Subcompartment Analyses for US-APWR Design Confirmation

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Mitsubishi Heavy Industries, Ltd. 16-5, Konan 2-chome, Minato-ku Tokyo 108-8215 Japan

ABSTRACT

In support of the US-APWR Design Certification application, this Technical Report (TR) provides subcompartment analyses to confirm that the calculated peak differential pressures during the piping break transients for each subcompartment are less than structural design differential pressures. Also, it describes the adequacy and conservatism of the subcompartment analysis methodology.

In the introductory chapter, the fundamental information on this Technical Report is presented. In the second and the third chapter, the design basis and the design features for the subcompartment analyses are elaborated. In the chapter four, the methodology used for analysis is discussed including the vent flow behavior models and the short-term mass and energy release model. In the chapter five, the model sensitivity studies and model validations are discussed in detail. In the chapter six, the plant analysis results are shown.

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List of Acronyms

APWR B/B BE BFMC CLG	Advanced Pressurized Water Reactor BYRON / BRAIDWOOD Stations Best estimated Battele-Frankfurt Model Containment Cold Leg
CSNI-OECD	Committee for the Safety of Nuclear Installations of the Organization for Economic Development and Cooperation
CVCS	Chemical and Volume Control System
DCD	US-APWR design control document
DVI	Direct Vessel Injection
EPRI	Electric Power Research Institute
FSAR	Final Safety Analysis Report
HDR	Heissdampfreactor
HLG	Hot Leg
LBB	Leak Before Break
LOCA	Loss Of Coolant Accident
MCP	Main Coolant Pipe
MHI	Mitsubishi Heavy Industries, Ltd
NAI	Numerical Applications, Inc
NRC	U.S. Nuclear Regulatory Commission
PWR	Pressurized Water Reactor
PZR	Pressurizer
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
SG	Steam Generator
SRP	Standard Review Plan
IK	iecnnical Report

1.0 Introduction

The subcompartment differential pressure analyses are performed for confirming the design differential pressure chosen for each subcompartment. A short-term pressure pulse would exist inside a containment subcompartment following a pipe rupture within the subcompartment. This pressure transient produces a pressure differential across the walls of the subcompartment which reaches a maximum value generally within the first few seconds after blowdown begins. The magnitude of the peak value is a function of several parameters, which include blowdown mass and energy release rates, subcompartment volume, vent area, and vent flow behavior. A transient differential pressure response analysis is done by the GOTHIC code.

This Technical report (TR) provides the plant subcompartment pressure analyses, which demonstrate that the calculated peak differential pressures during the piping break transients for each subcompartment are less than structural design differential pressures. Also it describes the adequacy and conservatism of the analysis models, through the code option, the analysis conditions, the above mentioned several parameters, and the model sensitivity studies.

2.0 Design Basis

To comply with GDC 4 and 50 of 10 CFR 50, Appendix A, subcompartments within the containment are designed to withstand the transient differential pressures due to a postulated pipe break.

The US-APWR has the following subcompartments inside the containment:

- Reactor cavity
- Steam generator (SG) subcompartments
- Pressurizer subcompartment
- Pressurizer surge piping room (Underneath the Pressurizer subcompartment, EL. 25 ft.- 3 in.)
- Pressurizer spray valve room (South side of the Pressurizer subcompartment, EL. 50 ft.- 2 in.)
- Regenerative heat exchanger room (Northwest side of the SG subcompartment, EL. 50 ft.- 2 in.)
- Letdown heat exchanger room (South side of the Pressurizer subcompartment, EL. 25 ft.- 3 in.)

Some piping segments of the US-APWR are classified as leak-before-break (LBB). For these components, it is not necessary to analyze the dynamic effects of a postulated pipe rupture, including pipe whip, jet impingement loads, and subcompartment pressurization. Chapter 3, Subsection 3.6.3 of the US-APWR design control document (DCD), discusses LBB criteria and evaluation procedures. One of the subcompartments that does not need to be analyzed is the pressurizer surge piping room, because the pressurizer surge line is classified as LBB.

Analyses are performed to conservatively calculate the peak differential pressure following the most severe specified pipe rupture for each subcompartment. The calculated value is then compared to a differential pressure representing the structural capability of the subcompartment walls, to show the peak differential pressure is within structural capabilities. These analyses are performed using a detailed evaluation model employing the GOTHIC computer program (Ref. 1).

Section 3.0 describes the basis for the selection of the postulated pipe breaks that are analyzed in detail for each subcompartment. This selection process factors in the LBB assessments described in Chapter 3, Subsection 3.6.3 of the US-APWR DCD. The evaluation of these postulated subcompartment piping breaks is described in Section 3.2.

The US-APWR design does not rely on piping restraints to limit the break area of potential high-energy piping failures within these subcompartments.

3.0 Plant Design Features

The plant design features of the subcompartments, component, equipment, vent locations and high energy line locations used in the GOTHIC model are provided below.

Vent paths such as openings in the walls, floor gratings, etc are considered in the subcompartment analysis. Vent paths created by the postulated pipe rupture as a result of insulation collapsing are not credited in the analysis.

3.1 Description of Each Subcompartment

3.1.1 Reactor Cavity

The reactor cavity consists of a cylindrical narrow gap between the reactor vessel and the concrete primary shield wall, the space under the reactor vessel, and the reactor cavity access tunnel. The area under the reactor vessel is designed to hold molten core debris in case of a Severe Accident. In the reactor cavity, four Direct Vessel Injection (DVI) pipes are connected to the reactor vessel at elevation 35 ft. - 3 in. The reactor vessel nozzles are considered as the termination points for the high-energy piping. Subcompartment analysis is required for the reactor cavity, as a 4-inch pipe break therein is assumed.

The reactor cavity has multiple vent paths which are capable of discharging the accident pressure surge to the containment atmosphere. The pressure generated from the pipe break was assumed to discharge to the SG subcompartment through the reactor coolant pipe sleeves (EL. 40 ft. - 4 in.) which penetrate the primary shield wall. The SG subcompartment is open to the containment atmosphere. The pressure is also vented to the bottom chamber through the gap between the reactor vessel and the primary shield wall, through the pressurizer surge pipe room (EL. 25 ft. - 3 in.), then through the two vertical vent openings and the personnel access. The Pressurizer surge pipe room is open to the SG subcompartment.

3.1.2 Steam Generator Subcompartment

Steam Generator (SG) subcompartments are composed of the secondary shield walls surrounding the primary loops from the SGs, and are open at the top of the subcompartment. The subcompartment walls are designed to protect equipment in other parts of the containment from postulated pipe ruptures inside the subcompartment. High-energy lines are routed in the subcompartment, such as the branch lines from the reactor coolant piping, feedwater piping, and steam generator blowdown lines. The subcompartment analysis is performed by assuming a 6-inch diameter break of the pressurizer spray line connected to the reactor coolant piping (cold leg at EL. 40 ft.- 4 in.), or a 16-inch feedwater pipe (EL. 90 ft.- 9 in.), as the worst case.

The subcompartment has an entrance opening for each quadrant at elevations 25 ft.- 3 in. and 50 ft.-2 in. These entrances and the open top of the subcompartment are assumed in the analysis as the vent openings to mitigate the accident pressure surge caused by the postulated pipe break.

3.1.3 Pressurizer Subcompartment

The pressurizer subcompartment houses the pressurizer and is located inside a secondary shield wall at elevation 58 ft. - 5 in. The worst case postulated pipe break in

the subcompartment assumes that the 8-inch pressurizer pressure relief line which connects to the top of the pressurizer fails (EL. 122 ft. - 6 in.).

While the top of the subcompartment is covered by a concrete ceiling, two personnel accesses are provided for the purpose of maintenance and inspection of the pressurizer relief valve. The discharge pressure from the accident is vented into the containment atmosphere through these openings. An entrance from SG subcompartment is also provided at the bottom of the Pressurizer subcompartment at elevation 58 ft. - 5 in.

3.1.4 Pressurizer Surge Piping Room

The pressurizer surge piping room is located underneath the pressurizer room at elevation 25 ft.- 3 in. Since the LBB is applied for the 14-inch pressurizer surge pipe, a postulated pipe break is not considered in this subcompartment.

3.1.5 Other Rooms

The following subcompartments are not evaluated since the vent paths are large compared to the line sizes. These conditions, in perspective to the compartment structural capacity, will not result in significant differential pressure between the subcompartment and the containment atmosphere.

3.1.5.1 Pressurizer Spray Valve Room

Pressurizer spray valve rooms are located outside the secondary shield wall, and adjacent to the pressurizer subcompartment at elevation 50 ft. - 2 in. These rooms are provided to access and inspect pressurizer spray control valves. The worst case postulated pipe break in the valve room assumes a 6-inch pressurizer spray pipe break that connects to the top of the pressurizer. The personnel access to the subcompartment is the vent path to the containment atmosphere.

3.1.5.2 Regenerative Heat Exchanger Room (Northwest of SG Subcompartment, EL.50'-2")

The regenerative heat exchanger room is located outside secondary shield walls, at elevation 50 ft. - 2 in. High-energy lines associated with the Chemical Volume and Control System (CVCS), considered as the postulated pipe break, are routed in the room. The worst case pipe break assumes a 4-inch pipe break at the heat exchanger nozzle. The personnel access to the room and additional openings are the vent paths to the containment atmosphere.

3.1.5.3 Letdown Heat Exchanger Room (South Side of Pressurizer Subcompartment, EL.25'-3")

The letdown heat exchanger room is located outside secondary shield walls, at elevation 25 ft. - 3 in. A high-energy line routed in the room, associated with CVCS, is considered as the postulated pipe break. The worst case pipe break was assumed to be a 4-inch pipe at the heat exchanger nozzle. The personnel access and additional vent openings are the vent paths to the containment atmosphere.

3.2 Break Assumption of High-Energy Lines

A list of high-energy lines within each subcompartment was developed. For each subcompartment, the high-energy lines excluded from pipe rupture considerations for

dynamic effects due to application of the LBB criterion discussed in Subsection 3.6.3 of the DCD are excluded from consideration in the subcompartment analysis. The remaining lines are grouped according to the pressure and temperature of the fluid in the line. Certain lines may be excluded from further analysis on a qualitative basis (i.e., the mass and energy of the lines located in the subcompartment are compared, to eliminate those lines that clearly do not challenge the bounding failure). A detailed pipe break simulation is performed for the largest diameter line in each group in each subcompartment from the lines that remain under consideration. Table 3-1 provides information about the pipes considered for evaluation of the SG subcompartment and pressurizer subcompartment. The lines with boldface in Table 3-1 are postulated to break in the subcompartment analyses.

	-				
Subcompartment	Break Line	Line Spec	Press. psi	Temp. °F	fluid
	Main Coolant Pipe-Hot Leg	31ID-RC-2505R	2235	617.0	Subcooled Water
	Main Coolant Pipe-Cold Leg	31ID-RC-2505R	2235	550.6	Subcooled Water
	Main Coolant Pipe-Cross-over Leg	31ID-RC-2505R	2235	550.6	Subcooled Water
	Pressurizer Surge Line	16-RC-2501R	2235	653.0	Subcooled Water
		14-RC-2501R	2235	550.6	Subcooled Water
	Accumulator Injection Line	14-SI-2501R	2235	550.6	Subcooled Water
		14-SI-2511R	2235	120.0	Subcooled Water
	RHR Pump Inlet Line	10-RC-2501R	2235	617.0	Subcooled Water
	RHR Pump Outlet Line	8-RC-2501R	2235	550.6	Subcooled Water
	Direct Vessel Injection Line	4-RC-2501R	2235	550.6	Subcooled Water
	SI High Head Injection Line	4-RC-2501R	2235	617.0	Subcooled Water
	SI Emergency Letdown Line	2-RC-2501R	2235	617.0	Subcooled Water
	Pressurizer Spray Line	6-RC-2501R	2235	550.6	Subcooled Water
Steam Generator	Loop Drain Line	2-RC-2501R	2235	550.6	Subcooled Water
Subcompartment		4-RC-2501R	2235	550.6	Subcooled Water
	Charging Line	4-CS-2501R	2235	550.6	Subcooled Water
		4-CS-2561R	2235	464.0	Subcooled Water
		3-RC-2501R	2235	550.6	Subcooled Water
		3-CS-2501R	2235	550.6	Subcooled Water
	Letdown Line	3-CS-2561R	2235	550.6	Subcooled Water
		3-CS-601R	350	269.1	Subcooled Water
		4-CS-601R	350	115.0	Subcooled Water
	DCD Sool Wrater Injustion Line	1_1/2-CS-2501R	2600	130.0	Subcooled Water
		1_1/2-CS-2511R	2600	130.0	Subcooled Water
	Feedwater Line	16-FW-1525N	1185	568.0	Saturated Water
	Main Steam Line	32-MS-1532N	907	535.0	Steam
	SG Blowdown Line	3-BD-1532N	907	535.0	Steam
		4-BD-1532N	907	535.0	Steam

Subcompartment Analyses for US-APWR Design Confirmation

Subcompartment	Break Line	Line Spec	Press. psi	Temp. °F	fluid
Subcompartment under Pressurizer Subcompartment	Pressurizer Surge Line	16-RC-2501R	2235	653.0	Subcooled Water
	Pressurizer Spray Line	6-RC-2501R	2235	550.6	Subcooled Water
	Pressurizer Auxiliary Spray Line	3-RC-2501R	2235	550.6	Subcooled Water
	Pressurizer Safety Valve Inlet Line	6-RC-2501R	2235	653.0	Subcooled Water
Pressurizer		8-RC-2501R	2235	653.0	
	Pressurizer Safety	6-RC-2501R	2235	653.0	Steam
	Depressurization Line	4-RC-2501R	2235	653.0	Saturated Water
		3-RC-2501R	2235	653.0	

4.0 Analytical Methodology

4.1 Subcompartment Analyses

4.1.1 GOTHIC Computer Code Overview

The GOTHIC computer code is used for the subcompartment differential pressure analysis (Ref. 1).

GOTHIC is a general purpose thermal-hydraulics code for performing design, licensing, safety and operating analysis of nuclear power plant containments and other confinement buildings. GOTHIC was developed for the Electric Power Research Institute (EPRI) by Numerical Applications, Inc. (NAI) (Ref. 1). A summary description of GOTHIC capabilities is given below. More detailed descriptions of the code user options, models and qualification are documented in References 1 through 3.

GOTHIC solves the conservation equations for mass, momentum and energy for multi-component, multi-phase flow in lumped parameter and/or multi-dimensional geometries. The phase balance equations are coupled by mechanistic models for interface mass, energy and momentum transfer that cover the entire flow regime from bubbly flow to film/drop flow, as well as single phase flows. The interface models allow for the possibility of thermal non-equilibrium between phases and unequal phase velocities, including countercurrent flow. GOTHIC includes full treatment of the momentum transport terms in multi-dimensional models, with optional models for turbulent shear and turbulent mass and energy diffusion. Other phenomena include models for commonly available safety equipment, heat transfer to structures, hydrogen burn and isotope transport.

Conservation equations are solved for up to three primary fields and three secondary fields. The primary fields are steam/gas mixture, continuous liquid and liquid droplet; the secondary fields are mist, ice, and liquid components. For the primary fields, GOTHIC calculates the relative velocities between the separate but interacting fluid fields, including the effects of two-phase slip on pressure drop. GOTHIC also calculates heat transfer between phases, and between surfaces and the fluid. Reduced equation sets are solved for the secondary fields by the application of appropriate assumptions as described in the reference documents.

The three primary fluid fields may be in thermal non equilibrium in the same computational cell. For example, saturated steam may exist in the presence of a superheated pool and subcooled drops. The solver can model steam, water and non-condensing gases over of full range of temperature and pressure conditions anticipated for the design basis accidents.

The steam/gas mixture is referred to as the vapor phase and is comprised of steam and, optionally, up to eight different non-condensing gases. The non-condensing gases available in the model are defined by the user. Mass balances are solved for each component of the steam/gas mixture, thereby providing the volume fraction of each type of gas in the mixture. The mist field is included to track very small water droplets that form when the atmosphere becomes super saturated with steam. The liquid component field allows particles or liquid globules to be tracked in the liquid phase.

The principal element of a model is a control volume, which is used to model the space

within a building or subsystem that is occupied by fluid. The fluid may include non-condensing gases, steam, drops or liquid water. GOTHIC features a flexible nodal scheme that allows computational volumes to be treated as lumped parameter (single node) or one-, two- or three-dimensional, or any combination of these within a single model.

Solid structures are referred to in GOTHIC as thermal conductors. Thermal conductors are modeled as one-dimensional slabs for which heat transfer occurs between the fluid and the conductor surfaces and, within a conductor, perpendicular to the surfaces. The one-dimensional thermal conductors can be combined into a conductor assembly to model two-dimensional conduction.

GOTHIC includes a general model for heat transfer between thermal conductors and the steam/gas mixture or the liquid. There is no direct heat transfer between thermal conductors and liquid droplets. Thermal conductors can exchange heat by thermal radiation. Any number of conductors can be assigned to a volume.

Fluid boundary conditions allow the user to specify mass sources and sinks and energy sources and sinks for control volumes. Thermal boundary conditions applied through a heat transfer option on a thermal conductor surface can be used as energy sources and sinks for solid structures.

There are four features in GOTHIC for modeling hydraulic connections, as follows:

- (a) Flow paths
- (b) Network models
- (c) Cell interface connections in subdivided volumes
- (d) 3D connectors for subdivided volumes

Flow paths model hydraulic connections between any two computational cells, which includes lumped parameter volumes and cells in subdivided volumes. Flow paths are also used to connect boundary conditions to computational cells where mass, momentum and energy can be added or removed. A separate set of momentum equations (one for each phase) is solved for each flow path.

Network nodes and links are available specifically for modeling building ventilation or piping systems. These types of hydraulic connections can include multiple branches between connected volumes. Network nodes are assigned to the branch points.

Adjacent cells within a subdivided volume communicate across the cell interface, based on the characteristics of the hydraulic connection. 3D flow connectors define the hydraulic connection across cell interfaces that are common to two subdivided volumes.

GOTHIC includes an extensive set of models for operating equipment. These items, referred to collectively as components, include pumps and fans, valves and doors, heat exchangers and fan coolers, vacuum breakers, spray nozzles, coolers and heaters, volumetric fans, hydrogen recombiners, igniters, pressure relief valves.

Initial conditions allow the user to specify the state of the fluid and solid structures within the modeled region at the start of a transient. These include the initial temperature and composition of the atmosphere, the location and temperature of liquid pools, the location and amount of liquid components, and the temperatures of solid structures within the building.

Additional resources available to expand the realm of situations that can be modeled by GOTHIC include functions, control variables, trips and material properties.

Using a conservative model prescription, GOTHIC predicts the time dependent subcompartment differential pressure.

4.1.2 GOTHIC Application to Subcompartment analyses

4.1.2.1 Vent Flow Behavior Models

Assumptions with regard to the distribution of mass and energy release are biased towards maximizing the subcompartment pressure, conforming to SRP 6.2.1.2 (Ref. 7). The vent flow behavior through all flow paths within the nodalized compartment model was treated as a homogeneous mixture in thermal equilibrium, with the assumption of 100-percent water entrainment by applying code options to force thermodynamic and velocity equilibrium and to disallow the deposition of drops in the volumes.

Also, the thermal homogeneous equilibrium model for air-steam-water mixtures is used as the vent critical flow correlation.

In addition, the evaluation models do not take credit for the vent areas that change during the transient as a result of insulation collapsing.

4.1.2.2 GOTHIC Input Data

In the GOTHIC input data, the base vent flow behavior model options (thereinafter called as **BASE** options) use all the default values, but the selected vent flow behavior model options that are acceptable according to SRP 6.2.1.2 (thereinafter called as **NRC** options) are realized as follows:

Table 4-1and Table 4-2 show the base options for the vent flow behavior model.

The above mentioned conditions and models are used through the plant subcompartment analyses in Section 7.

4.2 Short term mass and energy release

Mass and energy releases used for postulated primary piping breaks are basically calculated by the computer code M-RELAP5 (Ref. 6).

The computer code and volume noding of the piping system similar to those of small-break LOCA analyses are used with a flow multiplier of 1.0 of the applicable

choked flow correlation.

Also, the approach to assume a constant blowdown profile using the initial mass and energy release conditions calculated by the computer code M-RELAP5 and with the flow multiplier of 1.0 is used for postulated secondary piping breaks (Ref. 5).

Initial plant operating conditions assumed for mass and energy releases are the same as those described in Subsections 6.2.1.3 and 6.2.1.4 of DCD (Ref. 8) for postulated primary and secondary piping breaks, respectively.

Table 4-1 Base run options of Run Control

Table 4-2 Base Flow path parameter-3 of each Flow Path

5.0 Model Sensitivity Studies and Validation for Subcompartment Analyses

The base models and the test descriptions provided in section 5.1 and 5.1 are taken directly from the GOTHIC Assessment Report (Ref. 8-3) and the subcompartment analysis descriptions provided in section 5.3 are taken directly from the FSAR chapter 6 of Byron/Braidwood stations (Ref. 8-11), and repeated here for convenience.

5.1 Parameters and Models Sensitivity Studies

When a break occurs inside a compartment, the maximum pressure differential across the compartment walls occurs within a very short time (typically less than five seconds). The peak differential pressure is controlled primarily by the inertia of the fluid in and around the openings to the containment and the flow resistance through the openings. Heat transfer and condensation on the walls and structures in the compartment would tend to reduce the peak differential pressure but the impact is small due to the short time to the peak.

Vent loss coefficients and inertia terms sensitivity studies were performed to support the selection of the results to the vent loss coefficients and inertia terms. The set of vent loss coefficients and inertia terms is checked for sensitivity by comparing the selected output parameter with results obtained using larger or smaller values. This was accomplished by 1.2 times or 0.8 times the base values of vent loss coefficients (SS Vent Loss Coefficient) and inertia terms (SS INERTIA). In the explanatory notes of Figure 5.1-6 to Figure 5.1-20 and Figure 5.1-26 to Figure 5.1-35,, the symbol "sensitivity study 1.0 (base)" means that the calculation is conducted by the base option set described in section 4.1.2.2. As well, the symbol "sensitivity study 1.0(NRC)" means that the calculation is conducted by the set of 4.1.2.2, hereby incorporated by reference. Also, the symbol "sensitivity study 1.2" and symbol "sensitivity studies 0.8" mean that the calculations are conducted by 1.2 times and 0.8 times the base values of vent loss coefficients (SS Vent Loss Coefficient) and inertia terms (SS INERTIA), respectively.

Vent flow behavior model sensitivity studies (SS RUN OPTIONS) were conducted to find their conservatism of the results to the vent flow behavior models described in subsection 4.1.2.

These sensitivity studies were conducted using the applicable test data shown below. These test data and best estimated (BE) results were treated as the base data for the comparisons.

5.1.1 BATTELLE-FRANKFURT Test Facility

This section provides a summary description of the Battelle-Frankfurt Model Containment (BFMC) as a reference for the sections that follow. Information presented in this section was acquired from Ref. 8-3.

The BFMC was constructed specifically to study the thermal-hydraulic response of a containment system during accident conditions and to use test data to assist development of related thermal-hydraulic codes. The BFMC is a multi-room facility in cylindrical geometry, having an outside diameter of 12 m and a height of 12.5 m. The

structure is made of steel reinforced concrete capable of withstanding pressures to 6 *atm*. Total volume is about 600 m^3 , although room configuration can be altered by inclusion of concrete inserts that change the volume and surface area of rooms, and steel plates that block or partially block openings between rooms. This flexibility permits a test to be run in a single room or several rooms with a variety of geometries and flow paths (see Figure 5.1-1).

Steam is supplied from a pressure vessel in an adjacent building. The pressure vessel can operate up to 140 *atm* and 300 *C*.

Total volume of the pressure vessel and supply lines is 7 m^3 . A recirculation system is available to keep the fluid in the supply lines near the condition of the fluid in the vessel. The length of the supply line piping is on the order of 25 *m*. Pipe diameters are 15 and 20 *cm*.

The BFMC is extremely clean relative to large scale tests at the sites of unfinished or decommissioned reactors where rooms, passage ways, equipment, piping, and miscellaneous equipment make the modeling more difficult and less certain. For example, in the HDR experiments it is necessary to estimate the loss coefficient for flow through a spiral staircase which connects the upper dome to a room below. In contrast, the BFMC is essentially free of such complex internal fixtures. Rooms and openings between rooms are clearly defined. Documentation of geometric parameters, sensor locations, and test data is relatively good. As a result of these attributes, the tests are relatively easy to model in GOTHIC, providing a good basis for judging the validity of code models. A drawback is the small scale which makes the surface area to volume ratio much higher than in the full scale containment. Thus, there may be differences in the performance of the condensation models applied to BFMC tests versus other full scale tests.

The cutaway in Figure 5.1-1 is perhaps the best available drawing to see the general configuration of the containment. The internal room is an open cylinder having discrete diameters over different axial sections. The resulting ledges support inserts used to define separate rooms within this region. An annular region surrounding the inner cylindrical room is divided by a floor about midway up the cylinder. This floor and 3 radially oriented vertical walls in the annulus form boundaries that define 5 distinct rooms in this region. The enclosing walls of the containment form a continuous open annular space outside of that shown in the figure. This outer annular space is open to a domed region which bounds the top of the containment. Openings between rooms are sharply cut circles, rectangles, trapezoids and annular segments.

5.1.2 Comparisons of BFMC test with GOTHIC Calculation and Sensitivity Studies

Battelle-Frankfurt test D-16 is a pressurized water blowdown experiment. This test was also used as Standard Problem No. 2 by the Committee for the Safety of Nuclear Installations of the Organization for Economic Development and Cooperation (CSNI-OECD). Test D-16 is, in some notable respects, uniquely different from tests D-1 and D-15. First of all, the room configuration in test D-16 provides non-symmetric parallel flow paths from the break room to the dome. The room configuration for tests D-1 and D-15 is a series of linked rooms in which the flow must traverse the length of each room in the series before passing to the next room. A second unique aspect of test D-16 is the

fluid condition of the break. The blowdown is pressurized liquid, whereas tests D-1 and D-15 are steam blow-downs.

(a) Physical Description of the Test Facility

For BFMC test D-16, steel plates are used to block openings to provide a room configuration as shown in Figure 5.1-2. Not made clear in Figure 5.1-2 is the fact that the central region of the containment is open to room R9 so that the entire volume of the containment is involved in the test. The break orientation is horizontal and radially outward. Two openings, centered 1.8 *m* above the center elevation of the break, lead from the break room. The openings, shown in Figure 5.1-2 are on the opposing radially oriented vertical walls of R4. These openings, U45 and U47, direct flow circumferential to rooms R5 and R7. Both of these openings are 0.8-*m*-square and are covered with a steel plate having a sharp edged 0.75-*m*-diameter orifice. Flow entering R5 can escape to room R9 by traversing only a short length of R5. Trapezoidal opening U59B has a full open area of 2.25 m². It is covered with a steel plate having a 0.55-m-diameter sharp edged orifice. Flow entering R7 must traverse the length of R7 before escaping to room R8 through opening U78B. This is a 1.0-m-diameter opening covered with a steel plate having a 0.55-m diameter sharp edged orifice. Each of the orifice plates is made from 0.10-m-thick steel.

