event and less than 2 unaffected backup trains available for mitigation	HIGH
Initiating Event and at least 2, but less than 3, unaffected backup trains available for mitigation	MEDIUM (or IE category from Table 3.2, if higher)
Initiating Event and at least 3 unaffected backup trains available for mitigation	LOW (or IE category from Table 3.2, if higher)
Initiating Event and no additional mitigating ability affected	IE consequence category from Table 3.2

Table 3.9 **Guidelines for Assigning Consequence Categories to Pipe Failures Resulting in Increased Potential for an Unisolated LOCA Outside of Containment**

Protection Against LOCA Outside Containment	Consequence Category
One Active[1]	HIGH
One Passive[2]	HIGH
Two Active	MEDIUM
One Active, One Passive	MEDIUM
Two Passive	LOW
More than Two	NONE

Note 1: An Active Protection is presented by a valve that needs to close on demand.
Note 2: A Passive Protection is presented by a valve that needs to remain closed.

4.0 Results of Consequence Evaluation

4.1 Analysis Assumptions

In order to simplify and streamline the analysis, some assumptions are made without a detailed analysis, based on the analyst's judgment and experiences from previous analyses. The following are considered to be key analysis assumptions:

1. The plant PRA information (References 3, 5, 6, and 7) is used as the main input to the analysis. The model assumptions from the PRA are also accepted in this evaluation.

2. The lookup table from the EPRI Methodology TR (Table 3.5 in this report) is not used in the analysis. Instead, direct PRA information is used. Based on RAWs, CCDP values were estimated to evaluate a loss of mitigating ability.

3. It was concluded that consideration of the external initiators would not affect the consequence ranking (see Section 3.7).

4. Potential LOCAs are not analyzed further than one isolation valve. Isolable LOCAs inside containment are not analyzed further than one isolation valve. Isolable LOCAs outside containment are not analyzed further than two isolation valves.

5. SI system piping common for the recirculation and injection phases is assumed to fail during the injection phase.

6. A break in a FW line is assumed to lead to a loss of all main feedwater.

7. A break in a pump recirculation line is assumed to divert flow only before the flow orifice. After the orifice, the direct effect due to flow diversion is not considered.

8. It is assumed that Shutdown (S/D) cooling lines could fail on demand or in S/D operation.

9. Leak-before-break is not considered in the analysis.

10. Exposure time, during which an initiating event may occur following a pipe break, is determined as follows:

    - For a "demand" configuration, exposure time is equivalent to the test interval (typically quarterly, or 0.25 year) for tested systems, or to 1 year for portions of systems that are not functionally tested.

    - For an "operating" configuration, exposure time is the sum of the time needed to detect and isolate the pipe break, the allowed outage time (AOT) for the equipment disabled by the break, and the time the problem may extend into the transition from power into shutdown before correction. See further discussion in Section 3.3 – Exposure Time

11. The time available to isolate a pipe break is estimated only if isolation is possible and credited. Isolation time is based upon the critical event to be avoided, such as:

- The time required to flood RHR pumps.
- The time required to drain half the RWST inventory.
- The time required to flood an area to the level that will fail necessary isolation or mitigation equipment.

Additional guidelines regarding isolation capability are discussed in Section 4.3.

12. The RWST and discharge line(s) are assumed to be in the operating (rather than demand) configuration up to the ECCS pumps, because the line is normally pressurized.

13. A pipe break in the RWST discharge line is conservatively evaluated as a double-guillotine break, although previous ISI studies and flooding assessments have determined this line to have extremely low likelihood of break. No degradation mechanisms have been identified for this pipe, and it is believed pipe failure would occur in the form of a leak (200 to 500 gallons). This limit on postulated break size is not currently credited in the consequence evaluation.

14. For the case of containment bypass upon switchover to sump recirculation, the LERP is conservatively assumed to be 1.0, although there is no early core melt.

15. Previous design-basis and probabilistic analyses are based on steam line breaks no larger than 1 ft^2 (up to 14-inch diameter pipe), for which the MSIVs are assumed to close. Double-ended guillotine steam line breaks in larger pipes (e.g., 30 inch) outside containment may result in conditions that exceed the MSIV equipment qualification levels. An analysis documented in WCAP 10-544, however, states that for such large steam line breaks outside containment, the MSIVs will isolate prior to reaching their EQ temperature limit.

16. Further spatial analysis assumptions are discussed in Section 4.2.

17. Further isolation assumptions are discussed in Section 4.3.

18. The initiating event "ISLOCA" due to failure (open) of two shutdown cooling MOV's in series, 1-8702A and 1-8702A or 1-8701B and 1-8701B was not added to RHR pump discharge consequence segments which are located outside containment. This event has a "MEDIUM" rank. RHR pump discharge consequence segments already have a "HIGH" rank or "MEDIUM" rank, so "IS-LOCA" would not influence the final ranking.

19. Shutting down pumps would not significantly limit flow upstream of the pump. This is because of the elevation difference of the pump suction source (RWST) and the pump which results in gravity feeding to the pipe break downstream of the pump. Therefore, tripping the pump was not credited as a means of isolation.

20. Loss of half of the RWST outside containment (~ 226,900 GAL , Assuming Min RWST volume of 453,800 Gal) is assumed to fail sump (both RHR and SP) recirculation.

21. Flow through a worst case break was determined based on the following:

- For breaks in pump discharge lines, a break flow was assumed to be equivalent to the pump or pumps runout flow.

- For breaks in pump suction lines, the break flow was calculated based on the delta head between the pipe elevation and a full source (RWST), assuming an orifice break without any piping/fitting head losses.

22. The plant specific initiating event PST, Primary System Transient, was used for loss of the CVCS supplying normal RCS charging and RCP seal injection cases.

23. For RHR and SI hot and cold legs injection consequence segments in containment, which contain flow restriction orifices, it was assumed that a break upstream of the orifice would cause loss of the system where, as downstream breaks cause loss of the cold or hot leg.

24. The plant specific initiating events FLD2 (Flood 2) and FLD3 (Flood 3) were used for loss of Service Water Train A and B cases. For service water breaks within the RI-ISI scope, isolation of the break was not assumed since the isolation valves were located in the same pipe break area (indirect effect). Thus the break would cause reduction of flow to the remainder of heat loads cooled by SW, thus assumed failure of that train of SW.

25. It was assumed that water damage to motor operated valves would not cause the MOV to change position (no spurious actuation).

26. It was assumed that both the RHR sumps and Reactor Building Spray sumps are switched to at the same time during ECCS recirculation per the EOP's.

27. No isolation was assumed for pipe breaks in containment, since the initiating event (LOCA) would mask detection of the break location.

28. It was assumed that a hot leg injection is only required for Large and Medium LOCAs (not modeled in PRA).

4.2 Spatial Analysis

Information on the location of piping, the propagation paths from the location, the spatial impacts from the piping failure, and propagation (e.g., sprays, flooding) is required to assess the indirect impacts (e.g. flooding, impingement, etc.) in the consequence analysis. ISE Isometrics, (Reference 10), Arrangements (Reference 11), the PRA (Reference 3), and Internal Plant Flooding Analysis (Reference 4) were key inputs in the assessment of these impacts for each system. A plant-specific walkdown was conducted to confirm these spatial impacts.

Plant locations, as defined in the Appendix R fire study, were used in this analysis.
The list of equipment located in each area and the Appendix R fire areas were taken from the IPE Internal Flooding Analysis Notebook (Reference 4)

The description of each major plant location listed below contains the following information:

- Piping within the RI ISI analysis scope
- Important equipment and impact
- Propagation
- Detection

4.2.1. AB-74-09, AB-74-16, AB-74-17, Auxiliary Building Subbasement, RHR/Spray Pump Rooms A & B, Elevation 374'

The following piping within the RI-ISI analysis scope is located in this area:

10-, 14-inch RWST Suction RHR piping
8-, 10-12-inch Reactor Building Spray piping

Equipment located in this area and considered in the consequence analysis includes:

ITE-0604B-RH	Residual Heat Removal Discharge B RTD
XPP-0031B-RH	Residual Heat Removal (RHR) Pump B
XPP-0038B-SP	Spray Pump
ITE-0604A-RH	Residual Heat Removal Discharge A RTD
XPP-0031A-RH	Residual Heat Removal (RHR) Pump A
XPP-0038A-SP	Spray Pump
XAH-4B-VL	RHR/Spray Pump R#2 Cooling Unit
FIS-0602A-RH	Instrumentation
IFT-7368	Instrumentation
XAH-4A-VL	RHR/Spray Pump R#1 Cooling Unit
XFN-0049A-VL	Spray/RHR Pump Room A Cooling Unit Fan
XFN-0049B-VL	Spray/RHR Pump Room B Cooling Unit Fan

XPN-5441-SP Local Fuse Panel
XPN-5442-SP Local Fuse Panel
XPN-5443-RH Local Fuse Panel
XPN-5444-RH Local Fuse Panel
XPN-5453-VLLocal Fuse Panel
XPN-5454-VLLocal Fuse Panel

Propagation into this area would be from the upper elevations of the Auxiliary Building, through the open chase.

The following annunciators would alarm in the main control room a flooding condition:

AB SMP LVL HI
Leak Detect RB Spray Pump A Room Floor Drain 24 Level High
Leak Detect RHR Pump a Room Sump Leakage > 45 gpm
Leak Detect RB Spray Pump B Room Floor Drain 24 Level High
Leak Detect RHR Pump B Room Sump Leakage > 45 gpm

Elevation 374' available flooding floor area is 9269 ft^2. The worst postulated pump suction line break case would be the 14-inch RHR pump suction pipe, with a maximum flow rate of 58,313 gpm. This area would fill at a rate of .9 feet per minute. Assuming the RWST is emptied into the Auxiliary Building El 374, the flood level would be ≅7.5 ft.

The worst postulated RHR pump discharge line break case would be a 10-inch pipe, with a maximum flow rate of 5000 gpm. This area would fill at a rate of 0.07 ft/min.

The worst postulated Reactor Building Spray pump discharge line break case would be 10-inch pipe with a maximum flow rate of 4000 gpm. This area would fill at a rate of 0.06 feet/min.

SUMMARY/CONCLUSIONS FOR ELEVATION 374'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RHR Pump Normal Flow	3750	137	61
RHR Pump Runout Flow	5000	103	45
RB Spray Pump Normal Flow	2,500	206	91
RB Spray Pump Runout Flow	4000	129	57
RWST Suction line Gravity Flow	58,000	9	4

Spatial consequences due to RI-ISI analysis scope pipe breaks in this are area as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch RHR piping (RHR pump discharge)	Loss of RWST, Loss of RHR and SP Train B and A	Shutdown XPP-31B-RH, Shut 1-8809B, 1-8812B, 1-8701B, 18702B
10-inch SP piping (SP pump discharge)	Loss of RWST, Loss of RHR and SP Train A and B	Shutdown XPP-38B-SP, Shut 3001B-SP, 3005-SP, 3003-SP, 3010B-SP
12-inch SP piping (SP Pump RWST Suction)	Loss of RWST, Loss of RHR and SP Train A and B	Shut 3001B-SP
14-inch RHR (RWST Suction) pipe	Loss of RWST, Loss of RHR and SP Train A and B	Shut 1-8809B

4.2.2. AB-88-13, AB-88-19, Auxiliary Building, Subbasement, EL 388'

The following piping within the RI-ISI analysis scope is located in this area:

2 – inch CS/SI piping

14 – inch RHR piping

There is no equipment located in this area which was considered in the consequence analysis.

Propagation into this area would be from the upper elevations of the Auxiliary Building, through the open chase, open stairway.

There are no flood alarms in this area.

Elevation 388' available flooding floor area is 6444 ft^2. The worst postulated pump suction line break case would be the 14-inch RHR pump suction pipe, with a maximum flow rate of 59,000 gpm. The flood would propagate down to Elevation 374'.

The worst postulated Charging/SI pump discharge pipe would be a 2-inch discharge pipe, with a maximum flow rate of 1376 gpm (2 Charging/SI pumps). The flood would propagate down to Elevation 374'.

Flood levels on Elevation 388' can not be sustained.

Assuming the RWST is emptied into the Auxiliary Building, El 374, the flood level would be ≅7.5 ft.

SUMMARY/CONCLUSIONS FOR ELEVATION 388'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line Gravity Flow	54,000	10	4

Spatial consequences due to RI-ISI analysis scope pipe breaks in this are area as follows:

Pipe Break	Consequence	Isolation Possibility
2 – inch CS/SI piping	Loss of RWST, Loss of RHR and SP Train B and A	Shut 1-8133B, Shut XPP43B-CS
14-inch RHR (RWST Suction) pipe	Loss of RWST, Loss of RHR and SP Train A and B	Shut 1-8809B

4.2.3. AB-88-23, Auxiliary Building, Subbasement Charging Pump Room B, EL 388'

The following piping within the RI-ISI analysis scope is located in this area:

2-, 3-, 4-, 6-inch (RWST suction), 8-inch (RWST suction) CS/SI piping

Equipment located in this area and considered in the consequence analysis includes:

XPP-0043B-CS Charging/Safety Injection Pump B
XVT-8109B-CS MOV, Charging Pump B Miniflow

This equipment cannot be flooded or sprayed by in scope pipe breaks.

Propagation out of this area requires flow over a 6" curb exiting the room and flowing through the exit door, which swings away from the door jam (assume 1 foot of water would cause the doors to open).

The following annunciators will alarm in the main control room a flooding condition within AB-88-23:

Leak Detect CHG/SI Pump B Room Floor Drain 45 Level High

AB-88-23 floor area is 373 ft.^{2}. The worst postulated pump suction line break case would be an 8-inch Charging/SI Pump B suction pipe, with a maximum flow rate of 17,615 gpm. This area would fill at a rate of 6.3 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, General Area EL 388' and down to El 374'.

The worst postulated Charging/SI pump discharge pipe would be a 4-inch discharge pipe, with a maximum flow rate of 1376 gpm (2 Charging/SI pumps). This area would fill at a rate of .5 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, General Area EL 388' and down to El 379'.

Flood levels on Elevation 388' can not be sustained.

SUMMARY/CONCLUSIONS FOR ELEVATION 388'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line Gravity Flow	17,615	30	13

Spatial consequences due to RI-ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-8-inch CS/SI piping (CS/SI pump RWST suction)	Loss of RWST, SP and RHR Trains A and B	Shut 1-8131B, 1-LCV-115D, 1-8706B
2-, 3-, 4-inch CS/SI piping (CS/SI pump discharge)	Loss of RWST, SP and RHR Trains A and B	Shutdown XPP-43B-CS, Shut 1-8801B, 1-8801A, 1-8133B, 1-8131BB, 1-LCV-115D, 1-8760B

4.2.4. AB-88-24, Auxiliary Building, Subbasement Charging Pump Room C, EL 388'

The following piping within the RI-ISI analysis scope is located in this area:

2-, 3-, 4-, 6-(RWST suction), 8-inch (RWST suction) CS/SI piping

Equipment located in this area and considered in the consequence analysis includes:

XPP-0043C-CS Charging/Safety Injection Pump C
XVT-8109C-CS MOV, Charging Pump C Miniflow

Propagation out of this area requires flow over a 6" curb exiting the room and flowing through the exit door, which swings away from the door jam (assume 1 foot of water would cause the doors to open).

The following annunciators will alarm in the main control room a flooding condition within AB-88-24:

Leak Detect CHG/SI Pump C Room Floor Drain 50 Level High

AB-88-24 floor area is 430 ft.^{2}. The worst postulated pump suction line break case would be an 8-inch Charging/SI Pump C suction pipe, with a maximum flow rate of 17,615 gpm. This area would fill at a rate of 5.5 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, General Area EL 388' and down to El 374'.

The worst postulated Charging/SI pump discharge pipe would be a 4-inch discharge pipe, with a maximum flow rate of 1376 gpm (2 Charging/SI pumps). This area would fill at a rate of .4 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, General Area EL 388' and down to El 374'.

Flood levels on Elevation 388' can not be sustained.

SUMMARY/CONCLUSIONS FOR ELEVATION 388'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1733	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line Gravity Flow	17,615	30	13

Spatial consequences due to RI-ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-8-inch CS/SI piping (CS/SI pump RWST suction)	Loss of RWST, SP and RHR Trains A and B	Shut 1-8130B, 1-8131A, and 1-LCV-115E
2-, 3-, 4-inch CS/SI piping (CS/SI pump discharge)	Loss of RWST, SP and RHR Trains A and B	Shutdown XPP-43C-CS, Shut 1-8133A, 1-8132B, 1-8130B, 1-8131A and 1-LCV-115E

4.2.5. AB-88-25, Auxiliary Building, Subbasement Charging Pump Room A, EL 388'

The following piping within the RI-ISI analysis scope is located in this area:

2-, 3-, 4-, 6-(RWST suction), 8-inch (RWST suction) CS/SI piping
14-inch RHR piping (RWST suction)

Equipment located in this area and considered in the consequence analysis includes:

XPP-0043A-CS	Charging/Safety Injection Pump A
XVT-8109A-CS	MOV, Charging Pump A Miniflow

Propagation out of this area requires flow over a 6" curb exiting the room and flowing through the exit door, which swings away from the door jam (assume 1 foot of water would cause the doors to open).

The following annunciators will alarm in the main control room a flooding condition within AB-88-23:

Leak Detect CHG/SI Pump B Room Floor Drain 45 Level High

AB-88-25 floor area is 539 $ft.^2$. The worst postulated pump suction line break case would be a 14-inch RHR Pumps suction pipe, with a maximum flow rate of 53,941 gpm. This area would fill at a rate of 13.4 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, General Area EL 388' and down to El 374'.

Flood levels on Elevation 388' can not be sustained.

The worst postulated Charging/SI pump discharge pipe would be a 4-inch discharge pipe, with a maximum flow rate of 1376 gpm (2 Charging/SI pumps). This area would fill at a rate of.34 ft/min. Once the door is forced open (assumed the door opens with 1 foot of water), the flood would propagate through the Auxiliary Building, general area EL 388' and down to El 374'.

SUMMARY/CONCLUSIONS FOR ELEVATION 388'

FLOODING TIMES			
PUMP FLOW	FLOW RATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line CS/SI Gravity Flow	17,615	30	13
RWST Suction line RHR Gravity Flow	54,000	9	4

Spatial consequences due to RI-ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-, 8-inch CS/SI piping (CS/SI pump RWST suction)	Loss of RWST, SP and RHR Trains A and B	Shut 1-8706A, 1-LCV-115B, and 1-8130A
2-, 3-, 4-inch CS/SI piping (CS/SI pump discharge)	Loss of RWST, SP and RHR Trains A and B	Shutdown XPP-43A-CS, Shut 1-8885, 1-8884, 1-FCV-122, 1-8132A, 1-8706A
14-inch RHR piping (RWST suction to RHR pumps)	Loss of RWST, Loss of CS/SI, SP and RHR Train A and B	Shut 6700-SF

4.2.6. AB-97-02, AB-97-02N and AB-97-02S, Auxiliary Building Recirculation Valve Room, El. 397'

The following piping with the RI ISI analysis scope is located in this area:

10-, 12-, 14-inch RHR piping
12-inch RHR Shutdown Cooling piping from RCS
12-, 14-inch RHR piping (RWST suction)
8-, 10-, 12-inch Reactor Building Spray piping
12-inch Reactor Building Spray piping (RWST suction)
3-, 4-, 14-inch Safety Injection piping
8-inch Safety Injection piping (RWST suction)
8-inch CVCS piping

Equipment located in this area and considered in the consequence analysis includes:

XSM-0004B-SP	Spray System Recirc Sump Isolation Vlv Canister
XSM-0005B-SI	SI System Recirc Sump Isolation Valve Canister
XVG-3004B-SP	Motor Operated Valve
XVG-3005B-SP	Motor Operated Valve
XVG-8811B-SI	Motor Operated Valve
XVG-8812A-SI	Mtr Op Vlv, RH Pump A Suction Header
XVG-8812B-SI	Mtr Op Vlv, RH Pump B Suction Header
FCV-0602B-RH	RHR Pump B Miniflow Valve
XPN-5508-ES	Local Run Time Meter Panel
XVG-3001B-SP	Mtr Op Vlv, RWST to RB Spray Pump B Suction
FCV-0602A-RH	RHR Pump A Miniflow Valve
XSM-0005A-SI	SI Syst Recirc Sump Isolation Valve Canister
XVG-3001A-SP	Mtr Op Vlv, RWST to RB Spray Pump A Suction
XVG-3002A-SP	Motor Operated Valve
XVG-3002B-SP	Motor Operated Valve

XVG-3004A-SP Motor Operated Valve
XVG-3005A-SP Motor Operated Valve
XVG-8809A-SI Motor Operated Valve
XVG-8809B-SI Motor Operated Valve
XVG-8811A-SI Motor Operated Valve

Propagation out these areas would be from AB-97-01 through the doorway between AB-97-01 and AB-97-02. There is a wire gate in this doorway, thus allowing flow between areas. The flood can propagate further into El. 388' through the walkway between AB97-01 and AB-88-13S.

The following annunciators would alarm in the main control room a flooding condition within AB-97-02, AB-97-02N:

Leak Detection on Drain 9 Level High AB-397 SE Area
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 3 Level High
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 4 Level High
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 6 Level High
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 7 Level High
Leak Detection Drain 5 Level High AB-397-SE Area
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 8 Level High
Leak Detection RHR/CS Recirc VLV Area Alarm Drain 10 Level High

AB-97-02, 97-02S, and 97-02N's floor area available flooding is 6053 $ft.^2$. A line break in this area would flow into El. 388' and then propagate down to Elevation 374'. The worst postulated pump suction line break case would be a 14-inch RHR pump suction pipe with a maximum flow rate of 53,941 gpm

The worst postulated RHR discharge pipe break would be a 10-inch discharge pipe (single train) with a maximum run-out flow rate of 5000 gpm.

Flood levels on Elevation 397' can not be sustained.