The remaining openings are between R6 and R9 and between R8 and R9. These 2 collections of openings are compiled into 2 connections. At any rate, the openings to R9 infer the collection of flow paths to the annular section of R9 and to the central part of the containment. The connection between R6 and R9 is assigned a total flow area of 2.109 m2. The connection between R8 and R9 is assigned a total flow area of 1.933 m^2 .

During the test, a cover plate, located at the interface of the top of R4 and the dome portion of R9, became unattached along one seam, permitting fluid to escape from R4 to R9. This unintended gap was discovered after the test. An evaluation was performed to estimate the behavior of the gap during the test. It is probably fair to suggest that a considerable amount of speculation was involved. It is suggested that the gap size may actually reach the maximum value of 0.0292 m² by 0.01 sec and sustain this value to 16 sec following the break.

(b) Test Parameters

Break flow rate and enthalpy are shown in Figure 5.1-3 and Figure 5.1-4. Measured flow rate was derived from measurements taken with a gamma-densitometer and from the mean value of the measured curves of two drag bodies. The flow rates presented in Figure 5.1-3 were corrected to obtain a mass balance.

The flow was adjusted by a factor of 1.3 during the first 0.2 sec after the break. Over the next 0.15 sec the flow was adjusted by a factor that decreased linearly from 1.3 at 0.2 sec, to 1.0 at 0.35 sec. Next, the flow was adjusted by a factor that increased linearly from 1.0 at 1.2 sec, to 1.2 at 4 sec. Beyond 4 sec after the break, measured flow was adjusted by a factor of 1.2. The test report does not indicate whether the adjustment was a multiplication or division.

Specific enthalpy is from measured density and temperature for single-phase flow and density and pressure for 2-phase flow.

Break flow and enthalpy were taken from measurement point II, a position about 2.7 m upstream from the rupture disk. This position is approximately at the center of the containment. Initial containment pressure is 1.0 atm. Average initial temperature of the containment is 27 C. Actual initial room temperatures vary from 23.5 to 30.5 C. Initial relative humidity is 100%.

(c) GOTHIC Model Description

(d) GOTHIC Data Comparisons

Comparisons of predictions from the GOTHIC model to experimental data for test D-16 are shown in Figure 5.1-6 to Figure 5.1-20. A review of these figures indicates that GOTHIC predictions for this test are generally good. The following comments highlight particular aspects of the data comparison. These figures, Figure 5.1-6 through Figure 5.1 -10, are differential pressures in the first 2.5 sec following the break including the vent loss coefficient sensitivity study. Differential pressure data between the break room, R4, and the rooms immediately downstream, R5 and R7, exhibits oscillations of 10 to 20 kPa, with the highest oscillations occurring during the earliest part of the transient. This is reflected in the digitized data in Figure 5.1-6 and Figure 5.1-7. Similar oscillations occur in differential pressure data between R4 and R9. Since the pressure in R9 is relatively stable, the oscillations in differential pressure must result from small pressure oscillations in the break room, as would be expected.

Overall, prediction of differential pressures is good with the GOTHIC model using loss coefficients of 1.5 on all junctions. Orifice plates represented by the junctions are probably the same orifice plates used in BFMC test D-15 where we found good agreement with data using similar loss coefficients. If the same orifice separated two very large rooms, the loss coefficient would be 2.78, as noted with regard to test D-15. Smaller loss coefficients here, and for test D-15, are due to the influence of the openings in the concrete wall to which the plates are attached, and to the fact that the connected rooms are not large. That is, the effective cross-section flow area in each

room is not infinitely large relative to the flow area through the orifice.

For BFMC tests D-1 and D-15, over prediction of pressure in the first 2.5 sec of the transient exposed the possibility that the measured break flow rate was too high during that period. This suggests that the same possibility exists for test D-16. The reported adjustment of measured break flow rate for test D-16, invoked to obtain a mass balance, indicates that measurement techniques were not entirely reliable. The constant factors applied to measured flow rates to correct for the discrepancy lead to a mass balance, but such corrections cannot necessarily be expected to improve deviations between actual and measured flow rates on a short term basis. There was no explanation why the adjustment of measured flow rate was ramped in over 4 sec. For tests D-1 and D-15 the GOTHIC model gave improved results for the 2.5 sec transient when the measured break flow rate was multiplied by 0.8. For test D-15, adjustment of measured break flow rate was done in concert with adjustment of loss coefficients. A similar adjustment in the GOTHIC model for test D-16 led to better agreement between predicted and measured pressures and differential pressures for the first 2.5 sec of the transient. In spite of the similarity of data comparisons to GOTHIC predictions for the D-series tests, we do not have enough information to identify a consistent error in the data or other test parameter. It does highlight the fact that the first 2.5 sec of a blowdown is a very short period of time in which it may be very difficult to obtain consistently precise data.

These figures, Figure 5.1-11 through Figure 5.1-15, are differential pressures including the inertia sensitivity study. Also, Figure 5.1-16 through Figure 5.1-20, are differential pressures including the run option sensitivity study.

5.1.3 HDR FULL SCALE CONTAINMENT EXPERIMENTS

Heissdampfreaktor (HDR) is a decommissioned superheated steam reactor in the Federal Republic of Germany. Following its decommissioning, the HDR reactor vessel, subsequently referred to as the pressure vessel, and containment system were used in an experimental role designated as Project HDR. Beginning in the late 1970's, several blowdown and related tests were performed at the site.

Information presented in this section was acquired from Ref. 8-3. GOTHIC was used to simulate the HDR blowdown test designated as V21.1. Comparison of GOTHIC predictions to data for the test demonstrates the ability of GOTHIC to predict the thermal-hydraulic response of the full scale multi-compartment containment geometry to water or steam/water blowdown from a reactor vessel.

(a) Physical Description of Test Facility

Elevation views of the HDR containment are shown in Figure 5.1-21 and Figure 5.1-22. The containment is 20 m in diameter and 60 m high, with a total free volume of 11,300 m^3 . Notable features of the containment include the dome, which is about 42% of the total containment volume, the spiral stairs at the left of Figure 5.1-22, and the main stairway, identified as room 1307. The stairways are significant because they provide the dominant vertical flow paths from the lower portions of the containment to the dome.

Rooms in the containment are interconnected by a large number of openings

between the rooms. The connections are shown schematically in Figure 5.1-23.

Primary physical alterations that distinguish the tests selected for analysis includes the location of the break room. For tests V21.1, T31.1, and V44, the break is in room 1603. For test T31.5 the break is in room 1704. Another distinction between tests was the vent openings from the break room to adjacent rooms. Changes to vent openings may have been significant within a group of tests, but the combination of changes that differentiate the selected tests precludes any meaningful comparison of the tests on the basis of vent openings alone.

(b) Test Parameters

For each test selected for analysis, the initial containment pressure was 100 kPa. Temperatures within the containment were generally around 25 C with slight stratification from the bottom to the top of the containment. In the annular gap around the pressure vessel, initial temperatures were about 60 C.

For each test, initial vessel conditions included a pressure of about 11.1 *MPa* and a temperature of about 318 *C*. The initial water level in the vessel varied from a condition of full for test V21.1, that is, a depth of near 10.5 *m*, to a depth of 9.2 *m* for test V44, and a depth of about 7.8 *m* for tests T31.1 and T31.5.

The blowdowns continued until the pressure in the vessel reached equilibrium with the containment. The duration of the blowdowns is about 25 *seconds* for the liquid break test, that is, test V21.1, and about 50 *seconds* for the steam break tests, that is, tests T31.1, T31.5 and V44. Break flow rate and enthalpy for test V21.1 are shown in Figure 5.1-24 and Figure 5.1-25.

(c) GOTHIC Model Description

5.1.4 Comparisons of HDR test with GOTHIC Calculation and Sensitivity Studies

Predictions are compared to data in several graphs in the following sections.

(a) Results for Test V21.1

Differential pressures from the break room to one of the adjacent rooms, and from one of the adjacent room to another room are shown in Figure 5.1-26 to Figure 5.1-45. In the case shown, the predicted differential pressure is in good agreement with the data. In the test reports, data is provided for differential pressure between the break room and five other adjacent rooms. If the differential pressures were the focus of interest, better predictions might be achieved by subdividing the break room so that the jet effects and drop flow could be more accurately modeled. This would require accurate description of all features of the break room.

Figure 5.1-26 to Figure 5.1-30 show differential pressures for SS Vent Loss Coefficients. Figure 5.1-31 to Figure 5.1-35 show differential pressures for SS INERTIA. Figure 5.1-36 to Figure 5.1-40 show differential pressures for SS RUN OPTIONS. In addition to SS RUN OPTIONS, Sensitivity Study EACH RUN OPTION has been conducted. Table 5.1-2 shows the analysis cases. Figure 5.1-41 to Figure 5.1-45 show differential pressures for SS EACH RUN OPTION.

5.1.5 Conclusions

From Section 5.1.2 and 5.1.4, the following conclusions are made.

- (a) With respect to the Vent Loss Coefficient Sensitivity Study, the larger the vent loss coefficients are, the larger the differential pressures between the rooms become.
- (b) With respect to the Inertia Sensitivity Study, plus or minus effects of the inertia might depend on the mass and energy release rates characteristics. In either case, the effects are slight. Therefore, the selection of the base case (that is, the best estimated value) as the inertia is suitable for the analyses of the differential pressure between the rooms.
- (c) With respect to the Run option Sensitivity Study, the NRC acceptable options result in the larger differential pressures between the rooms.

The HEM critical flow model can have a large effect on the differential pressure for two-phase break conditions.

Room #	Volume #	Description	
R4	1	break room	
R5	2	upper annular room	
R6	3	lower annular room	
R7	4	upper annular room	
R8	5	lower annular room	
R9	6	combined R1, R2, R3, R9	

Table 5.1-1 GOTHIC Volumes for BFMC Test D-16

	Force	Drop-Liq.	Flow Path-table 3	Flow Path-table 3
	Equilibrium	Conversion	(Comp.Opt.)	(Critical flow
	-			model)
default	Ignore	include	No	Off
Case-0	Ignore	include	No	Off
(Test analysis.	-			
Same with the				
default.)				
Case-1	include	Ignore	On	HEM
(NRC		_		
acceptable, so				
called RUN				
OPTIONS)				
Case-2	include	include	No	Off
Case-3	Ignore	Ignore	No	Off
Case-4	Ignore	include	On	Off
Case-5	Ignore	include	No	HEM
Case-6	Ignore	include	On	HEM

Table 5.1-2 Analysis cases of SS EACH RUN OPTION


Figure 5.1-1 Cutaway View of Interior Rooms in BFMC.



Figure 5.1-2 Room Configuration; BFMC Test D-16.







Figure 5.1-4 Break Enthalpy for BFMC Test D-16



Figure 5.1-5 GOTHIC Model; BFMC Test D-16.



Figure 5.1-6 Differential Pressure, R4 to R5; BFMC Test D-16 for SS Vent Loss Coefficient



Figure 5.1-7 Differential Pressure, R4 to R7; BFMC Test D-16 for SS Vent Loss Coefficient



Figure 5.1-8 Differential Pressure, R4 to R9; BFMC Test D-16 for SS Vent Loss Coefficient



Figure 5.1-9 Differential Pressure, R5 to R9; BFMC Test D-16 for SS Vent Loss Coefficient



Figure 5.1-10 Differential Pressure, R7 to R8; BFMC Test D-16 for SS Vent Loss Coefficient



Figure 5.1-11 Differential Pressure, R4 to R5; BFMC Test D-16 for SS INERTIA



Figure 5.1-12 Differential Pressure, R4 to R7; BFMC Test D-16 for SS INERTIA



Figure 5.1-13 Differential Pressure, R4 to R9; BFMC Test D-16 for SS INERTIA



Figure 5.1-14 Differential Pressure, R5 to R9; BFMC Test D-16 for SS INERTIA



Figure 5.1-15 Differential Pressure, R7 to R8; BFMC Test D-16 for SS INERTIA



Figure 5.1-16 Differential Pressure, R4 to R5; BFMC Test D-16 for SS RUN OPTIONS



Figure 5.1-17 Differential Pressure, R4 to R7; BFMC Test D-16 for SS RUN OPTIONS



Figure 5.1-18 Differential Pressure, R4 to R9; BFMC Test D-16 for SS RUN OPTIONS



Figure 5.1-19 Differential Pressure, R5 to R9; BFMC Test D-16 for SS RUN OPTIONS



Figure 5.1-20 Differential Pressure, R7 to R8; BFMC Test D-16 for SS RUN OPTIONS



Figure 5.1-21 HDR containment – 0 deg to 180 deg.



Figure 5.1-22 HDR Containment – 90 deg to 270 deg.



Figure 5.1-23 HDR Room & Zone Numbers and Connections.



Figure 5.1-24 Break Flow; HDR Test V21.1



Figure 5.1-25 Break Enthalpy; HDR Test V21.1



Figure 5.1-26 Differential Pressure from the Break Room to Room 27; HDR V21.1 for SS Vent Loss coefficient



Figure 5.1-27 Differential Pressure from the Break Room to Room 19; HDR V21.1 for SS Vent Loss coefficient



Figure 5.1-28 Differential Pressure from the Break Room to Room 30; HDR V21.1 for SS Vent Loss coefficient



Figure 5.1-29 Differential Pressure from the Break Room to Room 24; HDR V21.1 for SS Vent Loss coefficient



Figure 5.1-30 Differential Pressure from Room 18 to Room 16; HDR V21.1 for SS Vent Loss coefficient



Figure 5.1-31 Differential Pressure from the Break Room to Room 27; HDR V21.1 for SS INERTIA



Figure 5.1-32 Differential Pressure from the Break Room to Room 19; HDR V21.1 for SS INERTIA



Figure 5.1-33 Differential Pressure from the Break Room to Room 30; HDR V21.1 for SS INERTIA



Figure 5.1-34 Differential Pressure from the Break Room to Room 24; HDR V21.1 for SS INERTIA



Figure 5.1-35 Differential Pressure from Room 18 to Room 16; HDR V21.1 for SS INERTIA



Figure 5.1-36 Differential Pressure from the Break Room to Room 27; HDR V21.1 for SS RUN OPTIONS



Figure 5.1-37 Differential Pressure from the Break Room to Room 19; HDR V21.1 for SS RUN OPTIONS



Figure 5.1-38 Differential Pressure from the Break Room to Room 30; HDR V21.1 for SS RUN OPTIONS


Figure 5.1-39 Differential Pressure from the Break Room to Room 24; HDR V21.1 for SS RUN OPTIONS



Figure 5.1-40 Differential Pressure from Room 18 to Room 16; HDR V21.1 for SS RUN OPTIONS



Figure 5.1-41 Differential Pressure from the Break Room to Room 27; HDR V21.1 for SS EACH RUN OPTION



Figure 5.1-42 Differential Pressure from the Break Room to Room 19; HDR V21.1 for SS EACH RUN OPTION



Figure 5.1-43 Differential Pressure from the Break Room to Room 30; HDR V21.1 for SS EACH RUN OPTION



Figure 5.1-44 Differential Pressure from the Break Room to Room 24; HDR V21.1 for SS EACH RUN OPTION



Figure 5.1-45 Differential Pressure from Room 18 to Room 16; HDR V21.1 for SS EACH RUN OPTION

5.2 Time Step Size Sensitivity Studies

Selection of time step size is an area of uncertainty. Generally, the smallest time step sizes are needed when the transient begins, particularly where a large amount of high temperature, flashing liquid is injected into small volumes. Time step sizing is highly dependent upon the blowdown spectra, the geometry, and the nodalization scheme. As specified in section C7.2 of ANSI/ANS-56.10-1982, time step sensitivity studies were performed to ensure the insensitivity of the results to the time step sizes chosen, and to find the reasonable practical time step. The set of optimum time steps is checked for sensitivity by comparing the selected output parameter with results obtained using larger or smaller time step sizes. This was accomplished by doubling or halving each of the maximum and minimum time steps that was specified for each time interval. As a first trial time step, the time step table shown below was used as the base case. Time step size sensitivity studies were conducted using the applicable test data shown in section 5.1 of this report.

			Rur	n Control	Parameter	s (Second	s)			
Time Int	DT Min	DT Max	DT Ratio	End Time	Print Int	Graph Int	Max CPU	Dump Int	Ph Chng T Scale	L Flow Shutoff
1 2	0.001	0.01	1. 1.	2.5 50.	200. 200.	0.05	10000. 10000.	0. 0.	DEFAULT DEFAULT	DEFAULT DEFAULT

5.2.1 Result for Test BFMC D-16

Figure 5.2-1 to Figure 5.2-5 show differential pressures for SS Time Step Size of BFMC D-16.

5.2.2 Result for Test HDR V21.1

Figure 5.2-6 to Figure 5.2-10 show differential pressures for SS Time Step Size of HDR V21.1.

5.2.3 Conclusions

From Sections 5.2.1 and 5.2.2, it is concluded that the base time step size selection is suitable for the subcompartment differential pressure analyses.



Figure 5.2-1 Differential Pressure, R4 to R5; BFMC Test D-16 for SS Time Step Size



Figure 5.2-2 Differential Pressure, R4 to R7; BFMC Test D-16 for SS Time Step Size



Figure 5.2-3 Differential Pressure, R4 to R9; BFMC Test D-16 for SS Time Step Size



Figure 5.2-4 Differential Pressure, R5 to R9; BFMC Test D-16 for SS Time Step Size



Figure 5.2-5 Differential Pressure, R7 to R8; BFMC Test D-16 for SS Time Step Size



Figure 5.2-6 Differential Pressure from the Break Room to Room 27; HDR V21.1 for SS Time Step Size



Figure 5.2-7 Differential Pressure from the Break Room to Room 19; HDR V21.1 for SS Time Step Size



Figure 5.2-8 Differential Pressure from the Break Room to Room 30; HDR V21.1 for SS Time Step Size



Figure 5.2-9 Differential Pressure from the Break Room to Room 24; HDR V21.1 for SS Time Step Size



Figure 5.2-10 Differential Pressure from Room 18 to Room 16; HDR V21.1 for SS Time Step Size

5.3 Comparisons with Calculation Results from Another Approved Computer Code

The model verification has been performed by comparisons with calculation results by the TMD computer code, using the same input data described in the subcompartment analysis of FSAR chapter 6 for BYRON/BRAIDWOOD (B/B) Stations (Ref. 8-11).

The TMD code has been reviewed by the NRC and approved for use in subcompartment differential pressure analyses (Ref. 8-13).

5.3.1 Containment Subcompartment Data of B/B Stations

The containment subcompartment nodalization diagram for B/B Stations is presented in Figure 5.3-1. The loop compartments, upper pressurizer cubicle, and steamline pipe chase were analyzed using the above-mentioned code. The subcompartment volume description and initial conditions are listed in Table 5.3-1. The subcompartment flowpath descriptive information is presented in Table 5.3-2.

The pressure transients for the steamline pipe chases were adopted for these comparisons. The steamline double-ended break with flow limiters provides maximum blowdown mass and energy releases to the steamline pipe chases. The steamline mass and energy releases are presented in Table 5.3-5. Breaks in volumes 25 and 26 are considered.Break compartments 25, 26 and upper containment (volume 7) pressure transients are graphed in Figure 5.3-2 and Figure 5.3-3 for TMD calculation results.

5.3.2 Calculation Results with GOTHIC

A GOTHIC model was constructed using the same data for BYRON/BRAIDWOOD Stations listed above. The results with comparison to those from TMD are shown in Figure 5.3-4 and Figure 5.3-5.

5.3.3 Conclusions

From these comparisons, the pressure transient analyses by GOTHIC code reproduce well the pressure responses by TMD. Therefore, it is concluded that GOTHIC code is suitable for the containment subcompartment pressure analyses.

		INI	TIAL CONDITI	ONS
ELEMENT NO.	VOLUME	TEMP. (°F)	AIR PRESS. (psia)	STEAM PRESS. (psia)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	$\begin{array}{c} 36,152\\ 33,294\\ 35,011\\ 41,024\\ 38,625\\ 36,251\\ 2,254,200\\ 9,983\\ 3,742\\ 4,159\\ 15,677\\ 20,743\\ 9,914\\ 3,515\\ 5,435\\ 25,159\\ 6,968\\ 10,232\\ 39,190\\ 51,611\\ 24,844\\ 6,250\\ 12,236\\ 3,145\\ 11,472\end{array}$	$\begin{array}{c} 120.00\\$	$ \begin{array}{r} 14.05 \\ 14.0$	0.85 0.85 0.85 0.85 0.85 0.85 0.85 0.85
26 27 28	11,138 2,838 4,993	120.00 120.00 120.00	14.05 14.05 14.05	0.85 0.85 0.85

Table 5.3-1 Subcompartment Nodal Description (B/B FSAR)

<u>A/A</u> 7	1.5900E-02 5.4170E-01 1.2200E-01 1.3620E-01 1.3620E-01 8.2110E-01 8.2110E-01 2.1280E-01 5.5630E-01 5.6630E-01	7.4200E-01 3.9600E-01 5.0000E-01 2.3530E-01 4.3200E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 1.1560E-01 2.3530E-01 2.35500E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.3530E-01 2.5500E-000E-000E-000E-000E-000E-000E-000	3.3910E-01 3.2010E-01 3.7700E-01 3.0810E-01 3.2790E-01 3.4240E-01 1.4170E-01 1.4170E-01 1.4170E-01 5.0000E-01
EQUI. ⁶	7.31008+00 4.00008+01 7.00008+01 2.00008+01 4.00008+01 5.30008+01 5.15108+01 5.15108+01 5.15108+01 5.85008+01 3.85008+01	2.49408+01 6.95008+00 3.40708+01 2.63108+01 3.79408-01 1.54308+01 1.54308+01 2.59008+01 2.59008+01 3.97008+01 3.97008+01 3.97008+01 4.22308+00 4.22308+00 6.82008+00 8.60008+00	4.50003401 6.00003401 4.50003401 4.50003401 6.00003401 4.70005401 4.70005401 4.70005401 1.80005401 1.80005401
FLOW ⁵	2.1000E+01 5.7200E+02 2.2000E+02 1.9400E+01 5.7200E+02 5.7200E+02 2.3200E+02 1.3300E+02 1.1900E+02	1.87008+02 6.32408+02 1.82008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.40008+02 1.75088+01 1.75088+020848+02 1.75088+0208484848484848484848484848484848484848	1.9700E+02 1.8600E+02 2.1900E+02 1.7900E+02 1.9950E+02 1.9950E+02 1.9905E+01 9.6400E+01 9.0000E+01
HYDR. ⁴ D.	4.2000E+00 1.1000E+01 1.0000E+01 1.0900E+01 1.0900E+01 1.1000E+01 1.000E+01 4.7300E+01 1.0580E+01 1.0600E+01	1.1050E+01 1.6600E-01 1.6600E-01 1.0200E+01 7.2000E+01 1.1910E+01 1.1320E+01 7.3100E+00 7.3100E+00 7.3100E+00 7.2000E+00 7.2000E+00 7.2000E+00 6.8200E+00 2.6100E+00	1.00008401 1.00008401 1.00008401 1.00008401 1.00008401 1.00008401 1.00008401 1.00008401 2.60008401 1.06008401 1.06008401
3 HLJNIIT	8.0400E+00 4.0000E+-1 8.0000E+01 9.7100E+01 4.0000E+01 5.2000E+01 8.5400E+01 8.5400E+01 2.7250E+01	3.2530E+01 3.410E+01 3.410E+01 3.250E+01 4.72630E+01 1.72830E+01 1.72830E+01 3.2420E+01 4.7420E+01 4.7420E+01 4.9180E+01 4.9180E+01 3.1500E+00 8.6900E+00 9.2000E+00	4.5008401 6.0008401 4.50008401 4.50008401 6.0008401 4.50008401 1.22008401 1.22008401 2.00008401 2.00008401
<u>e-fac</u> ²	2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02	2.20008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.220008-02 2.22008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02 2.2008-02008-02 2.2008-02 2.2008-02 2.2008-02008-02 2.2008-02 2.200	2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02 2.20008-02
<u>K-FAC</u> ¹	3.6530E+00 5.9000E-01 5.000E+00 1.7000E+00 1.7000E+00 1.7000E+00 1.7000E+00 2.5300E+00 2.5300E+00	2.51508+00 2.35008+00 2.05008+00 2.15008+00 7.15008+00 7.15008-01 3.330086-01 9.67008-01 9.67008-01 1.74808+00 8.29008-01 1.94808+00 8.70008-01 3.11408+00 8.76008-01 1.20008-01	1.8400E+00 1.8400E+00 1.8400E+00 1.8400E+00 1.8400E+00 1.8400E+00 1.8500E+00 1.8500E+00 2.2300E+00 2.5800E-01
FLOW PATH NO.	1 2 2 3 3 1 2 4 3 2 1 3 2 1 3 2 1 3 2 1 3 2 1 3 2 1 3 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 2 1 1 2 1 1 2 1 1 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 2 1 1 2 2 2 1 2 2 2 1 2 2 2 2 1 2	118 128 128 128 148 148 148 178 198 198 198 208 208 238 238 238 258 258 258 258 258 258 258 258 258 25	122 84 84 84 84 84 84 84 84 84 84 84 84 84
BETWEEN.	1084921-10 -1-10 -1-10 -1010 -10 -10 -10 -10 -	11-10 12-20 13-12 14-15 14-15 14-15 19-20 19-20 22-22 23-16 24-18 25-17 25-17 25-17 25-17	5-10

	2	K-PAC	P-WC2	LewGTH 3	р. Бой. С	Š.		ķ ,
	art.	00-20064.1	2.2000-02	2.09008+00	2.50008-01	1.32808402	1.20005-01	2.66500-02
	¥ (40-30007-9	×.000007400	10-30000.4.			
	¥ 4	1.020055400	20-20002.5	2.20007400		A BOORTON		
	K (* 4 * 4							10-4008.2
	10 9	10140351 °C	2.2000P-02	2.22708+01	1.10008-01	1.14802+02	2.07602+01	4.36108-01
	(@ ; ; ;	2.23408+00	2.2000E-02	1.1600E+00	1.33005-01	4.5000E+C1	5.90005-01	1.53908-01
į ani		1.84302+00	2.20005-02	1.7080E+01	1.78002-01	4.7300E+02	1.5480E+01	4.83608-01
E 2017	2	2.0000+00	2.2000-02	1.25005+01	1.33008-01	2,04002402	6.3900E+00	5.00008-01
ŧ.,	258	1.00008+00	2.20005-02	4.47108+01	9.2100D+00	1.98005+02	3.55008+01	1.0000E+00
*	262	2.7200E=01	2.20005-02	1.51008+01	1.91002401	4.2090E+02	L.2840E+01	4.78408-01
¥ .		1.6400R+00	2.20005-02	2.60002+02	6.1900E+00	8.2870E+01	8.38008+00	7.62008-01
	20R	7.0002-01	2.20002-02	2.00702+01	3.05308+00	5.8200E+01	1.87008+01	4.0670E-01
	×1	2.5300E+00	2.20005-02	8.5400E+01	4.73008+00	2.32008401	5.15108+01	2.1280%-01
	8	5.9000E-01	2.2000E-02	4.0000E+01	1.1000E+01	5.72008+02	4,00008+01	S.4170X-01
		2.53002400	2.20008-02	8.5400E+01	4,73008+00	2.3200B+01	5.15108+01	2.1280E-01
•		2.53008+00	2.2000E-02	8.5400E+01	4.73008+00	2.32005+0L	5. 1510E+01	2.12905-01
	ŝ	5.9008-01	2.2000E-02	4.0000.+01	1.1000E+01	5.72008+02	4.0000E+01	5.41705-01
e	4 I .	1.27308+00	2.2000E-02	3.35908+01	4.80002+00	3.6000E+01	7.9070E+01	1.68008-01
	(4	2 5000 - 01	2. 2000w-02	TO-AUOUL C	1.06002+01	1.1900E+02	1.95008+01	5.0000E-01
• •	C AC N NC N NC	1.00002400	2.2000K-02	7.82008+00	1.3300X-01	7.88005+00	3.0000E+00	3.0000E-02
1		1.76502100	2.2000E-02	6.63008+00	1.33008-01	1,39805+02	1.7200E+00	1.86008-01
١.		OUTAUSET C	2.20008-02	2.7040E+01	1.2930K+01	2.2950E+02	2.58408401	6.0720E-01
	(¥)(1,00008+00	2.2000E-02	4.4710E+01	9.21002+00	1.9800E+02	3.5500E+01	1.00002+00

Table 5.3-3	Subcompartmen	t flow path	description	(cont'd)
	ouscompartmen	t now path	acocription	

Table 5.3-4 Subcompartment flow path description (cont'd)

- Factor for form loss and area change pressure drop calculation.
- 2. Friction factor for frictional pressure drop calculation.
- 3. Length for inertial pressure drop calculation.
- 4. Hydraulic diameter for frictional pressure drop calculation.
- 5. Vent flow area.
- 6. Equivalent length for frictional pressure drop calculation.
- 7. [Minimum Area/Maximum Area] for compressibility effects.