SUMMARY/CONCLUSIONS FOR ELEVATION 397'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line CS/SI Gravity Flow	17,615	30	13
RHR Pump Normal Flow	3750	137	61
RHR Pump Runout	5000	105	45

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
Flow			
RB Spray Pump Normal Flow	2,500	206	91
RB Spray Pump Runout Flow	4000	129	57
RWST Suction line RHR Gravity Flow	54,000	10	4

Spatial consequences due to RI –ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch RHR Discharge Piping	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut XPP-31A or XPP-31B
12-, 14-inch RHR piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
8-, 10-, 12-inch Reactor Building Spray Discharge piping	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut XPP-38A-SP or XPP-38B-SP
12-inch Reactor Building Spray piping (RWST Suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
8-inch Safety Injection piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
3-, 4-, 14-inch Safety Injection piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 1-8132A, XPP-43A-CS

4.2.7. AB-00-01, Auxiliary Building, Subbasement shield slab, El. 400'

The following piping within the RI-ISI analysis swipe is located in this area:

12-inch Reactor Building Spray Piping (RWST suction)

14-, 20-inch RHR piping (RWST suction)

2-inch CVCS piping to RCP Seals

6-, 8-inch SI/CVCS Discharge Piping

3-, 4-inch SI/CVCS piping (RWST suction)

Equipment located in this area and considered in the consequence analysis includes:

ILI-0994-SF	Refueling Water Supply Tank Level Gauge
LCV-0115B-CS	MOV, Charging Pump A Suction Hdr RWST Iso Vlv
LCV-0115D-CS	MOV, Charging Pump B Suction Hdr RWST Iso Vlv

XVG-8130A-CS	Mtr Op Vlv, Charging Pump Sux A-C Cross Conx
XVG-8130B-CS	Mtr Op Vlv, Charging Pump Sux A-C Cross Conx
XVG-8131A-CS	Mtr Op Vlv, Charging Pump Sux B-C Cross Conx
XVG-8131B-CS	Mtr Op Vlv, Charging Pump Sux B-C Cross Conx
XVG-8132A-CS	Mtr Op Vlv, Charging Pump Discharge Isolation
XVG-8132B-CS	Mtr Op Vlv, Charging Pump Discharge Isolation
XVG-8133A-CS	Mtr Op Vlv, Charging Pump Discharge Isolation
XVG-8133B-CS	Mtr Op Vlv, Charging Pump Discharge Isolation

Propagation out this area would over flow from Elevation 400' down to Elevation 388' propagating down to Elevation 374'.

There are no flooding alarms in this area.

The worst postulated pump suction line break case would be a 20-inch RHR pump suction line from the RWST with a maximum flow rate of 102,000 gpm.

The worst postulated CS/SI Pump discharge pipe break would be a 8-inch discharge pipe (two trains) with a maximum run-out flow rate of 1376 gpm.

Flood levels on Elevation 400' can not be sustained.

SUMMARY/CONCLUSIONS FOR AREA AB-00-01

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	1513
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line RHR Gravity Flow	102,000	5	2

Spatial consequences due to RI –ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
14, 20-inch RHR piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
2-inch CS/SI piping to RCP Seals	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 1-8133B, Shut XPP-43B-CS
12-inch Reactor Building Spray piping (RWST Suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
6-, 8-inch Safety Injection piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 6700-SF
3-, 4-inch CS/SI piping (RWST suction)	Loss of RWST, Loss of SP, and RHR Trains A and B	Shut 1-8132A, XPP-43A-CS

4.2.8. AB-00-01C, Auxiliary Building, Subbasement shield slab, El. 400'

The following piping within the RI-ISI analysis swipe is located in this area:

8-inch SI/CVCS suction Piping (RHR)

There is no equipment located in this area which would be considered in the consequence analysis.

Propagation is out of this area into Elevation 388', then propagating down to Elevation 374'.

AB-00-01C available flooding area is 370 ft^2. The worst postulated pump suction line break case would be a 8-inch SI/CVCS suction piping with a maximum flow rate of 16,300 gpm.

Flood levels on Elevation 400' can not be sustained.

SUMMARY/CONCLUSIONS FOR AREA AB-00-01C

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RWST Suction line RHR Gravity Flow	16,300	32	14

Spatial consequences due to RI ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
8-inch SI/CVCS suction Piping (RHR)	Loss of RWST, Loss of SP and RHR Trains A and B	Shut 1-8706A, 1-LCV-115B 1-8130A

4.2.9. AB-00-01E, Auxiliary Building, Subbasement Shield Slab, Elevation 400'

The following piping within RI ISI analysis scope is located in this area:

8-inch SI/CVCS suction to RWST/RHR piping
3-, 4-inch SI/CVCS Discharge piping
12-inch Reactor Building Spray Suction to RWST piping

There is no equipment located in this area which would be considered in the consequence analysis.

Propagation is out of this area into Elevation 388', then propagating down to Elevation 374'.

AB-00-01E available flooding floor area is 380 ft^2. The worst postulated pump suction line break case would be a 12-inch Reactor Building Spray suction pipe with a maximum flow rate of 36,700 gpm.

The worst postulated SI/CVCS discharge pipe break would be a 4-inch discharge (2 trains) pipe with a maximum run-out flow rate of 1376 gpm.

Flood levels on Elevation 400' can not be sustained.

SUMMARY/CONCLUSIONS FOR AREA AB-00-01E

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line RB Spray, Gravity Flow	36,700	14	6
RWST Suction line RHR Gravity Flow	16,300	32	14

Spatial consequences due to RI ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
12-inch RHR piping (RWST suction)	Loss of RWST, Loss of SP and RHR Trains A and B	Shut 6700-SF
3-, 4-, 8-inch SI/CVCS Piping (Discharge)	Loss of RWST, Loss of SP and RHR Trains A and B	Shut XPP-43A-CS, XPP-43B-CS, XPP-43C-CS Shut Pump Suction Valves: 1-LCV-115B, D 1-8130A, B 1-8131A, B 1-8760A, B 1-LCV-115C, E

4.2.10. AB-00-01W, Auxiliary Building, Subbasement Shield Slab, Elevation 400'

The following piping within the RI ISI analysis scope is located in this area:

20-inch RHR suction piping

There is no equipment located in this area which would be considered in the consequence analysis.

Propagation out this area would be flood over flow from Elevation 400' down to Elevation 388' propagating down to Elevation 374'.

AB-00-01W available flooding floor area is 312 ft.[2] The worst postulated pump suction line break case would be a 20-inch RHR pump suction pipe with a maximum flow rate of 102,000 gpm.

Flood levels on Elevation 400' can not be sustained.

SUMMARY/CONCLUSIONS FOR AREA AB-00-01E

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RWST Suction line RHR Gravity Flow	102,000	5	2

Spatial consequences due to RI ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
20-inch RHR piping (RWST suction)	Loss of RWST, Loss of SI/CS, SP and RHR Trains A and B	Shut 6700-SF

4.2.11. AB-00-02, Auxiliary Building, Subbasement shield slab, Elevation 400'

The following piping within the RI-ISI analysis scope is located in this area:

8-inch SI/CVCS RWST Suction piping
3-inch SI/CVCS Discharge piping

Equipment located in this area and considered in the consequence analysis includes:

XAH-1A-VL	Charging Safety Inject Pump R#1 Cooling Unit
XAH-1B-VL	Charging Safety Inject Pump R#3 Cooling Unit
XAH-2-VL	Charging Safety Inject Pump R#2 Cooling Unit
XFN-0046A-VL	Charging/SI Pump Room A Supply Fan
XFN-0046B-VL	Charging/SI Pump Room B Supply Fan
XFN-0047-VL	Charging/SI Pump XPP-0043C-CS Room Fan
XPN-5521-VU	Local Isolation Fuse Panel
XPN-5522-VU	Local Isolation Fuse Panel
XPN-5523-VU	Local Isolation Fuse Panel
XVT-6372A-VU	Charging/SI Pump Room 2 Coil Inlet Valve
XVT-6372B-VU	Charging/SI Pump Room 2 Coil Alt Inlet Valve
XVT-6374A-VU	Charging/SI Pump Room 2 Outlet Isolation Valve
XVT-6404A-VU	Charging/SI Pump Room 2 Outlet Isolation Valve

XVT-6404B-VU	Charging/SI Pump Room 2 Alt Outlet Isolation Valve
XVT-6439A-VU	Charging/SI Pump Room 2 Inlet Valve
XVT-6439B-VU	Charging/SI Pump Room 2 Alt Inlet Valve
XVT-6524A-VU	SOV, XPP43A Aux L.O. Pump Cooling Water Isolation
XVT-6524B-VU	SOV, XPP43B Aux L.O. Pump Cooling Water Isolation
XVT-6524C-VU	SOV, XPP43C Aux L.O. Pump Cooling Water Isolation

Propagation out of this area into Elevation 388' would be over a 6-inch curb at Elevation 400', then propagating down to Elevation 374'.

There are no flooding alarms in this area.

AB-00-02 available flooding floor area is 1993 $ft.^2$. The worst postulated pump suction line break case would be an 8-inch SI/CVCS pump suction pipe with a maximum flow rate of 16,300 gpm. This area would fill at a rate of .3 ft./min, up to 6-inch curb in less than a minute, then overflow into Elevation 388'.

The worst postulated SI/CVCS discharge pipe break would be a 3-inch discharge (2 trains) pipe with a maximum run-out flow rate of 1376 gpm. AB-00-02 would fill to the 6" curb in 30 minutes, then overflow into Elevation 388', down to Elevation 374'.

SUMMARY/CONCLUSIONS FOR AREA AB-00-02

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RWST Suction line CS/SI Gravity Flow	16,300	32	14

Spatial consequences due to RI-ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
8-inch SI/CVCS piping (RWST suction)	Loss of RWST, Loss of SI/CS, SP and RHR Trains A and B	Shut 6700-SF
3-inch SI/CVCS Piping (Discharge)	Loss of RWST, Loss of SI/CS, SP and RHR Trains A and B	Shut XPP-43A-CS, XPP-43B-CS, XPP-43C-CS Shut Pump Suction Valves: 1-LCV-115B, D 1-8130A, B 1-8131A, B 1-8760A, B 1-LCV-115C, E

4.2.12. PAA-12-01, Auxiliary Building, West Penetration Access Area, Elevation 412'

The following piping within the RI-ISI analysis scope is located in this area:

12-inch RHR Suction piping (H/L S/D Cooling)
10-inch RHR Discharge piping (2 trains)
3-, 10-inch SI/CVCS Discharge piping (2 trains)
10-inch Reactor Building Spray Discharge piping (1 train)

Equipment located in this area and considered in the consequence analysis includes:

FCV-0122-CS	Charging Header Flow Control Valve
IFT-4496-SW	SW Booster Pump B Discharge Flow XMTR
XVG-0503A-BD	Steam Generator A Blowdown Isolation Valve
XVG-8107-CS	Charging Pump Discharge Header Isolation Valve
XVG-8108-CS	Charging Pump Discharge Header Isolation Valve
XVG-8887A-SI	Low Head to Hot Leg Cross-tie Valve
XVG-8887B-SI	Low Head to Hot Leg Cross-tie Valve
XVG-8888A-SI	Low Head t Cold Leg Cross-tie Valve
XVG-8889-SI	Low Head to Cold Leg Cross-tie Valve
XVT-8100-CS	Seal Water Return Isolation Valve 8100
XVT-8102A-CS	Seal Water Injection Filter Isolation Valve
XVG-8884-SI	High Head Hot Leg Injection Header Isolation MOV
XVG-8886-SI	High Head Hot Leg Injection Header Isolation MOV

There is no propagation in or out of this area from the Auxiliary Building since the doorways leading into AB-12-11N and AB-12-11 have Pressure HELB doors in place. There is a 3 inch gap in the floor near containment so flood flow could drain down into the tendon gallery.

The following annunciators would alarm in the control room a flooding condition within PAA-12-01:

Leak Detection Drain 20 Level High AB-412 W. Pen South
Leak Detection Drain 22 Level High Ab-412 W. Pen Middle
Leak Detection Drain 19 Level High AB412 W. Pen Middle
Leak Detection Drain 21 Level High AB-412 W. Pen Middle

PAA-12-01 available flooding floor area is 2769ft.^{2}. The worst postulated pump suction line break case would be a 12-inch RHR pump suction pipe with a maximum flow rate of 33,500 gpm. This area would fill at a rate of 1.6 ft/min.

SUMMARY/CONCLUSIONS FOR AREA PAA-12-01

FLOODING TIMES		
PUMP FLOW	FLOWRATE (GPM)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	165
RWST Suction line RHR Gravity Flow	33,500	7
RB Spray Pump Normal Flow	2,500	91
RB Spray Pump Runout Flow	4000	57
RHR Pump Normal Flow, 2 Pumps	7500	30
RHR Pump Normal Flow, 2 Pumps	10000	22

Spatial consequences due to RI-ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
12-inch RHR suction piping (H/L S/D Cooling)	Loss of RWST, RCP seal injection, charging, Train A RHR to cold leg injection, Both Trains of RHR to Hot Leg Injection	Shut 1-8701A, 1-8702A, 1-8812A, 1-8809A
10-inch RHR discharge piping (two trains)	Loss of RWST, RCP seal injection, charging, Train A RHR to cold leg injection, Both Trains of RHR to Hot Leg Injection	Shut XPP-31A-RH, Shut XPP-31B-RH Shut 1-FCV-605A, 1-HCV-803A, 1-FCV-605B, 1-HCV-803B
3-,10-inch SI/CVCS discharge piping (2 trains)	Loss of RWST, RCP seal injection, charging, Train A RHR to cold leg injection, Both Trains of RHR to Hot Leg Injection	Shut 1-8133A Shut XPP-43A-CS
10-inch Reactor Building Spray Discharge piping	Loss of RWST, RCP seal injection, charging, Train A RHR to cold leg injection, Both Trains of RHR to Hot Leg Injection	Shut XPP-38B-SP, Shut 3001B, 3005-SP

4.2.13. FH-12-01, Fuel Building, Boron Injection Tank Room, Elevation 412'

The following piping with the RI-ISI analysis scope is located in this area:

3-inch Safety Injection Cold Leg Injection Header (2 trains)

Equipment located in this area and considered in the consequence analysis includes:

8803A	Motor Operated Valve
8803B	Motor Operated Valve
1LT-1310-RC	Reactor Vessel Plenum Level XMTR
1PT-0403-RC	RCS Wide Range Pressure Transmitter
PT-403	Instrumentation
XTK-0027-SI	Boron Injection Tank
XVD-6242A-ND	Air Operated Valve
XVD-6442B	Air Op Valve, RB Sumps Discharge Header Drain
XVD-7136-WL	Air Operated Valve
XVD-7150-WL	Air Operated Valve
XVD-8028-RC	Air Operated Valve
XVD-8033-RC	Air Operated Valve
XVG-8801A-SI	Motor Operated Valve
XVG-8801B-SI	Motor Operated Valve

Propagation in or out of this area would be through a doorway from FH-12-01 into AB-12-11N. These doors open into AB-12-11N.

There are no flood alarms in FH-12-01.

FH-12-01 available flooding floor area is 822 $ft.^2$. The worst postulated discharge piping break case would be a 3-inch SI discharge header (2 trains) with a maximum run out flow of 1376 gpm. This area would fill at a rate of .2 ft./min. After filling one foot (5 minutes), the door to AB-12-11N would fail and would flood area FH-12-01 and AB-12-11, AB-12-11N. The flood would then propagate down to El. 374'.

SUMMARY/CONCLUSIONS FOR AREA FH-12-01

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
3-inch SI CL Injection Header (2 trains)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-43A, B, and C Shut 1-8133B, 1-8131B, 1-LCV-115D, and 1-8706B

4.2.14. AB-12-04, Auxiliary Building, RWST Area, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

20-inch suction header from RWST

Equipment located in this area and considered in the consequence analysis includes:

SC-2A Refueling Water Storage Tank

There is no propagation in or out of this area.

AB-12-01 available flooding floor area is 4600 $ft.^2$. A full RWST spill in this area would be contained in this area, , filling up to 15 feet.

No Consequence impact.

4.2.15. AB-12-05, Auxiliary Building, RHR HX Rooms and Partial Shield Slab, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

8-, 10-inch RHR discharge piping (single train)

Equipment located in this area and considered in the consequence analysis include:

FCV-0605B-RH	Air Op Vlv, RHR Heat Exchanger B Bypass
XHE-0005B-RH	RHR HX B
XVG-8706B-RH	Mtr Op Vlv, RHR to Charging Pump
XVT-8720B-RH	Letdown to RH Return B

Propagation out of this area would be through a doorway leading into AB-12-11, through a wire gate. Water would propagate down to Elevation 388' through an equipment hatch (grating) located just outside AB-12-05 and AB-12-06. This hatch is enclosed by a 6-inch berm where it meets AB-12-11. The flood would further propagate down to Elevation 374'.

The following annunciator would alarm in the control room a flooding condition with AB-12-05:

Leak Detection RHR Heat Exchangers B Room Alarm Drain 15 Level High

AB-12-05 available flooding floor area is 550 $ft.^2$. The worst postulated discharge piping break case would be a 10-inch RHR discharge pipe (single train) with a maximum run out flow of 5000 gpm.

SUMMARY/CONCLUSIONS FOR AREA AB-12-05

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RHR Pump Normal Flow	3750	137	61
RHR Pump Runout Flow	5000	105	45

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
8-, 10-inch RHR discharge piping (single train)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-31B-RH, Shut 1-8809B, 1-8701B, 1-8812B, and 1-8887A

4.2.16. AB-12-06, Auxiliary Building, RHR HX Rooms and Partial Shield Slab, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

8, 10-inch RHR discharge piping (single train)

Equipment located in this area and considered in the consequence analysis include:

FCV-0605A-RH	Air Op Vlv, RHR Heat Exchanger A Bypass
XHE-0005A-RH	RH HX A
XVG-8706A-RH	Mtr Op Vlv, RHR to Charging Pump
XVT-8702A-RH	Letdown to RH Return A

Propagation out of this area would be through a doorway leading into AB-12-11, through a wire gate. Water would propagate down to Elevation 388' through an equipment hatch (grating) located just outside AB-12-05 and AB-12-06. This hatch is enclosed by a 6-inch berm where it meets AB-12-11. The flood would further propagate down to Elevation 374'.

The following annunciator would alarm in the control room a flooding condition with AB-12-06:

Leak Detection RHR Heat Exchangers A Room Alarm Drain 8 Level High

AB-12-06 available flooding floor area is 550 ft.^{2}. The worst postulated discharge piping break case would be a 10-inch RHR discharge pipe (single train) with a maximum run out flow of 5000 gpm.

SUMMARY/CONCLUSIONS FOR AREA AB-12-06

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RHR Pump Normal Flow	3750	137	61
RHR Pump Runout Flow	5000	105	45

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
8-, 10-inch RHR discharge piping (single train)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-31B-RH, Shut Valves: 1-8809B, 1-8701B, 1-8812B, and 1-8887A

4.2.17. AB-12-11, Auxiliary Building, Basement Floor Area, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

10-inch RHR Discharge piping (2 trains)

Equipment located in this area and considered in the consequence analysis include:

IFE-7100-CC	CC Booster Pumps Suction Flow Element
IFS-7100A-CC	Booster Pumps CCW Flow Switch
IFS-7100B-CC	Booster Pumps CCW Flow Switch
XVB-9503B-CC	RHR Heat Exchanger B CC Inlet MOV
XVB-9524A-CC	Mtr Op Vlv, Non-essential Equipment Isolation
XVB-9524B-CC	Non-essential Equipment Isolation Valve

Propagation out of this area would be through doorways from, AB-26-01, AB-26-02 and FH-12-01. In addition, the flood would propagate down to Elevation 388, after flow over the 6 inch berms surrounding equipment hatchs (grating) on Elevation 412', with flow further propagating down to El. 377'.

There are no flood alarms in this area.

AB-12-11 available flooding floor area is 5119 $ft.^2$. The worst postulated discharge piping break case would be a 10-inch RHR discharge pipe (2 trains) with a maximum run-out flow of 10,000 gpm. This area would fill at a rate of .3 ft./min, then overflowing the berm and propagating into El. 374' within minutes.

SUMMARY/CONCLUSIONS FOR AREA AB-12-11

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RHR Pump Normal Flow, 2 Pumps	7500	69	30
RHR Pump Normal Flow, 2 Pumps	10000	52	22

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch RHR discharge piping (2 trains)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-31A-RH, XPP-31B-RH Shut Valves: 1-8809A, B 1-8701A, B 1-8812A, B 1-8887A, B

4.2.18. PAI-12-01, Intermediate Building, East Penetration Access Area, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

12-inch RHR suction from HL/SD

Equipment located in this area and considered in the consequence analysis includes:

XVG-503B-BD S/G B Blowdown Header Isolation AOV
XVG-503C-BD S/G C Blowdown Header Isolation AOV

Propagation into and out of this area would be through the doorway in to IB-12-02, which door opens into IB-12-02.

There are no flood alarms in this area.

PAI-12-01 available flooding floor area is 2720 ft.^{2}. The worst postulated suction pipe break case would be a 12-inch RHR suction pipe with a maximum flow of 33,400 gpm. This area would fill at a rate of 1.6 ft./min. The flood would propagate into IB-12-02 in less than a minute. Area IB-12-02 drains down to the Tendon Gallery. The volume of this area from El. 388' to El 412' is 447,700 gal. Assuming the loss of a RWST (514,665 gal.) and with an available flooding floor area of 19,860 $ft.^2$, the height in IB-12-02 and PAI-12-01 would be less than .5 feet.