TIME (sec)	MASS FLOW (1bm/sec)	ENERGY FLOW (Btu/sec)	AVE ENTHALPY (Btu/lbm)
0.0	20140.	24.03 (10 ⁶)	1193.15
0.187	20140.	24.03 (10 ⁶)	1193.15
0.1871	14560.	17.31 (10 ⁶)	1188.87
1.03	14560.	17.31 (10 ⁶)	1198.87
1.031	21980.	19.69 (10 ⁶)	895.81
1.480	21980.	19.69 (10 ⁶)	895.81
1.481	42560.	24.84 (10 ⁶)	583.65
4.0	42560.	24.84 (10 ⁶)	583.65

Table 5.3-5 Steam line mass and energy release rates (B/B FSAR)



Figure 5.3-1 Containment Subcompartment Nodalization Diagram (B/B FSAR)



Figure 5.3-2 Steamline compartment and upper compartment pressure transient for steamline break (element 25) from B/B FSAR



Figure 5.3-3 Steamline compartment and upper compartment pressure transient for steamline break (element 26) from B/B FSAR



Time (sec)Figure 5.3-4Steamline compartment and upper compartment pressure transient
for steamline break (element 25) by GOTHIC



Time (sec) Figure 5.3-5 Steamline compartment and upper compartment pressure transient for steamline break (element 26) by GOTHIC

6.0 Plant Subcompartment Analyses

As discussed in Section 3.0 the following cases have been analyzed.

- DVI (4-inch) line break in the reactor cavity
- RHR pump inlet (10-inch) line break and feedwater (14-inch) line break in the SG subcompartment
- Pressurizer spray (6-inch) line break and pressurizer safety depressurization (8-inch) line break in the pressurizer subcompartment

6.1 General Analytical Method

6.1.1 Nodalization Schemes

A separate GOTHIC evaluation model is prepared for each subcompartment. In these models, each subcompartment is divided into nodes, with paths defined to model the transfer of mass and energy between nodes during the analyzed transient. The subcompartment nodalization scheme is selected so that nodal boundaries are basically at the location of flow obstructions or geometry changes within the subcompartment. These discontinuities create pressure differentials across nodal boundaries. Within each node, no significant discontinuities would exist, resulting in a negligible pressure gradient within each node. Annular configurations are nodalized circumferentially when asymmetric pressure distribution is presumed.

The node selection for the reactor cavity analysis is in accordance with section 3.2.2.1 of NUREG-0609 (Ref.9). One approach to development of an acceptable nodalization arrangement for subcompartment analysis of the reactor cavity would be to model the reactor cavity with detailed nodalization accounting for all obstructions. In this case, further sensitivity studies are not required because of the subcompartment analysis based on section 3.2.2 of NUREG-0609.

Nodalization sensitivity studies have been performed using two nodalizations (that is; one base run and the sensitivity run with increased local nodalization) as required in section C5.1 of ANSI/ANS-56.10-1982(Ref. 10).

The sensitivity studies for the steam generator subcompartment and the pressurizer subcompartment are described in section 7.

6.1.2 Initial Conditions

The initial atmospheric conditions within a subcompartment are set to maximize the resultant differential pressure. That is, the air at the maximum allowable temperature, minimum absolute pressure, and zero percent relative humidity is assumed according to Standard Review Plan (SRP) 6.2.1.2.

6.1.3 Vent Loss Coefficient

The loss coefficients of vent flow paths are determined depending on their geometries referring to Reference 12.

(a)Friction Pressure Loss

Friction pressure loss was calculated using a friction length, a hydraulic diameter, and a wall friction factor calculated in the code. The friction length between two cells is given conservatively as 1.2 times the distance between centers of two cells through the center of connecting cell face.

(b) Expansion and Contraction Pressure Loss

An expansion loss coefficient is conservatively given as 1.0, assuming an abrupt expansion to infinite cross-sectional area for each flow path with expanding configuration. A contraction loss coefficient is conservatively given as 0.5 in the same way as expansion.

For grating, an aperture ratio of 0.6 is conservatively assumed and the loss coefficient was calculated as a thick-edged orifice using the aperture ratio as the cross-sectional area ratio.

For thick-walled orifice configurations like a vent path to the containment atmosphere, a loss coefficient is conservatively given as over 1.5 depending on the ratio of the wall thickness to the hydraulic diameter referring to Reference 12.

6.2 Reactor Cavity

6.2.1 Modeling

(a) Nodal description

The reactor cavity is a narrow annular region surrounded by the reactor vessel and the primary shield. Eight primary loop pipes and four DVI pipes penetrate the region. The postulated pipe break was assumed at one of four DVI pipes in the annular region. The nodalization used for US-APWR reactor cavity pressure and temperature analysis is shown on Figure 6.2-1 to Figure 6.2-7. The reactor cavity is azimuthally divided into eight equal sectors accounting for penetration of eight primary loop pipes. The upper part of reactor cavity region is blocked by the seal ridge at 45ft 9.41 in EL. The lower part of reactor cavity region is blocked by the base mat, the core catcher and the reactor vessel cooling air supply duct tunnel. Axial division of the reactor cavity region accounts for area change due to structures. Description and geometrical parameters for each node are summarized in Table 6.2-1. Total one hundred and ten nodes are used for the analysis including SG compartment nodes which provide boundary conditions for the analysis.

(b) Vent path description

The vent path connection diagram is shown in Figure 6.2-3 to Figure 6.2-6 for each loop direction respectively. Vent path connections in lower part of the cavity are shown in Figure 6.2-7. Geometric and hydraulic parameters for each vent path are summarized in Table 6.2-2.

Vent paths P1 to P8 run from reactor cavity to SG compartments through cooling air exhaust ducts in upper region. Vent paths P137 to P152 run from reactor cavity to SG compartments through reactor coolant pipe sleeves. Vent paths P153 toP156 run from reactor cavity to SG compartments through DVI penetration.

6.2.2 Short term mass and energy release data

High energy pipes penetrating the reactor cavity are the reactor coolant pipes and the DVI pipes. The reactor coolant pipes are LBB-qualified and no break is assumed. The inner diameter of the DVI pipe is 3.438 inches and LBB is not applicable. A guillotine break at one of the DVI pipes was assumed for short term mass and energy release analysis. The analysis was performed using M-RELAP5 code which is also used for the small break LOCA analysis for the US-APWR. Nodalization of reactor coolant system for short term mass and energy release is basically same as the small break LOCA analysis. The break mass and energy flow from the vessel side break is doubled to account for guillotine break. The resultant short term mass and energy release data are shown in Table 6.2-3.

6.2.3 Calculated pressure responses

The initial temperature and humidity of all nodes are 150 deg F and 0% humidity, respectively. The break was assumed to occur in the node V50 using the short term mass and energy release data shown in Table 6.2-3.

The calculated peak pressure is 7.6 psig at the break node V50 as shown on Figure 6.2-10. The design pressure at the V50 node is 39 psig. The calculated peak pressure is substantially lower than the design pressure. The calculated peak pressure and design pressure for each node are shown on Table 6.2-1. The peak pressure is substantially lower than the design pressure for all nodes.

A. Brea Breal Breal	Tat k Type : DVI(4B) guillotine br k Area : 0.065(ft²) k location : Volume number 5	ie 6.2-1 eak 50	Reactor c	avity com	ipartmei	nt Nodal	Description		
Volume	: (Heiaht	Free	Initia	I Conditi	suo	Calculated	Design	Marain
No.	Description	(tt)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
F	Exhaust duct:direction of A-CL	0.43	12.7	150	14.7	0	0.81	39	97.9
2	Exhaust duct:direction of A-HL	0.43	6.7	150	14.7	0	0.86	39	97.7
с	Exhaust duct:direction of B-HL	0.43	6.7	150	14.7	0	0.56	39	98.5
4	Exhaust duct:direction of B-CL	0.43	12.0	150	14.7	0	0.58	39	98.5
5	Exhaust duct:direction of C-CL	0.43	12.0	150	14.7	0	0.80	39	97.9
9	Exhaust duct:direction of C-HL	0.43	6.7	150	14.7	0	0.65	68	98.2
7	Exhaust duct:direction of D-HL	0.43	6.7	150	14.7	0	0.49	39	98.7
8	Exhaust duct:direction of D-CL	0.43	12.7	150	14.7	0	0.69	39	98.2
6	Approximately 1/8 of RV ring duct:direction of A-CL	1.65	10.9	150	14.7	0	1.12	30	97.2
10	Approximately 1/8 of RV ring duct:direction of A-HL	1.65	10.9	150	14.7	0	1.33	66	96.7
11	Approximately 1/8 of RV ring duct:direction of B-HL	1.65	10.9	150	14.7	0	1.11	39	97.2

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	Tat	Je 6.2-1	Reactor c	avity con	nartmer	t Nodal	Description		
Breal Breal Breal	 Type : DVI(4B) guillotine b Area : 0.065(ft²) location : Volume number (reak 50							
ume	:	Heiaht	Free	Initia	al Conditio	suc	Calculated	Design	Marain
<u>o</u>	Description	(ft)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
2	Approximately 1/8 of RV ring duct:direction of B-CL	1.65	10.9	150	14.7	0	1.13	0 30	97.2
3	Approximately 1/8 of RV ring duct:direction of C-CL	1.65	10.9	150	14.7	0	1.13	6 8	97.2
4	Approximately 1/8 of RV ring duct:direction of C-HL	1.65	10.9	150	14.7	0	1.13	30	97.2
15	Approximately 1/8 of RV ring duct:direction of D-HL	1.65	10.9	150	14.7	0	1.12	6 8	97.2
16	Approximately 1/8 of RV ring duct:direction of D-CL	1.65	10.9	150	14.7	0	1.12	6 8	97.2
2	Approximately 1/8 of the upper inner cavity:direction of A-CL	3.74	11.9	150	14.7	0	3.90	39	90.0
8	Approximately 1/8 of the upper inner cavity:direction of A-HL	3.74	11.6	150	14.7	0	3.93	39	0.06
	Approximately 1/8 of the								

Volume . No

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42

13

4

15

16

90.0

39

3.88

0

14.7

150

11.6

3.74

upper inner cavity direction of B-HL

19

8

1

		Marain	(%)	90.3			90.3			90.3			90.3			90.3			87.9			87.9			87.9	
		Design	Peak Press. Diff (psid)	39			39			39			39			39			39			39			39	
Description		Calculated	Peak Press. Diff. (psid)	3.83			3.80			3.79			3.81			3.85			4.66			4.66			4.66	
t Nodal	5	suc	Humid. (%)	0			0			0			0			0			0			0			0	
nartmer	5	al Conditio	Press. (psia)	14.7			14.7			14.7			14.7			14.7			14.7			14.7			14.7	
avity con		Initia	Temp. (deg F)	150			150			150			150			150			150			150			150	
Reactor c		Free	Volume (ft³)	11.9			11.9			11.6			11.6			11.9			19.5			20.7			20.7	
le 6.2-1	eak 50	Heiaht	(ft)	3.74			3.74			3.74			3.74			3.74			4.79			4.79			4.79	
Tab	Type : DVI(4B) guillotine br Area : 0.065(ft ²)	:	Description	Approximately 1/8 of the upper inner	cavity:direction of B-CL	Approximately 1/8 of the	upper inner	cavity:direction of C-CL	Approximately 1/8 of the	upper inner	cavity:direction of C-HL	Approximately 1/8 of the	upper inner	cavity:direction of D-HL	Approximately 1/8 of the	upper inner	cavity:direction of D-CL	Approximately 1/8 of the	lower inner	cavity:direction of A-CL	Approximately 1/8 of the	lower inner	cavity:direction of A-HL	Approximately 1/8 of the	lower inner	cavity:direction of B-HL
	A. Break Break Break	Volume	No.	20			21			22			23			24			25			26			27	

A. Breał Break Break	Tat < Type : DVI(4B) guillotine br < Area : 0.065(ft²) < location : Volume number 5	ile 6.2-1 eak 50	Reactor c	avity con	ıpartme	nt Nodal	Description		
Volume	:	Height	Free	Initia	al Conditi	suo	Calculated	Design	Maroin
No.	Description	(tt)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
28	Approximately 1/8 of the lower inner cavity:direction of B-CL	4.79	19.5	150	14.7	0	4.65	90 30	87.9
29	Approximately 1/8 of the lower inner cavity:direction of C-CL	4.79	19.5	150	14.7	0	4.65	30	88.2
30	Approximately 1/8 of the lower inner cavity:direction of C-HL	4.79	20.7	150	14.7	0	4.65	39	88.2
31	Approximately 1/8 of the lower inner cavity:direction of D-HL	4.79	20.7	150	14.7	0	4.65	39	88.2
32	Approximately 1/8 of the lower inner cavity:direction of D-CL	4.79	19.5	150	14.7	0	4.65	39	87.9
33	Path of cooling air in R/V support :direction of A-CL	5.46	9.6	150	14.7	0	4.95	39	87.4
34	Path of cooling air in R/V support :direction of A-HL	5.46	9.6	150	14.7	0	5.04	39	87.2
35	Path of cooling air in R/V support :direction of B-HL	5.46	9.6	150	14.7	0	4.85	39	87.7
36	Path of cooling air in R/V support :direction of B-CL	5.46	9.6	150	14.7	0	4.76	39	87.7
37	Path of cooling air in R/V support :direction of C-CL	5.46	9.6	150	14.7	0	4.70	39	87.9

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	4 C H	10604	Doactor	active con	10mtread	Ichold to	Decrintion		
A. Breal Breal Break	 Type : DVI(4B) guillotine bi Area : 0.065(ft²) location : Volume number 5 	reak 50							
Volume		Height	Free	Initia	al Conditi	suo	Calculated	Design	Maroin
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
38	Path of cooling air in R/V support :direction of C-HL	5.46	9.6	150	14.7	0	4.70	39	87.9
39	Path of cooling air in R/V support :direction of D-HL	5.46	9.6	150	14.7	0	4.72	39	87.9
40	Path of cooling air in R/V support :direction of D-CL	5.46	9.6	150	14.7	0	4.78	39	87.7
41	Approximately 1/8 of the upper inspection annulus:direction of A-CL	3.08	111.6	150	14.7	0	5.86	39	84.9
42	Approximately 1/8 of the upper inspection annulus:direction of A-HL	3.08	61.4	150	14.7	0	6.94	39	82.3
43	Approximately 1/8 of the upper inspection annulus:direction of B-HL	3.08	93.2	150	14.7	0	5.11	39	86.9
44	Approximately 1/8 of the upper inspection annulus:direction of B-CL	3.08	112.5	150	14.7	0	4.74	39	87.9
45	Approximately 1/8 of the upper inspection annulus:direction of C-CL	3.08	112.5	150	14.7	0	4.57	39	88.2
46	Approximately 1/8 of the upper inspection annulus:direction of C-HL	3.08	93.2	150	14.7	0	4.57	39	88.2

Mitsubishi Heavy Industries, Ltd.
c 6 3 1 Boorton consists comparatment	Benefer covity compartment	turity compartment	to onto oct	ŧ	Nodal	Decrintion		
iabi tine br∉ mber 5(l e o.z-1 eak	Reactor c	avity con	npartme		nescription		
	Heiaht	Free	Initia	al Conditi	suo	Calculated	Design	5.
	,(II)	volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Uiff. (psid)	Peak Press. Dif (psid)	_
H e	3.08	91.4	150	14.7	0	4.65	39	
с e	3.08	111.6	150	14.7	0	4.81	39	
	4.79	199.1	150	14.7	0	5.87	39	
	4.79	167.7	150	14.7	0	7.56	39	
	4.79	170.8	150	14.7	0	5.11	39	
	4.79	200.4	150	14.7	0	4.75	39	
e CL	4.79	200.4	150	14.7	0	4.57	39	
a =	4.79	170.8	150	14.7	0	4.57	36	

í.				1		·		·			
		Marain	(%)	87.9	87.7	87.7	89.5	90.8	90.3	90.8	92.3
		Design	Peak Press. Diff (psid)	39	39	39	39	39	39	39	39
	Description	Calculated	Peak Press. Diff. (psid)	4.66	4.82	4.85	4.08	3.59	3.76	3.58	3.04
	nt Nodal	suc	Humid. (%)	0	0	0	0	0	0	0	0
	ıpartmer	al Conditio	Press. (psia)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
	avity con	Initia	Temp. (deg F)	150	150	150	150	150	150	150	150
	Reactor c	Free	Volume (ft ³)	167.7	199.1	29.2	11.6	11.3	27.4	27.4	11.3
	ile 6.2-1 eak 50	Heiaht	(ff)	4.79	4.79	2.21	2.21	2.21	2.21	2.21	2.21
	Tab < Type : DVI(4B) guillotine br < Area : 0.065(ft ²) : location : Volume number 5	- - (Description	Approximately 1/8 of the lower inspection annulus:direction of D-HL	Approximately 1/8 of the lower inspection annulus:direction of D-CL	Upper portion of primary shield penetration for A-CL	Upper portion of primary shield penetration for A-HL	Upper portion of primary shield penetration for B-HL	Upper portion of primary shield penetration for B-CL	Upper portion of primary shield penetration for C-CL	Upper portion of primary shield penetration for C-HI
	A. Break Break Break	Volume	No.	55	56	57	58	59	60	61	62

	Marain	(%)	91.8	90.3	87.7	89.5	90.8	90.3	90.8	92.3
	Design	Peak Press. Diff (psid)	30	30	39	39	39	39	39	39
Description	Calculated	Peak Press. Diff. (psid)	3.16	3.83	4.85	4.08	3.59	3.76	3.58	3.04
nt Nodal	suc	Humid. (%)	0	0	0	0	0	0	0	0
ıpartmer	I Conditio	Press. (psia)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
avity con	Initia	Temp. (deg F)	150	150	150	150	150	150	150	150
Reactor c	Free	Volume (ft ³)	11.6	29.2	29.2	11.6	11.3	27.4	27.4	11.3
ile 6.2-1 eak 50	Heiaht	(Ħ)	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21
Tab C Type : DVI(4B) guillotine br Area : 0.065(ft ²) C location : Volume number 5	: (Description	Upper portion of primary shield penetration for D-HL	Upper portion of primary shield penetration for D-CL	Lower portion of primary shield penetration for A-CL	Lower portion of primary shield penetration for A-HL	Lower portion of primary shield penetration for B-HL	Lower portion of primary shield penetration for B-CL	Lower portion of primary shield penetration for C-CL	Lower portion of primary shield penetration for C-HL
A. Break Break Break	Volume	No.	63	64	65	66	67	68	69	70

	Margin	(%)	91.8	90.3	95.6	97.2	97.4	96.9	65.0	65.0	65.7	65.7
	Design	Peak Press. Diff (psid)	39	39	39	39	39	39	14	14	14	4
Description	Calculated	Peak Press. Diff. (psid)	3.16	3.83	1.66	1.09	1.05	1.21	4.89	4.91	4.83	4.76
nt Nodal	suo	Humid. (%)	0	0	0	0	0	0	0	0	0	0
npartmer	al Conditio	Press. (psia)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
avity con	Initia	Temp. (deg F)	150	150	150	150	150	150	150	150	150	150
Reactor c	Free	Volume (ft³)	11.6	29.2	5.3	4.6	4.6	5.3	12.4	12.4	12.4	12.4
le 6.2-1 eak	Height	(tt)	2.21	2.21	1.33	1.33	1.33	1.33	7.93	7.93	7.93	7.93
TabC Type : DVI(4B) guillotine brArea : 0.065(ft²): location : Volume number 5		Description	Lower portion of primary shield penetration for D-HL	Lower portion of primary shield penetration for D-CL	Primary shield penetration for A-DVI line	Primary shield penetration for B-DVI line	Primary shield penetration for C-DVI line	Primary shield penetration for D-DVI line	Approximately 1/8 of upper cavity annulus:direction of A-CL	Approximately 1/8 of upper cavity annulus:direction of A-HL	Approximately 1/8 of upper cavity annulus:direction of B-HL	Approximately 1/8 of upper cavity annulus direction of B-CI
A. Break Break Break	Volume	No.	71	72	73	74	75	76	77	78	62	80

A. Breal Breal Break	Tat < Type : DVI(4B) guillotine br < Area : 0.065(ft²) < location : Volume number €	ble 6.2-1 reak 50	Reactor (avity con	npartme	nt Nodal	Description		
Volume		Height	Free	Initia	al Conditi	ons	Calculated	Design	Margin
No.	Description	(#)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
81	Approximately 1/8 of upper cavity annulus:direction of C-CL	7.93	12.4	150	14.7	0	4.71	14	66.4
82	Approximately 1/8 of upper cavity annulus:direction of C-HL	7.93	12.4	150	14.7	0	4.71	14	66.4
83	Approximately 1/8 of upper cavity annulus:direction of D-HL	7.93	12.4	150	14.7	0	4.72	14	66.4
84	Approximately 1/8 of upper cavity annulus:direction of D-CL	7.93	12.4	150	14.7	0	4.78	14	65.7
85	Approximately 1/8 of lower cavity annulus:direction of A-CL	7.93	12.4	150	14.7	0	4.84	14	65.7
86	Approximately 1/8 of lower cavity annulus:direction of A-HL	7.93	12.4	150	14.7	0	4.85	14	65.7
87	Approximately 1/8 of lower cavity annulus:direction of B-HL	7.93	12.4	150	14.7	0	4.82	14	65.7
88	Approximately 1/8 of lower cavity annulus:direction of B-CL	7.93	12.4	150	14.7	0	4.78	14	65.7

		ble 6.2-1	Reactor c	avity con	npartme	nt Nodal	Description		
A. Breal Breal Breal	 < Iype : DVI(4b) guillotine b < Area : 0.065(ft²) < location : Volume number (50							
Volume	-	Heiaht	Free	Initia	al Conditi	suo	Calculated	Design	Marain
No.	Description	(#)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff (psid)	(%)
89	Approximately 1/8 of lower cavity annulus:direction of C-CL	7.93	12.4	150	14.7	0	4.76	14	65.7
06	Approximately 1/8 of lower cavity annulus:direction of C-HL	7.93	12.4	150	14.7	0	4.76	14	65.7
91	Approximately 1/8 of lower cavity annulus:direction of D-HL	7.93	12.4	150	14.7	0	4.77	14	65.7
92	Approximately 1/8 of lower cavity annulus:direction of D-CL	7.93	12.4	150	14.7	0	4.80	14	65.7
93	Operation space of NIS:direction of A-CL	14.78	84.4	150	14.7	0	4.86	18	72.8
94	Operation space of NIS:direction of A-HL	14.78	251.8	150	14.7	0	4.87	18	72.8
95	Operation space of NIS:direction of B-HL	14.78	84.4	150	14.7	0	4.83	18	73.3
96	Operation space of NIS:direction of B-CL	14.78	84.4	150	14.7	0	4.78	18	73.3
97	Operation space of NIS:direction of C-CL	14.78	84.4	150	14.7	0	4.76	18	73.3
98	Operation space of NIS:direction of C-HL	14.78	251.8	150	14.7	0	4.75	18	73.3
66	Operation space of NIS:direction of D-HL	14.78	84.4	150	14.7	0	4.76	18	73.3

A. Breal Breal Breal	Tat k Type : DVI(4B) guillotine bi k Area : 0.065(ft ²) k location : Volume number {	ble 6.2-1 reak 50	Reactor c	avity con	ipartmer	it Nodal	Description		
Volume		Heiaht	Free	Initia	I Conditio	suc	Calculated	Design	Marain
No.	Description	(ff)	volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Uitt (psid)	(%)
100	Operation space of NIS:direction of D-CL	14.78	84.4	150	14.7	0	4.80	18	73.3
101	Lower reactor cavity region EL -1'-2" to EL 19'-8.856"	20.90	4691.3	150	14.7	0	4.82	18	73.3
102	Lower reactor cavity region EL -9'-2" to EL -1'-2"	8.00	2722.2	150	14.7	0	4.83	18	73.3
103	RV cooling air supply duct tunnel horizontal passageway	8.00	2500.3	150	14.7	0	4.83	18	73.3
104	RV cooling air supply duct tunnel horizontal passageway	8.00	968.9	150	14.7	0	4.83	18	73.3
105	Core debris catcher	8.00	2038.5	150	14.7	0	4.83	18	73.3
106	RV cooling air supply duct tunnel	35.25	3920.7	150	14.7	0	4.82	18	73.3
107	A-SG compartment	1	50000.0	150	14.7	0		,	I
108	B-SG compartment	-	20000.0	150	14.7	0	•	-	I
109	C-SG compartment	I	50000.0	150	14.7	0	I	I	I
110	D-SG compartment	I	50000.0	150	14.7	0		ı	I

Subcompartment Analyses for US-APWR Design Confirmation

			Total	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		sient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	Length (ft)	18.79	9.86	9.86	17.62	17.62	9.86	9.86	18.79	10.96	6.77	6.77	10.96	10.96	6.77	6.77	10.96	9.72	9.72	9.72	9.72	9.72	9.72	9.72
Ipartment Ve		Hydraulic	Diameter (ft)	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.272	0.272	0.272	0.272	0.272	0.272	0.272
cavity Con		Inertia	Length (ft)	15.66	8.22	8.22	14.68	14.68	8.22	8.22	15.66	9.13	5.64	5.64	9.13	9.13	5.64	5.64	9.13	8.1	8.1	8.1	8.1	8.1	8.1	8.1
2 Reactor		Area	(ft ²)	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.37	0.37	0.37	0.37	26.0	26.0	0.37
Table 6.2- e break	ır 50	ption of ath Flow	Unchoked	X	×	×	Х	Х	Х	Х	Х	×	Х	Х	×	×	×	Х	Х	Х	Х	Х	Х	Х	Х	×
3) guillotin	ر ، ne numbe	Descri	Choked																							
DVI(4E	n.Volur	e No.	Ъ	V107	V107	V108	V108	V109	V109	V110	V110	۲۱	V2	V3	V4	V5	V6	77	V8	V10	V11	V12	V13	V14	V15	V16
ik Type	Incation	Volum	From	٧1	V2	V3	V4	V5	V6	77	V8	67	V10	V11	V12	V13	V14	V15	V16	67	V10	V11	V12	V13	V14	V15
A. Brea	Break	Vent	Path No.	-	7	ო	4	2	9	7	8	ი	10	11	12	13	14	15	16	17	18	19	20	21	22	23