SUMMARY/CONCLUSIONS FOR AREA PAI-12-01

FLOODING TIMES		
PUMP FLOW	FLOWRATE (GPM)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RWST Suction line RHR Gravity Flow	16,300	14

Spatial consequences due to RI-ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
12-inch RHR suction from HL/SD	Loss of RWST, Loss of CCW, Loss of both MD Aux Feed Pumps, Loss of Alternate Cold leg and Hot Leg Injection	Shut Valves: 1-8701B 1-8702B

4.2.19. IB-12-02, Intermediate Building, Basement Floor Area, CC and Aux Feed Pump Area, El. 412'

The following piping within the RI ISI analysis scope is located in this area:

3-inch SI Discharge piping (2 trains)
12-inch RHR suction from HL/SD

Equipment located in this area and considered in the consequence analysis includes:

DPN-1HX-ED	Battery Main Distribution Panel 1HX
1FT-3531	Instrumentation
1FT-3541-EF	Instrumentation
1FT-3551-EF	Instrumentation
1FT-3571A	Instrumentation
1FT-3571-EF	Instrumentation
1FT-3581A	Instrumentation
1FT-3581-EF	Instrumentation
1FV-3531-EF	Air Op Vlv, EF Flow Ctl MTR PP to Steam Gen A
1FV-3536-EF	Air Operated Valve
1FV-3541-EF	Air Op Vlv, EF Flow Ctl MTR PP to Steam Gen B
1FV-3546-EF	Air Operated Valve
1FV-3551-EF	Air Op Vlv, EF Flow Ctl MTR PP to Steam Gen C
1FV-3556-EF	Air Operated Valve
1FY-3531-EF	Signal Converter-Elec/Pnematic
1FY-3541-EF	Signal Converter-Elec/Pnematic
1FY-3551-EF	Signal Converter-Elec/Pnematic
1FY-3561-EF	Signal Converter-Elec/Pnematic

IPS-4521-SW	SW Booster Pump A Suct A Pressure Switch
IPS-4541-SW	SW Booster Pump A Suct B Pressure Switch
XBC-1X-2X-ED	Battery Charger 1X-2X
XBC-1X-ED	Battery Charger 1X
XFD-0089A-AH	Fire Damper
XFD-0091A-AH	Fire Damper
XFD-0093A-AH	Fire Damper
XFD-0095A-AH	Fire Damper
XFD-0136-AH	Fire Damper
XFD-0138-AH	Fire Damper
XFD-0139-AH	Fire Damper
XFD-0141-AH	Fire Damper
XFD-0151-VL	Fire Damper
XFD-0152-VL	Fire Damper
XHC-0047-AH	Battery Room A Ventil Syst Duct HC
XHC-0048-AH	Battery Room B Ventil Syst Duct HC
XHC-0051-AH	Battery Room B Ventil Syst Duct HC
XHE-0002A-CC	Service Water/CC HX
XHE-0002B-CC	Service Water/CC HX
XMD-0071-AH	Manual Damper
XMD-0073-AH	Manual Damper
XMD-0075-AH	Manual Damper
XMD-0077-AH	Manual Damper
XMD-0078-AH	Manual Damper
XMD-0079-AH	Manual Damper
XPN-5291-ED	Battery Charger (XBC1X-ED) Capacitor Box
XPN-5292-ED	Battery Charger (XBC1X2X) Capacitor Box
XPP-0001A-CC	Component Cooling Water Pump A
XPP-0001B-CC	Component Cooling Water Pump B
XPP-0001C-CC	Component Cooling Water Pump C
XPP-0045A-SW	Service Water Booster Pump A
XPP-0045B-SW	Service Water Booster Pump B
XVB-9519-CC	XPP-001C-CC Suct Header B Cross Conx Valve
XVB-9520-CC	XPP-001C-CC Suct Header B Cross Conx Valve
XVB-9521-CC	XPP-001C-CC Suct Header A Cross Conx Valve
XVB-9522-CC	XPP-001C-CC Suct Header A Cross Conx Valve
XVB-9523A-CC	XPP-001C-CC Discharge Header A Cross Conx Valve
XVB-9523B-CC	XPP-001C-CC Discharge Header B Cross Conx Valve
XVB-9523C-CC	XPP-001C-CC Discharge Header B Cross Conx Valve
XVB-9523D-CC	XPP-001C-CC Discharge Header A Cross Conx Valve
XVB-9526B-CC	Mtr Op Vlv, Non-essential Equipment Isolation
XVG-1001A-EF	Mtr Op Vlv, Emerg Feedwater Pump A Sux Isolation
XVG-1001B-EF	Mtr Op Vlv, Emerg Feedwater Pump B Sux Isolation
XVG-1037A-EF	MOV, Service Water Loop A Isolation
XVG-1037B-EF	MOV, Service Water Loop B Isolation
XVG-6516-VU	Mtr Op Vlv, Comp Cooling Pump Mtr Cooler Isolation
XVG-6517-VU	Mtr Op Vlv, Comp Cooling Pump C Mtr Cooler VU Alt Out Isolation
XVG-6518-VU	Mtr Op Vlv, Comp Cooling Pump C Mtr Cooler VU Alt Out Isolation

XVG-6519-VU	Mtr Op Vlv, Comp Cooling Pump Mtr Cooler Isolation
XVG-8885-SI	Motor Operated Valve
XVG-9627A-CC	Air Operated Valve
XVG-9627B-CC	Air Operated Valve
XVT-6362A-VU	XPP-0001C Mtr Chilled Wtr Alt Inlet Isolation Vlv
XVT-6362B-VU	XPP-0001C Mtr Chilled Wtr Alt Inlet Isolation Vlv
XVT-6378A-VU	XPP-0001C Mtr Chilled Wtr Inlet Isolation Vlv
XVT-6378B-VU	XPP-0001C Mtr Chilled Wtr Inlet Isolation Vlv
XVT-6379C-VU	XPP-0001C Mtr Chilled Wtr Outlet Isolation Vlv
XVT-6446B-VU	XPP-0001C Mtr Chilled Wtr Alt Outlet Isolation Vlv
XVT-6517-VU	XPP-0001C Mtr Chilled Wtr Isolation Vlv
XVT-6518-VU	XPP-0001C Mtr Chilled Wtr Isolation Vlv
XVX-9365C-SS	Solenoid Operated Damper
XVX-9398B-SS	Solenoid Operated Damper
XVX-9398C-SS	Solenoid Operated Damper

This area drains down into Tendon Gallery.

The following annunciator would alarm in the control room a flooding condition with IB-12-02:

IB SMP LVL HI

IB-12-02 available flooding floor area is 14,600 ft.^{2}. The worst postulated suction pipe break case would be a 12-inch RHR suction pipe with a maximum flow of 33,400 gpm. Area IB-12-02 drains down to the Tendon Gallery. The volume of this area from El. 388' to El 412' is 447,700 gal. Assuming the loss of a RWST (514,665 gal.) and with an available flooding floor area of 17,000 ft.^{2}, the height in IB-12-02 would be less than .5 feet.

SUMMARY/CONCLUSIONS FOR AREA IB-12-02

FLOODING TIMES		
PUMP FLOW	FLOWRATE (GPM)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow (2 Pumps)	300	150
CS/SI Pump Runout Flow (2 Pumps)	1376	33
RWST Suction line RHR Gravity Flow	16,300	14

Spatial consequences due to RI-ISI analysis scope pipe breaks in these areas are as follows:

Pipe Break	Consequence	Isolation Possibility
3-inch SI discharge piping (2 trains)	Loss of RWST, Loss of CCW, Loss of both MD Aux Feed Pumps	Shut 1-8132A, XPP-43A-CS, 1-8130A, 1-8706A
12-inch RHR suction from HL/SD	Loss of RWST, Loss of CCW, Loss of both MD Aux Feed Pumps	Shut Valves: 1-8701B 1-8702B

4.2.20. AB-26-01, Auxiliary Building, Basement Floor Area, Shield Slab, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

10-inch RHR Discharge piping (2 trains)
3-inch SI Discharge piping (2 trains)

There is no equipment located in this area which would be considered in the consequence analysis.

Propagation out this area would be over flow Elevation 412', down to Elevation 400', propagating down to Elevation 374' through Elevation 388'.

There are no flood alarms for this area.

AB-26-01 available flooding floor area is 4156 $ft.^2$. The worst postulated discharge piping break case would be a 10-inch RHR discharge piping break (2 trains) with a maximum run out flow of 10,000 gpm.

SUMMARY/CONCLUSIONS FOR AREA AB-26-01

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165
RHR Pump Normal Flow	7500	69	30
RHR Pump Runout Flow	10000	52	22

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch RHR discharge piping, (2 trains)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-31A-RH, Shut XPP-31B-RH Shut 1-FCV-605A, 1-HCV-803A, 1-FCV-605B, 1-HCV-803B
3-inch SI CL Injection Header (2 trains)	Loss of RWST, Loss of RHR and SP Trains A and B	Shut XPP-43A, B, and C Shut 1-8133B, 1-8131B, 1-LCV-115D, and 1-8706B

4.2.21. AB-26-02, Auxiliary Building, Basement Floor Area, Shield Slab, Elevation 412'

The following piping within the RI ISI analysis scope is located in this area:

10-inch Reactor Building Spray discharge piping (one train)

Equipment located in this area considered in the consequence analysis includes:

HCV-0142-CS	RHR Cleanup Header Flow Control Valve
LCV-0115C-CS	Mtr Op Vlv, VCT Outlet Isolation Valve
LCV-0115E-CS	Mtr Op Vlv, VCT Outlet Hdr Isolation Valve
XVG-8106-CS	Mtr Op Vlv, Charging Pump Miniflow
XVT-8409-CS	Letdown Header Bypass

Propagation out this area would over flow to Elevation 412', down to Elevation 400', propagating down to Elevation 374' through Elevation 388'.

AB-26-02 available flooding floor area is 588 $ft.^2$. The worst postulated discharge piping break would be a 10-inch RB Spray discharge pipe (1 train) with a maximum run-out flow of 4000 gpm

Flood levels in Elevation 426' can not be sustained.

SUMMARY/CONCLUSIONS FOR AB 26-02'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RB Spray Pump Normal Flow	2,500	206	91
RB Spray Pump Runout Flow	4000	129	57

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch Reactor Building Spray Discharge Piping (1 train)	Loss of RWST, Loss of RHR Trains A and B, SP Trains A and B, Loss of Charging, RCP Seal Injection, SI both Trains	Shut XPP-38B-SP Shut valves: 3001B-SP 3005-SP

4.2.22. PAA-36-01, Auxiliary Building, West Penetration Area, Elevation 436'

The following piping within the RI ISI analysis scope is located in this area:

18-inch Main Feedwater piping
6-, 8-, 10-, 14-, 32-inch Main Steam piping
10-inch Reactor Building Spray piping

Equipment located in this area considered in the consequence analysis includes:

IFT-0476-FW	Steam Gen A Feedwater Flow DP Transmitter
IFT-0477-FW	Steam Gen A Feedwater Flow DP Transmitter
IFT-4466-SW	SW Booster Pump A Discharge Flow Transmitter
IPV-2000-MS	Air Op Vlv, Main Steam Header A PORV
IPY-2000-MS	Signal Modifier
IVV-7096-CC	CCW Surge Tank Vent Valve
XVG-1009A-EF	Air Op Vlv, Steam Gen A EF Header Discharge Isolation
XVG-1611A-FW	Air Op Vlv, Main Feed to SG A Header Isolation
XVG-1689A-FW	MOV, FW Loop A Forward Flush Isolation
XVG-9568-CC	Mtr Op Vlv, Excess Letdown HX Inlet CC Hdr Isol
XVG-9608-CC	Mtr Op Vlv, RB CC Return Header
XVK-1633A-FW	Mtr Op Vlv, SG A Chem Feed Hdr Stop Check Valve
XVT-1678A-FW	Air Op Vlv, Main FW to SG A Warm-up Header Flow
XVT-2660-IA	Air Op Vlv, RB Instr Air Suppy Isolation
XVT-2877A-MS	Air Op Vlv, Main Stm Hdr A Moist Collect Drain
XVT-9357-SS	SOV, Pressurizer Sample header Isolation

Propagation out this area is down into PAA-12-01 through gaps in the floor next to containment.

There are no flood alarms for this area.

PAA-36-01 available flooding floor area is 2770 ft.^{2}. The worst postulated discharge piping break case would be an 18-inch main feedwater piping break. In this area flood height would be 18".

SUMMARY/CONCLUSIONS FOR PAA 36-01

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-, 8-, 10-, 14-, 32-inch Main Steam piping		Shut down Auxiliary feedwater and or Trip Main Feedwater Pump supplying the S/G A
18-inch Main Feedwater piping	Loss of CST	Shut down Auxiliary feedwater and or Trip Main Feedwater Pump supplying the S/G A
10-inch Reactor Building Spray piping	Loss of RWST	Shutdown Reactor Building Spray Pump

4.2.23. AB-36-16, Auxiliary Building, Valve Gallery, Elevation 436'

The following piping within the RI ISI analysis scope is located in this area:

2-inch SI/CS discharge piping to RCP Seals (2 trains)

Equipment located in this area considered in the consequence analysis includes:

LCV-0115A-CS	VCT Volume Control Valve
XVT-8105-CS	Seal injection Header Isolation MOV
XVT-8389-CS	Seal injection Header Isolation Bypass

Propagation out this area would be to flood Elevation 436' up to 6 inches, (berm height around equipment hatch made of grating) then overflow down to Elevation 400' and propagate down to Elevation 374' through Elevation 388'.

There are no flood alarms for this area.

The worst postulated discharge piping break (2 trains) would be an 2-inch SI/CS discharge pipe with a maximum run-out flow of 1376 gpm

SUMMARY/CONCLUSIONS FOR AREA AB 36-16'

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
CS/SI Pump Normal Flow, (2 Pumps)	300	1716	756
CS/SI Pump Runout Flow, (2 Pumps)	1376	374	165

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
2-inch SI/CS discharge piping to RCP Seals (2 trains)	Loss of RWST, Loss of RHR and SP Trains A and B, Loss RCP Seal Injection of	Shut XPP-43B, Shut 1-8133B, 1-8131B, 1-LCV-115D, and 1-8706B

4.2.24. AB-36-18, Auxiliary Building, Mezzanine Floor Area, Elevation 436'

The following piping within the RI ISI analysis scope is located in this area:

10-inch Reactor Building Spray Discharge (1 train)

Equipment located in this area considered in the consequence analysis includes:

ILS-2008-MS	Main Steam Header A Moisture Coll
IPT-0474-MS	S/G A Main Steam Header Pressure Transmitter
IPT-0475-MS	S/G A Main Steam Header Pressure Transmitter
IPT-0476-MS	S/G A Main Steam Header Pressure Transmitter
IPT-2000A-MS	Steam Generator A Outlet Pressure Trans-CREP
IPT-2000-MS	Steam Generator A Outlet Pressure Transmitter
XSW-1B3-ES	B Train 480V Unit Substation, Bus 1B3

Propagation after flooding Elevation 436' up to 6 inches, (berm height around equipment hatch made of grating) would be overflow down to Elevation 400' and propagating down to Elevation 374' through Elevation 388'.

There are no flood alarms for this area.

The worst postulated discharge piping break (1 trains) would be an 10-inch SP discharge pipe with a maximum run-out flow of 4000 gpm

SUMMARY/CONCLUSIONS FOR AREA AB 36-18

FLOODING TIMES			
PUMP FLOW	FLOWRATE (GPM)	TIME TO FLOOD RHR PUMP MOTOR (7.5' ABOVE FLOOR) (MIN)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RB Spray Pump Normal Flow	2500	206	91
RB Spray Pump Runout Flow	4000	129	57

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
10-inch Reactor Building Spray Discharge (1 train)	Loss of RWST, Loss of RHR and SP Trains A and B, loss of Bus 1B3	Shut XPP-38A, Shut 1-3001A, 1-3005A

4.2.25. PAI-36-01, Intermediate Building, East Penetration Area, Elevation 436'

The following piping within the RI ISI analysis scope is located in this area:

18-inch main Feedwater piping
6-, 8-, 14-, 32- Main Steam piping

Equipment located in this area considered in the consequence analysis includes:

IPT-0484-MS	Steam Generator B Steam Pressure Transmitter
IPT-0485-MS	S/G B Main Steam Header Pressure Transmitter
IPT-0486-MS	Instrumentation
IPT-0494-MS	S/G C Main Steam Header Pressure Transmitter
IPT-0495-MS	Steam Generator C Steam Pressure Transmitter
IPT-0496-MS	S/G C Main Steam Header Pressure Transmitter
IPT-2010A-MS	Steam Generator B Outlet Pressure Transmitter
IPT-2010-MS	Steam Generator B Outlet Pressure Transmitter
IPT-2010C-MS	Steam Generator C Outlet Pressure Transmitter
IPT-2020-MS	Steam Generator C Outlet Pressure Transmitter
IPY-2020-MS	Signal Modifier
XVG-1611B-FW	Air Op Vlv, Main FW to SG B Hdr Isolation Valve
XVG-1611C-FW	Air Op Vlv, Main FW to SG C Hdr Isolation Valve
XVG-1689B-FW	MOV, FW Loop B Forward Flush Isolation
XVG-1689C-FW	MOV, FW Loop C Forward Flush Isolation
XVG-2802A-MS	MOV, MS Header B EF Pump Turbine Supply
XVT-1678B-FW	Air Op Vlv, Main FW to SG B Warm-up Header Flow
XVT-1678C-FW	Air Op Vlv, Main FW to SG C Warm-up Header Flow
XVT-2877B-MS	Air Op Vlv, Main Stm Hdr B Moist Collect Drain
IPV-2020-MS	Air Op Vlv, Main Steam Power Relief – SG C
XVG-2802B-MS	MOV, MS Header C EF Pump Turbine Supply

Propagation out this area is down into PAI-12-01 through gaps in the floor next to containment.

There are no flood alarms for this area.

PAA-36-01 available flooding floor area is 2766 ft.^{2}. The worst postulated discharge piping break case would be an 18-inch main feedwater piping break. In this area flood height would be 18".

SUMMARY/CONCLUSIONS FOR AREA PAA 36-01

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-, 8-, 10-, 14-, 32-inch Main Steam piping		Shut down Auxiliary feedwater and or Trip Main Feedwater Pump supplying the S/G A
18-inch Main Feedwater piping	Loss of CST,	Shut down Auxiliary feedwater and or Trip Main Feedwater Pump supplying the S/G A

4.2.26. IB-36-02, Intermediate Building, Main Steam Header Area, Elevation 436'

The following piping within the RI ISI analysis scope is located in this area:

6-, 8-, 14-, 32- Main Steam piping

Equipment located in this area considered in the consequence analysis includes:

2802A	Motor Operated Valve
APN-1DA2-EM	240/120 VAC Distribution Panel
APN-1DA3-	240/120 VAC Distribution Panel
FE-7273	Instrumentation
FE-7273A	Instrumentation
FE-7273B	Instrumentation
IFE-0486-FW	Instrumentation
IFE-0496-FW	Instrumentation
IFT-0486-FW	Steam Gen B Feedwater Flow DP Transmitter
IFT-0487-FW	Steam Gen B Feedwater Flow DP Transmitter
IFT-0497-FW	Steam Gen C Feedwater Flow DP Transmitter
IFT-0498-FW	Steam Gen C Feedwater Flow DP Transmitter
IFV-0478-FW	AOV, Main Feedwater Reg Valve
IFV-04988-FW	AOV, Main Feedwater Reg Valve
IFV-0498-FW	AOV, Main Feedwater Reg Valve
IFV-3321-FW	Air Operated Valve,
IFV-3331-FW	Air Operated Valve,
IFV-3341-FW	Air Operated Valve,
ILS-2002-MS	Instrumentation
ILS-2012-MS	Instrumentation
ILS-2022-MS	Instrumentation
ILS-2028-MS	Instrumentation
IPT-0953-SI	RB Narrow Range Pressure Transmitter
IPV- 2010-MS	Air Op Vlv, Main Steam Power Relief – SG B
IPY-2010-MS	Signal Modifier
XVB-9526A-CC	Mtr Op Vlv, Non-essential Equipment Isolation
XVC-1009B-EF	MOV, SG B EF Header Disch Isolation Check Vlv
XVC-1009C-EF	MOV, SG C EF Header Disch Isolation Check Vlv
XVG-7501-AC	MOV, AC Suppy Header Containment Isolation
XVG-7504-AC	MOV, AC Suppy Header Containment Isolation
XVG-9600-CC	MOV, RC CC Suppy Header Isolation
XVK-1633B-FW	MOV, SG B Chem Feed Header Stop Check
XVK-1633C-FW	MOV, SG C Chem Feed Header Stop Check
XVM-2801A-MS	AOV, Main Steam Isolation Header A
XVM-2801B-MS	AOV, Main Steam Isolation Header B
XVM-2801C-MS	AOV, Main Steam Isolation Header C
XVT-2843A-MS	AOV, MS Header A Moisture Collector Drain

XVT-2843B-MS	AOV, MS Header B Moisture Collector Drain
XVT-2843C-MS	AOV, MS Header C Moisture Collector Drain
XVT-2869A-MS	Air Op Vlv, Main Steam Line A Bypass Isolation
XVT-2869B-MS	Air Op Vlv, Main Steam Line B Bypass Isolation
XVT-2869C-MS	Air Op Vlv, Main Steam Line C Bypass Isolation

This area drains down into IB-12-02 and down into the Tendon Gallery

There are no flood alarms for this area.

IB-36-02 available flooding floor area is 14,600 ft.^{2}. The worst postulated line pipe break case would be a 32-inch MS pipe.

SUMMARY/CONCLUSIONS FOR IB 36-02

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
6-, 8-, 10-, 14-, 32-inch Main Steam piping		Shut down Auxiliary feedwater and or Trip Main Feedwater Pump supplying the S/G A

4.2.27. PAA-63-03 Auxiliary Building, East Penetration Area, Elevation 463'

The following piping within the RI ISI analysis scope is located in this area:

10-inch Reactor Building Spray Discharge piping (1 train)
12-, 16- Service Water piping

Equipment located in this area considered in the consequence analysis includes:

IPT-0950-SI	Reactor Building Narrow Range Pressure XMTR
XVA-9311B-SS	AOV, Containment Air Sample Supply Isolation
XVB-3106A-SW	Reactor Building Inlet A Isolation Valve
XVG-3003A-SP	RB Spray Header A Supply MOV
XVG-3003B-SP	Mtr Op Vlv, RB Spray Header B Suppy
XVG-3103A-SW	Recirc Unit A Containment Isolation Valve
XVG-3107A-SW	Reactor Building Outlet A isolation valve
XVG-6067-HR	Air Op Valve, Alternate Purge Exhaust Isolation

This area drains down into PAA-36-01 further propagating to PAA-12-01 and then into the Tendon Gallery

There are no flood alarms for this area.

PAA-63-03 available flooding floor area is 1526 ft.^{2}. The worst postulated line pipe break case would be a 10-inch SP discharge pipe with a maximum run-out flow of 4000 gpm.

SUMMARY/CONCLUSIONS FOR AREA PAA 63-03

FLOODING TIMES		
PUMP FLOW	FLOWRATE (GPM)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
RB Spray Pump Normal Flow	2500	91
RB Spray Pump Runout Flow	4000	57
Service Water Booster Pump Post Accident Flow	2400	No Impact on RWST

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
12-, 16- Service Water piping	Loss of SP Train A	Shut XPP-45A-SW
10-inch Reactor Building Spray Discharge piping (1 train)	Loss of SW supply to Containment, Train A	Shut XPP-38A-SP

4.2.28. FH-63-01S, Fuel Handling Building Area, Elevation 463'

The following piping within the RI ISI analysis scope is located in this area:

12-, 16- Service Water piping

Equipment located in this area considered in the consequence analysis includes:

XVB-0001A-AH	AOV, Reactor Building Purge Supply Header
XVB-0002A-AH	AOV, Reactor Building Purge Exhaust Header
XVG-3106B-SW	Mtr Op Vlv, RB Inlet B isolation
XVG-3103B-SW	Recir Unit B Containment Isolation valve
XVG-3107B-SW	Mtr Op Vlv, RB Outlet B isolation

This area propagates into AB-63-01, spent fuel pool area.

There are no flood alarms for this area.

FH-63-01S available flooding floor area is 1753 ft.^{2}. The worst postulated line pipe break case would be a 16-inch SW pipe.

SUMMARY/CONCLUSIONS FOR FH 63-01S

FLOODING TIMES		
PUMP FLOW	FLOWRATE (GPM)	TIME TO EMPTY ½ RWST (453,800 GAL, MIN)
Service Water Booster Pump Post Accident Flow	2400	No Impact on RWST

Spatial consequences due to RI ISI analysis scope pipe breaks in this area are as follows:

Pipe Break	Consequence	Isolation Possibility
12-, 16- Service Water piping	None	Shut XPP-45A-SW

Walkdown

On November 04, 2001, a walkdown was performed at Virgil C. Summer Nuclear Station to assess potential spatial interactions (including effects on propagation paths) associated with splashing, spraying, and flooding. The following individuals participated in the walkdown

Roy Caban (SCE&G)
Dave Pepe (DE&S)

A summary of the major direct impacts from RI ISI analysis scope piping is presented below:

Auxiliary Building RI ISI analysis scope pipe breaks result in flood propagation to the RHR and Reactor Building Spray pump areas, Elevation 374'. If unisolated, these components will be flooded. Equipment on higher elevations cannot be flooded as water levels more than a couple of feet cannot be sustained. No direct flood impacts were identified other than on Elevation 374' due to the accumulation of water.

Intermediate Building RI ISI analysis scope pipe breaks result in flood propagation to the Tendon Gallery (no in-scope piping or required equipment), where water collects with no impact on equipment needed to mitigate risk.

The largest source of water potentially being released by a RI ISI analysis scope pipe break is the RWST. Flood levels within the Auxiliary Building would reach a maximum height of 7.5 feet in the area of the RHR pumps.

The major impact of flooding the RHR and Reactor Building Spray pump areas would be a loss of RHR pumps and reactor building spray pumps, thus, loss of containment sump recirculation.

This impact takes approximately the loss of the RWST (520,000 gallons) to cause a loss of RHR pumps.

Walkdown notes are summarized in Appendix B.

4.3 Isolation

The EPRI TR indicates that isolation of pipe breaks should be considered in the consequence analysis. Isolation can reduce the indirect effect of the pipe breaks, such as spatial impacts or loss of inventory. Isolation itself usually results in a loss of the isolated line.

The guidance provided in the EPRI TR states that isolation can be credited if the following conditions are met:

1. There is indication/alarm.
2. There is an alarm response procedure.
3. There is enough time to perform isolation.
4. Isolation equipment is not affected by the break.

Time to Isolate is the most controversial factor in evaluating isolation possibilities. The controversy begins when selecting the size of the break to evaluate. The guidance provided in the EPRI TR recommends analyzing the worst, double-ended guillotine break. At the same time, degradation mechanism analysis is performed for leaks larger than 50 gpm. Obviously, the actual break size can have a wide range between those two values, and it is conservative to evaluate a double-ended guillotine break.

Another parameter that is difficult to estimate is the actual flow rate. The rate is function of many factors, including pressures, pipe frictions, obstructing equipment, etc. Pump flow rates, or pump run out flow rates, are often used in the analysis.

Once the break size and flow rates have been estimated, the time to isolate is selected based on the most limiting factor. Limiting factors could be: time to reach a certain flood level in the area, time to propagate to another area, or time to drain a specific water source. In this analysis, the most limiting factor is the time it takes to drain one-half of the RWST (loss of recirculation due to potential loss of NPSH fron the containment sumps). Based on the analysis provided in Section 4.2, it would take approximately 520,000 gallons to flood the RHR pump motor located 7.5 ft. above the floor. Loss of one-half of the RWST is approximately 226,900 gallons (assuming a minimum RWST volume of 453,800 gallons).

Estimated times to disable RHR pumps and to drain one-half the RWST, for breaks in different piping based on the pump flow rates is provided in Table 4.1. Table 4.2 identifies the position of the valves needed for isolation.

In this analysis, isolation actions were credited if the above guidances are satisfied, and at least 45 minutes are available for isolation.

Based on this, the isolation was not considered in the following cases:

1) The break is in the pump suction lines, because of the short times available for isolation (see Assumption 21, and Section 4.2).
2) The break is in the pump discharge line, but two RHR pumps are pumping through the break.
3) The break is in the same room as the isolation equipment.

Isolation was credited for all other breaks. Credit is equivalent to one backup train (1E-2).

Note: Isolation of LOCAs outside containment during shutdown is a specific case, discussed in detail in the shutdown templates (Appendix D).

4.4 Summary of Initiating Events and Effects on Mitigating Ability

The scope of the analysis is illustrated on Figures 1-1 through 1-7 in Appendix A. The detailed Consequence Segments are provided in Appendix D.

The entries in segment evaluation forms refer to the configurations and FMEA elements described in Section 2. Each entry is described below.

Consequence Segment ID: The first entry identifies the consequence segments on which the consequence analysis was performed. The first letters identifies the system, for example: RCS, CVCS, SI, RHR, IL (injection lines), CS, MS, and FW.

Segment Functional ID: To better identify a consequence segment, this entry summarizes the segment's function, with short abbreviations.

Segment Description: This entry describes the consequence segment as the section of pipe between two major components (valves, pumps, etc.). Segments can also be positioned between a major component and a penetration between two areas (a change in pipe location could affect the consequences).

Configuration: This entry identifies the analyzed configuration, as described in Section 2.2 and Table 2.2. Configurations can be: O-Operating, S-Standby, D-Demand, S/D – Shutdown.

Analyzed Break Size: This entry identifies the pipe size

Spatial Effects: In this entry, the location of the break is identified. Spatial effects of the break, associated with given locations, can be found in Section 4.2.

Consequence Key: This entry identifies the consequence(s) analyzed for the specific segment, by an assigned abbreviation. The postulated breaks in the segments will have the identical consequence key and consequences and, therefore, the same CCDP and CLERP assigned (even though there is over 150 consequence segments in the VCSNS analysis, there is only approximately 50 different consequence combinations analyzed.)

Isolation: This entry identifies the means to isolate the break, and prevent the consequences. Any isolation valves: check valves (CV), motor-operated valves (MOV) or manual valves (MV) are identified in this column. If isolation is possible, but not credited (NC), or not important (NI), it is indicated in the column.

Time to isolate: This entry discusses estimated time to isolate and the basis for it.

Initiating Event: This entry identifies "initiating event," caused by PBF, as described in the FMEA (Section 2.3) and the initiating event impact group (Section 3.2). This entry also identifies an "assumed initiating event," if the demand configuration is being analyzed.

Exposure Time: This entry identifies exposure time as defined in Section 3.3.

Impacts on Mitigating Ability: Those multiple entries summarize the PBF impact on the plant's functions, systems, and subsystems. Impact for both, isolation success and isolation failure, are presented. Available trains for the corresponding safety functions are also identified. The information is organized in the following entries;

Disabled Trains (Direct Effects)
Disabled Trains (Indirect Effects)
Disabled Trains (ISO Success)
Available Trains (ISO Failure)
Available Trains (ISO Success)

Containment Isolation: This entry defines the status of the containment isolation.

LERF Effects: This entry defines the effects of the analyzed event on LERF.

CCDP Estimate: In this entry, the effect of PBF is measured by estimating corresponding CCDPs. CCDP values and their basis should be discussed.

CLERP Estimate: In this entry, the effect of PBF is measured by estimating corresponding CLERPs. CLERP values and their basis should be discussed.

Rank: In this column, the final rank for the consequence segment is determined, based on the evaluated CCDP or LERP value (or on the worst CCDP and LERP value, if multiple configurations are evaluated) and on numerical guidelines provided in Table 2.1.

4.5 New Summary Section With Number of Welds

The results of the consequence evaluation are provided in Attachment D. The majority of Class 1 piping breaks results in LOCA. Based on Table 3-2, large LOCA, medium LOCA and small LOCA are ranked in the "HIGH " consequence category.

Potential and isolable LOCAs based on Table 3.4 are ranked in the "MEDIUM" consequence category.

There are 2303 welds in the scope of this analysis. Attachment C provides a list of welds with the applicable consequence segment ID. Attachment D documents the consequence evaluation for each consequence segment ID. The following summarizes the number of welds in each consequence category:

Consequence Category	Number of Welds	Fraction of Total
Low	18	.008
Medium	1711	.743
High	574	.249

Table 4.1 **Pump Flow Rates and Times to Isolate Used in the VCSNS RI ISI Analysis**

Pumps	Design Flow Rate [gpm]	Assumed Run Out Flow Rate [gpm]	Time to Flood RHR Pumps, 515000 gal [min]	Time to Empty 1/2 RWST, 226,900gal, assuming RWST at Minimum Volume of 453,800 gals
1 SI Pump	150	689	747	329
2 SI Pumps	300	1378	373	164
1 RHR PUMP	3750	5000	103	45
2 RHR PUMPS	7500	10000	51	22
1 SP PUMP	2500	4000	128	56
2 SP PUMPS	5000	8000	64	28

Table 4.2 Valves That Could Be Considered In Break Isolation

Valve	Function	Elevation	Location Fire Zone	Elevation (FEET)
1-8131B	Charging Pump Suction, B-C Cross Connection	401	AB-00-01	400
1-8131A	Charging Pump Suction, B-C Cross Connection	401	AB-00-01	400
1-8130A	Charging Pump Suction, A-C Cross Connection	401	AB-00-01	400
1-8130B	Charging Pump Suction, A-C Cross Connection	401	AB-00-01	400
1-LCV-115B	Charging Pump A Suction Header RWST Isolation Valve	401	AB-00-01	400
1-LCV-115D	Charging Pump B Suction Header RWST Isolation Valve	401	AB-00-01	400
1-8809A	RHR Pump A Suction from RWST	400	AB-97-02S	397
1-8809B	RHR Pump B Suction from RWST	400	AB-97-02S	397
1-8702A	RHR Loop A Inlet Isolation	-	Containment	
1-8701A	RHR Loop A Inlet Isolation		Containment	
1-8702B	RHR Loop C Inlet Isolation	-	Containment	
1-8701B	RHR Loop C Inlet Isolation	-	Containment	
1-8801A	High Head Cold Leg Injection Isolation	413	FH-12-01	412
1-8801B	High Head Cold Leg Injection Isolation	417	FH-12-01	412
1-8888A	Low Head to Cold Leg Header Isolation	413	PAA-12-01	412
1-8888B	Low Head to Cold Leg Cross Tie	413	PAA-12-01	412
1-8889	Low Head to Cold Leg Cross Tie	413	PAA-12-01	412
1-3001A-SP	RB Spray Pump A Suction from RWST	399	AB-97-02S	397
1-3001B-SP	RB Spray Pump B Suction from RWST	399	AB-97-02S	397
1-3003A-SP	RB Spray Header A Supply	464	PAA-63-03	463
1-3003B-SP	RB Spray Header B Supply	464	PAA-63-03	463
1611A-FW	Steam Generator A Feedwater Isolation Valve	439	PAA-36-01	436
1611B-FW	Steam Generator A Feedwater Isolation Valve	440	PAI-36-01	436
1611C-FW	Steam Generator A Feedwater Isolation Valve	445	PAI-36-01	436

Table 4.3 VCSNS Consequence Segments

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
			REACTOR COOLANT SYSTEM													
1	RCS11	HLA	HLA, Reactor Vessel to SG1, XSG-2A-RC	RC	29	7	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
1	RCS12	XLA	XLA, XSG-2A-RC to RCP XPP-30A-RC	RC	31	7	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
1	RCS13	CLA	CLA, XPP-30A-RC to Reactor Vessel	RC	27.5	4	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
1	RCS14	WCA-XL	Weld Cap from XLA	RC	3	2	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3.6E-03	3.5E-05	HIGH
1	RCS15A	LD	XLA L/D, XLA to 1-LCV-460	CS	3	20	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3.6E-03	3.5E-05	HIGH
1	RCS15B	LD-ISO	XLA L/D, 1-LCV-460 to 1-LCV-459	CS	3	2	CONT	O	N/A	IMLO(AOV)	AOV: 1-LCV-460	LOCA Std	IMLO(AOV)	7.2E-06	7.0E-08	MEDIUM
1	RCS15C	DRA	XLA, XLA L/D 3"x2" Reducer To 1-8057A	CS	2	4	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3.4E-03	3.4E-05	HIGH
1	RCS15D	DRA-ISO	XLA L/D, 1-8057A to 1-8058A	CS	2	2	CONT	O	N/A	PSLOC(MV)	MV: 1-8057A	LOCA Std.	PSLOC(MV)	1.5E-05	1.5E-07	MEDIUM
1	RCS16	WCA-CL	Weld Cap from CLA	RC	2	2	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3.4E-03	3.4E-05	HIGH
1	RCS21	HLB	HLB, Reactor Vessel to SG1, XSG-2B-RC	RC	29	5	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
1	RCS22	XLB	XLB, XSG-2B-RC to RCP XPP-30B-RC	RC	31	7	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3.8E-03	3.5E-05	HIGH
1	RCS23	CL B	CLB, XPP-30B-RC to Reactor Vessel	RC	27.5	4	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3.8E-03	3.5E-05	HIGH
1	RCS24	WCB-XL	Weld Cap from XLB	RC	3	2	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3.6E-03	3.5E-05	HIGH
1	RCS25A	DRB	XLB Drain A, XL2 to 1-8057B	RC	2	5	CONT	O	N/A	SLOC	NO	LOCA Std.	SLOC	3.4E-03	3.4E-05	HIGH

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
1	RCS25B	DRB-ISO	XLB Drain A, 1-8057B to 1-8058B & Flow Restrictor	RC	2	5	CONT	O	N/A	PSLOC(MV)	MV: 1-8057B	LOCA Std.	PSLOC(MV)	1.5E-05	1.5E-07	MEDIUM
1	RCS26	WCB-CL	Weld Cap from XLB	RC	2	2	CONT	O	N/A	SLOC	NO	LOCA Std.	SLOC	3.4E-03	3 4E-05	HIGH
1	RCS31	HLC	HLC, Reactor Vessel to SG3, XSG-2C-RC	RC	29	5	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
1	RCS32	XLC	XLC, XSG-2C-RC to RCP XPP-30C-RC	RC	31	7	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3 8E-03	3 5E-05	HIGH
1	RCS33	CL C	CLC, XPP-30C-RC to Reactor Vessel	RC	27.5	4	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3 8E-03	3 5E-05	HIGH
1	RCS34	WCC-XL	Weld Cap from XLC	RC	3	2	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
1	RCS35A	DRC	XLC Drain , XLC to 1-8057C	RC	2	10	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3 4E-03	3 4E-05	HIGH
1	RCS35B	DRC-ISO	XLC Drain , 1-8057C to 1-8058C	RC	2	2	CONT	O	N/A	PSLOC(MV)	MV: 1-8057C	LOCA Std.	PSLOC(MV)	1.5E-05	1.5E-07	MEDIUM
1	RCS36	WCB-CL	Weld Cap from CLC	RC	2	2	CONT	O	N/A	SLOC	NO	LOCA Std.	SLOC	3 4E-03	3 4E-05	HIGH
1	RCS37	PZR SRG HLA	Pressurizer Surge, HLA to Pressurizer	RC	14	14	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3 8E-03	3.5E-05	HIGH
1	RCS51	PZR SV1	Pressurizer to Relief Valve 1-8010A	RC	6	11	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3.5E-05	HIGH
1	RCS52	PZR SV2	Pressurizer to Relief Valve 1-8010B	RC	6	11	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3.5E-05	HIGH
1	RCS53	PZR SV3	Pressurizer to Relief Valve 1-8010C	RC	6	11	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3.6E-03	3.5E-05	HIGH
1	RCS54	PZR PORVS	Pressurizer to Block Valves 1-8000A, 1-8000B, 1-8000C	RC	3, 6, 8?	31	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3 5E-05	HIGH
1	RCS55	PZR PORV A	Block Valve 1-8000A to PORV 1-PCV-445A	RC	3	4	CONT	O	N/A	MLO	NC: MOV: 1-8000A	LOCA Std	MLO	3 6E-03	3 5E-05	HIGH
1	RCS56	PZR PORV B	Block Valve 1-8000B to PORV 1-PCV-444B	RC	3	2	CONT	O	N/A	MLO	NC: MOV: 1-8000B	LOCA Std.	MLO	3 6E-03	3.5E-05	HIGH
1	RCS57	PZR PORV C	Block Valve 1-8000C to PORV 1-PCV-445B	RC	3	2	CONT	O	N/A	MLO	NC: MOV: 1-8000C	LOCA Std.	MLO	3.6E-03	3 5E-05	HIGH