		1	r –	1						l –						1											г
			Total	1.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0	0	0	0	c
		cient K	Contraction	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	~
		Loss Coeffic	Expansion	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	c
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	c
ent Path De		Friction	(ft)	9.72	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	10.18	10.18	10.18	10.18	10.18	10.18	10.18	10.18	11.58	10.99	10.99	11.58	11.58	10.99	10.00
Ipartment Ve		Hydraulic	Ulailleter (ft)	0.272	0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.184	0.184	0.184	0.184	0.184	0.184	0.184	0.184	0.168	0.168	0.168	0.168	0.168	0.168	0 1 6 0
cavity Com		Inertia	(ft)	8.1	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	9.65	9.16	9.16	9.65	9.65	9.16	010
2 Reactor		Area	(ft²)	0.37	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Table 6.2-	e break r 50	ption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	X	×	Х	×	X	×	Х	Х	X	×	Х	Х	Х	Х	>
:	3) guillotin t ²) ne numbe	Descri Vent Pa	Choked																								
	DVI(4E 0.065(f : Volur	e No.	To	67	67	V10	V11	V12	V13	V14	V15	V16	V18	V19	V20	V21	V22	V23	V24	V17	V17	V18	V19	V20	V21	V22	1/00
	ak Type : ak Area : < location	Volum	From	V16	V17	V18	V19	V20	V21	V22	V23	V24	71V	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	121
	A. Bre Bre Breal	Vent	No.	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	77

			_																								
			Tota	0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		cient K	Contraction	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		Loss Coeffic	Expansion	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ft)	11.58	9.77	9.6	9.77	9.6	9.77	9.6	9.77	9.6	4.04	3.53	3.6	4.04	4.04	3.6	3.53	4.04	5.78	5.62	5.69	5.78	5.78	5.69	5.62
partment Ve		Hydraulic	Ulailleter (ft)	0.168	1.914	1.281	1.914	1.281	1.914	1.281	1.914	1.281	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.066	0.064	0.064	0.066	0.066	0.064	0.064
cavity Com		Inertia	(ft)	9.65	8.14	8.0	8.14	8.0	8.14	8.0	8.14	8.0	3.37	2.94	3.0	3.37	3.37	3.0	2.94	3.37	4.82	4.68	4.74	4.82	4.82	4.74	4.68
2 Reactor		Area	(ft²)	0.67	5.89	3.69	5.89	3.69	5.89	3.69	5.89	3.69	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.25	0.25	0.30	0.30	0.25	0.25
Table 6.2-; e break	r 50	otion of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	Х	×	×	×	Х	Х	×	×	×
() guillotine	t⁺) ne numbe	Descrip Vent Pa	Choked																								
DVI(4E	0.065(f : Volur	e No.	Ъ	V24	V26	V27	V28	V29	V30	V31	V32	V25	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31
ak Type :	ak Area : < location	Volume	From	V32	V25	V26	V27	V28	V29	V30	V31	V32	V41	V42	V43	V44	V45	V46	V47	V48	V49	V50	V51	V52	V53	V54	V55
A. Bre	Brea	Vent	No.	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	99	67	68	69	20	71

			_																								
			Total	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0
		cient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0
		Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ft)	5.78	12.05	12.1	12.1	12.05	9.28	8.92	8.96	9.28	9.28	8.96	8.92	9.28	13.18	12.88	13.19	13.15	13.19	12.88	13.18	13.15	11.83	11.12	11.15
Ipartment Ve		Hydraulic Diamotor	(ft)	0.066	0.063	0.063	0.063	0.063	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	3.422	3.035	3.451	3.035	3.451	3.035	3.422	3.035	3.545	3.277	3.308
cavity Com		Inertia	(ft)	4.82	10.04	10.08	10.08	10.04	7.73	7.43	7.47	7.73	7.73	7.47	7.43	7.73	10.98	10.73	10.99	10.96	10.99	10.73	10.98	10.96	9.86	9.27	9.29
2 Reactor (Area	(ft²)	0.30	0.09	0.09	0.09	0.09	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	11.85	9.21	12.08	9.21	12.08	9.21	11.85	9.21	26.97	23.07	23.46
Table 6.2-	e preak r 50	ption of ath Flow	Unchoked	×	×	×	Х	×	Х	Х	Х	Х	Х	Х	×	×	Х	Х	Х	Х	Х	Х	Х	Х	×	Х	×
citollino (0	s) guilloun ft ²) ne numbe	Descri Vent Pa	Choked																								
	0.065(i	e No.	To	V32	V26	V27	V30	V31	V33	V34	V35	V36	V37	V38	V39	V40	V42	V43	V44	V45	V46	V47	V48	V41	V41	V42	V43
. 000,T 10	ak Type : ak Area : < location	Volume	From	V56	V50	V51	V54	V55	V49	V50	V51	V52	V53	V54	V55	V56	V41	V42	V43	V44	V45	V46	V47	V48	V49	V50	V51
	A. Bre Bre Breal	Vent	No.	72	73	74	75	76	77	78	62	80	81	82	83	84	85	86	87	88	89	06	06	92	93	94	95

-																											
			Total	0	0	0	0	0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		cient K	Contraction	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		Loss Coeffi	Expansion	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ft)	11.86	11.86	11.15	11.12	11.83	13.38	13.04	13.4	13.22	13.4	13.04	13.38	13.22	10.01	4.78	4.79	9.6	9.6	4.79	4.78	10.01	10.42	5.33	5.32
ipartment Ve		Hydraulic	Ulameter (ft)	3.561	3.561	3.308	3.277	3.545	3.873	3.154	3.917	3.154	3.917	3.154	3.873	3.154	1.089	0.784	0.782	1.089	1.089	0.782	0.784	1.089	1.089	0.784	0.782
cavity Com		Inertia	(ft)	9.88	9.88	9.29	9.27	9.86	11.15	10.87	11.17	11.02	11.17	10.87	11.15	11.02	8.34	3.98	3.99	8.0	8.0	3.99	3.98	8.34	8.68	4.44	4.43
2 Reactor (Area	(ft²)	27.19	27.19	23.46	23.07	26.97	18.56	12.26	18.92	12.26	18.92	12.26	18.56	12.26	4.75	2.66	2.66	4.75	4.75	2.66	2.66	4.75	4.75	2.66	2.66
Table 6.2- le break		ption of ath Flow	Unchoked	×	×	Х	Х	×	×	Х	Х	Х	Х	Х	Х	×	Х	Х	Х	×	×	×	Х	Х	Х	Х	×
) guillotin (2)		Descri Vent Pa	Choked																								
DVI(4B 0.065(fl	. voluli	e No.	То	V44	V45	V46	V47	V48	V50	V51	V52	V53	V54	V55	V56	V49	V57	V58	V59	V60	V61	V62	V63	V64	V65	V66	V67
ak Type : ak Area :		Volum	From	V52	V53	V54	V55	V56	V49	V50	V51	V52	V53	V54	V55	V56	V41	V42	V43	V44	V45	V46	V47	V48	V49	V50	V51
A. Breć Breć Breć	הוכמו	Vent	No.	96	97	98	66	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119

			F																								
			Tota	1.5	1.5	1.5	1.5	1.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		sient K	Contraction	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	9.0	9.0	9.0	0.5	0.5
		Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ft)	10.01	10.01	5.32	5.33	10.42	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	10.7	10.28	10.28	10.7	13.56	5.4	5.26	12.74	12.74	5.26	5.4
partment Ve		Hydraulic	Ulameter (ft)	1.089	1.089	0.782	0.784	1.089	1.524	1.382	1.377	1.518	1.518	1.377	1.382	1.524	0.463	0.463	0.463	0.463	0.881	0.767	0.769	0.881	0.881	0.769	0.767
cavity Com	`	Inertia	(ft)	8.34	8.34	4.43	4.44	8.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	8.92	8.57	8.57	8.92	11.3	4.5	4.38	10.62	10.62	4.38	4.5
2 Reactor		Area	(ft²)	4.75	4.75	2.66	2.66	4.75	9.24	3.68	3.58	8.67	8.67	3.58	3.68	9.24	0.82	0.82	0.82	0.82	3.64	2.58	2.59	3.64	3.64	2.59	2.58
Table 6.2-	e break r 50	ption of ath Flow	Unchoked	×	×	×	×	×	Х	×	×	×	×	Х	Х	×	×	Х	Х	×	Х	×	Х	Х	Х	Х	×
	3) guillotin t ²) ne numbe	Descrip Vent Pa	Choked																								
	DVI(4E 0.065(f : Volun	s No.	Ъ	V68	V69	V70	V71	V72	V65	V66	V67	V68	V69	V70	V71	V72	V73	V74	V75	V76	V107	V107	V108	V108	V109	V109	V110
	ak Type : ak Area : clocation	Volume	From	V52	V53	V54	V55	V56	V57	V58	V59	V60	V61	V62	V63	V64	V49	V52	V53	V56	V57	V58	V59	V60	V61	V62	V63
	A. Breć Breć Break	Vent	No.	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143

			=																								
			Tota	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5
		sient K	Contraction	0.5	0.5	9.0	0.5	0.5	0.5	9.0	0.5	0.5	9.0	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	9.0	0.5
		-oss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ff)	13.56	13.56	5.4	5.26	12.74	12.74	5.26	5.4	13.56	7.99	7.08	7.08	7.99	6.24	6.24	6.24	6.24	6.24	6.24	6.24	6.24	5.28	5.28	5.28
partment Ve		Hydraulic	Ulailleter (ft)	0.881	0.881	0.767	0.769	0.881	0.881	0.769	0.767	0.881	0.525	0.525	0.525	0.525	0.225	0.225	0.225	0.225	0.225	0.225	0.225	0.225	1.968	1.968	1.968
cavity Com		Inertia	(ft)	11.3	11.3	4.5	4.38	10.62	10.62	4.38	4.5	11.3	6.66	5.9	5.9	6.66	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.4	4.4	4.4
2 Reactor (Area	(ft²)	3.64	3.64	2.58	2.59	3.64	3.64	2.59	2.58	3.64	1.11	1.11	1.11	1.11	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	4.36	4.36	4.36
Table 6.2-; e break	r 50	ption of ath Flow	Unchoked	×	×	Х	×	×	×	×	×	×	Х	×	×	×	×	×	×	Х	Х	×	×	×	×	Х	×
) auillotin	(²) Te numbe	Descri	Choked																								
DVI(4B	0.065(f : Volun	∋ No.	To	V110	V107	V107	V108	V108	V109	V109	V110	V110	V107	V108	V109	V110	V77	V78	V79	V80	V81	V82	V83	V84	V77	V78	V79
k Tvne :	ak Area : Iocation	Volume	From	V64	V65	V66	V67	V68	V69	V70	V71	V72	V73	V74	V75	V76	V25	V26	V27	V28	V29	V30	V31	V32	V33	V34	V35
A. Brea	Breé Breé	Vent	No.	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167

			_																								
			Tota	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5
		sient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	9.0	0.5	9.0	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5
		Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0
scription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ft)	5.28	5.28	5.28	5.28	5.28	9.14	9.14	9.14	9.14	9.14	9.14	9.14	9.14	9.53	9.53	9.53	9.53	9.53	9.53	9.53	9.53	9.14	9.14	9.14
ipartment Ve		Hydraulic	Ulailleter (ft)	1.968	1.968	1.968	1.968	1.968	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.396	0.396	0.396
cavity Com		Inertia	(ft)	4.4	4.4	4.4	4.4	4.4	7.62	7.62	7.62	7.62	7.62	7.62	7.62	7.62	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.62	7.62	7.62
2 Reactor		Area	(ft²)	4.36	4.36	4.36	4.36	4.36	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.61	1.61	1.61
Table 6.2-2	e break r 50	otion of ith Flow	Unchoked	×	×	×	×	×	×	Х	Х	×	Х	×	×	×	Х	×	Х	Х	Х	×	×	×	×	×	×
	3) guillotine t ²) ne numbei	Descrip Vent Pa	Choked																								
	DVI(4E 0.065(f : Volun	e No.	To	V80	V81	V82	V83	V84	V78	V79	V80	V81	V82	V83	V84	V77	V85	V86	V87	V88	V89	V90	V91	V92	V86	V87	V88
	ak Type : ak Area : < location	Volume	From	V36	V37	V38	V39	V40	V77	V78	V79	V80	V81	V82	V83	V84	V77	V78	V79	V80	V81	V82	V83	V84	V85	V86	V87
	A. Brea Brea Breat	Vent	No.	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191

		Total	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0
	cient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0
	-oss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0
scription		Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ent Path De	Friction	(ft)	9.14	9.14	9.14	9.14	9.14	16.67	16.67	16.67	16.67	16.67	16.67	16.67	16.67	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	26.34	26.34	26.34
partment Ve	Hydraulic Diamotor	(ft)	0.396	0.396	0.396	0.396	0.396	0.119	0.164	0.119	0.119	0.119	0.164	0.119	0.119	0.216	0.307	0.216	0.216	0.216	0.307	0.216	0.216	0.397	0.397	0.397
cavity Com	Inertia	(ft)	7.62	7.62	7.62	7.62	7.62	13.89	13.89	13.89	13.89	13.89	13.89	13.89	13.89	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	21.95	21.95	21.95
2 Reactor (Area	(ft²)	1.61	1.61	1.61	1.61	1.61	0.04	0.16	0.04	0.04	0.04	0.16	0.04	0.04	0.08	0.32	0.08	0.08	0.08	0.32	0.08	0.08	1.56	1.56	1.56
Table 6.2- e break r 50	ption of ath Flow	Unchoked	×	×	×	×	×																	Х	Х	×
3) guillotin t ²) ne numbe	Descri Vent Pa	Choked						×	×	Х	×	Х	×	×	×	Х	Х	Х	Х	Х	×	Х	Х			
: DVI(4E 0.065(f	e No.	To	V89	06A	V91	V92	V85	V93	V94	26N	96N	26N	V98	66A	V100	£67	794	26N	96A	26N	V98	66A	V100	101V	V101	V101
ak Type ak Area : locatior	Volum	From	V88	V89	V90	V91	V92	V77	V78	V79	V80	V81	V82	V83	V84	V85	V86	V87	V88	V89	V90	V91	V92	V85	V86	V87
A. Brea Brea Break	Vent	No.	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	207	209	210	211	212	213	214	215

			Total	0	0	0	0	0	0	1.5	1.5	1.5	0
		cient K	Contraction	0	0	0	0	0	0	0.5	0.5	0.5	0
		Loss Coeffic	Expansion	0	0	0	0	0	0	1.0	1.0	1.0	0
escription			Turning and Obstruction	0	0	0	0	0	0	0	0	0	0
ent Path De		Friction	(ff)	26.34	26.34	26.34	26.34	26.34	11.76	26.1	15.53	13.11	28.06
partment Ve		Hydraulic	(ft)	0.397	0.397	0.397	0.397	0.397	19.717	11.338	11.659	11.659	8.926
cavity Con	,	Inertia	(ft)	21.95	21.95	21.95	21.95	21.95	9.8	17.4	10.35	8.74	23.38
2 Reactor (Area	(ft²)	1.56	1.56	1.56	1.56	1.56	305.36	155.64	171.97	171.97	121.11
Table 6.2-3	e break r 50	otion of ith Flow	Unchoked	×	Х	Х	Х	×	Х	Х	×		
) guillotine [²) ne numbe	Descrip Vent Pa	Choked									Х	Х
	DVI(4B 0.065(f	e No.	То	V101	V101	V101	V101	V101	V102	V103	V104	V105	V106
	ak Type : ak Area : < location	Volum	From	V88	V89	06N	V91	V92	V101	V102	V103	V104	V104
	A. Brei Brei Brea	Vent Dath	No.	216	217	218	219	220	221	222	223	224	225

Table 6.2-3 Mass and F	Release Rates for Reactor Cav	ity Compartment Peak
A. Break Type : DVI(4B) gu	illotine break	
Break Area : 0.065(ft ²)		
Break location : Volume	number 50	
Time	Mass Release Rate	Enthalpy
(s)	(lbm/s)	(BTU/lbm)
0	0	553.17
0.1	1463.88	553.143
0.2	1541.46	553.075
0.3	1538.33	553.018
0.4	1532.47	552.976
0.5	1528.36	552.949
0.6	1526.07	552.934
0.7	1525.48	552.932
0.8	1526.17	552.94
0.9	1527.61	552.952
1	1529.28	552.967
1.1	1530.83	552.98
1.2	1532.05	552.991
1.3	1532.86	552.999
1.4	1533.18	553.003
1.5	1533.02	553.004
1.6	1532.39	553.001
1.7	1531.33	552.995
1.8	1529.91	552.988
1.9	1528.24	552.978
2	1526.4	552.969
2.1	1524.45	552.959
2.2	1522.48	552.95
2.3	1520.54	552.942
2.4	1518.69	552.936
2.5	1516.97	552.931
2.6	1515.38	552.927
2.7	1513.93	552.926
2.8	1512.62	552.926
2.9	1511.41	552.927
3	1510.27	552.929
3.1	1509.17	552.931
3.2	1508.06	552.934
3.3	1506.95	552.937
3.4	1505.81	552.94
3.5	1504.66	552.943
3.6	1503.5	552.947
3.7	1502.33	552.951
3.8	1501.14	552.954
3.9	1499.94	552.958
4	1498.71	552.962

Table 6.2-3 Mass and F	Release Rates for Reactor Cav	ity Compartment Peak
	Pressure Analyses	
A. Break Type : DVI(4B) gu	illiotine break	
Break location : Volume	number 50	
Time	Mass Release Rate	Enthalpy
(S)	(lbm/s)	(BTU/lbm)
4.1	1497.56	552.967
4.2	1496.28	552.972
4.3	1494.92	552.976
4.4	1493.63	552.981
4.5	1492.4	552.987
4.6	1491.22	552.994
4.7	1490.07	553.001
4.8	1488.94	553.009
4.9	1487.84	553.018
5	1486.75	553.027
5.1	1485.66	553.037
5.2	1484.56	553.047
5.3	1483.46	553.058
5.4	1482.35	553.07
5.5	1481.22	553.082
5.6	1480.06	553.095
5.7	1478.97	553.109
5.8	1477.85	553.123
5.9	1476.71	553.138
6	1475.56	553.154
6.1	1474.42	553.171
6.2	1473.29	553.189
6.3	1472.17	553.208
6.4	1471.06	553.228
6.5	1469.95	553.249
6.6	1468.84	553.27
6.7	1467.74	553.292
6.8	1466.65	553.315
6.9	1465.55	553.339
7	1464.46	553.364
7.1	1463.37	553.389
7.2	1462.3	553.414
7.3	1461.23	553.44
7.4	1460.16	553.467
7.5	1459.09	553.493
7.6	1458	553.52
7.7	1456.91	553.547
7.8	1455.83	553.574
7.9	1454.74	553.6
8	1453.65	553.627
8.1	1452.57	553.654
8.2	1451.49	553.68

Table 6.2-3 Mass and	Release Rates for Reactor Ca	wity Compartment Peak
A Break Type : DV/I(4B) a	uilloting break	
A. Dieak Type : $DVI(+D)$ g		
Break location : Volumo	number 50	
	Mass Delesse Dete	Entholoy
	Mass Release Rale	Enthalpy (DTL ((b.rs.)
(S)	(IDM/S)	
8.3	1450.42	553.706
8.4	1449.35	553.731
8.5	1448.3	553.756
8.6	1447.26	553.78
8.7	1446.21	553.804
8.8	1445.17	553.827
8.9	1444.13	553.85
9	1443.1	553.872
9.1	1442.07	553.892
9.2	1441.04	553.912
9.3	1440.02	553.932
9.4	1439.01	553.95
9.5	1438	553.968
9.6	1437	553.984
9.7	1436.01	554
9.8	1435.02	554.015
9.9	1434.02	554.029
10	1433.02	554.042

Figure 6.2-2 Nodalization scheme of reactor cavity

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Figure 6.2-4 Nodalization diagram of reactor cavity in B-loop direction

Figure 6.2-6 Nodalization diagram of reactor cavity in D-loop direction



Figure 6.2-7 Nodalization diagram of reactor cavity



Figure 6.2-8 Short term mass and energy release data for reactor cavity (1/2)



Figure 6.2-9 Short term mass and energy release data for reactor cavity (2/2)



Figure 6.2-10 Pressure transient at the peak pressure node(V50) in reactor cavity analysis

6.3 Steam Generator Subcompartment

6.3.1 Modeling and nodalization sensitivity study

(a) Nodal description

The Steam Generator (SG) compartment consists of the upper region which is nearly a rectangular chimney shaped and includes the upper part of SG, and lower region including the Reactor Coolant Pump (RCP), Main Coolant Pipes (MCPs) and other pipes connecting MCPs.

All SG compartments have almost the same configuration. In particular the A and D loop compartments are identical and the B and C loop compartments are identical. Since the free volume of the A-loop compartment is slightly smaller than that of B-loop, the A-loop compartment is chosen among 4 compartments as the object for SG compartment pressure analyses.

The SG compartment has 2 openings to the containment atmosphere at the top, 2 openings to the containment atmosphere through the side wall, 7 openings to adjacent SG compartments through the side wall and 2 openings to reactor coolant drain tank compartment. There are some openings between the SG compartment and reactor cavity, these openings are not modeled as vent paths. This assumption generates conservatively high pressure differentials.

The nodalization scheme for US-APWR SG compartment pressure analysis is shown in Figure 6.3-1 to Figure 6.3-5. The SG compartment is azimuthally divided into each 4 sectors around the SG and the RCP, and vertically divided into 8 sectors for SG region, and 6 sectors for RCP region. The vertical nodal boundaries are basically at the location of flow obstructions (gratings) or geometry changes. The GOTHIC nodalization for SG compartment analysis is shown in Figure 6.3-6. A total of 57 nodes, including the containment atmosphere node, are used for the SG compartment analyses. To calculate conservative pressure differences between of the SG compartment atmosphere and adjacent compartments are assumed constant at 0.0 psig. This assumption generates conservatively high pressure differentials.

The description and geometric parameters for each node are summarized in Table 6.3-2. The free volume of each node is estimated by subtracting the obstructed volume from the room volume. The obstructed volume is estimated from the volume of main components with margin to assure minimum free volume for the node. This assumption generates conservative results.

(b) Vent path description

The vent path connection diagram is shown in Figure 6.3-6. Geometric and hydraulic parameters for each vent path are summarized in Table 6.3-3. Vent paths P7, P49, P68, P111 to P114 and P131 to P134 are openings from the SG compartment to the containment atmosphere. Vent paths P14, P15, P34, P35, P74, P93 and P110 are openings from the SG compartment (A-loop) to adjacent SG compartment (B-loop). Vent paths P3 and P9 are openings from the SG compartment to the reactor coolant drain tank compartment. To obtain

conservative results, all vent paths were connected to containment atmosphere node which is maintained at constant pressure.

The flow area of each vent path is conservatively estimated considering the flow obstruction by main components including margin. The friction length is conservatively estimated considering the length of the estimated flow line plus margin. The loss coefficient is conservatively estimated considering the effect of obstruction, contraction and expansion plus margin.

6.3.2 Short term mass and energy release data

High energy pipes penetrating the SG compartment are listed in Table3-1. The postulated breaks were chosen from this table, considering the inner diameter of pipe, fluid temperature (density), and inside fluid pressure. The LBB-qualified pipes were not considered. For the SG compartment pressure analyses, breaks of RHR pump inlet line, RHR pump outlet line and Feedwater line were postulated.

(a) RHR pump inlet line break

A guillotine break of the RHR pump inlet line was assumed. The RHR pump inlet line is connecting to the RCS hot leg (HLG). The mass and energy release from a HLG break was calculated using M-RELAP5 code which is the small break LOCA analysis code for the US-APWR. The opposite side (RHR pump side) is isolated by valves, therefore the amount of break flow from RHR pump side is limited. However, the break mass and energy flow from HLG is conservatively doubled. The resultant short term mass and energy release data are shown in Figure 6.3-7 and Figure 6.3-8.

(b) RHR pump outlet line break

A guillotine break of the RHR pump outlet line was assumed. The RHR pump outlet line is connecting to the RCS cold leg (CLG). The mass and energy release from CLG side break was calculated using M-RELAP5 code which is the small break LOCA analysis code for the US-APWR. The opposite side (RHR pump side) is isolated by valves, therefore the amount of break flow from RHR pump side is limited. However, the break mass and energy flow from CLG was conservatively doubled. The resultant short term mass and energy release data are shown in Figure 6.3-10 and Figure 6.3-11.

(c) Feedwater line break

A guillotine break in the feedwater line was assumed. The feedwater line connects to the secondary side of SG.

For estimating the mass and energy, two operating conditions are considered, full power operation and just after hot shutdown. The parameters for these operating conditions are listed in Table 6.3-1. The resultant short term mass and energy release data are shown in Figure 6.3-13 to Figure 6.3-16 and Figure 6.3-18 to Figure 6.3-22.

6.3.3 Calculated pressure responses

(a) RHR pump inlet line break

The analysis was performed with the pipe break at various locations. The sensitivity studies for break location confirmed that worst case conditions were obtained with the break in V16.

The calculated peak pressure was 3.16 psig at the break node V16. The pressure transient at V16 is shown in Figure 6.3-9. The design pressure of this node is 7 psig and the calculated peak pressure is less than the design pressure.

(b) RHR pump outlet line break

The analysis was performed with the pipe break at various locations. The sensitivity studies for break location confirmed that worst case conditions were obtained with the break in V17

The calculated peak pressure was 4.15 psig at the break node V17. The pressure transient at V17 is shown in Figure 6.3-12. The design pressure of this node is 7 psig and the calculated peak pressure is less than the design pressure.

(c) Feedwater line break (full power operating condition)

The calculated peak pressure was 13.81 psig with the break in node V55. The pressure transient at V55 is shown in Figure 6.3-17. The design pressure of this node is 14 psig and the calculated peak pressure is less than the design pressure.

- (d) Feedwater line break (just after hot shutdown condition)
 - The calculated peak pressure was 11.19 psig with the break in node V55. The pressure transient at V55 is shown in Figure 6.3-22. The design pressure of this node is 14 psig and the calculated peak pressure is less than the design pressure.

Table 6.3-1	Considered Operating	a Conditions fo	or Feedwater I	ine Break
	ounsidered operating	g oonanions ie	Ji i ccuwater i	

	Pressure of secondary	Temperature of SG
Operating condition	system	secondary side
	(psia)	(deg F)
Full power	986	515.4*
Just after hot shutdown	1110	557.1

* This value is not a design value. It is conservatively estimated for sub compartment analysis.

	Tab Type : RHR pump inlet line	ile 6.3-2 \$(10B) guill	Steam Ge otine breal	nerator C	ompartm	ient Noda	l Description		
Área ocatio	: 0.788(ft²) n : Volume number 1	, 16							
	:	Height	Free	Initi	al Condit	ions	Calculated	Design	Maroin
	Description	(ff)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
West A-RC	quadrant around P in A-SG				1	c			
comp EL 29	bartment:between 5'-3" and 36'-5"	11.11	8/4	071	14.7	5	¢0.1	18	90.X
North	n quadrant around								
A-R(CP in A-SG	11 17	750	120	7 71	C	163	4	000
COMP EL 2	bartment:between 5'-3" and 36'-5"	-	202	07	<u>t</u>	>	<u>.</u>	2	0.00
East	quadrant around								
A-R(CP in A-SG	11 17	1346	120	14.7	C	1 87	4	0 08
com	partment:between		0+0	071		5	20.1	2	00.00
EL 2	5'-3" and 36'-5"								
Sout	h quadrant around								
A-R(CP in A-SG	11 17	1257	120	14.7	C	1 60	ά	906
	bartment:between בי פי מהל פני ביי	-	104	04	Ē	þ	20.	2	0.00
Nort	west guadrant								
arou	nd A-SG in A-SG	7 4 7	1500			c	7.7	0	
com	partment:between			170		5	07.1	0	90.H
EL 2	5'-3" and 36'-5"								
Nort	neast quadrant								
arou	nd A-SG in A-SG	11 17	1820	120	14 7	C	1 84	18	808
com	oartment:between	-	010	24		>	-	2	0.00
	25'-3" and 36'-5"								
	4°F	10627	Ctoom Go		m traction of the	Chold the	Decription		
---------------------------	---	------------------	-----------------	------------------	-------------------	---------------	-----------------------------	-----------------------------	--------
A. Break Brea Break	Type : RHR pump inlet line k Area : 0.788(ft²) location : Volume number 1	e(10B) guil 6	lotine breal						
Volume		Heicht	Free	Initia	al Conditi	ons	Calculated	Design	Maroin
No.	Description	(#)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
~	Southeast quadrant around A-SG in A-SG	11 17	15.10	120	7 7 7		1 75	ά	00 3
_	compartment:between EL 25'-3" and 36'-5"			071	·.+	5	2	2	0.00
	Southwest quadrant								
œ	around A-SG in A-SG	11 17	1370	120	14 7	С	1 77	18	00 2
)	compartment:between EL 25'-3" and 36'-5"	-		24		>	-	2	1
	West quadrant around								
σ	A-RCP in A-SG	10.01	677	120	14 7	C	1 86	α,	89.7
0	compartment:between			071		5	00	2	1.00
	EL 36'-5" and 46'-5.08"								
	North quadrant around								
01	A-RCP in A-SG	10.01	500	120	14 7	C	1 82	α,	0 08
2	compartment:between		200	04		5	70.1	2	0.00
	EL 36'-5" and 46'-5.08"								
	East quadrant around								
5		10.01	1183	120	14.7	0	1.74	18	90.3
	compartment: between								
	EL 36'-5" and 46'-5.08"								
	South quadrant around								
12	A-RCP in A-SG	10.01	1037	120	14.7	С	1.60	18	91.1
	compartment:between)	0)	

A Break	Tab Tvne · RHR numn inlet line	le 6.3-2 (10B) quill	Steam Gel	nerator Co	ompartm	ent Nodal	Description		
Break Break	k Area : 0.788(ft²) location : Volume number 1	6 6		2					
Volume		Height	Free	Initi	al Conditi	ions	Calculated	Design	Mardin
No.	Description	(ff)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
13	Northwest quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1283	120	14.7	0	1.73	18	90.4
4	Northeast quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1586	120	14.7	0	1.73	18	90.4
15	Southeast quadrant around A-SG in A-SG compartment:between EL 36'-5' and 46'-5.08"	10.01	1272	120	14.7	0	1.83	18	8.68
16	Southwest quadrant around A-SG in A-SG compartment:between EL 36'-5' and 46'-5.08"	10.01	1108	120	14.7	0	3.16	18	82.4
17	West quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	572	120	14.7	0	1.68	7	76.0
18	North quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	474	120	14.7	0	1.72	7	75.4

-	Tab	le 6.3-2	Steam Ge	nerator Co	ompartm	ent Noda	Description		
A. Break Brea Break	K Type : KHK pump inter inter ik Area : 0.788(ft ²) location : Volume number 10	(105) guil 6	lotine prea	×					
Volume		Heinht	Free	Initi	al Conditi	ions	Calculated	Design	Maroin
No.	Description	(#)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
19	East quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	935	120	14.7	0	1.79	7	74.4
20	South quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	896	120	14.7	0	1.55	7	6.77
21	Northwest quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	1007	120	14.7	0	1.54	7	0.87
22	Northeast quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	582	120	14.7	0	1.64	7	9.97
23	Southeast quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	954	120	14.7	0	1.68	7	0.97
24	Southwest quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	882	120	14.7	0	1.96	7	72.0
25	West quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	431	120	14.7	0	1.49	2	7.87

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Table 6.3-2 Steam Generator Compartment Nodal Description et line(10B) guillotine break ber 16	Heicht Free Initial Conditions Calculated Design Marcin	(ft) Volume Temp. Press. Humid. Peak Press. Diff. Peak Press. Diff. (%) (ft. ³) (deg F) (psid) (%) (psid) (psid) (psid)	EL 7.25 350 120 14.7 0 1.45 7 79.3	EL 7.25 746 120 14.7 0 1.51 7 78.4	EL 7.25 697 120 14.7 0 1.43 7 79.6	und 7.25 843 120 14.7 0 1.50 7 78.6	und T.25 577 120 14.7 0 1.63 7 76.7	und 7.25 799 120 14.7 0 1.54 7 78.0	
m Generator Co break	ee Initia	ume Temp. t ³) (deg F)	50 120	46 120	97 120	43 120	77 120	99 120	
e 6.3-2 Stea 10B) guillotine	Hainht Fi		7.25 3	7.25 7.	7.25 6	7.25 8	7.25 5	7.25 7	
Tabl Type : RHR pump inlet line < Area : 0.788(ft²) location : Volume number 16		Description	North quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	East quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	South quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	Northwest quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	Northeast quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	Southeast quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	Southwest quadrant around A-SG in A-SG
A. Break Break Break I	Volume	No.	26	27	28	29	30	31	Ċ

break Breal	Tab Type : RHR pump inlet line (Area : 0.788(ft²)	ile 6.3-2 e(10B) guill e	Steam Ge llotine breal	nerator Co	ompartm	ent Noda	I Description		
/ [2							
	:	Height	Free	Initi	al Conditi	ions	Calculated	Design	Maroin
	Description	(H)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Southwest quadrant around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	603	120	14.7	0	1.31	7	81.3
	West quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	356	120	14.7	ο	1.38	7	80.3
	North quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	324	120	14.7	ο	1.36	7	80.6
İ	East quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	387	120	14.7	ο	1.38	7	80.3
	South quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	260	120	14.7	ο	1.43	7	79.6
İ	Northwest quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	274	120	14.7	ο	1.34	7	80.9
	Northeast quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	508	120	14.7	0	1.21	7	82.7

	Maroin	(%)	83.3	82.3	83.7	85.0	84.1	84.1	94.3
	Design	Peak Press. Diff. (psid)	7	7	7	7	7	7	14
I Description	Calculated	Peak Press. Diff. (psid)	1.17	1.24	1.14	1.05	1.11	1.11	0.80
ent Noda	suo	Humid. (%)	0	0	0	0	0	0	0
ompartm	al Conditi	Press. (psia)	14.7	14.7	14.7	14.7	14.7	14.7	14.7
nerator Co	Initi	Temp. (deg F)	120	120	120	120	120	120	120
Steam Ge l otine break	Free	Volume (ft³)	523	277	481	960	1034	517	379
le 6.3-2 (10B) guill 3	Height	(Ħ)	4.83	4.83	10.67	10.67	10.67	10.67	11.33
Tabl Type : RHR pump inlet line(Area : 0.788(ft²) location : Volume number 16	:	Description	Southeast quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	Southwest quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	Northwest quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	Northeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	Southeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	Southwest quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	Northwest quadrant around A-SG in A-SG compartment:between EL 83'-9" and 95'-1"
A. Break Break Break I	Volume	No.	47	48	49	50	51	52	53

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		Maroin	(%)		950	0.00		370	94.0		c 10	1		ı
		Design	Peak Press. Diff. (psid)		11	t		7	<u>+</u>		11	<u>t</u>		I
I Description		Calculated	Peak Press. Diff. (psid)		0 70	0.0		0 76	C/.N		0 84	- 0.0		ı
ent Nodal		suo	Humid. (%)		c	5		c	5		c	þ		0
ompartm		al Conditi	Press. (psia)		7 7 7			277	4.7		7 7 7			14.7
nerator C		Initi	Temp. (deg F)		120	071			120		120	24		120
Steam Ger	lotine break	Free	Volume (ft³)		840			065	COA		877			2861000
le 6.3-2	(10B) guil 6	Height	(ff)		11 33	00.11		CC 11	CC.11		11 33	00.11		200
Tab	Type : RHR pump inlet line k Area : 0.788(ft²) location : Volume number 1		Description	Northeast quadrant around	A-SG in A-SG	compartment:between EL	83'-9" and 95'-1"	Southeast quadrant around A-SG in A-SG	compartment:between EL 83'-9" and 95'-1"	Southwest quadrant around	A-SG in A-SG	compartment:between EL	83'-9" and 95'-1"	Containment atmosphere
	A. Break Break Break I	Volume	No.		77	5		L L	00		Ц Ц	3		57

				able 6.3-3	Steam Ge	enerator (Compartme	nt Vent Pat	th Description			
A. Brea	k Type	: RHR	pump inle	et line(10B)	guillotine b	reak	-		-			
Brea Brea	ik Area k locatio	: 0.788 on : Vo	(ft ²) lume num	nber 16								
Vent	Volum	ne No.		ription of		Inertia	Hydraulic	Friction		oss Coeffici	ent K	
Path No	Erom	Ļ	Choked	Linchoked	Area (ft²)	Length (ff)	Diameter (ff)	Length (ft)	Turning and	Expansion	Contraction	Total
		2 0		X	101 35	7 4 7	0 50	8 OF	Obstruction		0 Y	1 D
- 2		14		<	135.39	8.68	9.30 11.10	0.30		1.0	0.5	10
က	-	57			61.86	14.24	7.86	17.09	0	1.0	0.5	1.5
4	2	e		×	86.79	9.87	8.66	11.84	0	1.0	0.5	1.5
5	З	4		×	79.51	10.36	5.66	12.43	0	1.0	0.5	1.5
9	ო	9		×	145.18	11.93	11.44	14.32	0	1.0	0.5	1.5
7	ო	57		×	30.94	10.28	5.46	12.34	1.84	1.0	0.5	3.34
∞	4	2		×	168.39	12.50	12.26	15.00	0	1.0	0.5	1.5
6	4	57		×	28.87	18.64	5.01	22.37	0	1.0	0.5	1.5
10	5	9		×	84.29	11.69	6.18	14.03	0	1.0	0.5	1.5
11	5	8		×	183.69	10.36	13.30	12.43	0	1.0	0.5	1.5
12	9	2		×	135.63	13.13	11.64	15.76	0	1.0	0.5	1.5
13	7	8		×	133.49	9.97	11.55	11.96	0	1.0	0.5	1.5
14	7	22		×	36.65	14.12	5.90	16.94	0	1.0	0.5	1.5
15	8	57		×	21.94	13.72	4.42	16.46	0	1.0	0.5	1.5
16	-	6		×	49.88	6.39	8.15	24.06	2.0	0	0	0.7
17	2	10		×	42.85	6.39	8.28	24.25	2.0	0	0	0.7
18	ო	1		×	80.97	6.39	11.43	28.69	0.7	0	0	0.7
19	4	12		×	71.52	6.39	10.16	26.90	2.0	0	0	0.7
20	2	13		×	86.56	6.39	11.20	28.37	2.0	0	0	0.7
21	9	14		×	109.95	6.39	13.94	32.23	2.0	0	0	0.7
22	7	15		×	87.11	6.39	12.05	29.56	0.7	0	0	0.7
23	8	16		×	77.48	6.39	10.72	27.69	0.7	0	0	0.7

			F	able 6.3-3	Steam G	enerator (Compartme	nt Vent Pat	th Description			
A. Brea Brea	ik Type : ik Area :	: RHR : 0.788	pump inle (ft ²)	et line(10B) (guillotine b	oreak	ı		1			
Brea	ik locatio	on : Vo	lume nun	nber 16								
Vent	Volum	le No.	Desci Vent F	ription of ath Flow	Area	Inertia	Hydraulic	Friction		-oss Coeffici	ent K	
No	From	To	Choked	Unchoked	(ft²)	(ft)	Ulameter (ft)	(ft)	Turning and Obstruction	Expansion	Contraction	Total
24	6	10		×	68.97	9.96	8.16	11.95	0	1.0	0.5	1.5
25	ი	12		×	68.72	10.83	5.13	13.00	0	1.0	0.5	1.5
26	10	1		×	55.92	12.50	7.17	15.00	0	1.0	0.5	1.5
27	11	12		×	74.98	12.76	8.57	15.31	0	1.0	0.5	1.5
28	11	14		×	133.47	10.34	11.43	12.41	0	1.0	0.5	1.5
29	12	13		×	154.26	7.96	12.14	9.55	0	1.0	0.5	1.5
30	13	14		×	54.82	16.62	4.24	19.94	0	1.0	0.5	1.5
31	13	16		×	97.42	14.34	7.36	17.21	0	1.0	0.5	1.5
32	14	15		×	97.75	18.17	8.83	21.80	0	1.0	0.5	1.5
33	15	16		×	95.83	13.89	8.73	16.67	0	1.0	0.5	1.5
34	15	57		×	13.17	9.74	3.07	11.69	0	1.0	0.5	1.5
35	16	57	×		16.46	15.52	3.62	18.62	0	1.0	0.5	1.5
36	6	17		×	44.84	5.64	7.60	21.79	0.7	0	0	0.7
37	10	18		×	37.78	5.64	7.61	21.80	0.7	0	0	0.7
38	11	19		×	72.34	5.64	10.69	26.15	2.0	0	0	0.7
39	12	20		×	67.58	5.64	10.16	25.40	0.7	0	0	0.7
40	13	21		×	69.40	5.64	9.50	24.47	0.7	0	0	0.7
41	14	22		×	42.47	5.64	5.88	19.36	0.7	0	0	0.7
42	15	23		×	69.59	5.64	10.18	25.43	0.7	0	0	0.7
43	16	24		×	64.34	5.64	9.94	25.09	0.7	0	0	0.7
44	17	18		×	57.97	9.96	7.45	11.95	0	1.0	0.5	1.5
45	17	20		×	77.66	10.83	8.35	13.00	0	1.0	0.5	1.5
46	18	19		×	39.97	12.40	5.61	14.88	0	1.0	0.5	1.5
47	19	20		×	62.24	12.67	7.71	15.20	0	1.0	0.5	1.5

				able 6.3-3	Steam G	enerator (Sompartme	nt Vent Pat	h Description			
A. Brea Brea	ık Type ik Area	: RHR : 0.788	pump inle (ft ²)	et line(10B) (guillotine b	reak			ı			
Brea	ak locati	on : Vo	lume nun	nber 16								
Vent	Volum	le No.	Desci Vent F	ription of ath Flow	Area	Inertia	Hydraulic	Friction		oss Coeffici	ent K	
No	From	To	Choked	Unchoked	(ft²)	(ft)	Ulameter (ft)	(ft)	Turning and Obstruction	Expansion	Contraction	Total
48	19	22		×	70.67	12.92	8.40	15.50	0	1.0	0.5	1.5
49	19	57		×	14.75	10.76	3.73	12.91	1.84	1.0	0.5	3.34
50	20	21		×	133.50	2.96	11.09	9.55	0	1.0	0.5	1.5
51	21	22		×	34.51	14.48	5.46	17.38	0	1.0	0.5	1.5
52	21	24		×	89.66	14.34	9.43	17.21	0	1.0	0.5	1.5
53	22	23		×	52.38	16.36	7.12	19.63	0	1.0	0.5	1.5
54	23	24		×	50.72	13.89	6.99	16.67	0	1.0	0.5	1.5
55	17	25		×	37.54	4.82	6.14	18.09	0.7	0	0	0.7
56	18	26		×	30.50	4.82	5.90	17.75	0.7	0	0	0.7
57	19	27		×	64.56	4.82	9.25	22.47	0.7	0	0	0.7
58	20	28		×	60.68	4.82	8.93	22.02	0.7	0	0	0.7
59	21	29		×	73.43	4.82	10.18	23.78	0.7	0	0	0.7
60	22	30		×	70.79	7.96	5.88	9.55	0	0	0	0
61	23	31		×	115.99	96'.	10.18	9.55	0	0	0	0
62	24	32		×	51.33	4.82	7.93	20.61	0.7	0	0	0.7
63	25	26		×	46.64	10.89	6.82	13.07	0	1.0	0.5	1.5
64	25	28		×	55.78	12.50	7.47	15.00	0	1.0	0.5	1.5
65	26	27		×	24.22	13.84	4.57	16.61	0	1.0	0.5	1.5
99	27	28		×	49.21	14.18	6.14	17.02	0	1.0	0.5	1.5
67	27	30		×	65.64	12.95	6.38	15.54	0	1.0	0.5	1.5
68	27	57		×	6.00	9.50	2.40	11.40	1.84	1.0	0.5	3.34
69	28	29		×	111.77	6.33	9.86	7.60	0	1.0	0.5	1.5
70	29	30		×	28.88	14.48	5.14	17.38	0	1.0	0.5	1.5
71	29	32		×	75.05	14.34	8.53	17.21	0	1.0	0.5	1.5

				able 6.3-3	Steam G	enerator (Compartme	nt Vent Pat	th Description			
A. Brea	k Type :	RHR	pump inle	et line(10B) (guillotine b	reak						
Brea Brea	ik Area : ik locatic	: 0.788 oV : nc	(ft²) lume nun	nber 16								
Vent	Volum	e No.	Desci Vent F	ription of ath Flow	Area	Inertia	Hydraulic	Friction		oss Coefficio	ent K	
No	From	P	Choked	Unchoked	(ft²)	(ft)	Ulameter (ft)	(ft)	Turning and Obstruction	Expansion (Contraction	Total
72	30	31		×	43.85	16.36	6.59	19.63	0	1.0	0.5	1.5
73	31	32		×	42.46	13.89	6.48	16.67	0	1.0	0.5	1.5
74	32	57		×	13.17	11.40	3.07	13.68	0	1.0	0.5	1.5
75	25	33		×	62.57	6.59	6.14	7.91	0	0	0	0
76	26	34		×	50.84	6.59	5.90	7.91	0	0	0	0
77	27	35		×	107.60	6.59	8.89	7.91	0	0	0	0
78	28	36		×	101.14	6.59	8.93	7.91	0	0	0	0
79	29	37		×	60.79	4.00	8.43	19.67	0.7	0	0	0.7
80	30	38		×	42.47	4.00	5.39	15.38	0.7	0	0	0.7
81	31	39		×	69.59	4.00	10.18	22.14	0.7	0	0	0.7
82	32	40		×	46.82	4.00	7.23	17.98	0.7	0	0	0.7
83	33	34		×	56.91	10.89	7.07	13.07	0	1.0	0.5	1.5
84	33	36		×	73.39	12.50	7.67	15.00	0	1.0	0.5	1.5
85	34	35		×	47.64	13.93	6.44	16.72	0	1.0	0.5	1.5
86	35	36		×	60.25	14.27	7.22	17.12	0	1.0	0.5	1.5
87	35	38		×	78.92	10.13	8.20	12.16	0	1.0	0.5	1.5
88	36	37		×	91.21	6.33	8.55	7.60	0	1.0	0.5	1.5
89	37	38		×	23.57	16.62	4.76	19.94	0	1.0	0.5	1.5
06	37	40		×	61.25	14.34	7.53	17.21	0	1.0	0.5	1.5
91	38	39		×	35.78	18.17	5.98	21.80	0	1.0	0.5	1.5
92	39	40		×	34.65	13.89	5.89	16.67	0	1.0	0.5	1.5
93	39	57		×	11.83	8.20	2.99	9.84	0	1.0	0.5	1.5
94	33	41		×	83.14	5.38	8.15	6.46	0	0	0	0
95	34	42		×	71.41	5.38	8.28	6.46	0	0	0	0

				able 6.3-3	Steam Ge	snerator (Compartme	nt Vent Pat	h Description			
A. Brea	k Type :	RHR	pump inl€	et line(10B)	guillotine b	reak						
Brea	k Area : k Iocatio	: 0.788	(ft ²) 1)							
סומס												
Vent	Volum	le No.	Desc Vent F	ription of Path Flow	Area	Inertia	Hydraulic	Friction		oss Coeffici	ent K	
No	From	Ъ	Choked	Unchoked	(ft²)	(ft)	Ulameter (ft)	(ft)	Turning and Obstruction	Expansion (Contraction	Total
96	35	43		×	134.95	5.38	14.39	6.46	0	1.0	0.5	1.5
67	36	44		×	119.20	5.38	12.97	6.46	0	1.0	0.5	1.5
<u> 8</u> 6	37	45		×	73.43	3.27	14.06	26.16	0.7	0	0	0.7
66	38	46		×	87.69	3.27	12.18	23.51	0.7	0	0	0.7
100	39	47		×	67.14	3.27	8.70	18.60	0.7	0	0	0.7
101	40	48		×	64.34	3.27	13.31	25.10	0.7	0	0	0.7
102	41	42		×	49.17	7.47	6.55	8.96	0	1.0	0.5	1.5
103	41	44		×	63.91	8.62	7.08	10.34	0	1.0	0.5	1.5
104	42	43		×	42.87	8.22	6.26	9.86	0	1.0	0.5	1.5
105	43	44		×	32.72	7.05	5.64	8.46	0	1.0	0.5	1.5
106	45	46		×	19.26	14.70	4.37	17.64	0	1.0	0.5	1.5
107	45	48		×	20.66	11.54	4.54	13.85	0	1.0	0.5	1.5
108	46	47		×	29.23	17.00	5.37	20.40	0	1.0	0.5	1.5
109	47	48		×	28.31	13.50	5.30	16.20	0	1.0	0.5	1.5
110	47	22		×	1.33	8.20	1.00	9.84	0	1.0	0.5	1.5
111	41	22		×	25.64	1.52	6.39	11.85	2.05	0	0	2.05
112	42	22		×	38.77	1.52	8.11	14.28	2.05	0	0	2.05
113	43	22		×	49.66	1.52	8.82	15.28	2.05	0	0	2.05
114	44	57		×	18.39	1.52	5.45	10.53	2.05	0	0	2.05
115	45	49		×	35.85	4.69	6.86	18.85	2.0	0	0	0.7
116	46	50		×	66.39	4.69	9.22	22.18	0.7	0	0	0.7
117	47	51		×	68.75	4.69	9.21	22.16	0.7	0	0	0.7
118	48	52		×	36.25	4.69	7.50	19.75	0.7	0	0	0.7
119	49	50		×	30.70	16.57	3.98	19.88	0	1.0	0.5	1.5

					Total	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.05	2.05	2.05	2.05
				ent K	Contraction	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0
				oss Coeffici	Expansion	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0
h Description					Turning and Obstruction	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	2.05	2.05	2.05	2.05
nt Vent Pat				Friction	(ff)	15.60	22.66	17.95	19.05	22.34	23.43	20.80	19.90	15.60	22.67	17.95	12.72	16.01	18.23	14.47
ompartme				Hydraulic	(ff)	4.52	6.31	6.13	4.24	6.57	7.34	5.48	3.06	3.49	5.73	5.51	4.24	6.57	8.15	5.48
enerator C	reak			Inertia	(ff)	13.00	18.88	14.96	6.64	6.64	6.64	6.64	16.58	13.00	18.89	14.96	3.47	3.47	3.95	3.47
Steam G	guillotine b			Area	(ft²)	33.79	52.71	20.67	21.50	47.30	53.73	24.98	20.08	23.37	43.47	41.30	21.50	47.30	62.19	24.98
able 6.3-3	t line(10B)		iber 16	iption of ath Flow	Unchoked	×	×	×	×	Х	×	×	×	Х	×	×	×	×	Х	×
Ĩ	pump inle	(ft²)	lume num	Descr Vent P	Choked															
	RHR	0.788	oV : nc	e No.	То	52	51	52	53	54	55	56	54	56	55	56	57	57	57	57
	K Type :	k Area :	k locati	Volum	From	49	50	51	49	50	51	52	53	53	54	55	53	54	55	56
	A. Breal	Brea	Brea	Vent	No	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134

Table 6.3-4 Mass a	nd Energy Release Rates for	r Steam Generator
Compa	artment Peak Pressure Analy	yses
A. Break Type : RHR pump in	nlet line(10B) guillotine break	
Break Area : 0.788(ft ²)		
Break location : Volume n	umber 16	
Time	Mass Release Rate	Enthalpy
(s)	(lbm/s)	(BTU/lbm)
0	0	644.862
0.1	5909.39	644.862
0.2	6054.49	644.586
0.3	5850.24	644.328
0.4	5672.42	644.199
0.5	5570.89	644.203
0.6	5468.55	644.278
0.7	5424.98	644.457
0.8	5372.76	644.663
0.9	5345.04	644.913
1	5062.54	645.178
1.1	4892.86	645.44
1.2	4830.15	645.702
1.3	4800.3	645.949
1.4	4786.47	646.18
1.5	4774.95	646.388
1.6	4766.58	646.574
1.7	4763.21	646.739
1.8	4759.12	646.881
1.9	4756.23	647.003
2	4752.55	647.104
2.1	4749.15	647.187
2.2	4745.48	647.25
2.3	4742.03	647.297
2.4	4738.39	647.326
2.5	4735.05	647.34
2.6	4731.69	647.339
2.7	4728.43	647.325
2.8	4724.59	647.297
2.9	4721.88	647.259
3	4719.88	647.214
3.1	4719.67	647.165
3.2	4720	647.114
3.3	4719.87	647.061
3.4	4718.79	647.003
3.5	4717.39	646.941
3.6	4715.77	646.874
3.7	4714.02	646.803
3.8	4712.2	646.73
3.9	4710.82	646.658

Table 6.3-4Mass and Energy Release Rates for Steam GeneratorCompartment Peak Pressure Analyses