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
1	RCS58	PZR SPR CLA	PZR Spray: CLA to 1-PCV-444D	RC	4	25	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
1	RCS59	PZR SPR CLC	PZR Spray: CLC to 1-PCV-444C	RC	4	33	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
1	RCS60	PZR SPR	PZR Spray: 1-PCV-455D and 455C to PZR Nozzle	RC		20	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
			CVCS													
2	CVCS01	CSN-ISO	CVCS Normal: 1-8346 to 1-8379	CS	3	6	CONT	O	N/A	PMLO(CV)	CV: 1-8379	LOCA Std.	PMLO(CV)	1.6E-05	1.5E-07	MEDIUM
2	CVCS02	CSN-CLA	CVCS Normal. 1-8379 to CLA	CS, RC	3	5	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3 5E-05	HIGH
2	CVCS03	CSN-ISO	CVCS Alt: 1-8347 to 1-8378	CS	3	6	CONT	O	N/A	PMLO(CV)	CV:1-8378	LOCA Std.	PMLO(CV)	1.6E-05	1.5E-07	MEDIUM
2	CVCS04	CSN-CLA	CVCS Alt· 1-8378 to CLB	CS, RC	3	7	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3.6E-03	3.5E-05	HIGH
2	CVCS05	PZR AUX SPR - ISO	CVCS Aux Spray: 1-8145 to 1-8377	CS	2	52	CONT	O	N/A	PSLOC(CV)	CV: 1-8377	LOCA Std	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
2	CVCS06	PZR AUX SPR	CVCS Aux Spray: 1-8377 to HDR Tee	CS	2	3	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3.4E-03	3 4E-05	HIGH
			RWST													
2	RWST-C-01	RWST-AB1204	RWST Discharge in AB-12-04, Between RWST XTK-25-RW and AB-12-04/AB-00-01W Pen	SI	20	4	AB-12-04	SB	36	Possible LOCA	NO	RWST	RWST	5.1E-06	1.0E-06	MEDIUM
2	RWST-C-02	RWST-AB0001W	RWST Discharge in AB-00-01W, Between AB-12-04/AB-00-01W Pen and AB-00-01W/AB-00-01 Pen	SI	20	5	AB-00-01W	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1.0E-06	MEDIUM
2	RWST-C-03	RWST-CVCS/SI	RWST Discharge in AB-00-01, Between AB-00-01W/AB-00-01 Pen and AB-00-01/AB88-13S Pen, AB-00-01E Pen and MOVs 1-LCV-115B and 1-LCV-115D	CS, SI, SP	8,12,14,20	22	AB-00-01	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1.0E-06	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [In]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	RWST-C-04	RWST-AB8813S	RWST Discharge in AB-88-13S, Between AB-00-01/AB-88-13S Pen and AB-88-13S/AB88-25 Pen	SI	14	5	AB-88-13S	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1 0E-06	MEDIUM
2	RWST-C-05	RWST-AB8825	RWST Discharge in AB-88-25, Between AB-88-13S/AB88-25 Pen and AB-88-25/AB-97-02S Pen	SI	14	3	AB-88-25	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5 1E-06	1 0E-06	MEDIUM
2	RWST-C-06	RWST-RHR	RWST Discharge in AB-97-02S, Between AB-88-25/AB-97-02S Pen and AB-97-02S/PAA-12-01 Pen (toward 1-8881) and MOVs 1-8809B and 1-8309A	SI	8,14	23	AB-97-02S	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1 0E-06	MEDIUM
2	RWST-C-07	RWST-RHR Recirc	RWST Discharge, Between AB-97-02S/PAA-12-01 Pen and MV 1-8881 (Flow Change) -From RHR Between MV-1-8881 & PAA12-01/AB-97-02S	SI	8	8	PAA-12-01	SB	36	Possible LOCA	NO	RWST	RWST	5.1E-06	1 0E-06	MEDIUM
2	RWST-C-08	RHR-SP1	RWST Discharge toward MOVs 3001A-SP and 3001B-SP in Area AB-00-01E	SP	12	4	AB-00-01E	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1 0E-06	MEDIUM
2	RWST-C-09	RHR-SP2	RWST Discharge toward MOVs 3001A-SP and 3001B-SP in Area AB-97-02E, Between AB-00-01E/AB-97-02 Pen and MOVs 3001A-SP & 3001B-SP	SP	12	22	AB-97-02N/AB-97-02S	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5 1E-06	1 0E-06	MEDIUM
2	RWST-C-10	SP-RECIRC1	RB Spray Recirculation to RWST, Between MV 3011-SP and Flow Orifice XPS-67-SP	SP	8	4	AB-74-16	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1.0E-06	MEDIUM
2	RWST-C-11	SP-RECIRC2	RB Spray Recirculation to RWST, Between Flow Orifice XPS-67-SP and AB-74-16/AB-97-02 Pen	SP	8	13	AB-74-16	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1.0E-06	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	RWST-C-12	SP-RECIRC3	RB Spray Recirculation to RWST, Between AB-74-16/AB-97-02 Pen and AB-97-02/AB-00-01W Pen	SP	8	9	AB-97-02	SB	36	Possible LOCA	NO	RWST/RHR	RWST (RHR)	5.1E-06	1.0E-06	MEDIUM
			SAFETY INJECTION													
2	SI-C-01	SI-SUCT COM	SI/Charging Pump Suction Common Line to Pumps, Between 1-LCV-115B, 1-LCV-115D, AB-00-01/AB-00-01E Penetrations To Pumps, (RHRA) Pen AB-00-01C/AB-00-01and (RHRB) Pen AB-00-02/AB-00-01	CS	8	38	AB-00-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-02A	SIA-SUCT-AB0001E	SI/Charging Pump A Suction, Between AB-00-01/AB-00-01E Pen and AB-00-01E/AB-88-25 Pen in AB-00-01E	CS	8	1	AB-88-25	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-02B	SIB-SUCT-AB0001E	SI/Charging Pump B Suction, Between AB-00-01/AB-00-01E Pen and AB-00-01E/AB-88-23 Pen in AB-00-01E	CS	8	2	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-02C	SIC-SUCT-AB0001E	SI/Charging Pump C Suction, Between AB-00-01/AB-00-01E Pen and AB-00-01E/AB-88-24 Pen in AB-00-01E	CS	8	4	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-03A	SIA-SUCT-AB8825	SI/Charging Pump A Suction, Between AB-00-01E/AB-88-25 Pen and Pump XPP-43A-CS	CS	6,8	17	AB-88-25	O	N/A	Loss of CVCS	YES. CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-03B	SIB-SUCT-AB8823	SI/Charging Pump B Suction, Between AB-00-01E/AB-88-23 Pen and Pump XPP-43B-CS	CS	6,8	21	AB-88-23	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-03C	SIC-SUCT-AB8824	SI/Charging Pump C Suction, Between AB-00-01E/AB-88-24 Pen and Pump XPP-43C-CS	CS	6,8	18	AB-88-24	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SI-C-04A	SIA/RHRA-AB0001C	SI/Charging Pump A Suction from RHRA, Between AB-00-01/AB-00-01C Pen and AB-00-01C/AB-00-01E Pen in AB-00-01C	CS	8	3	AB-00-01C	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-04B	SIB/RHRB-AB0002	SI/Charging Pump B Suction from RHRB, Between AB-00-01/AB-00-02 Pen and AB-00-02/AB-97-02 Pen in AB-00-02	CS	8	14	AB-00-02	O	N/A	Loss of CVCS	YES. CVCS Suction MOVs	CVCS, SI	PST	2 1E-06	1 5E-08	MEDIUM
2	SI-C-05A	SIA/RHRA-AB0001E	SI/Charging Pump A Suction from RHRA, Between AB-00-01C/AB-00-01E Pen and AB-00-01E/AB-97-02 Pen in AB-00-01E	CS	8	7	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-05B	SIB/RHRB-AB9702	SI/Charging Pump B Suction from RHRB, Between AB-00-02/AB-97-02 Pen and AB-97-02/AB-12-05 Pen in AB-97-02	CS	8	7	AB-97-02	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2 1E-06	1.5E-08	MEDIUM
2	SI-C-06A	SIA/RHRA-AB9702	SI/Charging Pump A Suction from RHRA, Between AB-00-01E/AB-97-02 Pen and MOV 1-8706A	CS	8	11	AB-97-02	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-06B	SIB/RHRB-AB1205	SI/Charging Pump B Suction from RHRB, Between AB-97-02/AB-12-05 Pen and MOV 1-8706B	CS	8	3	AB-12-05	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-07A	SIA-DISCHA1	SI/Charging Pump A Discharge, Between Pump XPP-43A-CS and CVs 1-8480A and 1-8481A	CS	2,3,4	8	AB-88-25	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2 7E-06	2.3E-08	MEDIUM
											YES. 1-LCV-115B and MOVs 1-8130A or 1-8130B	SIA	SIA (ISO=S)	5 8E-06	8.1E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SI-C-07B	SIB-DISCHB1	SI/Charging Pump B Discharge, Between Pump XPP-43B-CS and CVs 1-8480B and 1-8481B	CS	2,3,4	8	AB-88-23	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MEDIUM
											YES: MOVs (1-8130B or 1-8130A) and (1-8131A or 1-8131B)	SIB	SIB (ISO=S)	8.3E-06	1.9E-07	MEDIUM
2	SI-C-07C	SIC-DISCHC1	SI/Charging Pump C Discharge, Between Pump XPP-43C-CS and CVs 1-8480C and 1-8481C	CS	2,3,4	8	AB-88-24	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MEDIUM
											YES: 1-LCV-115D and MOVs 1-8131A or 1-8131B	SIC	SIC (ISO=S)	8.3E-06	1.9E-07	MEDIUM
2	SI-C-08A	SIA-DISCHA2	SI/Charging Pump A Discharge, Between CV 1-8481A and MV 1-8485A	CS	3	7	AB-88-25	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2 1E-06	1.5E-08	MEDIUM
2	SI-C-08B	SIB-DISCHB2	SI/Charging Pump B Discharge, Between CV 1-8481B and MV 1-8485B	CS	3	7	AB-88-23	O	N/A	Loss of CVCS	YES· CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-08C	SIC-DISCHC2	SI/Charging Pump C Discharge, Between CV 1-8481C and MV 1-8485C	CS	3	6	AB-88-24	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-09A	SIA-DISCH-AB8825	SI/Charging Pump A Discharge, Between MV 1-8485A and Penetrations AB-88-25/AB-00-01E & AB-88-25/AB-00-02E	CS, SI	3	21	AB-88-25	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-09B1	SIB-DISCH-AB8823	SI/Charging Pump B Discharge, Between MV 1-8485B and Penetrations AB-88-23/AB-00-01E & AB-88-23/AB-88-24 (toward 1-8886)and AB-88-23/AB-88-24 (toward 1-8801B)	CS, SI	3,4	22	AB-88-23	Q	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SI-C-09B2	SIB-DISCH-AB0001E	SI/Charging Pump B Discharge, Between AB-88-23/AB-00-01E Pen and AB-00-01E/AB-00-01 Pen in AB-00-01E	CS	4	4	AB-00-01E	O	N/A	Loss of CVCS	YES. CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1 5E-08	MEDIUM
2	SI-C-09C1	SIC-DISCH-AB8824	SI/Charging Pump C Discharge, Between MV 1-8485C and Penetrations AB-88-24/AB-00-01E	CS	3	5	AB-88-24	O	N/A	Loss of CVCS	YES. CVCS Suction MOVs	CVCS, SI	PST	2 1E-06	1.5E-08	MEDIUM
2	SI-C-09C2	SIC-DISCH-AB0001E	SI/Charging Pump C Discharge, Between AB-88-24/AB-00-01E Pen and AB-00-01E/AB-00-01 Pen in AB-00-01E	CS	3	5	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1 5E-08	MEDIUM
2	SI-C-10A1	SICVCS-AB0002E	SI/Charging Pump Discharge to CVCS, Between AB-88-25/AB-00-02E Pen and AB-00-02E/PAA-12-01 Pen in AB-00-02E	CS	3	1	AB-00-02E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1 5E-08	MEDIUM
2	SI-C-10A2	SIACVCS-PAA1201	SI/Charging Pump Discharge to CVCS, Between AB-00-02E/PAA-12-01 Pen and MV 1-8402B	CS	3	9	PAA-12-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2 1E-06	1 5E-08	MEDIUM
2	SI-C-11A1	SIA-CLHL-AB0001E	SI/Charging Pump A Discharge Line to Hot/Cold Legs, Between AB-88-25/AB-00-01E Pen and AB-00-01E/AB-97-02 Pen in AB-00-01E	SI	3	2	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1 5E-08	MEDIUM
2	SI-C-11A2	SIA-CLHL-AB9702	SI/Charging Pump A Discharge Line to Hot/Cold Legs, Between AB-00-01E/AB-97-02 Pen and AB-97-02/PAA-12-01 Pen, in AB-97-02	SI	3, 4	14	AB-97-02	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-11A3	SIA-CLHL-8884	SI/Charging Pump A Discharge Line to Hot/Cold Legs Between AB-97-02/AB-12-01 Pen and MOV 1-8884, PAA-12-01/IB-12-01 Pen	SI	3	25	PAA-12-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys.	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SI-C-11A4	SIA-CLHL-8885	SI/Charging Pump A Discharge Line to Hot/Cold Legs from Pump A Discharge, Between PAA-12-01/IB-12-01 Pen and MOV 1-8885	SI	3	13	IB-12-02	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-11B1	SIB-CL-AB8824	SI/Charging Pump B Discharge to CLs, Between AB-88-23/AB-88-24 Pen and AB-88-24/AB-00-02E Pen in AB-88-24	SI	3	2	AB-88-24	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-11B2	SIB-CL-AB0002E	SI/Charging Pump B Discharge to CL, Between AB-88-24/AB-00-02E Pen and AB-00-02E/AB-26-01 Pen in AB-00-02E	SI	3	7	AB-00-02E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-11B3	SIB-CL-AB2601	SI/Charging Pump B Discharge to CL, Between AB-00-02E/AB-26-01 Pen and AB-26-01/FH-12-01 Pen in AB-26-01	SI	3	19	AB-26-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-11B4	SIB-CL-8801A/B	SI/Charging Pump B Discharge to CL, Between AB-26-01/FH-12-01 Pen and MOVs 1-8801A and 1-8801B	SI	3	17	FH-12-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-12	SIB-HL-AB0824	SI/Charging Pump B Discharge Line to Hot Legs, Between AB-88-23/AB-88-24 Pen and AB-88-24/AB-00-02E Pen in AB-88-24	SI	3	5	AB-88-24	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-13	SIB-HL-AB0002E	SI/Charging Pump B Discharge Line to Hot Legs, Between AB-88-24/AB-00-02E Pen AB-00-02E/PAA-12-01 Pen, in AB-00-02E	SI	3	2	AB-00-02E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-14	SIB-HL-8886	SI/Charging Pump B Discharge Line to Hot Legs Between AB-00-02E/PAA-12-01 Pen and MOV 1-8886	SI	3	17	PAA-12-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SI-C-15	SI-XTIE-AB0001E	SI/Charging Pumps Discharge XTIE, Between AB-88-25/AB-00-01E Pen and AB-00-01E/AB-00-01 Pen in AB-00-01E	CS	3,4	2	AB-00-01E	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-16	SI-XTIE-AB0001	SI/Charging Pumps Discharge XTIE, Between AB-00-01E/AB-00-01 Pen and AB-00-01/AB-88-19 Pen, and the two AB-00-01/AB-00-01E Pens	CS	3,4	33	AB-00-01	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-17	SI-SEAL AB8819	Charging-Seal Injection, Between AB-00-01/AB-88-19 Pen and AB-88-19/AB-36-16 Pen in AB-88-19	CS	2	9	AB-88-19	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SI-C-18	SI-SEAL-AB3616	Charging-Seal Injection, Between AB-88-19/AB-36-16 Pen and Valves MV 1-8389 and MOV 1-8105	CS	2	11	AB-36-16	O	N/A	Loss of CVCS	YES: CVCS Suction MOVs	CVCS, SI	PST	2.1E-06	1.5E-08	MEDIUM
2	SIAC-A1	ACC 1	ACC 1 Line Between CV 1-8956A and 1-8948A	SI	12	15	CONT	O	N/A	PLLO(CV)	CV: 1-8948A	LOCA Std.	PLLO(CV)	1.7E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NO	ACC1	ACC1	2.1E-05	1.5E-07	MEDIUM
2	SIAC-A2	ACC 1 CLA	ACC 1 Line, CV 1-8948A to CLA	RC	12	6	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
2	SIAC-B1	ACC 2	ACC 2 Line Between CV 1-8956B and 1-8948B	SI	12	7	CONT	O	N/A	PLLO(CV)	CV: 1-8948B	LOCA Std.	PLLO(CV)	1.7E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NO	ACC2	ACC2	2.1E-05	1.5E-07	MEDIUM
2	SIAC-B2	ACC 2 CLA	ACC 2 Line, CV 1-8948B to CLB	SI, RC	12	7	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3.8E-03	3.5E-05	HIGH
2	SIAC-C1	ACC 3	ACC 3 Line Between CV 1-8956C and 1-8948C	SI	12	7	CONT	O	N/A	PLLO(CV)	CV: 1-8948C	LOCA Std.	PLLO(CV)	1.7E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NO	ACC3	ACC3	2.1E-05	1.5E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SIAC-C2	ACC 3 CLA	ACC 3 Line, CV 1-8948C to CLC	SI, RC	12	6	CONT	O	N/A	LLO	NO	LOCA Std.	LLO	3 8E-03	3 5E-05	HIGH
2	SIHL-A1	SI/RHR HLA ISO6"	SI/RHR Injection to HLA, CV 1-8988A to 1-8993A, 6" HDR	SI	6	17	CONT	O	N/A	PMLO(CV)	CV: 1-8993A	LOCA Std	PMLO(CV)	1.6E-05	1 5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ A	HLA	<1E-06	<1E-07	LOW
2	SIHL-A2	SI/RHR HLA ISO2"	SI/RHR Injection to HLA, CV 1-8990A & 1-8992A to 2x6 Tee, 2" HDR	SI	2	12	CONT	O	N/A	PSLOC(CV)	CV: 1-8993A	LOCA Std	PSLOC(CV)	1.5E-05	1 5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ A	HLA	<1E-06	<1E-07	LOW
2	SIHL-A3	SI/RHR HLA	SI/RHR Injection to HLA, CV 1-8993A to HLA	RC	6	5	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3.6E-03	3 5E-05	HIGH
2	SIHL-B1	SI/RHR HLB ISO6"	SI/RHR Injection to HLB, CV 1-8988B to 1-8993B, 6" HDR	SI	6	6	CONT	O	N/A	PMLO(CV)	CV: 1-8993B	LOCA Std	PMLO(CV)	1 6E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ B	HLB	<1E-06	<1E-07	LOW
2	SIHL-B2	SI/RHR HLB ISO2"	SI/RHR Injection to HLB, CV 1-8990B & 1-8992B to 2x6 Tee, SI HDR	RC	2	16	CONT	O	N/A	PSLOC(CV)	CV: 1-8993B	LOCA Std.	PSLOC(CV)	1 5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ B	HLB	<1E-06	<1E-07	LOW
2	SIHL-B3	SI/RHR HLB	SI/RHR Injection to HLB, CV 1-8993B to HLB	SI	6	5	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3.6E-03	3 5E-05	HIGH
2	SIHL-C1	SI HLC ISO6"	SI Injection to HLC, CV 6X2 Reducer, 6" HDR to CV 1-8993C	SI	6	4	CONT	O	N/A	PMLO(CV)	CV: 1-8993C	LOCA Std.	PMLO(CV)	1 6E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ C	HLC	<1E-06	<1E-07	LOW
2	SIHL-C2	SI HLC ISO2"	SI Injection to HLC, CV 1-8990C & 1-8992C to 2x6 Reducer, 2 " HDR	SI	2	53	CONT	O	N/A	PSLOC(CV)	CV: 1-8993C	LOCA Std.	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	HL INJ C	HLC	<1E-06	<1E-07	LOW