A. Break Type : RHR pump in Break Area : 0.788(ft ²) Break location : Volume n	nlet line(10B) guillotine break	
	Mass Polosso Poto	Entholoy
TITLE	Wass Release Rale	Епшару
(S)	(Ibm/s)	(BTU/lbm)
4	4708.46	646.585
4.1	4706.49	646.514
4.2	4704.51	646.445
4.3	4702.14	646.377
4.4	4700.04	646.307
4.5	4698.36	646.238
4.6	4696.66	646.166
4.7	4694.88	646.089
4.8	4693.09	646.006
4.9	4691.38	645.915
5	4689.92	645.813

		e 6.3-5 S	steam Gen	nerator Co	mpartmer	nt Nodal D	escription	
в. Бreak Break Break	 Iype : KHK pump outlet III Area : 0.506(ft²) location : Volume number 	ie(85) guil 17	lotine prea	×				
Volume		Heinht	Free	Initi	al Conditio	suc	Calculated	Design
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)
~	West quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	874	120	14.7	0	1.13	18
N	North quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	750	120	14.7	0	1.33	18
с	East quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1346	120	14.7	0	1.31	18
4	South quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1257	120	14.7	0	1.18	18
ນ	Northwest quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1530	120	14.7	0	1.19	18
Q	Northeast quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1820	120	14.7	0	1.15	18

92.6

92.7

93.7

Margin (%)

93.4

93.6

93.4

	Table	e 6.3-5	Steam Gen	nerator Co	mpartmer	nt Nodal E	Description		
B. Break Break	Type : RHR pump outlet lin Area : 0.506(ft ²)	le(8B) guil	lotine brea	×					
Break	location : Volume number	17							
Volume		Heinht	Free	Initi	al Conditic	suc	Calculated	Design	Maroin
No.	Description	(#)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
7	Southeast quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1540	120	14.7	0	1.28	18	92.9
8	Southwest quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1370	120	14.7	0	1.10	18	93.9
o	West quadrant around A-RCP in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	677	120	14.7	0	1.75	18	90.3
10	North quadrant around A-RCP in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	599	120	14.7	0	1.58	18	91.2
11	East quadrant around A-RCP in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1183	120	14.7	0	1.16	18	93.6
12	South quadrant around A-RCP in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1037	120	14.7	0	1.39	18	92.3

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	Tahl	0 6 3-5 0	Steam Ger	orator Co	mnartmer	t Nodal I	Decrintion		
B. Break Break Break	Type : RHR pump outlet lin Area : 0.506(ft²)	ie(8B) guil	lotine brea	×	5	3			
Volume		Height	Free	Init	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
6	Northwest quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1283	120	14.7	0	1.17	18	93.5
4	Northeast quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1586	120	14.7	0	1.30	18	92.8
15	Southeast quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1272	120	14.7	0	1.20	18	93.3
16	Southwest quadrant around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1108	120	14.7	0	1.28	18	92.9
17	West quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	572	120	14.7	0	4.15	7	40.7
18	North quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	474	120	14.7	0	2.02	2	71.1

B. Break Break	Type : RHR pump outlet lin Area : 0.506(ft²)	e 6.3-5 \$ e(8B) guil	steam Ger lotine brea	ierator Co k	mpartmei	nt Nodal E	escription		
DICAL		2		_					
Volume		Height	Free	Initi	ial Conditio	suc	Calculated	Design	Margin
No.	Description	(#)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
19	East quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	935	120	14.7	0	1.22	2	82.6
20	South quadrant around A-RCP in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	896	120	14.7	0	1.49	2	78.7
21	Northwest quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	1007	120	14.7	0	1.23	2	82.4
22	Northeast quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	582	120	14.7	0	1.32	2	81.1
23	Southeast quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	954	120	14.7	0	1.13	2	83.9
24	Southwest quadrant around A-SG in A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	882	120	14.7	0	1.15	2	83.6

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B. Break Break Break	Tabl (Type : RHR pump outlet lin (Area : 0.506(ft ²) (location : Volume number ⁽	e 6.3-5 	steam Ge r lotine brea	ierator Co k	mpartmer	ıt Nodal I	Jescription		
Volume		Heinht	Free	Initi	ial Conditic	suc	Calculated	Design	Mardin
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
25	West quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	431	120	14.7	0	1.25	2	82.1
26	North quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	350	120	14.7	0	1.36	2	80.6
27	East quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	746	120	14.7	0	1.20	۷	82.9
28	South quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	269	120	14.7	0	1.21	۷	82.7
29	Northwest quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	843	120	14.7	ο	1.17	2	83.3
30	Northeast quadrant around A-SG in A-SG compartment:between EL	7.25	577	120	14.7	0	1.27	2	81.9

	1		T					
	Maroin	(%)	84.6	82.7	83.1	83.7	83.9	83.3
	Design	Peak Press. Diff. (psid)	2	2	7	2	2	7
Description	Calculated	Peak Press. Diff. (psid)	1.08	1.21	1.18	1.14	1.13	1.17
nt Nodal D	suc	Humid. (%)	0	0	0	0	0	0
mpartmer	al Conditic	Press. (psia)	14.7	14.7	14.7	14.7	14.7	14.7
erator Co <	Initi	Temp. (deg F)	120	120	120	120	120	120
steam Gen lotine breal	Free	Volume (ft³)	662	739	450	384	739	655
e 6.3-5 S e(8B) guill I7	Hainht	(#)	7.25	7.25	5.92	5.92	5.92	5.92
Table Type : RHR pump outlet lin Area : 0.506(ft²) location : Volume number 1		Description	Southeast quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	Southwest quadrant around A-SG in A-SG compartment:between EL 55'-1" and 62'-4"	West quadrant around A-RCP in A-SG compartment:between EL 62'-4" and 68'-3"	North quadrant around A-RCP in A-SG compartment:betweenEL 62'-4" and 68'-3"	East quadrant around A-RCP in A-SG compartment:between EL 62'-4" and 68'-3"	South quadrant around A-RCP in A-SG compartment:between EL
B. Break Break Break	Volume	No.	31	32	33	34	35	36

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B. Break Break Break	Table Type : RHR pump outlet lin Area : 0.506(ft²)	e 6.3-5 	Steam Ger lotine brea	lerator Co k	mpartmer	ıt Nodal [Description		
Volume		Heinht	Free	Init	ial Conditic	suc	Calculated	Design	Mardin
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
37	Northwest quadrant around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	688	120	14.7	0	1.08	2	84.6
38	Northeast quadrant around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	822	120	14.7	o	1.04	2	85.1
39	Southeast quadrant around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	652	120	14.7	ο	0.99	2	85.9
40	Southwest quadrant around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	603	120	14.7	ο	1.02	2	85.4
41	West quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	356	120	14.7	0	1.13	2	83.9
42	North quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	324	120	14.7	0	1.09	2	84.4

B. Break Break Break	Tabl (Type : RHR pump outlet lin (Area : 0.506(ft ²) (location : Volume number 1	e 6.3-5 	Steam Ger lotine brea	herator Co K	mpartmer	nt Nodal I	Description		
Volume		Heinht	Free	Initi	ial Conditic	SUC	Calculated	Design	Maroin
No.	Description	(tt)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
43	East quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	387	120	14.7	0	1.10	2	84.3
44	South quadrant around A-RCP in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	260	120	14.7	0	1.14	2	83.7
45	Northwest quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	274	120	14.7	0	1.06	2	84.9
46	Northeast quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	508	120	14.7	0	0.95	2	86.4
47	Southeast quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	523	120	14.7	0	0.93	2	86.7
48	Southwest quadrant around A-SG in A-SG compartment:between EL 68'-3" and 73'-1"	4.83	277	120	14.7	0	0.98	2	86.0

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	Tabl	e 6.3-5 S	Steam Ger	nerator Co	mnartmei	nt Nodal D	lescrintion		
B. Break Break Break	Type : RHR pump outlet lin Area : 0.506(ft ²) location : Volume number 1	ie(8B) guil 17	lotine brea	×					
Volume		Heinht	Free	Init	ial Conditio	suc	Calculated	Design	Maroin
No.	Description	(Ħ)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
49	Northwest quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	481	120	14.7	0	0.93	2	86.7
50	Northeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	096	120	7.41	0	0.77	7	89.0
51	Southeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	1034	120	14.7	0	0.80	7	88.6
52	Southwest quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	517	120	7.41	0	0.84	7	88.0
53	Northwest quadrant around A-SG in A-SG compartment:between EL 83'-9" and 95'-1"	11.33	379	120	7.41	0	0.54	14	96.1
54	Northeast quadrant around A-SG in A-SG compartment:between EL 83'-9" and 95'-1"	11.33	849	120	14.7	0	0.51	14	96.4

Subcompartment Analyses
for US-APWR Design Confirmation

		Maroin	(%)	OG E	0.02		90.Z	
		Design	Peak Press. Diff. (psid)	V F	<u>t</u>		4	I
Description		Calculated	Peak Press. Diff. (psid)	07.0	0 †. 0		0.53	ı
nt Nodal D		suc	Humid. (%)	U	þ	¢	D	0
mpartme	1	ial Conditi	Press. (psia)	2 11		1	14.7	14.7
ierator Co	×	Init	Temp. (deg F)	UCF	071		07L	120
steam Gen	otine brea	Free	Volume (ft³)	ORE	000		44α	2861000
e 6.3-5 S	e(8B) guill 17	Heiaht	(ff)	11 33	C)		11.33	200
Tabl	Type : RHR pump outlet lin Area : 0.506(ft²) Cocation : Volume number 1		Description	Southeast quadrant around A-SG in A-SG	compartment:between EL 83'-9" and 95'-1"	Southwest quadrant around A-SG in A-SG	compartment:between EL 83'-9" and 95'-1"	Containment atmosphere
	B. Break Break Break	Volume	No.	ц К	3	C	QC	57

		1	1	r																				,
		Total	1.5	1.5	1.5	1.5	1.5	1.5	3.34	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	sient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0
	Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0
Description		Turning and Obstruction	0	0	0	0	0	0	1.84	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7
: Vent Path	Friction	(ff)	8.96	10.42	17.09	11.84	12.43	14.32	12.34	15.00	22.37	14.03	12.43	15.76	11.96	16.94	16.46	24.06	24.25	28.69	26.90	28.37	32.23	29.56
mpartment	Hydraulic	(ft)	9.50	11.10	7.86	8.66	5.66	11.44	5.46	12.26	5.01	6.18	13.30	11.64	11.55	5.90	4.42	8.15	8.28	11.43	10.16	11.20	13.94	12.05
nerator Co reak	Inertia	(ff)	7.47	8.68	14.24	9.87	10.36	11.93	10.28	12.50	18.64	11.69	10.36	13.13	9.97	14.12	13.72	6.39	6.39	6.39	6.39	6.39	6.39	6.39
Steam Ge guillotine b	Area	(ft²)	101.35	135.39	61.86	86.79	79.51	145.18	30.94	168.39	28.87	84.29	183.69	135.63	133.49	36.65	21.94	49.88	42.85	80.97	71.52	86.56	109.95	87.11
ible 6.3-6 tlet line(8B) mber 17	ption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	Х
Ta pump out 6(ft²) /olume nui	Descri Vent Pa	Choked																						
: RHR 1: 0.50 (tion : \	e No.	To	2	4	57	ო	4	9	57	5	57	9	ω	7	8	57	57	6	10	11	12	13	14	15
ik Type ak Area ak loca	Volum	From	-	-	~	2	З	ო	З	4	4	5	5	9	7	7	8	-	2	З	4	5	6	7
Brea Brea Brea	Vent	No.	-	2	ო	4	5	9	7	8	6	10	1	12	13	14	15	16	17	18	19	20	21	22

			Total	0.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1.5	1.5	1.5
		ient K	Contraction	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5
		Loss Coeffic	Expansion	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0
Description			Turning and Obstruction	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0	0	0
Vent Path		Friction	(ff)	27.69	11.95	13.00	15.00	15.31	12.41	9.55	19.94	17.21	21.80	16.67	11.69	18.62	21.79	21.80	26.15	25.40	24.47	19.36	25.43	25.09	11.95	13.00	14.88
mpartment		Hydraulic	(ft)	10.72	8.16	5.13	7.17	8.57	11.43	12.14	4.24	7.36	8.83	8.73	3.07	3.62	7.60	7.61	10.69	10.16	9.50	5.88	10.18	9.94	7.45	8.35	5.61
nerator Co		Inertia	(ft)	6.39	96.6	10.83	12.50	12.76	10.34	7.96	16.62	14.34	18.17	13.89	9.74	15.52	5.64	5.64	5.64	5.64	5.64	5.64	5.64	5.64	96.6	10.83	12.40
Steam Ger		Area	(ft²)	77.48	68.97	68.72	55.92	74.98	133.47	154.26	54.82	97.42	97.75	95.83	13.17	16.46	44.84	37.78	72.34	67.58	69.40	42.47	69.59	64.34	57.97	77.66	39.97
ble 6.3-6 let line(8B)	mber 17	ption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×		×	×	×	×	×	×	×	×		×
Ta Dumo out	6(ft ²) olume nu	Descri Vent Pa	Choked														Х									Х	
. RHR	: 0.50 tion : V	e No.	To	16	10	12	11	12	14	13	14	16	15	16	57	57	17	18	19	20	21	22	23	24	18	20	19
k Tvne	ak Area	Volum	From	ω	6	6	10	11	11	12	13	13	14	15	15	16	6	10	11	12	13	14	15	16	17	17	18
R Bres	n B B B B B B B B B B B B B B B B B B B	Vent	No.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

				Fotal	1.5	1.5	3.34	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0	0	0.7	1.5	1.5	1.5	1.5	1.5	3.34	1.5	ע ע
			ient K	Contraction 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0 5
			Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0
Description	ı			Turning and Obstruction	0	0	1.84	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0	0	0.7	0	0	0	0	0	1.84	0	C
t Vent Path			Friction	(ft)	15.20	15.50	12.91	9.55	17.38	17.21	19.63	16.67	18.09	17.75	22.47	22.02	23.78	9.55	9.55	20.61	13.07	15.00	16.61	17.02	15.54	11.40	7.60	17 38
ompartment	1		Hydraulic	Ulailleter (ft)	7.71	8.40	3.73	11.09	5.46	9.43	7.12	6.99	6.14	5.90	9.25	8.93	10.18	5.88	10.18	7.93	6.82	7.47	4.57	6.14	6.38	2.40	9.86	5 1A
nerator Co	oreak		Inertia	(ft)	12.67	12.92	10.76	7.96	14.48	14.34	16.36	13.89	4.82	4.82	4.82	4.82	4.82	96.7	7.96	4.82	10.89	12.50	13.84	14.18	12.95	9.50	6.33	14.48
Steam Ge	guillotine b		Area	(ft²)	62.24	70.67	14.75	133.50	34.51	89.66	52.38	50.72	37.54	30.50	64.56	60.68	73.43	70.79	115.99	51.33	46.64	55.78	24.22	49.21	65.64	6.00	111.77	28,88
able 6.3-6	tlet line(8B)	mber 17	ption of ath Flow	Unchoked	×	×	×	×	×	×	×	×		×	×	×	×	×	×	Х	×	×	×	×	×	Х	×	×
Ta	bump out 6(ft ²)	/olume nu	Descri Vent Pa	Choked									×															
	: RHR 1: 0.50	ition: \	e No.	Ъ	20	22	57	21	22	24	23	24	25	26	27	28	29	30	31	32	26	28	27	28	30	57	29	30
	ak Type ak Area	eak loca	Volum	From	19	19	19	20	21	21	22	23	17	18	19	20	21	22	23	24	25	25	26	27	27	27	28	29
	B. Bre; Bre	Bre	Vent	No.	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	99	67	68	69	70

			afficient K	on Contraction Total	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0	0	0 0	0 0	0 0.7	0 0.7	0 0.7	0 0.7	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	0.5 1.5	-
Description			Loss Coe	Turning and Expansic	0 1.0	0 1.0	0 1.0	0 1.0	0	0	0	0 0	0.7 0	0.7 0	0.7 0	0.7 0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	0 1.0	
t Vent Path			Friction	(ff)	17.21	19.63	16.67	13.68	7.91	7.91	7.91	7.91	19.67	15.38	22.14	17.98	13.07	15.00	16.72	17.12	12.16	7.60	19.94	17.21	21.80	16.67	9.84	-
ompartment			Hydraulic	Ularifieler (ft)	8.53	6.59	6.48	3.07	6.14	5.90	8.89	8.93	8.43	5.39	10.18	7.23	7.07	7.67	6.44	7.22	8.20	8.55	4.76	7.53	5.98	5.89	2.99	
nerator Co	oreak		Inertia	(ft)	14.34	16.36	13.89	11.40	6.59	6.59	6.59	6.59	4.00	4.00	4.00	4.00	10.89	12.50	13.93	14.27	10.13	6.33	16.62	14.34	18.17	13.89	8.20	
Steam Ge) guillotine t		Area	(ft²)	75.05	43.85	42.46	13.17	62.57	50.84	107.60	101.14	60.79	42.47	69.59	46.82	56.91	73.39	47.64	60.25	78.92	91.21	23.57	61.25	35.78	34.65	11.83	
able 6.3-6	tlet line(8B)	imber 17	iption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
Ta	pump ou 6(ft ²)	/olume nu	Descri Vent Pá	Choked																								
	: RHR a : 0.50	ation : V	ne No.	To	32	31	32	57	33	34	35	36	37	38	39	40	34	36	35	36	38	37	38	40	39	40	57	
	ak Type ३ak Areá	eak loca	Volum	From	29	30	31	32	25	26	27	28	29	30	31	32	33	33	34	35	35	36	37	37	38	39	39	
	B. B. B. B. B. B. B. B. B. B. B. B. B. B	Ъ́Я	Vent	No.	71	72	73	74	75	76	77	78	62	80	81	82	83	84	85	86	87	88	89	06	91	92	93	

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			L	able 6.3-6	Steam Ge	nerator C	ompartment	t Vent Path	Description			
Bre	ak iype ak Area	. KTK	6(ft ²)	Juet line(8b)	guillotine t	Jreak						
Bre	eak loca		/olume nt	umper 1 /								
Vent	Volum	le No.	Desci Vent F	ription of ath Flow	Area	Inertia	Hydraulic	Friction		Loss Coeffic	ient K	
No.	From	Ъ	Choked	Unchoked	(ft²)	(ft)	Ulalificier (ft)	(ff)	Turning and Obstruction	Expansion	Contraction	Total
95	34	42		×	71.41	5.38	8.28	6.46	0	0	0	0
96	35	43		×	134.95	5.38	14.39	6.46	0	1.0	0.5	1.5
97	36	44		×	119.20	5.38	12.97	6.46	0	1.0	0.5	1.5
98	37	45		×	73.43	3.27	14.06	26.16	2.0	0	0	0.7
66	38	46		×	87.69	3.27	12.18	23.51	2.0	0	0	0.7
100	39	47		×	67.14	3.27	8.70	18.60	0.7	0	0	0.7
101	40	48		×	64.34	3.27	13.31	25.10	0.7	0	0	0.7
102	41	42		×	49.17	7.47	6.55	8.96	0	1.0	0.5	1.5
103	41	44		×	63.91	8.62	7.08	10.34	0	1.0	0.5	1.5
104	42	43		×	42.87	8.22	6.26	9.86	0	1.0	0.5	1.5
105	43	44		×	32.72	7.05	5.64	8.46	0	1.0	0.5	1.5
106	45	46		×	19.26	14.70	4.37	17.64	0	1.0	0.5	1.5
107	45	48		×	20.66	11.54	4.54	13.85	0	1.0	0.5	1.5
108	46	47		×	29.23	17.00	5.37	20.40	0	1.0	0.5	1.5
109	47	48		×	28.31	13.50	5.30	16.20	0	1.0	0.5	1.5
110	47	57		×	1.33	8.20	1.00	9.84	0	1.0	0.5	1.5
111	41	57		×	25.64	1.52	6.39	11.85	2.05	0	0	2.05
112	42	57		×	38.77	1.52	8.11	14.28	2.05	0	0	2.05
113	43	57		×	49.66	1.52	8.82	15.28	2.05	0	0	2.05
114	44	57		×	18.39	1.52	5.45	10.53	2.05	0	0	2.05
115	45	49		×	35.85	4.69	6.86	18.85	0.7	0	0	0.7
116	46	50		×	66.39	4.69	9.22	22.18	0.7	0	0	0.7
117	47	51		×	68.75	4.69	9.21	22.16	0.7	0	0	0.7
118	48	52		×	36.25	4.69	7.50	19.75	0.7	0	0	0.7

				Total	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.05	2.05	2.05	2.05
			sient K	Contraction	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0
			Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0
Description				Turning and Obstruction	0	0	0	0	2.0	2.0	2.0	2.0	0	0	0	0	2.05	2.05	2.05	2.05
: Vent Path			Friction	(ft)	19.88	15.60	22.66	17.95	19.05	22.34	23.43	20.80	19.90	15.60	22.67	17.95	12.72	16.01	18.23	14.47
ompartment			Hydraulic Diameter	(ft)	3.98	4.52	6.31	6.13	4.24	6.57	7.34	5.48	3.06	3.49	5.73	5.51	4.24	6.57	8.15	5.48
nerator Co	reak		Inertia	(ft)	16.57	13.00	18.88	14.96	6.64	6.64	6.64	6.64	16.58	13.00	18.89	14.96	3.47	3.47	3.95	3.47
Steam Ge	guillotine b		Area	(ft²)	30.70	33.79	52.71	50.67	21.50	47.30	53.73	24.98	20.08	23.37	43.47	41.30	21.50	47.30	62.19	24.98
ible 6.3-6	:let line(8B) mhar 17		ption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ta	pump out 6(ft ²) /olume pu		Vent Pa	Choked																
	: RHR a : 0.50		le No.	Ъ	20	52	13	52	23	1 5	22	99	54	99	22	56	57	22	25	57
	ak Type ak Area		Volum	From	49	49	50	51	49	50	51	52	53	53	54	55	53	54	55	56
	B. Brei Bre	Í	Vent	No.	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134

Table 6.3-7 Mass and End	ergy Release Rates for Stean	n Generator Compartment
	Peak Pressure Analyses	
B. Break Type : RHR pump	Outlet line(8B) guillotine break	
Break Area : 0.506(ft ²)	-	
Break location : Volume	number 17	
Time	Mass Release Rate	Enthalpy
(S)	(lbm/s)	(BTU/lbm)
4.1	5153.03	552.852
4.2	5146.37	552.909
4.3	5139.6	552.966
4.4	5132.7	553.024
4.5	5125.82	553.084
4.6	5118.96	553.144
4.7	5112.12	553.207
4.8	5105.29	553.27
4.9	5098.44	553.336
5	5091.31	553.403

	Tab	ole 6.3-8	Steam G	Senerator	r Compar	tment No	dal Description		
C. Brea Brea Brea	k Type : Feed Water line(16 k Area :2.234(ft ²) k location : Volume number	3B) guillot	ine break	(Full pov	ver opera	ting cond	lition)		
\/olime		Haiaht	Free	Initi	ial Conditi	suo	Calculated	Design	Marcin
No.	Description	(tt)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
~	West quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	874	120	14.7	0	1.60	18	91.1
5	North quadrant around A-RCP in A-SG compartment:between	11.17	750	120	14.7	0	1.83	ő.	89.8
	EL 25'-3" and 36'-5"								
3	East quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1346	120	14.7	0	1.42	18	92.1
4	South quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1257	120	14.7	0	1.45	18	91.9
2	Northwest quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1530	120	14.7	0	1.29	6	92.8
9	Northeast quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1820	120	7.41	0	1.24	18	93.1

C. Brea Brea	Tat k Type : Feed Water line(16 k Area :2.234(ft²)	ble 6.3-8 3B) guillot	Steam C ine break	enerato (Full pov	r Compar ver opera	tment Nc ting con	dal Description dition)		
brea	k location : volume number	CC _						-	
Volume		Height	Free	Init	ial Conditi	suo	Calculated	Design	Margin
No.	Description	(#)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Southeast quadrant								
7	around A-SG in A-SG	11_17	1540	120	14.7	С	1.04	18	94.2
	compartment:between EL 25'-3" and 36'-5")		2	1
	Southwest quadrant								
α	around A-SG in A-SG	11 17	1370	120	7 7 7	C	0.07	ά,	97.6
5	compartment:between EL 25'-3" and 36'-5"			04	<u>F</u>	5	0.0	2	
	West quadrant around								
σ	A-RCP in A-SG	10.01	677	120	7 7 7	C	1 11	ά,	00 0
ת	compartment:between	0.0		04	t t	5	- + -	2	32.2
	EL 36'-5" and 46'-5.08"					_			
	North quadrant around								
10	A-RCP in A-SG	10 01	500	120	147	C	1 50	α1	917
2	compartment:between בו 36'-5 מאל 46'-5 מאי	0.00	0	04-		>	2	2	
	East quadrant around								
7	A-RCP in A-SG	10.01	1102	1 20	L L L	C	70	Q	03.4
-	compartment:between FL 36'-5" and 46'-5.08"	0.00	2	04	<u>.</u>	5	0	2	r.
	South quadrant around								
10	A-RCP in A-SG	10 01	1037	120	14.7	C	1 14	ά	03 7
4	compartment:between EL 36'-5" and 46'-5.08"	0.0	200	0	<u>.</u>	>	<u>-</u>	2	
C. Brea Brea Brea	Tat k Type : Feed Water line(16 k Area :2.234(ft²) k location : Volume number	ole 6.3-8 5B) guillot · 55	Steam C ine break	enerato (Full pov	r Compar ver opera	tment No ting con	dal Description dition)		
-------------------------	---	---	------------------------------	----------------------	-----------------------	----------------------	-----------------------------	-----------------------------	--------
		Haiaht	Free	Initi	ial Conditi	suo	Calculated	Design	Maroin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Northwest quadrant								
13	around A-SG in A-SG	10.01	1283	120	14.7	0	1.10	18	93.9
	compartment:between EL 36'-5" and 46'-5.08")))
	Northeast quadrant								
77	around A-SG in A-SG	10.01	1586	120	7 7 7	C	4	81	03 7
<u>+</u>	compartment:between	0.0	000	04	<u> </u>	>	2	2	00.1
	EL 30-5 and 40-5.08								
	Southeast quadrant								
ע גי	around A-SG in A-SG	10.01	1272	120	14.7	C	1 07	81	04 1
2	compartment:between	0.0	1	-		>	0	2	
	EL 36'-5" and 46'-5.08"								
	Southwest quadrant								
16	around A-SG in A-SG	10.01	1108	120	14.7	C	0 00	8	945
2	compartment:between	2	2	2		>	0	2	0.00
	EL 30 -5 and 40 -5.08								
	West quadrant around								
17	A-RCP in A-SG	8.66	572	120	147	C	1 20	7	87 Q
-	compartment:between	000	1	-		>	-	-	0.40
	North quadrant around								
18	A-RCP in A-SG	8.66	474	120	14.7	С	1.22	7	82.6
2	compartment:between בו אניב חמי מאי לגיייו		-) -	-)	4	-	
	LL +0 -3.00 alla 33 -1								