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SIHL-C3	SI HLC	SI Injection to HLC, CV 1-8993C to HLC	RC	6	5	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3 5E-05	HIGH
2	SIRH-A1	RHR/SI CLA ISO6"	RHR Injection to CLA, CV 1-8973A to 1-8998A	SI	6	10	CONT	O	N/A	PMLO(CV)	CV: 1-8998A	LOCA Std	PMLO(CV)	1 6E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ A	CLA	4.7E-05	5.4E-07	MEDIUM
2	SIRH-A2	RHR/SI CLA	RHR/SI Injection to CLA, CV 1-8998A to CLA	SI, RC	6	7	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
2	SIRH-ASI1	SIB/RHR CLA ISO2"	SIB/RHR Injection to CLA, CV 1-8995A to 2x6 Tee, SI HDR	SI	2	12	CONT	O	N/A	PSLOC(CV)	CV: 1-8998A	LOCA Std.	PSLOC(CV)	1 5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ A	CLA	4 7E-05	5.4E-07	MEDIUM
2	SIRH-ASI2	SIA/RHR CLA ISO2"	SIA/RHR Injection to CLA, CV 1-8997A to 2x6 Tee, SI HDR	SI	2	40	CONT	O	N/A	PSLOC(CV)	CV: 1-8998A	LOCA Std	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ A	CLA	4 7E-05	5.4E-07	MEDIUM
2	SIRH-B1	RHR/SI CLB ISO6"	RHR/SI Injection to CLB, CV 1-8973B to 1-8998B	SI	6	14	CONT	O	N/A	PMLO(CV)	CV: 1-8998B	LOCA Std	PMLO(CV)	1 6E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ B	CLB	4.7E-05	5 4E-07	MEDIUM
2	SIRH-B2	RHR/SI CLB	RHR/SI Injection to CLB, CV 1-8998B to CLB	SI, RC	6	7	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3.5E-05	HIGH
2	SIRH-BSI1	SI CLB ISO 2",CVCS A	SI Injection to CLB, CV 1-8995B to 2x6 Tee, SI HDR	SI	2	10	CONT	O	N/A	PSLOC(CV)	CV: 1-8998B	LOCA Std.	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ B	CLB	4.7E-05	5.4E-07	MEDIUM
2	SIRH-BSI2	SIA/RHR CLB ISO2"	SI/RHR Injection to CLB, CV 1-8997B to 2x6 Tee, SI HDR	SI	2	24	CONT	O	N/A	PSLOC(CV)	CV: 1-8998B	LOCA Std.	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ B	CLB	4.7E-05	5 4E-07	MEDIUM
2	SIRH-C1	RHR/SI CLC ISO6"	RHR/SI Injection to CLC, CV 1-8973C to 1-8998C	SI	6	14	CONT	O	N/A	PMLO(CV)	CV: 1-8998C	LOCA Std.	PMLO(CV)	1.6E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ C	CLC	4.7E-05	5 4E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
2	SIRH-C2	RHR/SI CLC	RHR/SI Injection to CLC, CV 1-8998C to CLC	SI, RC	6	5	CONT	O	N/A	MLO	NO	LOCA Std.	MLO	3 6E-03	3 5E-05	HIGH
2	SIRH-CSI1	SIB/RHR CLC ISO2"	SIB/RHR Injection to CLC, CV 1-8995C to 2x6 Tee, SI HDR	SI	2	8	CONT	O	N/A	PSLOC(CV)	CV: 1-8998C	LOCA Std	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ C	CLC	4.7E-05	5 4E-07	MEDIUM
2	SIRH-CSI2	SIA/RHR CLC ISO2"	SIA/RHR Injection to CLC, CV 1-8997C to 2x6 Tee, SI HDR	SI	2	26	CONT	O	N/A	PSLOC(CV)	CV: 1-8998C	LOCA Std	PSLOC(CV)	1.5E-05	1.5E-07	MEDIUM
								D	Y	Assumed LOCA	NC	CL INJ C	CLC	4.7E-05	5 4E-07	MEDIUM
			RESIDUAL HEAT REMOVAL													
3	RHR-C-01A1	RHRA-RWST1	RHRA Suction form RWST, Between MOV-1-8809A and CV 1-8958A	SI	14	2	AB-97-02S	SB	24	Possible LOCA	Yes: MOV 1-8809A	RWST/RHR	RWST (RHR) -ISO	3.4E-06	6.7E-07	MEDIUM
3	RHR-C-01A2	RHRA-RWST2	RHRA Suction, From RWST, Between CV 1-8958A and Suction Line A, MOV-8812A, and AB-97-02S/AB-74-17 Pen, AB-97-02S/AB-97-02N	RHR, SI	14	14	AB-97-02S	SB	24	Possible LOCA	Yes: MOV 1-8809A	RWST/RHR	RWST (RHR) -ISO	3.4E-06	6 7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1 2E-06	1.2E-06	MEDIUM
3	RHR-C-01A3	RHRA-SUMP	RHRA Sump Suction, Between MOV 1-8811A and 1-8812A	SI	14	3	AB-97-02S	D	Y	Assumed LOCA	NO	RHR/SUMP BYP	RHR/SUMP (ISO=GF)	1.1E-03	1.1E-03	HIGH
											NC: MOV 1-8818A	RHR/SUMPA	RHR-SUMPA (ISO=S/NC)	0 0E+00	0 0E+00	---
3	RHR-C-01A4	RHRA-HL-CONT	RHRA HLA Suction, Between MOV 1-8701A and Penetration 316	RHR	14	13	CONT	SB	24	Possible LOCA	YES: MOV 1-8809A	RWST	RWST*-ISO	3 4E-06	6.7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA* (ISO=S)	1 0E-04	1.0E-05	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-01A5	RHA-HL-PAA1201	RHRA HLA Suction, Between Penetration 316 and PAA-12-01/ABB-97-02N Penetration	RHR	12	8	PAA-12-01	SB	24	Possible LOCA	YES: MOV 1-8809A	RWST/RHR	RWST - ISO	3 4E-06	6 7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1.0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	2.1E-06	2 1E-06	MEDIUM
3	RHR-C-01A6	RHRA-HL-AB9702N	RHRA HLA Suction, Between PAA-12-01/ABB-97-02N Pen and ABB-97-02N/AB-97-02S Pen	RHR	12	7	AB-97-02N	SB	24	Possible LOCA	YES: MOV 1-8809A	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6 7E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1.2E-06	1.2E-06	MEDIUM
3	RHR-C-01A7	RHRA-PMP-S	RHRA Suction, Between AB-97-02S/AB-74-17 Pen to Pump XPP-31A-RH	RHR	12	12	AB-74-17	SB	24	Possible LOCA	YES: MOV 1-8809A	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6.7E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1 0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1.2E-06	1 2E-06	MEDIUM
3	RHR-C-01B1	RHRB-RWST1	RHRB Suction, From RWST, Between MOV 1-8809B and CV 1-8958B	RHR	14	2	AB-97-02	SB	24	Possible LOCA	YES: MOV 1-8809B	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6.7E-07	MEDIUM
3	RHR-C-01B2	RHB-RWST2	RHRB Suction, From RWST, Between CV 1-8958B and Suction Line B, MOV-8812B, and AB-97-02N/AB-74-16 Pen	RHR	12	18	AB-97-02	SB	24	Possible LOCA	YES: MOV 1-8809B	RWST/RHR	RWST (RHR) - ISO	3.4E-06	6.7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-87C1B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1.2E-06	1 2E-06	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-01B3	RHRB-SUMP	RHRB Sump Suction, Between MOVs 1-8811B and 1-8812B	SI	14	5	AB-97-02	D	Y	Assumed LOCA	NO	RHR/SUMP BYP	RHR/SUMP (ISO=GF)	1.1E-03	1.1E-03	HIGH
											NC: MOV 1-8818B	RHR/SUMPB	RHR-SUMPB (ISO=S/NC)	0 0E+00	0 0E+00	---
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1.2E-06	1.2E-06	MEDIUM
3	RHR-C-01B4	RHRB-HL-CONT	RHRB HLB Suction, Between MOV 1-8701B and Penetration 226	SI	14	14	CONT	SB	24	Possible LOCA	YES· MOV 1-8809B	RWST	RWST* - ISO	3 4E-06	6.7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1 0E-04	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1.0E-05	MEDIUM
3	RHR-C-01B5	RHRB-HL-PAI1201	RHRB HLB Suction, Between Pen 226 and PAI-12-01/IB-22-01 Penetration	RHR	12	10	PAI-12-01	SB	24	Possible LOCA	YES: MOV 1-8809B	RWST (CCW, AFW)	RWST (CCW, AFW) - ISO	3 4E-06	6 7E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1.0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1 2E-06	1.2E-06	MEDIUM
3	RHR-C-01B6	RHRB-HL-IB1202	RHRB HLB Suction, Between PAI-12-01/IB-12-02 Penetration & IB-12-02/PAA-12-01 Penetration in IB-12-02	RHR	12	1	IB-12-02	SB	24	Possible LOCA	YES· MOV 1-8809B	RWST (CCW, AFW)	RWST (CCW, AFW) - ISO	3 4E-06	6.7E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1.2E-06	1.2E-06	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-01B7	RHRB-HL-PAA1201	RHRB HLB Suction, Between IB-12-02/PAA-12-01 Penetration and PAA-12-01/AB-97-02N Penetration in PAI-12-01	RHR	12	3	PAA-12-01	SB	24	Possible LOCA	YES: MOV 1-8809B	RWST	RWST - ISO	3 4E-06	6 7E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1.0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1 2E-06	1 2E-06	MEDIUM
3	RHR-C-01B8	RHRB-PMP-S	RHRB Suction, Between AB-97-02N/AB-74-16 Pen to Pump XPP-31B-RH	RHR	10, 14	9	AB-74-16	SB	24	Possible LOCA	YES: MOV 1-8809B	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6 7E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES· (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1 0E-05	MEDIUM
								O	Q	ISLOCA	NO	ISLOCA	IS-LOCA (2MOVs)	1 2E-06	1.2E-06	MEDIUM
3	RHR-C-02A	RHRA-PMP-D	RHRA Discharge, Between Pump XPP-31A-RH and AB-74-17/AB-97-02S Pen	RHR	10, 14	16	AB-74-17	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MEDIUM
											NC: MOV 1-8809A	RHRA	RHRA (ISO=S)	1.3E-05	6 2E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM
3	RHR-C-02B	RH-B-AB7416(D)	RHRB Discharge, Between Pump XPP-31B-RH and AB-74-16/AB-97-02 Pen	RHR	12, 14	23	AB-74-16	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2 7E-06	2.3E-08	MEDIUM
											NC: MOV 1-8880B	RHRB	RHRB (ISO=S)	5.6E-06	2 6E-08	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1 0E-05	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-03A2	RHRA-DIS-AB9702S	RHRA Discharge, Between AB-74-17/AB-97-02S Pen and AB-97-02S/AB-12-06 Pen in AB-97-02S	RHR	12, 14	12	AB-97-02S	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MEDIUM
											NC: MOV 1-8809A	RHRA	RHRA (ISO=S)	1.3E-05	6 2E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM
3	RHR-C-03B2	RHRB-DIS-AB9702	RHRB Discharge, Between AB-74-16/AB-97-02 Pen and AB-97-02/AB-12-05 Pen in AB-97-02	RHR	10	7	AB-97-02	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2 7E-06	2.3E-08	MEDIUM
											NC: MOV 1-8809B	RHRB	RHRB (ISO=S)	5 6E-06	2 6E-08	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1 0E-05	MEDIUM
3	RHR-C-04A1	RHRA-HX1	RHRA Discharge, Between AB-97-02S/AB-12-06 Pen and CV 1-8716A (thru 1-FCV-605A and 1-HCV-603A), MOV 1-8706A	RHR	10	39	AB-12-06	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MEDIUM
											NC: MOV 1-8809A	RHRA	RHRA (ISO=S)	1.3E-05	6 2E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM
3	RHR-C-04A2	RHRA-HX2	RHRA Discharge, Between CV 1-8716A and AB-12-06/AB-26-01 Pen.	RHR	10	14	AB-12-06	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=GF)	2 7E-04	2.3E-06	HIGH
											NC: MOV 1-8809A and 1-8887A	RHRA	RHRA (ISO=S/NC)	0 0E+00	0 0E+00	---
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-04B1	RHRB-HX1	RHRB Discharge, Between AB-97-02/AB-12-05 Pen and CV 1-8716B (thru 1-FCV-605B and 1-HCV-603B), MOV 1-8706B	CS, RHR	8, 10	35	AB-12-05	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MEDIUM
											NC: MOV 1-8809B	RHRB	RHRB (ISO=S)	5.6E-06	2.6E-8	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1.0E-05	MEDIUM
3	RHR-C-04B2	RHRB-HX2	RHRB Discharge, Between CV 1-8716B and AB-12-05/AB-12-06 Pen	RHR	10	7	AB-12-05	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8809B and 1-8887B	RHRB	RHRB (ISO=S/NC)	0.0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1.0E-05	MEDIUM
3	RHR-C-05A	RHRA-HXD-AB2601	RHRA HX Discharge, Between AB-12-06/AB-26-01 Pen and AB-26-01/PAA-12-01 Pen in AB-26-01	RHR	10	15	AB-26-01	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8809A and 1-8887A	RHRA	RHRA (ISO=S/NC)	0.0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1.0E-05	MEDIUM
3	RHR-C-05B	RHRB-HXD-AB1206	RHRB HX Discharge, Between AB-12-05/AB-12-06 Pen and AB-12-06/AB-12-11 Pen in AB-12-06	RHR	10	2	AB-12-06	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8809B and 1-8887B	RHRB	RHRB (ISO=S/NC)	0.0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1.0E-05	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-06B	RHRB-HXD-CL	RHRB HX Discharge, Between AB-12-06/AB-12-11 Pen and AB-12-11/PAA-12-01 Pen in AB-12-11	RHR, SI	8, 10	11	AB-12-11	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=GF)	2.7E-04	2 3E-06	HIGH
											NC: MOV 1-8809B and 1-8887B	RHRB	RHRB (ISO=S/NC)	0 0E+00	0 0E+00	---
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1 0E-05	MEDIUM
3	RHR-C-07A	RHRA-HXD-CL	RHRA Hx Discharge to Cold Legs, Between AB-26-01/PAA-12-01 Pen and MOVs 1-8888A, 1-8887A	RHR	10	16	PAA-12-01	D	Q	Assumed LOCA	NO	RHR/RWST	RHR[b]/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC· MOV 1-8809A and 1-8887A	RHRA	RHRA (ISO=S/NC)	0 0E+00	0 0E+00	---
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0 1	SD START	Yes (1-8702A or 1-8701A and 1-8702B or 1-8701B)	LSDC	LSDC (ISO=S)	1 0E-04	1 0E-05	MEDIUM
	RHR-C-07B	RHRB-HXD-CL	RHRB HX Discharge to Cold Legs, Between AB-12-11/PAA-12-01, and MOV 1-8888B, 1-8887B	RHR	10	30	PAA-12-01	D	Q	Assumed LOCA	NO	RHR/RWST	RHR[b]/RWST (ISO=GF)	2.7E-04	2 3E-06	HIGH
											NC: MOV 1-8809B and 1-8887B	RHRB	RHRB (ISO=S/NC)	0 0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1 0E-05	MEDIUM
								S/D	0.1	SD START	Yes: (1-8702A or 1-8701A and 1-8702B or 1-8701B)	LSDC	LSDC (ISO=S)	1.0E-04	1.0E-05	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHR-C-07C	RHRAB-HXD-HL	RHRAB HX Discharge to Hot Legs, Between MOVs 1-8887A, 1-8887B, and 1-8889	RHR	10	16	PAA-12-01	D	Q	Assumed LOCA	NO	RHR/RWST	RHR[D]/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8887A and 1-8887B	RHR HL	RHR HL (ISO=S/NC)	0 0E+00	0 0E+00	---
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1 0E-05	1 0E-05	MEDIUM
								S/D	0.1	SD START	Yes: (1-8702A or 1-8701A and 1-8702B or 1-8701B)	LSDC	LSDC (ISO=S)	1 0E-04	1 0E-05	MEDIUM
3	RHRA1	RHR-HLA	RHR HLA Suction From HLA to 1-8702A	RC, RHR	12	7	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3 8E-03	3 5E-05	HIGH
3	RHRA2	RHR HLA - ISO	RHR HLA Suction From 1-8702A to 1-8701A	RHR	12	16	CONT	O	N/A	PLLO(MOV)	MOV: 1-8702A	LOCA Std.	PLLO(MOV)	1.7E-05	1.5E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1.0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1 0E-04	1 0E-05	MEDIUM
3	RHRA3	RHR-HLA-PT-MLO	RHR HLA SUC LINE to PT1A, To First Reducer	RHR	3	1	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3 5E-05	HIGH
3	RHRA4	RHR-HLA-PT-SLOC	RHR HLA LINE to PT1A, From First Reducer to Second Reducer	RHR	2	1	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3 4E-03	3 4E-05	HIGH
3	RHRA5	RHR-HLA-PT-ISO-MLO	RHR HLA SUC LINE to PT2A, To First Reducer	RHR	3	1	CONT	O	N/A	PMLO(MOV)	MOV: 1-8702A	LOCA Std.	PMLO (MOV)	1 6E-05	1 5E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1 0E-04	1 0E-05	MEDIUM
3	RHRA6	RHR-HLA-PT-ISO-PT-SLOC	RHR HLA SUC LINE to PT2A, from First Reducer to Second Reducer	RHR	2	1	CONT	O	N/A	PSLOC(MOV)	MOV: 1.8702A	LOCA Std.	PSLOC(MOV)	1 5E-05	1 5E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1 0E-04	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA (ISO=S)	1.0E-04	1 0E-05	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys.	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
3	RHRC1	RHR-HLC	RHR HLC Suction From HLC to 1-8702B	RC, SI	12	11	CONT	O	N/A	LLO	NO	LOCA Std	LLO	3.8E-03	3 5E-05	HIGH
3	RHRC2	RHR-HLC-ISO	RHR HLC Suction From 1-8702B to 1-8701B	SI	12	14	CONT	O	N/A	PLLO(MOV)	MOV: 1-8702B	LOCA Std	PLLO(MOV)	1 7E-05	1.5E-07	MEDIUM
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1 0E-04	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1.0E-05	MEDIUM
3	RHRC3	RHR-HLC-PT-MLO	RHR HLC SUC LINE to PT1C, To First Reducer	SI	3	1	CONT	O	N/A	MLO	NO	LOCA Std	MLO	3 6E-03	3.5E-05	HIGH
3	RHRC4	RHR-HLC-PT-SLOC	RHR HLC SUC LINE to PT1C, From First Reducer to Second Reducer	SI	2	1	CONT	O	N/A	SLOC	NO	LOCA Std	SLOC	3.4E-03	3 4E-05	HIGH
3	RHRC5	RHR-HLC-PT-ISO-MLO	RHR HLC LINE to PT2C, To First Reducer	SI	3	1	CONT	O	N/A	PMLO(MOV)	MOV: 1-8702B	LOCA Std	PMLO (MOV)	1 6E-05	1.5E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1 0E-05	MEDIUM
								S/D	0 1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1 0E-04	1 0E-05	MEDIUM
3	RHRC6	RHR-HLC-PT-ISO-SLOC	RHR HLC SUC LINE to PT2C, From First Reducer to Second Reducer	SI	2	1	CONT	O	N/A	PSLOC(MOV)	MOV: 1-8702B	LOCA Std	PSLOC(MOV)	1.5E-05	1.5E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1.0E-05	MEDIUM
3	RHRC7	RHR-HLC-VT-ISO SLOC	RHR SUC LINE to Vent, To First Reducer	SI	2	2	CONT	O	N/A	PSLOC(MOV)	MOV: 1-8702B	LOCA Std.	PSLOC(MOV)	1.5E-05	1.5E-07	MEDIUM
								S/D	0 1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1 0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB (ISO=S)	1.0E-04	1 0E-05	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
4	INJECTION LINES															
4	IL-C-01	SIB-CLs-FH1201	Safey Injection Line, Between MOVs 1-8801A and 1-8801B and Containment Penetration 426	SI	3	11	FH-12-01	D	Y	Assumed LOCA	NC: MOVs 1-8801A and 1-8801B	SIA, SIB, SIC	SI	1.4E-03	1.7E-04	HIGH
4	IL-C-02	SIB-CLs-CONT	Safety Injection Lines to Cold Legs, Between Containment Penetration 426 and MVs 1-8996A, 1-8996B, and 1-8996C	SI	2, 3	31	CONT	D	Y	Assumed LOCA	NC: MOVs 1-8801A and 1-8801B	SIA, SIB, SIC	SI	1.4E-03	1.7E-04	HIGH
	IL-C-02A	SIB-CLA	SI to CLA, Between MV 1-8996A and CV 1-8997A	SI	2	6	CONT	D	Y	Assumed LOCA	NO	SI CLA	SI/CLA	1.3E-06	1.0E-07	MEDIUM
	IL-C-02B	SIB-CLB	SI to CLB, Between MV 1-8996B and CV 1-8997B	SI	2	14	CONT	D	Y	Assumed LOCA	NO	SI CLB	SI/CLB	1.3E-06	1.0E-07	MEDIUM
4	IL-C-02C	SIB-CLC	SI to CLC, Between MV 1-8996C and CV 1-8997C	SI	2	4	CONT	D	Y	Assumed LOCA	NO	SI CLC	SI/CLC	1.3E-06	1.0E-07	MEDIUM
4	IL-C-03A	RHRA-CL-PAA1201	RHRA Discharge to Cold Legs, Between MOV 1-8888A and Containment Penetration 322	SI	10	6	PAA-12-01	D	Q	Assumed LOCA	NO	RHR INJ and RWST	RHR^{D}/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8888A	RHRA	RHRA (ISO=S/NC)	0.0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	Yes: (1-8702A or 1-8701A and 1-8702B or 1-8701B)	LSDC	LSDC (ISO=S)	1.0E-04	1.0E-05	MEDIUM
4	IL-C-03B	RHRB-CL-PAA1201	RHRB Discharge to Cold Legs, Between MOV 1-8888B and Containment Penetration 227	SI	10	7	PAA-12-01	D	Q	Assumed LOCA	NO	RHR INJ and RWST	RHR^{D}/RWST (ISO=GF)	2.7E-04	2.3E-06	HIGH
											NC: MOV 1-8888B	RHRB	RHRB (ISO=S/NC)	0.0E+00	0.0E+00	---
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA (ISO=F)	1.0E-05	1.0E-05	MEDIUM
								S/D	0.1	SD START	Yes: (1-8702A or 1-8701A and 1-8702B or 1-8701B)	LSDC	LSDC (ISO=S)	1.0E-04	1.0E-05	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
4	IL-C-04A	RHRA-CL	RHRA Discharge to Cold Legs, Between Containment Penetration 322 and CV 1-8974A	SI	10	2	CONT	D	Q	Assumed LOCA	NC	RWST/RHR INJ	RHR^D/RWST* (NC ISO)	2.7E-04	2.3E-06	HIGH
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702A or 1-8701A)	LSDCA	LSDCA* (ISO=S)	1.0E-04	1.0E-05	MEDIUM
4	IL-C-04B	RHRB-CL	RHRB Discharge to Cold Legs, Between Containment Penetration 227 and CV 1-8974B	SI	10	2	CONT	D	Q	Assumed LOCA	NC	RWST/RHR INJ	RHR^D/RWST* (NC ISO)	2.7E-04	2.3E-06	HIGH
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: (1-8702B or 1-8701B)	LSDCB	LSDCB* (ISO=S)	1.0E-04	1.0E-05	MEDIUM
4	IL-C-05	RHR-CLS	RHR Discharge to Cold Legs, Between CLs CVs 1-8974A, 1-8974B and CVs 1-8973A, 1-8973B, & 1-8973C	SI	6, 10	59	CONT	D	Q	Assumed LOCA	NC	RWST/RHR INJ	RHR^D/RWST* (NC ISO)	2.7E-04	2.3E-06	HIGH
								S/D	0.1	SD START	NO	SD LOCA	SD LOCA* (ISO=F)	1.0E-04	1.0E-05	MEDIUM
								S/D	0.1	SD START	YES: All S/D MOVs	LSDC	LSDC* (ISO=S)	1.0E-04	1.0E-05	MEDIUM
4	IL-C-06	RH-HL-PAA1201	RHRA Discharge to Hot Legs, Between MOV 1-8889 and Containment Penetration 325	SI	10	7	PAA-12-01	D	Y	Assumed LOCA	NC: MOV 1-8889	RHR HL INJ	RHR HL	<1E-06	<1E-07	LOW
4	IL-C-07	RH-HLS	RHR Discharge to Hot Legs, Between Containment Penetration 325 and CVs 1-8988A and 1-8988B	SI	6, 10	22	CONT	D	Y	Assumed LOCA	NC: MOV 1-8889	RHR HL INJ	RHR HL*	<1E-06	<1E-07	LOW
			REACTOR BUILDING SPRAY													

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
4	SP-C-01A	SPA-SUCT1	RB A Spray Suction, Between MOV 3001A-SP and AB-97-02S/AB-74-17 Pen, MOV 3005A-SP	SP	12	8	AB-97-02S	SB	24	Possible LOCA	YES. MOV 3001A-SP	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6 7E-07	MEDIUM
4	SP-C-01A2	SPA-SUMP	RB A Spray Sump Suction, Between MOV 3004A-SP and MOV 3005A-SP	SP	12	4	AB-97-02S	D	Y	Assumed LOCA	NO	RHR/SUMP BYP	RHR/SUMP (ISO=GF)	1 1E-03	1 1E-03	HIGH
											NC: MOV 3004A-SP	SP RECIRC A	SPA/SUMP (ISO=S/NC)	0 0E+00	0 0E+00	---
4	SP-C-01B	SPB-SUCT1	RB B Spray Suction, Between MOV 3001B-SP and AB-97-02S/AB-74-17 Pen, MOV 3005-SP	SP	12	15	AB-97-02N	SB	24	Possible LOCA	YES· MOV 3001B-SP	RWST/RHR	RWST (RHR) - ISO	3.4E-06	6.7E-07	MEDIUM
4	SP-C-01B2	SPB-SUMP	RB B Spray Sump Suction, Between MOV 3004B-SP and MOV 3005B-SP	SP	12	3	AB-97-02N	D	Y	Assumed LOCA	NO	RHR/SUMP BYP	RHR/SUMP (ISO=GF)	1.1E-03	1 1E-03	HIGH
											NC: MOV 3004B-SP	SP RECIRC B	SPB/SUMP (ISO=S/NC)	0 0E+00	0 0E+00	---
4	SP-C-02A	SPA-SUCT2	RB A Spray Suction, Between AB-97-02S/AB-74-17 Pen and RB Spray Pump XPP-38A-SP	SP	10,12	13	AB-74-17	SB	24	Possible LOCA	YES: MOV 3001A-SP	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6 7E-07	MEDIUM
4	SP-C-02B	SPB-SUCT2	RB B Spray Suction, Between AB-97-02N/AB-74-16 Pen and RB Spray Pump XPP-38B-SP	SP	10,12	15	AB-74-16	SB	24	Possible LOCA	YES: MOV 3001B-SP	RWST/RHR	RWST (RHR) - ISO	3 4E-06	6.7E-07	MEDIUM
4	SP-C-03A	SPA-DISCH	RB A Spray Discharge, Between RB Spray Pump XPP-38A-SP and MV 3010A-SP, AB-74-17/AB-97-02S Pen	SP	8,10	23	AB-74-17	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MED
											NC: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-03B	SPB-DISCH	RB B Spray Discharge, Between RB Spray Pump XPP-38B-SP and MV 3010B-SP, AB-74-16/AB-97-02 Pen	SP	8, 10	24	AB-74-16	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MED
											NC: MOV 3001B-SP	SP B	SPB (ISO=S)	<1E-6	<1E-7	LOW