C. Brea Brea Brea	Tat Ik Type : Feed Water line(16 Ik Area :2.234(ft²) Ik location : Volume number	ble 6.3-8 5B) guillot 55	Steam (ine break	Generato (Full pov	r Compar wer opera	tment No ting con	dal Description dition)		
Volume		Heinht	Free	Init	ial Conditi	suo	Calculated	Design	Maroin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	East quadrant around								
19	A-RCP in A-SG	8.66	935	120	14.7	0	1.10	7	84.3
	EL 46'-5.08" and 55'-1"								
	South quadrant around								
00	A-RCP in A-SG	866	806	120	147	C	1 15	7	83 G
4	compartment:between דו 46'-5 08" and 55'-1"	0.0			- -	>	2	-	0.00
	Northwest guadrant								
č	around A-SG in A-SG	0		0		(I	
71	compartment:between	Q0.Ω	1001	120	14.7	Э	1.10		83.4
	EL 46'-5.08" and 55'-1"								
	Northeast quadrant								
22	around A-SG in A-SG	8 66	582	120	14 7	C	1 07	7	84 7
1	compartment:between	0	100		-)	2	-	
	Southeast quadrant								
23	around A-SG in A-SG	866	05.0	120	14.7	C	1 30	7	81.4
9	compartment:between	0.0			- -	>	00	-	<u>-</u>
	EL 40 -3.00 allu 33 - 1								
	Southwest quadrant								
24	around A-SG in A-SG	8.66	882	120	14.7	0	1.23	7	82.4
I	compartment:between EL 46'-5.08" and 55'-1")) -)			

Volume No.Description Temp.Height (ft)Free (ft)Initial ConditionsC.25West quadrant around A-RCP in A-SG compartment:between7.25 431 120 14.7 0 26West quadrant around A-RCP in A-SG compartment:between7.25 431 120 14.7 0 26A-RCP in A-SG compartment:between7.25 350 120 14.7 0 26Compartment:between compartment:between7.25 350 120 14.7 0 26Compartment:between compartment:between7.25 350 120 14.7 0 27Bast quadrant around compartment:between7.25 746 120 14.7 0 28South quadrant around A-RCP in A-SG compartment:between7.25 697 120 14.7 0 28Compartment:between A-RCP in A-SG Compartment:between7.25 697 120 14.7 0 28Compartment:between Compartment:between7.25 697 120 14.7 0 29Compartment:between7.25 697 120 14.7 0 20Compa	otion Height V (ft) taround 7.25 between 7.25	Free 'olume ' (ft ³) (431 350	Initi Temp. deg F)	ial Conditic				
DescriptionTermp.Termp.Press.Humid.PeakNo.West quadrant around(ft)(ft)(ft)(ft)(%)West quadrant aroundWest quadrant around7.2543112014.7025compartment:between7.2543112014.7026compartment:between7.2535012014.7026A-RCP in A-SG7.2535012014.7026compartment:between7.2574612014.7027compartment:between7.2574612014.7027compartment:between7.2574612014.7028A-RCP in A-SG7.2569712014.7028compartment:between7.2569712014.7028compartment:between7.2569712014.7028compartment:between7.2569712014.7028compartment:between7.2569712014.7029compartment:between7.2569712014.7020both quadrant around7.2569712014.7029compartment:between7.2569712014.7020both quadrant around7.2569712014.7020both quadrant around7.25697120	tion (ff) V taround (ff) V 3 between 7.25 62'-4"	olume (ft ³) ((ft ³) (431 350	Temp. deg F)		ons	Calculated	Design	Mardin
25West quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2543112014.7026compartment:between A-RCP in A-SG7.2535012014.7026compartment:between Compartment:between7.2535012014.7027A-RCP in A-SG Compartment:between7.2574612014.7027A-RCP in A-SG Compartment:between7.2574612014.7027A-RCP in A-SG Compartment:between7.2574612014.7028A-RCP in A-SG Compartment:between7.2569712014.7028Compartment:between Compartment:between7.2569712014.7028Compartment:between Compartment:between7.2569712014.7028Morthwest rutadrant7.2569712014.7029Morthwest rutadrant7.2569712014.70	t around 3 between 7.25 62'-4"	431 350		Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
25A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2543112014.7026compartment:between A-RCP in A-SG7.2535012014.7026compartment:between EL 55'-1" and 62'-4"7.2535012014.7027compartment:between East quadrant around 277.2574612014.7028compartment:between EL 55'-1" and 62'-4"7.2569712014.7028compartment:between EL 55'-1" and 62'-4"7.2569712014.7029compartment:between EL 55'-1" and 62'-4"7.2569712014.70	3 oetween 7.25 62'-4"	431 350						
Compariment.Detween EL 55'-1" and 62'-4"7.2535012014.7026A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2535012014.7027A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2574612014.7027A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2574612014.7028A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2569712014.7028Compartment:between 	Jetween 62'-4"	350	120	14.7	0	1.09	7	84.4
SolutionNorth quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2535012014.7027compartment:between 		350						
26A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2535012014.7027East quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2574612014.7028South quadrant around A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"7.2569712014.7028compartment:between EL 55'-1" and 62'-4"7.2569712014.7028compartment:between A-RCP in A-SG EL 55'-1" and 62'-4"7.2569712014.7028compartment:between A-RCP in A-SG EL 55'-1" and 62'-4"7.2569712014.70	t around	350						
Compartment:between7.2574612014.70EL 55'-1" and 62'-4"7.2574612014.70Z7A-RCP in A-SG7.2574612014.70South quadrant around7.2574612014.70South quadrant around7.2569712014.7028A-RCP in A-SG7.2569712014.7028Compartment:between7.2569712014.7028Compartment:between7.2569712014.7028Compartment:between7.2569712014.7028Compartment:between7.2569712014.7028Compartment:between7.2569712014.7028Compartment:between7.2569712014.7010EL 55'-1" and 62'-4"12014.7011Northwest runadrant12014.70	3 7 75	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	120	147	C	1 04	7	85 1
27 East quadrant around East quadrant around 7.25 746 120 14.7 0 27 A-RCP in A-SG compartment:between 7.25 746 120 14.7 0 28 South quadrant around A-RCP in A-SG 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0	between ''			ř	>	<u>t</u>		
27 A-RCP in A-SG 7.25 746 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 South quadrant around 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 A-RCP in A-SG 7.25 697 120 14.7 0 28 Morthwest runadrant 7.25 697 120 14.7 0	around							
²¹ compartment:between 7.20 7.20 7.20 7.1 0 EL 55'-1" and 62'-4" South quadrant around 7.25 697 120 14.7 0 28 A-RCP in A-SG 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0	Э 7 ЛК	746	120	777	C	1 05	7	85.0
EL 55-1" and 62'-4" EL 55'-1" and 62'-4" South quadrant around South quadrant around 28 A-RCP in A-SG compartment:between 7.25 697 120 14.7 0 EL 55'-1" and 62'-4" Northwest runadrant Northwest runadrant 0 14.7 0	between ''		24	r F	>	00-	-	0.00
28 South quadrant around 7.25 697 120 14.7 0 28 compartment:between 7.25 697 120 14.7 0 EL 55'-1" and 62'-4" Northwest runadrant Northwest runadrant 0	62'-4"							
28 A-RCP in A-SG 7.25 697 120 14.7 0 EL 55'-1" and 62'-4" Northwest runadrant Northwest runadrant 0 0	nt around							
EL 55'-1" and 62'-4"	G 7 25	697	120	14.7	C	1 18	7	83 1
EL 55-1" and 62-4" Northwest rundrant	between		-		>	2	-	
Northweet auadrant	02-4"							
	Idrant							
29 around A-SG 7 25 843 120 14 7 0	n A-SG 7 25	843	120	14.7	С	131	7	81.3
	between	2		-)	2		2
Northeast quadrant	drant 2							
30 around A-SG I 7.25 577 120 14.7 0	n A-SG 7.25	577	120	14.7	0	1.53	7	78.1
EL 55'-1" and 62'-4"	between 62'-4"))			

C. Brea Brea Brea	Tab lk Type : Feed Water line(16 lk Area :2.234(ft ²) k location : Volume number	ble 6.3-8 5B) guillot 55	Steam C ine break	enerato (Full pov	r Compari ver opera	tment No ting con	dal Description dition)		
Volume		Heinht	Free	Init	ial Conditi	ons	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
Ċ	Southeast quadrant around A-SG in A-SG	Ц О Ч	000		1	c		7	76 J
- 0	compartment:between EL 55'-1" and 62'-4"	C7. /	88 2			5	00.1	~	0.0/
	Southwest quadrant								
32	around A-SG in A-SG	7 25	739	120	14 7	С	1.58	2	77 4
1	compartment:between EL 55'-1" and 62'-4"	2	3			>)		
	West quadrant around								
33	A-RCP in A-SG	<i>г</i> 07	450	120	147	C	0 03	2	86 7
2	compartment:between FI 62'-4" and 68'-3"	10.0				>	0	-	
	North quadrant around								
72	A-RCP in A-SG	<i>д</i> 00	387	120	7 7 7	C	0 85	٢	87.0
t ว	compartment:betweenEL 62'-4" and 68'-3"	2.02	1		<u>.</u>	5	000	-	6.10
	East quadrant around								
35	A-RCP in A-SG	д Д	730	120	7 7 7	C	0 80	7	87 3
2	compartment:between EL 62'-4" and 68'-3"	10.0	00		<u>.</u>	5	0	-	0.00
	South quadrant around								
36	A-RCP in A-SG	д 00	655	120	14.7	C	1 00	7	84.4
0	compartment:between EL 62'-4" and 68'-3"	10.0		04	-	>	2		

C. Brea Brea Brea	Tab k Type : Feed Water line(16 k Area :2.234(ft ²) k location : Volume number	ble 6.3-8 5B) guillot 55	Steam (ine break	Generato (Full pov	r Compar wer opera	tment Nc ting con	idal Description dition)		
Volume		Height	Free	Init	ial Conditi	ons	Calculated	Design	Maroin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
1	Northwest quadrant around A-SG in A-SG	C L			1	c		1	0 0 1
31	compartment:between EL 62'-4" and 68'-3"	28.0	000	071	14.7	5	1.04	~	0.07
	Northeast quadrant								
38	around A-SG in A-SG	5 92	822	120	14.7	C	2.32	7	66 9
2	compartment:between EL 62'-4" and 68'-3"	10.0	011	24	-	>	1		2.20
	Southeast quadrant								
90	around A-SG in A-SG	5 92	652	120	14.7	C	2 57	7	63.3
)	compartment:between	1	100	2	-)	2	-	2
	Southwest guadrant								
0	around A-SG in A-SG	л СО СО	603		7	C	0 05	٢	67.0
) t	compartment:between EL 62'-4" and 68'-3"	2.32	200	04	<u>.</u>	5	0.7.7	-	6.10
	West quadrant around								
11	A-RCP in A-SG	4 83	356	120	14.7	C	0.83	٢	88 1
- F	compartment:between EL 68'-3" and 73'-1"	20 F			È	>	0000	-	-
	North quadrant around								
42	A-RCP in A-SG	4 83	324	120	14.7	C	0 73	7	80.6
74	compartment:between EL 68'-3" and 73'-1"))) 		04	- -	>	0.0	_	0.00

Subcompartment Analyses for US-APWR Design Confirmation

C. Brea Brea Brea	TabIk Type : Feed Water line(16Ik Area :2.234(ft²)Ik location : Volume number	ile 6.3-8 6B) guillot 55	Steam G ine break	enerato (Full pov	r Compari wer opera	tment No ting con	dal Description dition)		
Volume		Heinht	Free	Init	ial Conditi	suc	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	East quadrant around								
43	A-RCP IN A-SG compartment:between EI 60' 21' 22' 1"	4.83	387	120	14.7	0	0.76	7	89.1
	South duadrant around								
× v	A-RCP in A-SG	C0 1	000		7	c	000	٢	0 C
1	compartment:between EL 68'-3" and 73'-1"	4.00	007	120		5	0.90		c.00
	Northwest quadrant								
45	around A-SG in A-SG	4 83	774	120	7.4.7	C	2 44	7	65 1
P F	compartment:between) 	ł	04	Ē	þ	+ + -3	-	
	EL 08-3" and /3-1"								
	Northeast quadrant								
46	around A-SG in A-SG	4 83	508	120	14.7	C	3 18	7	54.6
2	compartment:between	20.		2	-	þ	5	-	2
	Southeast guadrant								
7	around A-SG in A-SG	C0 1	500		7	c	0 C	٢	75.6
- +	compartment:between	4. 0.	020	170		5	0.0		0.04
	EL 68-3" and 73-1"								
	Southwest quadrant								
48	around A-SG in A-SG	4 83	770	120	14 7	С	3.05	7	56 4
2	compartment:between EL 68'-3" and 73'-1"	8	i		-)	0		-

C. Brea Brea Brea	Tab k Type : Feed Water line(16 k Area :2.234(ft ²) k location : Volume number	ole 6.3-8 5B) guillot 55	Steam C ine break	enerato (Full pov	r Compar wer opera	tment No ting con	dal Description dition)		
Volume		Height	Free	Init	ial Conditi	ons	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Northwest quadrant								
49	compartment:between	10.67	481	120	14.7	0	3.63	7	48.1
	Northeast quadrant								
20	around A-SG in A-SG	10.67	QRO	120	14.7	C	3 50	7	48.7
2	compartment:between EL 73'-1" and 83'-9"	0.0	000		ř.	>	0	~	
	Southeast quadrant								
ר ב	around A-SG in A-SG	10.67	1034	120	14.7	C	4 76	7	32.0
-	compartment:between	0.0	-	0	-	>		-	0.10
	Southwest guadrant								
5	around A-SG in A-SG	10 67	547		7 7 7	C	70	٢	C 07
70	compartment:between	10.01	10	120	- + -	5	<u>.</u>		40.0
	Northwest guadrant								
73	around A-SG in A-SG	11 22	370	1 20	7 7 7	C	02 0	2	80 7
3	compartment:between	<u>.</u>	0	2	È.	5	0	t	
	Northeast quadrant								
54	around A-SG in A-SG	11 33	840	120	14.7	C	7 88	14	70 4
5	compartment:between EL 83'-9" and 95'-1"			07		>	00.7	<u>t</u>	t.0

Subcompartment Analyses for US-APWR Design Confirmation

 -	L	-	Table 6.3-9	Steam G	enerator C	ompartmen	t Vent Path	Description			
ak Typi ak Area	е : гее я : 2.23	dwater IIn \4(ft ²)	ie(16B) guillo	otine break	(Full powe	er operating	condition)				
eak loca	ation : \	Volume nu	umber 55								
Volur	ne No.	Desci Vent P	ription of ath Flow	Area	Inertia	Hydraulic	Friction		Loss Coeffic	ient K	
Fron	To	Choked	Unchoked	(ft²)	(ft)	Ulameter (ft)	(ft)	Turning and Obstruction	Expansion (Contraction	Total
-	2		×	101.35	7.47	9.50	8.96	0	1.0	0.5	1.5
-	4		×	135.39	8.68	11.10	10.42	0	1.0	0.5	1.5
-	57		×	61.86	14.24	7.86	17.09	0	1.0	0.5	1.5
2	ო		×	86.79	9.87	8.66	11.84	0	1.0	0.5	1.5
ო	4		×	79.51	10.36	5.66	12.43	0	1.0	0.5	1.5
ო	9		×	145.18	11.93	11.44	14.32	0	1.0	0.5	1.5
с	57		×	30.94	10.28	5.46	12.34	1.84	1.0	0.5	3.34
4	2		×	168.39	12.50	12.26	15.00	0	1.0	0.5	1.5
4	57		×	28.87	18.64	5.01	22.37	0	1.0	0.5	1.5
5	9		×	84.29	11.69	6.18	14.03	0	1.0	0.5	1.5
5	8		×	183.69	10.36	13.30	12.43	0	1.0	0.5	1.5
9	7		×	135.63	13.13	11.64	15.76	0	1.0	0.5	1.5
7	8		×	133.49	9.97	11.55	11.96	0	1.0	0.5	1.5
7	57		×	36.65	14.12	5.90	16.94	0	1.0	0.5	1.5
8	57		×	21.94	13.72	4.42	16.46	0	1.0	0.5	1.5
-	6		×	49.88	6.39	8.15	24.06	0.7	0	0	0.7
2	10		×	42.85	6.39	8.28	24.25	0.7	0	0	0.7
с	11		×	80.97	6.39	11.43	28.69	2.0	0	0	0.7
4	12		×	71.52	6.39	10.16	26.90	2.0	0	0	0.7
5	13		×	86.56	6.39	11.20	28.37	0.7	0	0	0.7
9	14		×	109.95	6.39	13.94	32.23	0.7	0	0	0.7
7	15		×	87.11	6.39	12.05	29.56	2.0	0	0	0.7
8	16		×	77.48	6.39	10.72	27.69	0.7	0	0	0.7

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				Total	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5
			cient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5
			Loss Coeffi	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
Description				Turning and Obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0	0	0	0
t Vent Path	condition)		Friction	(ff)	11.95	13.00	15.00	15.31	12.41	9.55	19.94	17.21	21.80	16.67	11.69	18.62	21.79	21.80	26.15	25.40	24.47	19.36	25.43	25.09	11.95	13.00	14.88	15.20
ompartmen	r operating		Hydraulic	Ulameter (ft)	8.16	5.13	7.17	8.57	11.43	12.14	4.24	7.36	8.83	8.73	3.07	3.62	7.60	7.61	10.69	10.16	9.50	5.88	10.18	9.94	7.45	8.35	5.61	7.71
enerator C	(Full powe		Inertia	(ft)	9.96	10.83	12.50	12.76	10.34	7.96	16.62	14.34	18.17	13.89	9.74	15.52	5.64	5.64	5.64	5.64	5.64	5.64	5.64	5.64	9.96	10.83	12.40	12.67
Steam G	otine break		Area	(ft²)	68.97	68.72	55.92	74.98	133.47	154.26	54.82	97.42	97.75	95.83	13.17	16.46	44.84	37.78	72.34	67.58	69.40	42.47	69.59	64.34	57.97	77.66	39.97	62.24
Table 6.3-9	e(16B) guill	Imber 55	iption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	lwater lin 1(ff ²)	olume nu	Descr Vent P	Choked																								
	: Feed	on : <	e No.	To	10	12	11	12	14	13	14	16	15	16	57	57	17	18	19	20	21	22	23	24	18	20	19	20
	ak Type Ik Area	ak locati	Volum	From	6	6	10	11	11	12	13	13	14	15	15	16	6	10	11	12	13	14	15	16	17	17	18	19
	C. Brea Brea	Brea	Vent	No.	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

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				Total	1.5	3.34	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0	0	0	1.5	1.5	1.5	1.5	1.5	3.34	1.5	1.5	1.5
			cient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	9.0	0.5	0.5	0.5	0.5	0.5	0.5
			Loss Coeffi	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Descriptior	1			Turning and Obstruction	0	1.84	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0	0	0.7	0	0	0	0	0	1.84	0	0	0
t Vent Path	condition)		Friction	(ff)	15.50	12.91	9.55	17.38	17.21	19.63	16.67	18.09	17.75	22.47	22.02	23.78	9.55	9.55	20.61	13.07	15.00	16.61	17.02	15.54	11.40	7.60	17.38	17.21
ompartmen	r operating		Hydraulic	Ulameter (ft)	8.40	3.73	11.09	5.46	9.43	7.12	6.99	6.14	5.90	9.25	8.93	10.18	5.88	10.18	7.93	6.82	7.47	4.57	6.14	6.38	2.40	9.86	5.14	8.53
enerator C	(Full powe		Inertia	Lerigui (ft)	12.92	10.76	96'.2	14.48	14.34	16.36	13.89	4.82	4.82	4.82	4.82	4.82	96'.2	96'.2	4.82	10.89	12.50	13.84	14.18	12.95	9.50	6.33	14.48	14.34
Steam G	otine break		Area	(ft²)	70.67	14.75	133.50	34.51	89.66	52.38	50.72	37.54	30.50	64.56	60.68	73.43	70.79	115.99	51.33	46.64	55.78	24.22	49.21	65.64	6.00	111.77	28.88	75.05
Table 6.3-9	e(16B) guill	umber 55	iption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	X
	twater lin 4(ft ²)	olume nu	Descr Vent P	Choked																								
	: Feed	on : V	e No.	To	22	57	21	22	24	23	24	25	26	27	28	29	30	31	32	26	28	27	28	30	57	29	30	32
	ak Type	ak locati	Volumo	From	19	19	20	21	21	22	23	17	18	19	20	21	22	23	24	25	25	26	27	27	27	28	29	29
	C. Breć Breć	Bre	Vent	No.	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	99	67	68	69	70	71

				otal	1.5	1.5	1.5	0	0	0	0	J.7	J.7	J.7	J.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0
				n Tc								0							<u> </u>				<u> </u>	·	,	·		
			cient K	Contractio	0.5	<u> </u>	<u> </u>	0	0	0	0	0	0	0	0	0.5	0.5	<u>9</u> .0	0.5	<u>9</u> .0	<u> </u>	<u>9</u> .0	0.5	0.5	0.5	0.5	0	0
			Loss Coeffi	Expansion	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0
Description				Turning and Obstruction	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0
t Vent Path	condition)		Friction	(ff)	19.63	16.67	13.68	7.91	7.91	7.91	7.91	19.67	15.38	22.14	17.98	13.07	15.00	16.72	17.12	12.16	7.60	19.94	17.21	21.80	16.67	9.84	6.46	6.46
ompartment	· operating ·		Hydraulic	(ft)	6.59	6.48	3.07	6.14	5.90	8.89	8.93	8.43	5.39	10.18	7.23	7.07	7.67	6.44	7.22	8.20	8.55	4.76	7.53	5.98	5.89	2.99	8.15	8.28
enerator C	(Full powei		Inertia	(ff)	16.36	13.89	11.40	6.59	6.59	6.59	6.59	4.00	4.00	4.00	4.00	10.89	12.50	13.93	14.27	10.13	6.33	16.62	14.34	18.17	13.89	8.20	5.38	5.38
Steam G	otine break		Area	(ft²)	43.85	42.46	13.17	62.57	50.84	107.60	101.14	60.79	42.47	69.59	46.82	56.91	73.39	47.64	60.25	78.92	91.21	23.57	61.25	35.78	34.65	11.83	83.14	71.41
Table 6.3-9	e(16B) guille	mber 55	iption of ath Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	X
	twater line 4(ft ²)	olume nu	Descri Vent Pa	Choked																								
	: Feec 2.234	∧ : no	s No.	To	31	32	57	33	34	35	36	37	38	39	40	34	36	35	36	38	37	38	40	39	40	57	41	42
	k Type k Area :	ak locati	Volum€	From	30	31	32	25	26	27	28	29	30	31	32	33	33	34	35	35	36	37	37	38	39	39	33	34
	C. Brea Brea	Brea	Vent	No.	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	06	91	92	93	94	95

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				=																10	10	10	10					
				Tota	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.05	2.05	2.05	2.05	0.7	0.7	0.7	0.7	1.5
			cient K	Contraction	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5
			Loss Coeffi	Expansion	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0
Description				Turning and Obstruction	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	2.05	2.05	2.05	2.05	0.7	0.7	0.7	0.7	0
t Vent Path	condition)		Friction	(ff)	6.46	6.46	26.16	23.51	18.60	25.10	8.96	10.34	9.86	8.46	17.64	13.85	20.40	16.20	9.84	11.85	14.28	15.28	10.53	18.85	22.18	22.16	19.75	19.88
ompartmen	r operating		Hydraulic	Ulameter (ft)	14.39	12.97	14.06	12.18	8.70	13.31	6.55	7.08	6.26	5.64	4.37	4.54	5.37	5.30	1.00	6.39	8.11	8.82	5.45	6.86	9.22	9.21	7.50	3.98
enerator C	(Full powe		Inertia	(ft)	5.38	5.38	3.27	3.27	3.27	3.27	7.47	8.62	8.22	7.05	14.70	11.54	17.00	13.50	8.20	1.52	1.52	1.52	1.52	4.69	4.69	4.69	4.69	16.57
Steam G	otine break		Area	(ft²)	134.95	119.20	73.43	87.69	67.14	64.34	49.17	63.91	42.87	32.72	19.26	20.66	29.23	28.31	1.33	25.64	38.77	49.66	18.39	35.85	66.39	68.75	36.25	30.70
Table 6.3-9	e(16B) guille	mber 55	iption of ath Flow	Unchoked	×	×	Х	×	×	Х	×	×	X	×	X	X	×	×	X	×	X	Х	×	X	Х	Х	Х	×
	dwater line	4(tt ⁻) /olume nu	Descri Vent P.	Choked																								
	: Fee(: 2.23 on : V	e No.	To	43	44	45	46	47	48	42	44	43	44	46	48	47	48	57	57	57	57	57	49	50	51	52	50
	k Type	ik Area ik locati	Volum	From	35	36	37	38	39	40	41	41	42	43	45	45	46	47	47	41	42	43	44	45	46	47	48	49
	C. Brea	Brea	Vent	No.	96	97	98	66	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119

					Total	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.05	2.05	2.05	2.05
				cient K	Contraction	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0
				Loss Coeffi	Expansion	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0
Description					Turning and Obstruction	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	2.05	2.05	2.05	2.05
t Vent Path	condition)			Friction	Lengu (ft)	15.60	22.66	17.95	19.05	22.34	23.43	20.80	19.90	15.60	22.67	17.95	12.72	16.01	18.23	14.47
ompartmen	r operating			Hydraulic	Ulalifieter (ft)	4.52	6.31	6.13	4.24	6.57	7.34	5.48	3.06	3.49	5.73	5.51	4.24	6.57	8.15	5.48
enerator C	(Full powe			Inertia	(ft)	13.00	18.88	14.96	6.64	6.64	6.64	6.64	16.58	13.00	18.89	14.96	3.47	3.47	3.95	3.47
Steam G	otine break			Area	(ft²)	33.79	52.71	50.67	21.50	47.30	53.73	24.98	20.08	23.37	43.47	41.30	21.50	47.30	62.19	24.98
Table 6.3-9	e(16B) guille	mhar 55		iption of ath Flow	Unchoked	×	×	×	×	×		×	×	×			×	×		
	water lin	4(ft²) Aliime nii		Descr Vent P	Choked						×				×	×			Х	×
	: Feed	2.23		e No.	To	52	51	52	53	54	55	56	54	56	55	56	57	57	57	57
	ik Type	ik Area		Volum	From	49	50	51	49	50	51	52	53	53	54	55	53	54	55	56
	C. Brea	Brea	ממ	Vent	No.	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134