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
4	SP-C-03X1	SP-XA	RB Spray XTie, Between MV 3010A-SP and AB-74-17/AB-74-16 Pen	SP	10	5	AB-74-17	D*	Y	Assumed LOCA	ISOLATED	NONE	ISO-Xtie	<1E-6	<1E-7	LOW
4	SP-C-03X2	SP-XB	RB Spray XTie, Between MV 3010B-SP, MV 3011-SP and AB-74-16/AB-74-17 Pen	SP	10	9	AB-74-16	D*	Y	Assumed LOCA	ISOLATED	NONE	ISO-Xtie	<1E-6	<1E-7	LOW
4	SP-C-04A	SPA-AB9702S	RB A Spray Discharge Between AB-74-17/AB-97-02S Pen and AB-97-02S/AB-97-02 Pen in AB-97-02S	SP	10	6	AB-97-02S	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2 7E-06	2.3E-08	MED
											NC: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-04B	SPB-AB9702	RB B Spray Discharge Between AB-74-16/AB-97-02 Pen and AB-97-02/PAA-12-01 Pen in AB-97-02	SP	10	20	AB-97-02	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MED
											NC: MOV 3001B-SP	SP B	SPB (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-05A	SPA-AB9702	RB A Spray Discharge Between AB-97-02S/AB-97-02 Pen and AB-97-02/AB-26-02 Pen in AB-97-02	SP	10	10	AB-97-02	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MED
											NC: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-05B	SPB-PAA1201	RB B Spray Discharge Between AB-97-02/PAA-12-01 Pen and PAA-12-01/PAA-36-01 Pen in PAA-12-01	SP	10	11	PAA-12-01	D	Q	Assumed LOCA	NO	RWST	RWST (ISO=F)	3.0E-06	6 0E-07	MEDIUM
											YES: MOV 3001B-SP	SP B	SPB (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-06A	SPA-AB2602	RB A Spray Discharge Between AB-97-02/AB-26-02 Pen and AB-26-02/AB-36-01B Pen in AB-26-02	SP	10	6	AB-26-02	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2.3E-08	MED
											NC: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
4	SP-C-06B	SPB-PAA3601	RB B Spray Discharge Between PAA-12-01/PAA-36-01 and PAA-36-01/PAA-63-03 Pen in PAA-36-01	SP	10	1	PAA-36-01	D	Q	Assumed LOCA	NO	RWST	RWST (ISO=F)	3 0E-06	6 0E-07	MEDIUM
											YES· MOV 3001B-SP	SP B	SPB (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-07A	SPA-AB3601B	RB A Spray Discharge Between AB-26-02/AB-36-01B Pen and AB-36-01B/PAA-36-01 Pen in AB-36-01B	SP	10	5	AB-36-18	D	Q	Assumed LOCA	NO	RHR/RWST	RHR/RWST (ISO=F)	2.7E-06	2 3E-08	MED
											NC: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-08A	SPA-PAA3601	RB A Spray Discharge Between AB-36-01B/PAA-36-01 Pen and PAA-36-01/PAA-63-03 Pen in PAA-36-01	SP	10	4	PAA-36-01	D	Q	Assumed LOCA	NO	RWST	RWST (ISO=F)	3.0E-06	6 0E-07	MEDIUM
											YES: MOV 3001A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-09A	SPA-DS-3003A	RB A Spray Discharge Between PAA-36-01/PAA-63-03 Pen and MOV 3003A-SP	SP	10	4	PAA-63-03	D	Q	Assumed LOCA	NO	RWST	RWST (ISO=F)	3 0E-06	6 0E-07	MEDIUM
											YES: MOV 3003A-SP	SP A	SPA (ISO=S)	<1E-6	<1E-7	LOW
4	SP-C-09B	SPB-DS-3003B	RB B Spray Discharge Between PAA-36-01/PAA-63-03 Pen and MOV 3003B-SP	SP	10	4	PAA-63-03	D	Q	Assumed LOCA	NO	RWST	RWST (ISO=F)	3.0E-06	6 0E-07	MEDIUM
											YES· MOV 3003B-SP	SP B	SPB (ISO=S)	<1E-6	<1E-7	LOW
5			FEEDWATER													
5	FW-C-01A	FWA-PAA3601(1)	FW Line A, Between CV 1684A-FW and 1611A-FW	FW	18	2	PAA-36-01	O	N/A	LMF/FWLB-OUT	NC:1611A-FW	FWLBO	SSBO	9 8E-05	7.4E-07	MEDIUM

Fig	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
5	FW-C-01B	FWB-PAA3601(1)	FW Line B, Between CV 1684B-FW and 1611B-FW	FW	18	7	PAI-36-01	O	N/A	LMF/FWLB-OUT	NC-1611B-FW	FWLBO	SSBO	9.8E-05	7.4E-07	MEDIUM
5	FW-C-01C	FWC-PAA3601(1)	FW Line C, Between CV 1684C-FW and 1611C-FW	FW	18	2	PAI-36-01	O	N/A	LMF/FWLB-OUT	NC:1611C-FW	FWLBO	SSBO	9.8E-05	7.4E-07	MEDIUM
5	FW-C-02A	FWA-PAA3601(2)	FW Line A, Between Valve 1611A-FW and Pen 306	FW	18	4	PAA-36-01	O	N/A	LMF/FWLB-OUT	NO	FWLBO	SSBO	9.8E-05	7.4E-07	MEDIUM
5	FW-C-02B	FWB-PAA3601(2)	FW Line B, Between Valve 1611B-FW and Pen 206	FW	18	2	PAI-36-01	O	N/A	LMF/FWLB-OUT	NO	FWLBO	SSBO	9.8E-05	7.4E-07	MEDIUM
5	FW-C-02C	FWC-PAA3601(2)	FW Line C, Between Valve 1611C-FW and Pen 203	FW	18	4	PAI-36-01	O	N/A	LMF/FWLB-OUT	NO	FWLBO	SSBO	9.8E-05	7.4E-07	MEDIUM
5	FW-C-03A	FWA-CONT	FW Line A, Between Pen 306 and SG XSG-2A-RC	FW	16, 18	14	CONT	O	N/A	LMF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
5	FW-C-03B	FWB-CONT	FW Line B, Between Pen 206 and SG XSG-2B-RC	FW	16, 18	11	CONT	O	N/A	LMF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
5	FW-C-03C	FWC-CONT	FW Line C, Between Pen 203 and SG XSG-2C-RC	FW	16, 18	28	CONT	O	N/A	LMF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
5	FW-C-04A	FWA-AFW	EFW Line A, Between 4x6 reducer and XSG-2A-RC	EF	6	3	CONT	O	N/A	EF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
5	FW-C-04B	FWB-AFW	EFW Line B, Between 4x6 reducer and XSG-2B-RC	EF	6	3	CONT	O	N/A	EF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
5	FW-C-04C	FWC-AFW	EFW Line C, Between 4x6 reducer and XSG-2C-RC	EF	6	2	CONT	O	N/A	EF/FWLB-IN	NO	FWLBI	SSBI	9.8E-05	7.3E-07	MEDIUM
6	MAIN STEAM															
6	MS-C-01A	MSA-CONT	MS Line A, Between SG XSG-2A-RC and Containment Penetration 428	MS	32	11	CONT	O	N/A	SSBI	NO	SSBI	SSBI	9.8E-05	7.3E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys.	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
6	MS-C-01B	MSB-CONT	MS Line B, Between SG XSG-2B-RC and Containment Penetration 207	MS	32	11	CONT	O	N/A	SSBI	NO	SSBI	SSBI	9.8E-05	7 3E-07	MEDIUM
6	MS-C-01C	MSC-CONT	MS Line C, Between SG XSG-2C-RC and Containment Penetration 202	MS	32	13	CONT	O	N/A	SSBI	NO	SSBI	SSBI	9 8E-05	7 3E-07	MEDIUM
6	MS-C-02A	MSA-PAA3601	MS Line A, Common Line to Safety Valves, Between Containment Penetration 428 and PAA-36-01/IB-36-02 Pen	MS	32	19	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-02B	MSB-PAI3601	MS Line B, Common Line to Safety Valves, Between Containment Penetration 207 and PAI-36-01/IB-36-02 Pen	MS	32	3	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-02C	MSC-PAI3601	MS Line C, Common Line to Safety Valves, Between Containment Penetration 202 and PAI-36-01/IB-36-02 Pen	MS	32	16	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-03A	MSA-IB3602	MS Line A, Common Line to Safety Valves, Between PAA-36-01/IB-36-02 Pen and MSIV 2801A-MS	MS	32	2	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-03B	MSB-IB3602	MS Line B, Common Line to Safety Valves, Between PAI-36-01/IB-36-02 Pen and MSIV 2801B-MS	MS	32	14	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-03C	MSC-IB3602	MS Line C, Common Line to Safety Valves, Between PAI-36-01/IB-36-02 Pen and MSIV 2801C-MS	MS	32	3	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7.4E-07	MEDIUM
6	MS-C-04A	MSA-ADV-2000	MS Line A, Between Common Line to Safety Valves Tee and Atmospheric Dump Valve IPV-2000-MS	MS	8	7	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size (in)	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
6	MS-C-04B	MSB-ADV-2010	MS Line B, Between Common Line to Safety Valves Tee and Atmospheric Dump Valve IPV-2010-MS	MS	8	7	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-04C	MSC-ADV-2020	MS Line C, Between Common Line to Safety Valves Tee and Atmospheric Dump Valve IPV-2020-MS	MS	8	7	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-05A	MSA-SRV-2806A	MS Line A, Safety Valve 2806A-MS	MS	6	1	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05F	MSB-SRV-2806F	MS Line B, Safety Valve 2806F-MS	MS	6	1	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7.4E-07	MEDIUM
6	MS-C-05K	MSC-SRV-2806K	MS Line C, Safety Valve 2806K-MS	MS	6	1	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05B	MSA-SRV-2806B	MS Line A, Safety Valve 2806B-MS	MS	6	1	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05G	MSB-SRV-2806G	MS Line B, Safety Valve 2806G-MS	MS	6	1	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05L	MSC-SRV-2806L	MS Line C, Safety Valve 2806L-MS	MS	6	1	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-05C	MSA-SRV-2806C	MS Line A, Safety Valve 2806C-MS	MS	6	1	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05H	MSB-SRV-2806H	MS Line B, Safety Valve 2806H-MS	MS	6	1	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05M	MSC-SRV-2806M	MS Line C, Safety Valve 2806M-MS	MS	6	1	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7.4E-07	MEDIUM
6	MS-C-05D	MSA-SRV-2806D	MS Line A, Safety Valve 2806D-MS	MS	6	1	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7.4E-07	MEDIUM
6	MS-C-05I	MSB-SRV-2806I	MS Line B, Safety Valve 2806I-MS	MS	6	1	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-05N	MSC-SRV-2806N	MS Line C, Safety Valve 2806N-MS	MS	6	1	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7.4E-07	MEDIUM
6	MS-C-05E	MSA-SRV-2806E	MS Line A, Safety Valve 2806E-MS	MS	6	1	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM

Fig.	Consequence ID	Segment Functional ID	Segment Description	Sys	Line Size [in]	Weld Total	LOC	C	ET	Initiating Event	Isolation	Impact on Mitigating	Consequence Key	CCDP	CLERP	Rank
6	MS-C-05J	MSB-SRV-2806J	MS Line B, Safety Valve 2806J-MS	MS	6	1	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-05P	MSC-SRV-2806P	MS Line C, Safety Valve 2806P-MS	MS	6	1	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-10A	MSA-CAP1	MS Line A, 14" Capped Branch, Between Pen 428 and 8" Branch Connection	MS	14	3	PAA-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-10C	MSC-CAP1	MS Line C, 14" Capped Branch, Between Pen 202 and 8" Branch Connection	MS	14	3	PAI-36-01	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7 4E-07	MEDIUM
6	MS-C-11A	MSA-CAP2	MS Line A, 14" Capped Branch, Upstream from MSIV 2801A-MS	MS	14	3	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-11B	MSB-CAP2	MS Line B, 14" Capped Branch, Upstream from MSIV 2801B-MS	MS	14	3	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9 8E-05	7 4E-07	MEDIUM
6	MS-C-11C	MSC-CAP2	MS Line C, 14" Capped Branch, Upstream from MSIV 2801C-MS	MS	14	3	IB-36-02	O	N/A	SSBO	NO	SSBO	SSBO	9.8E-05	7.4E-07	MEDIUM
			SERVICE WATER													
7	SW-C-01A	SWA-PAA6303	Service Water Cooling, Between MOV 3106A-SW, 3110A-SW and Containment Penetration 304	SW	12, 16	11	PAA-63-03	D	Y	SW A	NO	SW A	FLD2	2 4E-05	1.7E-07	MEDIUM
7	SW-C-01B	SWB-FH6301	Service Water Cooling, Between MOV 3106B-SW, 3116B-SW and Containment Penetration 403	SW	12, 16	16	FH-63-01	D	Y	SW B	NO	SW B	FLD3	2 9E-06	1.9E-08	MEDIUM
7	SW-C-02A	SWA-CONT	Service Water Cooling, Between Containment Penetration 304 and CV 3137A-SW	SW	16	4	CONT	D	Y	SW A	NO	SW A	FLD2	2.4E-05	1.7E-07	MEDIUM
7	SW-C-02B	SWB-CONT	Service Water Cooling, Between Containment Penetration 403 and CV 3137B-SW	SW	16	4	CONT	D	Y	SW B	NO	SW B	FLD3	2 9E-06	1 9E-08	MEDIUM

5.0 References

1. American Society of Mechanical Engineers, "Case N-578, Risk Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1, " September 2, 1997

2. EPRI TR-112657 "Revised Risk-Informed Inservice Inspection Evaluation Procedure" Final Report, Rev B-A, December 1999.

3. V.C. Summer Nuclear Station Individual Plant Examination report in Response to Generic Letter 88-20, June 1993

4. V.C. Summer Nuclear Station Individual Plant Examination, Internal Flooding Analysis Notebook, April 1993, Revision 0

5. Email from John M Cobb (SCANA) to DM Pepe (DE&S), Subject: "Response to VC Summer Risk ISI Consequence Calc" dated 08/17/01 – Contains LOCA Sizes, Initiator Summary Report, updated IE Frequencies, Unavailability Values, System Raws.

6. Email from John M Cobb (SCANA) to DM Pepe (DE&S), Subject: "RB ISI info" dated 09/18/01 – Contains Basic Events RAWS, Basic Events, Initiator Summary Report with LERF.

7. Email from John M Cobb (SCANA) to DM Pepe (DE&S), Subject: "RE: RB ISI INFO" dated 08/29/01 – Contains failure data.

8. AOP-112.1, Shutdown LOCA, Abnormal Operating Procedure

9. Email from Eric W Rumfelt (SCANA) to DM Pepe (DE&S), Subject: "VC Summer Outage Management Program" dated 10/17/01.

10. ISE Isometric's
    CGE-1-4100 thur 4104
    CGE-1-4106
    CGE-1-4107
    CGE-1-4110 thru 4113
    CGE-1-4200 thru 4203
    CGE-1-4205
    CGE-1-4208 thru 4211
    CGE-1-4300 thru 4304
    CGE-1-4308 thru 4311
    CGE-1-4500 thru 4506
    CGE-2-2100 thru 2104
    CGE-2-2200 thru 2204
    CGE-2-2300 thru 2304

CGE-2-2500 thru 2501
CGE-2-2520 thru 2526
CGE-2-2540 thru 2541
CGE-2-2551 thru 2554
CGE-2-2556 thru 2557
CGE-2-3000 thru 3014

11. V.C. Summer Nuclear Station Plant Layout Drawings
    E-001-001
    E-001-002
    E-001-011
    E-001-012
    E-001-014
    E-001-021
    E-001-031

12. CALC NO DC03290-002, Determine Flood Levels in Areas Containing Safe Shutdown Equipment That are not Affected by the FW System

13. CALC NO DC03290-001, Determine the maximum Expected Water Level in the Ab, IB, and East and West Penetration Access Areas Due to the FW Pipe Break or Worse case pipe or Tank Rupture.

14. V.C. Summer Nuclear Station Final Safety Analysis report, Amendment 00-01

15. APR-001 and APR-002, Annunciator Response Procedures, Outside Flooding

16. V.C. Summer Nuclear Station, Technical Specifications, Amendment Number 150, 02/02/01

17. HELB/MSLB Evaluation Report NO. 2616, Rev 07

18. Piping System Flow Drawings
    302-001
    302-002
    302-011
    302-083
    302-222
    302-601
    302-602
    302-641
    302-651
    302-661
    302-673
    302-675
    302-691
    302-692
    302-693

19. Email from John M Cobb (SCANA) to DM Pepe (DE&S), Subject: "FW: RB ISI info" dated 10/08/01 – Contains System Operating Procedure Safety Injection System, SOP-112, Revision 12, IST of charging, RH and RB pumps flow paths..

20. Email from Adam R Caban (SCANA) to DM Pepe (DE&S), Subject: "VCS Service Water Flow" dated 12/20/01.

21. Email from Eric W Rumfelt (SCANA) to DM Pepe (DE&S), Subject: "RE: RHRS injection to CL and HL" dated 01/11/02.

22. VCSNS PRA Model @ 3EUP.CAF and supporting files found on DFS01\SHARES\GROUP\PRA\@3EUPCURRENT MODEL.

23. Email from Leo J Kachnik (SCANA) to DM Pepe (Framatome ANP DE&S), Subject: "New CDF and LERF for %SSBO and %SSBI" dated 06/04/02 – Contains revised CDF and LERF, Technical Work Report: Revision of Human Error Probabilities for OAT4 and OAT2 (Work Done: PRA Revision VCSNS_3G.UP, fault tree @3GUP.CAF).

Appendix A: V.C. Summer Risk Informed Inservice Inspection Scope (Drawings)

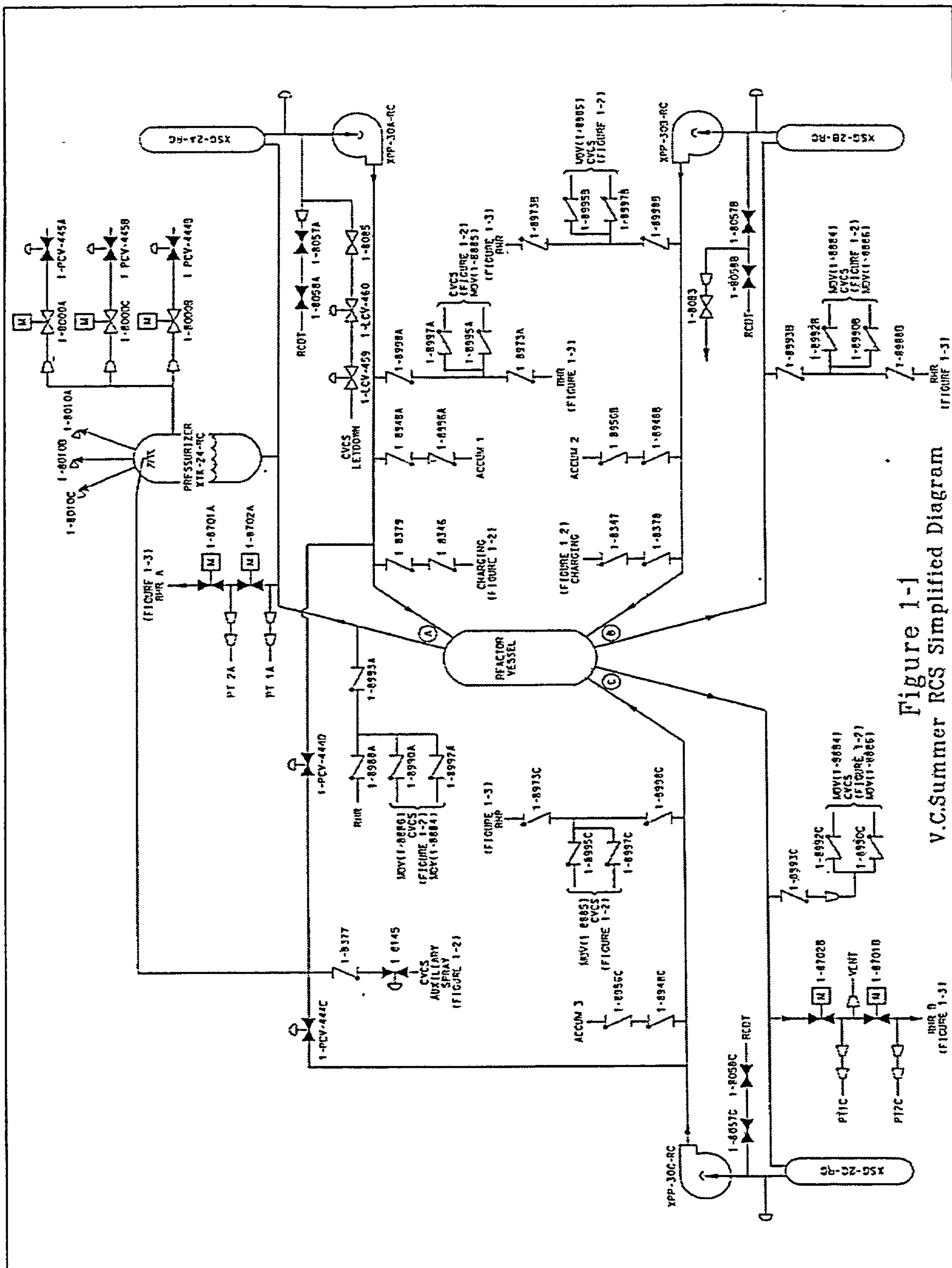

Figure 1-1
V.C.Summer RCS Simplified Diagram

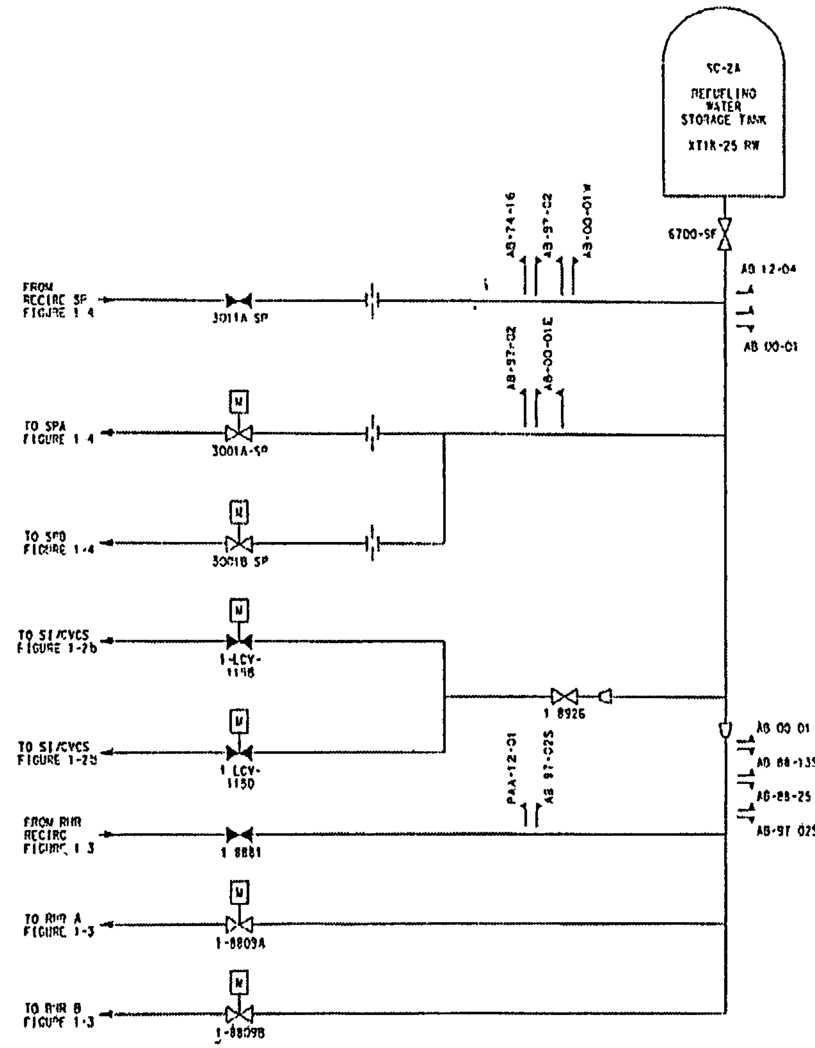

Figure 1-2a

V.C.Summer RWST Simplified Diagram

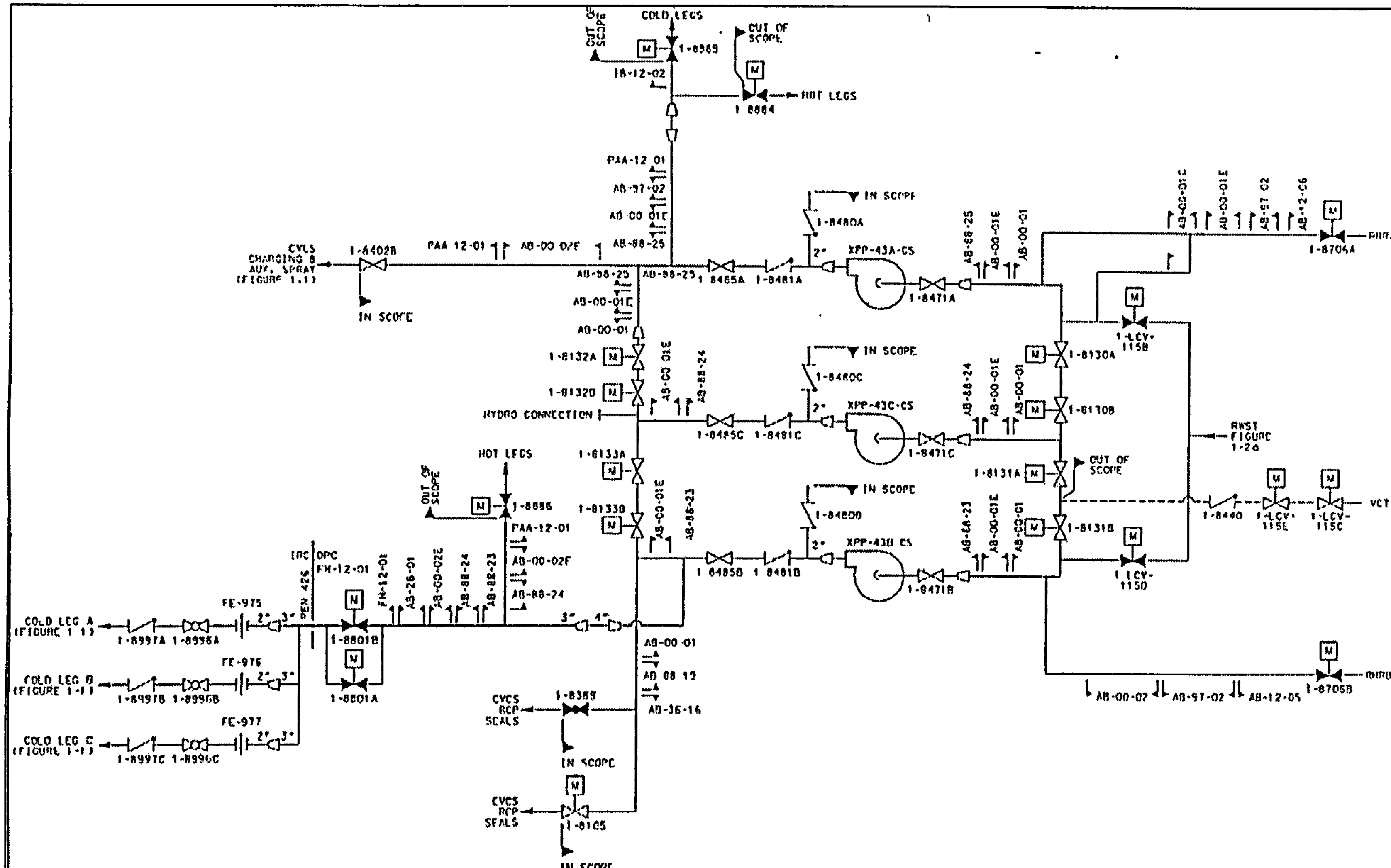

Figure 1-2b
V.C.Summer CVCS and Safety Injection System Simplified Diagram

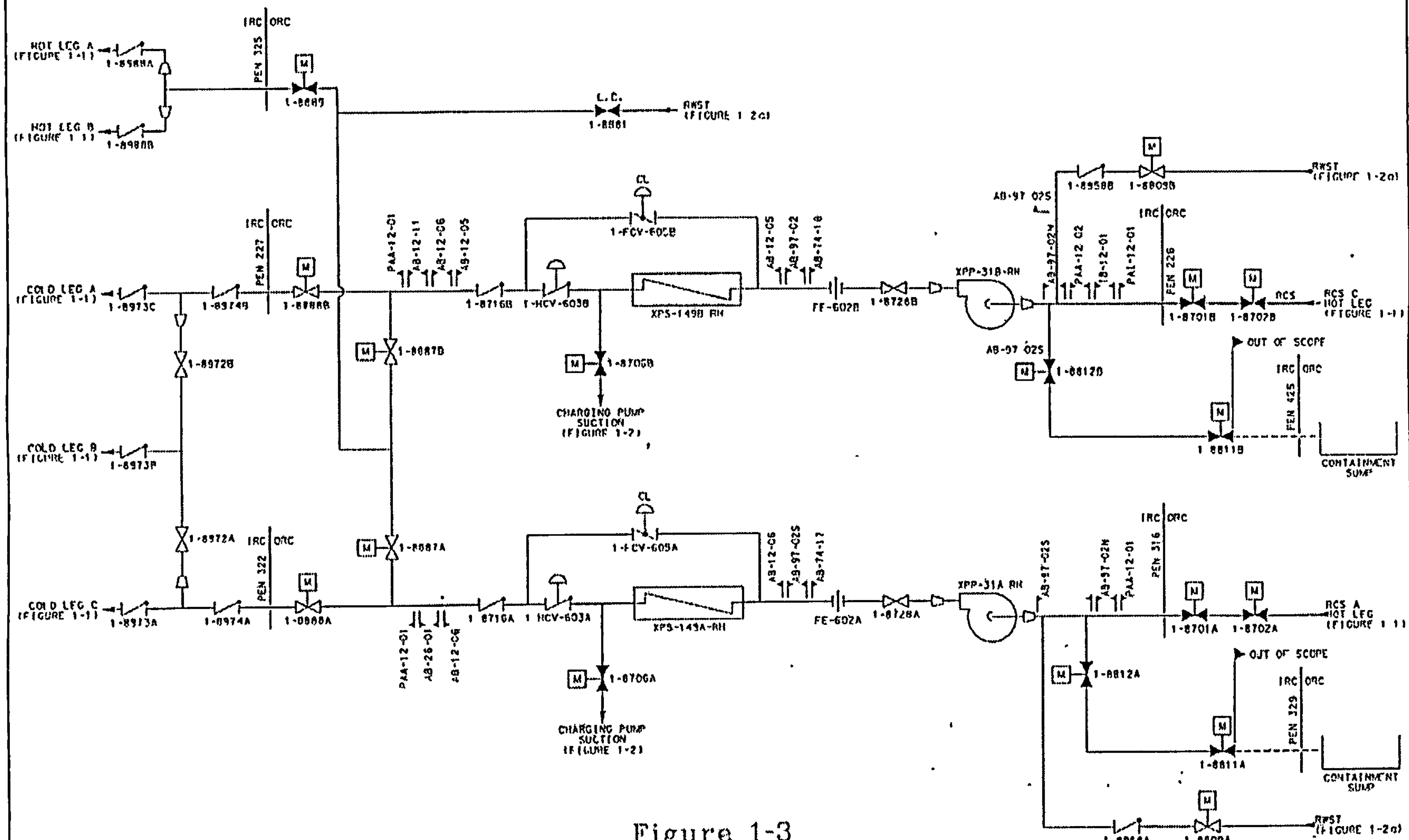

Figure 1-3
V.C.Summer Residual Heat Removal System Simplified Diagram

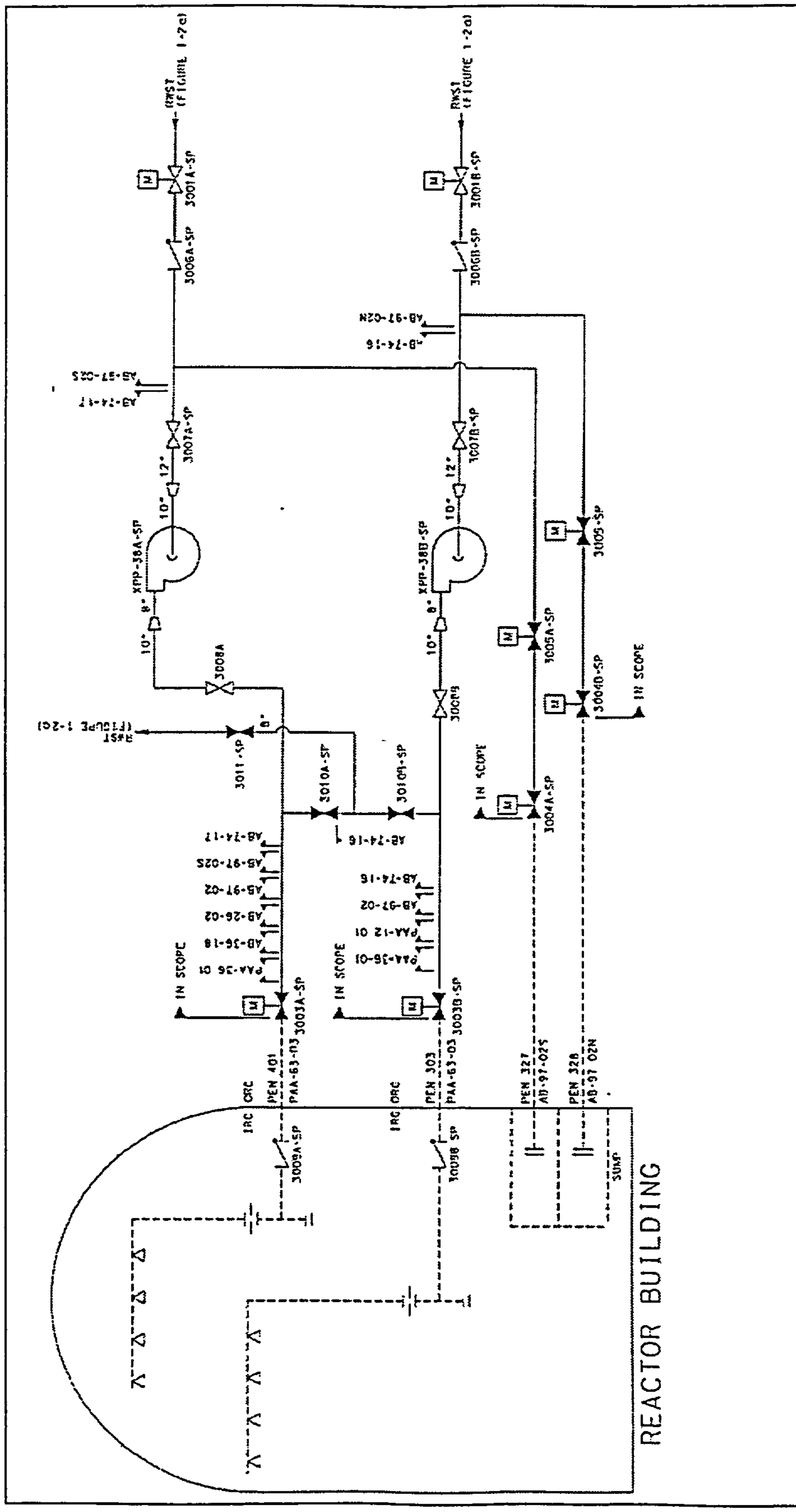

Figure 1-4
V.C.Summer Reactor Building Spray System Simplified Diagram

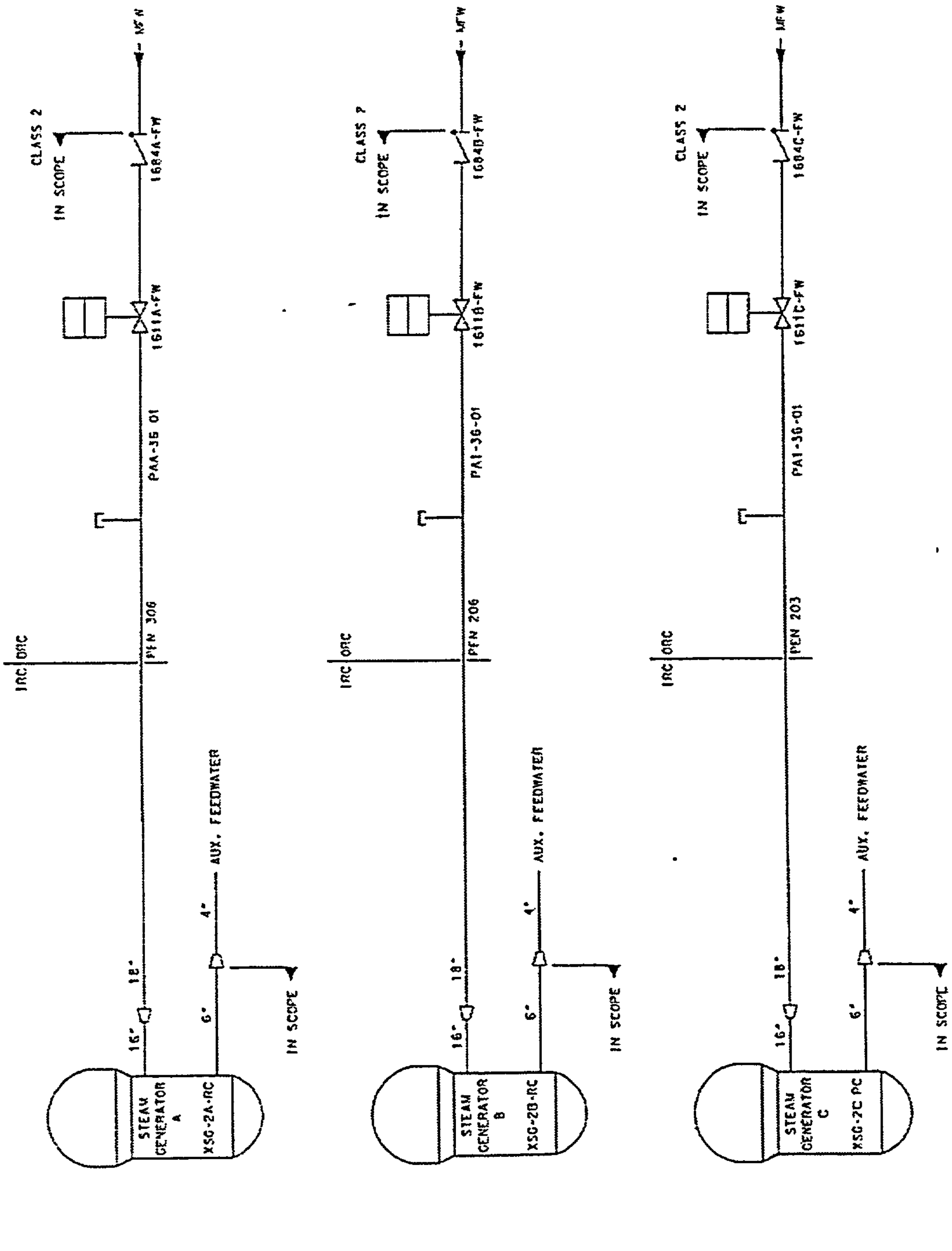

Figure 1-5
V.C.Summer Feedwater (Nuclear) System Simplified Diagram

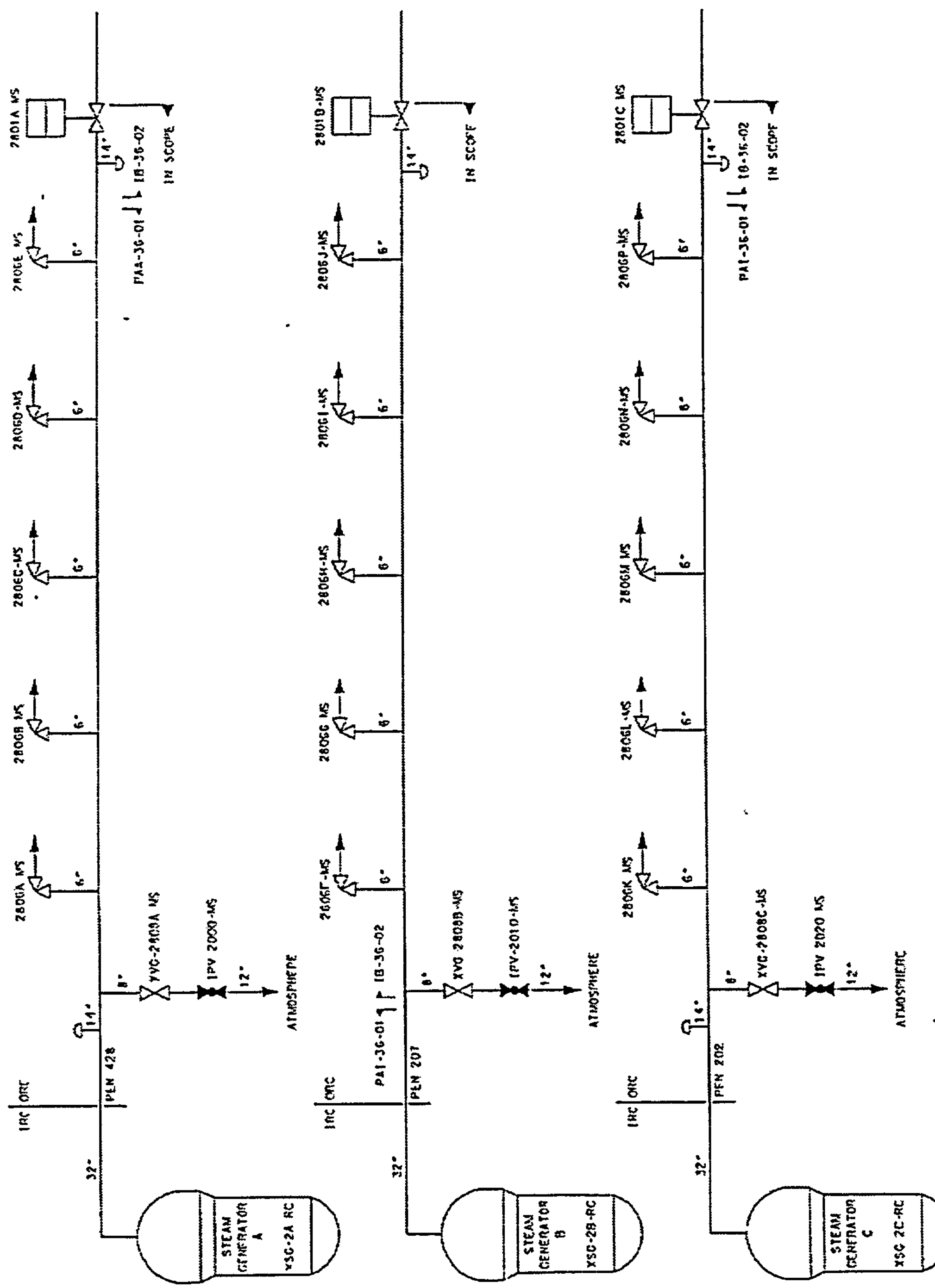

Figure 1-6
V.C.Summer Main Steam (Nuclear) System Simplified Diagram

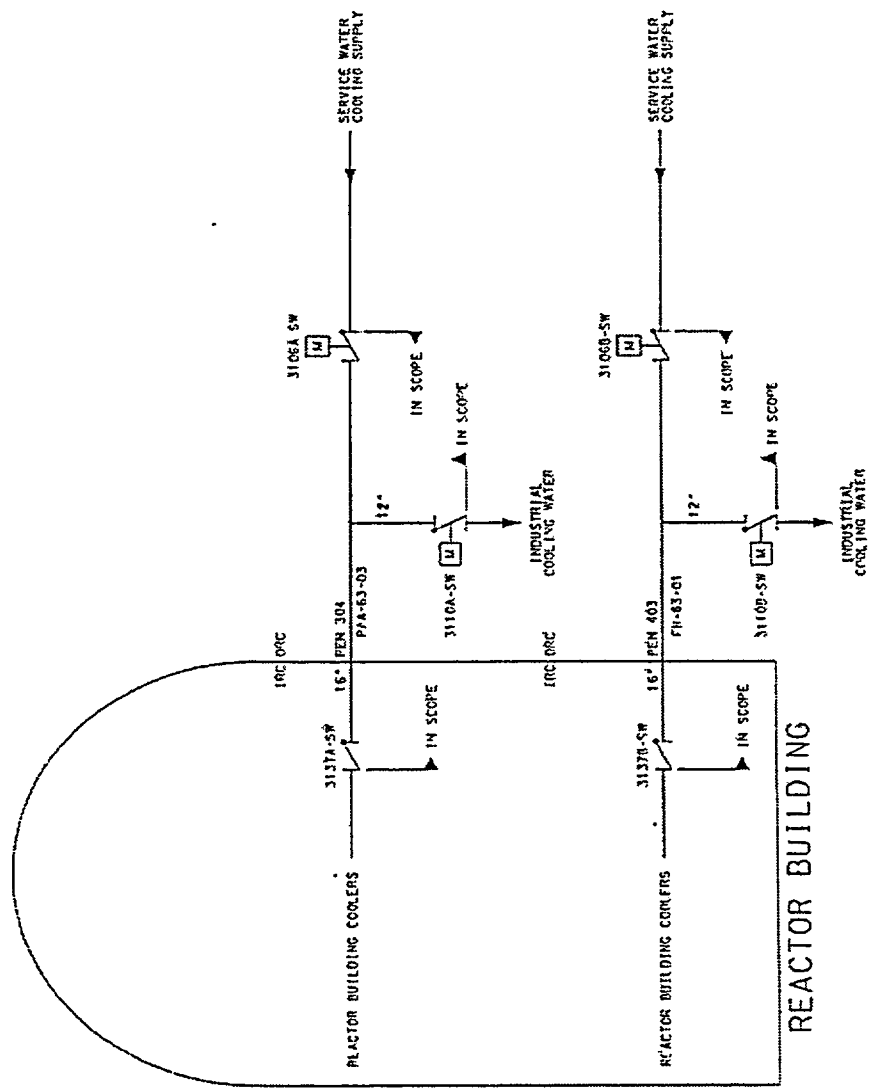

Figure 1-7
V.C.Summer Service Water Cooling System Simplified Diagram