Table 6.3-10	Mass and Energy F	Release Rates	for Steam Generator	
0 0 1 7	Compartment Pea	ak Pressure A	nalyses	
C. Break Ty	pe : Feedwater line(16	B) guillotine bro	eak	
	wer operating condit	ion)		
Break Are	ea : 2.234(π⁻) ation : Volumo numbo	r 66		
Dieak ioc		1 55		
	SG side	9	Feedwater Pum	ps side
Time (s)	Mana Dalaasa Data	E se tile se bras s	Masa Dalaasa Data	E se tile se lass s
	Mass Release Rate	Enthalpy	Mass Release Rate	Enthalpy
	(IDM/S)	(BIU/IDM)	(ibm/s)	(BTU/IDM)
0	0	506.238	0	438.168
0.002	4906.78	504.977	960.818	438.15
0.004	5367.61	504.977	1795.73	438.15
0.006	6435.88	505.007	2516.12	438.117
0.008	7062.11	505.272	3132.05	438.071
0.01	7866.93	505.332	3652.45	438.013
0.02	10999.1	505.802	5082.04	437.612
0.03	11461.3	505.864	5100.2	437.139
0.04	11627	505.869	4305.39	436.701
0.05	11727.7	505.866	3209.74	436.351
0.06	11801	505.863	3077.81	436.1
0.07	11856.3	505.861	4194.29	436.138
0.08	11898.3	505.859	5027.55	436.139
0.09	11930.3	505.857	5653.94	436.14
0.1	11954.7	505.856	6124.8	436.142
0.12	11987.4	505.855	6744.8	436.145
0.14	12006.4	505.853	7095.08	436.149
0.16	12017.4	505.853	7292.93	436.153
0.18	12023.9	505.852	7404.64	436.156
0.2	12027.6	505.852	7467.66	436.16
0.22	12029.8	505.851	7503.18	436.164
0.24	12031.1	505.851	7523.14	436.168
0.26	12031.8	505.851	7534.32	436.172
0.28	12032.3	505.851	7540.53	436.176
0.3	12032.5	505.851	7543.94	436.179
0.32	12032.7	505.85	7545.76	436.183
0.34	12032.8	505.85	7546.68	436.187
0.36	12032.8	505.85	7547.1	436.191
0.38	12032.9	505.85	7547.23	436.195
0.4	12032.9	505.85	7547.21	436.198
0.42	12032.9	505.85	7547.16	436.202
0.44	12032.9	505.85	7547.07	436.206
0.46	12032.9	505.85	7546.96	436.21
0.48	12032.9	505.85	7546.83	436.213
0.5	12032.9	505.85	7546.68	436.217
0.6	12033	505.85	7545.79	436.236
0.7	12033	505.849	7544.74	436.254

Table 6.3-10	Mass and Energy F Compartment Pea	Release Rates ak Pressure Ar B) quillotine bro	for Steam Generator nalyses	
(Full po Break Are Break loc	wer operating condit ea : 2.234(ft ²) cation : Volume numbe	ion) r 55	Can	
	SG side)	Feedwater Pum	ps side
Time (s)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)
0.8	12033	505.849	7543.64	436.272
0.9	12033	505.849	7542.52	436.291
1	12033	505.849	7541.39	436.308

D. Brea Brea Brea	TableAk Type : Feedwater line(16B)ik Area :2.234(ft²)ik location : Volume number 5	e 6.3-11 guillotine	Steam Ger break (just	nerator Co t after hot	ompartme shutdowr	nt Nodal r conditio	Jescription n)		
om lov		Hainht	Free	Initi	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ft)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
~	West quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	874	120	14.7	0	1.79	8	90.1
5	North quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	750	120	14.7	0	2.06	8	88.6
3	East quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1346	120	14.7	0	1.58	18	91.2
4	South quadrant around A-RCP in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1257	120	14.7	0	1.62	18	91.0
2	Northwest quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1530	120	14.7	0	1.46	18	91.9
Q	Northeast quadrant around A-SG in A-SG compartment:between EL 25'-3" and 36'-5"	11.17	1820	120	14.7	0	1.36	6	92.4

D Brea	Tabl k Tvne · Feedwater line(16R)	e 6.3-11	Steam Ge	nerator Co t after hot	shutdown	nt Nodal	Description n)		
Brea Brea Brea	Ik Area :2.234(ft ²) k location : Volume number {	55					Ē		
ominov		Hainht	Free	Initi	al Conditio	suc	Calculated	Design	Marcin
No.	Description	(tt)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Southeast quadrant								
~	compartment:between EL 25'-3" and 36'-5"	11.17	1540	120	14.7	0	1.06	0	94.1
	Southwest quadrant								
α	around A-SG in A-SG	11 17	1370	120	14.7	C	1 08	ά	07.0
5	compartment:between EL		202	07	÷. F	D	00	2	0.10
	Meet alladrant amilind								
თ		10.01	677	120	14.7	0	1.55	18	91.4
	compartment:between EL 36'-5" and 46'-5.08"					•			
	North quadrant around								
0	A-RCP in A-SG	10.01	200	120	117	C	1 66	ά	8 U0
2	compartment:between EL 36'-5" and 46'-5.08"	0.0		071		D	00	2	0.00
	East quadrant around								
~	A-RCP in A-SG	10.01	1183	120	117	C	1 2.4	4	03 1
-	compartment:between EL 36'-5" and 46'-5.08"	0.0	2	071		D	F 2	2	
	South quadrant around								
10	A-RCP in A-SG	10.01	1037	120	117	C	1 27	ά	0,00
4	compartment:between EL 36'-5" and 46'-5.08"		1001	120		þ	17.1	2	02.20

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	Tabl	e 6.3-11	Steam Gei	nerator Co	mpartme	nt Nodal	Description		
D. Brea Brea	k Type:Feedwater line(16B) k Area:2.234(ft²)) guillotine	break (jus t	t after hot	shutdowr	ı conditio	u		
Brea	k location : Volume number {	55							
Volume		Hainht	Free	Initi	al Conditic	suc	Calculated	Design	Maroin
No.	Description	(H)	Volume (ft³)	Temp. (dea F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Northwest quadrant			2					
13	around A-SG in A-SG compartment:between EL 36'-5" and 46'-5.08"	10.01	1283	120	14.7	0	1.23	18	93.2
	Northeast quadrant								
14	around A-SG in A-SG	10.01	1586	120	147	C	1 17	81	03 F
<u>-</u>	compartment:between EL 36'-5" and 46'-5.08"	-	2000-	2		þ	-	2	2.22
	Southeast quadrant								
ר ער	around A-SG in A-SG	10.01	1272	120	14.7	C	1 06	α1	04.1
2	compartment:between EL 36'-5" and 46'-5.08"	0.0	7171	04		þ	00	2	
	Southwest quadrant								
16	around A-SG in A-SG	10.01	1108	120	147	C	1 04	81	6 70
2	compartment:between EL 36'-5" and 46'-5.08"		201	04		þ	- -	2	1.
	West quadrant around								
17	A-RCP in A-SG	866	570	120	1 1 7	C	1 31	7	0 08
2	compartment:between EL 46'-5.08" and 55'-1"	0.00	710	071	+	5	† -	-	6.00
	North quadrant around								
ά	A-RCP in A-SG	866	V 7 A	120	7 7	C	1 36	7	80.6
2	compartment:between EL 46'-5.08" and 55'-1"	0.0	+	04		þ	2	-	0.00

D. Brea Brea	Tabl ik Type : Feedwater line(16B) ik Area :2.234(ft²)	e 6.3-11) guillotine	Steam Ge l break (j us t	nerator Co t after hot	ompartme shutdowr	nt Nodal 1 conditic	Description n)		
Brea	ik location : Volume number !	55							
Volume		Hainht	Free	Initi	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	East quadrant around								
19	A-RCP II A-SG compartment:between EL 46'-5.08" and 55'-1"	8.66	935	120	14.7	0	1.09	7	84.4
	South quadrant around								
00	A-RCP in A-SG	866	806	120	777	C	1 30	~	81 J
2	compartment:between EL	0.0	000	04	<u>.</u>	5	000	•	†. - -
	Northwest quadrant		_						
21	around A-SG in A-SG	8,66	1007	120	147	C	1 32	7	81 1
-	compartment:between EL	0.0	200		÷	>	10.	_	-
	46'-5.08" and 55'-1"		_						
	Northeast quadrant								
00	around A-SG in A-SG	8 66	587	120	14.7	C	1 22	~	87 G
1	compartment:between EL	0.0	100		÷	>	77.	_	0.40
	46'-5.08" and 55'-1"		_						
	Southeast quadrant								
23	around A-SG in A-SG	8 66	051	120	7.71	C	1 40	~	787
2	compartment:between EL	0.0	5		÷	5	0 t.	_	
	46'-5.08" and 55'-1"		_						
	Southwest quadrant								
24	around A-SG in A-SG	8 66	682	120	147	C	1 40	~	80.0
-	compartment:between EL	0000	1		-	>			0.00
	46-5.08" and 55-1"								

6-100

D. Brea	Tabl Ik Type : Feedwater line(16B)	e 6.3-11 () guillotine	Steam Ge l break (just	nerator Co t after hot	ompartme shutdowr	nt Nodal n conditic	Description n)		
Brea Brea	IK Area :2.234(tt²) Ik location : Volume number {	35							
		Hainht	Free	Initi	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (dea F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	West quadrant around					-			
25	A-RCP in A-SG compartment:between EL 55'-1" and 62'-4"	7.25	431	120	14.7	0	1.21	2	82.7
	North quadrant around								
26	A-RCP in A-SG	7 75	350	100	777	C	1 17	7	02 2
0	compartment:between EL 55'-1" and 62'-4"	C7		071	- - -	5	1.17	~	0.00
	East quadrant around								
70	A-RCP in A-SG	7 75	746	001	777	C	1 16	7	82 J
4	compartment:between EL 55'-1" and 62'-4"	07.1	0	071	- -	5	01.1	~	1 . 70
	South quadrant around								
äc	A-RCP in A-SG	7 JE	607	120	- <i>r</i> +	c	1 21	٢	0 00
0	compartment:between EL 55'-1" and 62'-4"	C7		04	- -	5	t -	~	0.00
	Northwest quadrant								
00	around A-SG in A-SG	7 25	843	120	147	C	1 48	7	78.0
0	compartment:between EL 55'-1" and 62'-4"	- -	2			þ		-	2.2
	Northeast quadrant								
30	around A-SG in A-SG	7 25	577	120	147	C	1 70	7	75.7
0	compartment:between EL 55'-1" and 62'-4"	04:-		04		þ			

	Table	e.3-11	Steam Gei	nerator Co	ompartme	nt Nodal	Description		
U. Brea Brea	k Type : Feedwater line(Tob) k Area :2.234(ft ²)	guillotine	oreak (jus i	t arter not	snutdowr				
brea	k location : Volume number :	с Г							
Volume		Hainht	Free	Init	ial Conditic	SUC	Calculated	Design	Maroin
No.	Description	(tt)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Southeast quadrant								
31	around A-SG in A-SG	7.25	799	120	14.7	0	1.90	7	72.9
	compartment: between EL 55'-1" and 62'-4"								
	Southwest quadrant								
32	around A-SG in A-SG	7 25	730	120	14.7	C	1 81	7	74.1
1	compartment:between EL 55'-1" and 62'-4"	2		2		0	2	-	Ē
	West quadrant around								
33	A-RCP in A-SG	д 0 0	150	120	117	C	1 03	٢	85 3
2	compartment:between EL 62'-4" and 68'-3"	10.0) t		- -	þ	000	~	2.20
	North quadrant around								
27	A-RCP in A-SG	<i>д</i> 00	287	120	117	C	0 05	٢	R6 A
	compartment:betweenEL 62'-4" and 68'-3"	10.0		04	<u>.</u>	þ	0	.	t. 0
	East quadrant around								
35	A-RCP in A-SG	д 0 0	730	120	14.7	C	0 08	7	Se O
2	compartment:between EL 62'-4" and 68'-3"	10.0	2	07	È.	0	0	-	0.00
	South quadrant around								
36	A-RCP in A-SG	д 02	655	120	14.7	C	1 22	~	87 G
2	compartment:between EL 62'-4" and 68'-3"	10.0		07	È	0	77.	-	0.70

	Table 14 Time : Ecodimeter line/16P)	e 6.3-11 \$	Steam Gen	nerator Co	ompartme	nt Nodal	Description		
D. D. C. Brea	ak Area :2.234(ft ²) ik location : Volume number 5	guinomie i	JICAN JUS				Î		
//olime		Haiaht	Free	Initi	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ft)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Northwest quadrant								
37	around A-SG in A-SG compartment:between EL 62'-4" and 68'-3"	5.92	688	120	14.7	0	1.82	7	74.0
	Northeast quadrant								
30	around A-SG in A-SG	<i>к</i> 07	877	120	117	C	2 55	7	63.6
5	compartment:between EL	0.34	770	07	+	5	00.7		0.00
	02 -4 allo 00 -3								
	sourneast quadrant								
99	around A-SG in A-SG	5.92	652	120	14 7	С	2 89	7	58.7
)	compartment:between EL		1000		-)		-	
	02-7 alla 00-0 Conthurset anodrost								
40		5.92	603	120	14.7	0	2.55	7	63.6
	62'-4" and 68'-3"								
	West quadrant around								
7	A-RCP in A-SG	202	366	120	7 7 7	C	000	7	06.0
- +	compartment:between EL) ; ;	000	04		5	20.0		00.90
	North quadrant around								
с х	A-RCP in A-SG	00 1	100	100	7 7 7	c		٢	c 00
t 1	compartment:between EL 68'-3" and 73'-1"	,	177 1	071		5	70.0	-	0.00

D. Brea Brea Brea	Tabl k Type : Feedwater line(16B) k Area :2.234(ft²) k Incertion : Molume pumber F	e 6.3-11) guillotine	Steam Ge break (jus	nerator Co t after hot	отраrtme shutdowi	nt Nodal n conditic	Description n)		
		8	Free	Initi	ial Conditio	SUC	Calculated	Decian	
Volume		Height	1/01/1000				Dool Droce Diff	Dool Droop Diff	Margin
No.	Description	(ft)	volume (ft ³)	Iemp. (deg F)	Press. (psia)	Humid. (%)	reak riess. UIII. (psid)	reak riess. UIII. (psid)	(%)
	East quadrant around								
43	A-RCP in A-SG	4,83	387	120	14.7	0	0.79	7	88.7
2	compartment:between EL 68'-3" and 73'-1")))			
	South quadrant around								
VV	A-RCP in A-SG	1 83	260	120	777	C	1 03	7	85 2
† †	compartment:between EL	t 0.	007	071	- +	5	00.1	4	0.00
	68'-3" and 73'-1"								
	Northwest quadrant								
15	around A-SG in A-SG	1 83	777	120	777	C	2 G7	7	610
) F	compartment:between EL	20 	1	24	- -	>	10.4	-	0
	68'-3" and 73'-1"								
	Northeast quadrant								
46	around A-SG in A-SG	4 83	508	120	14.7	C	3 48	7	503
þ	compartment:between EL	0 	2		- -	þ	0	-	0.00
	68'-3" and 73'-1"								
	Southeast quadrant								
47	around A-SG in A-SG	4 83	503	120	14.7	C	4 3U	7	38.6
F	compartment:between EL	20 F	040	24	- -	>	00. F	-	0.00
	68'-3" and 73'-1"								
	Southwest quadrant								
48	around A-SG in A-SG	4 83	277	120	147	C	3 45	7	50.7
2	compartment:between EL	2	i	2)	5	-	
	1-C/ DIN C- 00								

D. Brea Brea Brea	TablIk Type : Feedwater line(16B)Ik Area :2.234(ft²)Ik location : Volume number 5	e 6.3-11 {) guillotine 55	Steam Ge l break (just	nerator Co t after hot	om partme shutdowr	nt Nodal conditic	Description n)		
Volume		Heinht	Free	Initi	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
49	Northwest quadrant around A-SG in A-SG compartment:between EL	10.67	481	120	14.7	0	4.01	7	42.7
50	Northeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	960	120	14.7	0	3.98	~	43.1
51	Southeast quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	1034	120	14.7	0	5.51	7	21.3
52	Southwest quadrant around A-SG in A-SG compartment:between EL 73'-1" and 83'-9"	10.67	517	120	14.7	0	4.82	2	31.1
53	Northwest quadrant around A-SG in A-SG compartment:between EL 83'-9" and 95'-1"	11.33	379	120	14.7	0	2.99	14	78.6
54	Northeast quadrant around A-SG in A-SG compartment:between EL 83'-9" and 95'-1"	11.33	849	120	14.7	0	3.47	14	75.2

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	Table	e 6.3-11	Steam Ger	nerator Co	ompartme	nt Nodal	Description		
D. Breć Breć Brea	ak Type : Feedwater line(16B) ak Area :2.234(ft²) ak location : Volume number 5	guillotine	break (jus t	t after hot	shutdown	ר conditic	(Li		
Volume		Hainht	Free	Init	ial Conditic	suc	Calculated	Design	Marcin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
	Southeast quadrant								
L L	around A-SG in A-SG	11 22	OGE	100	7 7 7	c	07 77	7	
0	compartment:between EL	00.11	000	04	+ -	5		<u>+</u>	
	83'-9" and 95'-1"								
	Southwest quadrant								
9	around A-SG in A-SG	11 00	077	001	7	c	200	7	C 7
00	compartment:between EL	00.11	4 0	0	- + - /	5	00	<u>+</u>	1.00
	83'-9" and 95'-1"								
57	Containment atmosphere	200	2861000	120	14.7	0	-	-	ı

			Ľ	able 6.3-12	Steam Ge	nerator C	Compartmen	t Vent Path	Description			
D. Breć	ak Type	: Fee	dwater line	(16B) guillot	ine break (j	ust after	hot shutdow	/n conditio	(u)			
Bre	ak Area	: 2.23	4(ft²)			_						
Bre	ak locati	∧ : no	'olume nun	nber 55								
Vent	Volume	No.	Descripti Path	ion of Vent 1 Flow	Area	Inertia	Hydraulic	Friction		Loss Coeffic	ient K	
Path No.	From	To	Choked	Unchoked	(ft ²)	Length (ft)	Diameter (ft)	Length (ft)	Turning and Obstruction	Expansion	Contraction	Total
-	-	7		×	101.35	7.47	9.50	8.96	0	1.0	0.5	1.5
7	Ţ	4		×	135.39	8.68	11.10	10.42	0	1.0	0.5	1.5
ო	-	57		×	61.86	14.24	7.86	17.09	0	1.0	0.5	1.5
4	2	e		×	86.79	9.87	8.66	11.84	0	1.0	0.5	1.5
5	3	4		×	79.51	10.36	5.66	12.43	0	1.0	0.5	1.5
9	3	9		×	145.18	11.93	11.44	14.32	0	1.0	0.5	1.5
7	3	57		×	30.94	10.28	5.46	12.34	1.84	1.0	0.5	3.34
8	4	5		×	168.39	12.50	12.26	15.00	0	1.0	0.5	1.5
6	4	57		×	28.87	18.64	5.01	22.37	0	1.0	0.5	1.5
10	2	9		×	84.29	11.69	6.18	14.03	0	1.0	0.5	1.5
11	2	∞		×	183.69	10.36	13.30	12.43	0	1.0	0.5	1.5
12	9	2		×	135.63	13.13	11.64	15.76	0	1.0	0.5	1.5
13	7	∞		×	133.49	9.97	11.55	11.96	0	1.0	0.5	1.5
14	7	57		×	36.65	14.12	5.90	16.94	0	1.0	0.5	1.5
15	8	57		×	21.94	13.72	4.42	16.46	0	1.0	0.5	1.5
16	٢	6		×	49.88	6.39	8.15	24.06	2.0	0	0	0.7
17	2	10		×	42.85	6.39	8.28	24.25	0.7	0	0	0.7
18	3	11		×	80.97	6.39	11.43	28.69	0.7	0	0	0.7
19	4	12		×	71.52	6.39	10.16	26.90	0.7	0	0	0.7
20	5	13		×	86.56	6.39	11.20	28.37	0.7	0	0	0.7
21	9	14		×	109.95	6.39	13.94	32.23	0.7	0	0	0.7
22	7	15		×	87.11	6.39	12.05	29.56	2.0	0	0	0.7

				Total	0.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1.5	1.5	1.5
			sient K	Contraction	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5
			Loss Coeffic	Expansion	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0
Description	(u			Turning and Obstruction	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0	0	0
t Vent Path	/n conditio		Friction	Length (ft)	27.69	11.95	13.00	15.00	15.31	12.41	9.55	19.94	17.21	21.80	16.67	11.69	18.62	21.79	21.80	26.15	25.40	24.47	19.36	25.43	25.09	11.95	13.00	14.88
ompartmen	not shutdow		Hydraulic	Diameter (ft)	10.72	8.16	5.13	7.17	8.57	11.43	12.14	4.24	7.36	8.83	8.73	3.07	3.62	7.60	7.61	10.69	10.16	9.50	5.88	10.18	9.94	7.45	8.35	5.61
nerator C	just after l		Inertia	Length (ft)	6.39	9.96	10.83	12.50	12.76	10.34	7.96	16.62	14.34	18.17	13.89	9.74	15.52	5.64	5.64	5.64	5.64	5.64	5.64	5.64	5.64	9.96	10.83	12.40
Steam Ge	ine break (j			(ft²)	77.48	68.97	68.72	55.92	74.98	133.47	154.26	54.82	97.42	97.75	95.83	13.17	16.46	44.84	37.78	72.34	67.58	69.40	42.47	69.59	64.34	57.97	77.66	39.97
ble 6.3-12	(16B) guillot	iber 55	on of Vent Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ta	Iwater line(4(ft²) olume num	Descriptic Dath	Choked																								
	: Feec	: 2.23 [,] on : V(No.	To	16	10	12	11	12	14	13	14	16	15	16	57	57	17	18	19	20	21	22	23	24	18	20	19
	k Type	k Area k locati	Volume	From	8	6	6	10	11	11	12	13	13	14	15	15	16	6	10	11	12	13	14	15	16	17	17	18
	D. Breal	Brea	Vent	Path No.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

				Total	1.5	1.5	3.34	1.5	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	0.7	0	0	0.7	1.5	1.5	1.5	1.5	1.5	3.34	1.5	1.5
			cient K	Contraction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
			Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Description	(L			Turning and Obstruction	0	0	1.84	0	0	0	0	0	0.7	0.7	0.7	0.7	0.7	0	0	0.7	0	0	0	0	0	1.84	0	0
t Vent Path	/n conditio		Friction	Length (ft)	15.20	15.50	12.91	9.55	17.38	17.21	19.63	16.67	18.09	17.75	22.47	22.02	23.78	9.55	9.55	20.61	13.07	15.00	16.61	17.02	15.54	11.40	7.60	17.38
ompartmen	not shutdow		Hydraulic	Diameter (ft)	7.71	8.40	3.73	11.09	5.46	9.43	7.12	6.99	6.14	5.90	9.25	8.93	10.18	5.88	10.18	7.93	6.82	7.47	4.57	6.14	6.38	2.40	9.86	5.14
nerator C	just after l		Inertia	Length (ft)	12.67	12.92	10.76	7.96	14.48	14.34	16.36	13.89	4.82	4.82	4.82	4.82	4.82	7.96	7.96	4.82	10.89	12.50	13.84	14.18	12.95	9.50	6.33	14.48
Steam Ge	ine break (Area	(ft^2)	62.24	70.67	14.75	133.50	34.51	89.66	52.38	50.72	37.54	30.50	64.56	60.68	73.43	70.79	115.99	51.33	46.64	55.78	24.22	49.21	65.64	6.00	111.77	28.88
ible 6.3-12	(16B) guilloti	nber 55	on of Vent Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Ta	twater line 4(ft ²)	olume num	Descriptio Path	Choked																								
	: Feed	on : Vo	No.	To	20	22	57	21	22	24	23	24	25	26	27	28	29	30	31	32	26	28	27	28	30	57	29	30
	k Type k Area	k locati	Volume	From	19	19	19	20	21	21	22	23	17	18	19	20	21	22	23	24	25	25	26	27	27	27	28	29
	D. Brea Brea	Brea	Vent	Path No.	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	99	67	68	69	20

			Total	1.5	1.5	1.5	1.5	0	0	0	0	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0
		sient K	Contraction	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0
_		Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0
Description	Ē		Turning and Obstruction	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0
t Vent Path	/n conditio	Friction	Length (ft)	17.21	19.63	16.67	13.68	7.91	7.91	7.91	7.91	19.67	15.38	22.14	17.98	13.07	15.00	16.72	17.12	12.16	7.60	19.94	17.21	21.80	16.67	9.84	6.46
ompartmen	not shutdow	Hydraulic	Diameter (ft)	8.53	6.59	6.48	3.07	6.14	5.90	8.89	8.93	8.43	5.39	10.18	7.23	7.07	7.67	6.44	7.22	8.20	8.55	4.76	7.53	5.98	5.89	2.99	8.15
nerator C	just after I	Inertia	Length (ft)	14.34	16.36	13.89	11.40	6.59	6.59	6.59	6.59	4.00	4.00	4.00	4.00	10.89	12.50	13.93	14.27	10.13	6.33	16.62	14.34	18.17	13.89	8.20	5.38
Steam Ge	ine break (Area	(ft ²)	75.05	43.85	42.46	13.17	62.57	50.84	107.60	101.14	60.79	42.47	69.59	46.82	56.91	73.39	47.64	60.25	78.92	91.21	23.57	61.25	35.78	34.65	11.83	83.14
ble 6.3-12	(16B) guillot hber 55	on of Vent Flow	Unchoked	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
. Ta	lwater line(4(ft²) olume num	Descriptic Path	Choked																								
	: Feec : 2.23 on : V(No.	To	32	31	32	57	33	34	35	36	37	38	39	40	34	36	35	36	38	37	38	40	39	40	57	41
	k Type k Area k locati	Volume	From	29	30	31	32	25	26	27	28	29	30	31	32	33	33	34	35	35	36	37	37	38	39	39	33
	D. Brea Brea Brea	Vent	Path No.	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	06	91	92	93	94

			Ľ	able 6.3-12	Steam Ge	nerator C	Sompartmen	it Vent Path	Description	_		
D. Brea	ik Type	: Feec	dwater line	e(16B) guillot	ine break (j	just after	hot shutdov	vn conditic	(u			
Brea	ak Area ik locati	: 2.23 on : V	4(ft²) olume nur	nber 55								
Vent	Volume	∋ No.	Descripti Path	ion of Vent າ Flow	Area	Inertia	Hydraulic	Friction		Loss Coeffic	sient K	
Path No.	From	To	Choked	Unchoked	(ft ²)	Length (ft)	Diameter (ft)	Length (ft)	Turning and Obstruction	Expansion	Contraction	Total
95	34	42		×	71.41	5.38	8.28	6.46	0	0	0	0
96	35	43		×	134.95	5.38	14.39	6.46	0	1.0	0.5	1.5
67	36	44		×	119.20	5.38	12.97	6.46	0	1.0	0.5	1.5
98	37	45		×	73.43	3.27	14.06	26.16	2.0	0	0	0.7
66	38	46		×	87.69	3.27	12.18	23.51	2.0	0	0	0.7
100	39	47		×	67.14	3.27	8.70	18.60	2.0	0	0	0.7
101	40	48		×	64.34	3.27	13.31	25.10	2.0	0	0	0.7
102	41	42		×	49.17	7.47	6.55	8.96	0	1.0	0.5	1.5
103	41	44		×	63.91	8.62	7.08	10.34	0	1.0	0.5	1.5
104	42	43		×	42.87	8.22	6.26	9.86	0	1.0	0.5	1.5
105	43	44		×	32.72	7.05	5.64	8.46	0	1.0	0.5	1.5
106	45	46		×	19.26	14.70	4.37	17.64	0	1.0	0.5	1.5
107	45	48		×	20.66	11.54	4.54	13.85	0	1.0	0.5	1.5
108	46	47		×	29.23	17.00	5.37	20.40	0	1.0	0.5	1.5
109	47	48		×	28.31	13.50	5.30	16.20	0	1.0	0.5	1.5
110	47	57		×	1.33	8.20	1.00	9.84	0	1.0	0.5	1.5
111	41	57		×	25.64	1.52	6.39	11.85	2.05	0	0	2.05
112	42	57		×	38.77	1.52	8.11	14.28	2.05	0	0	2.05
113	43	57		×	49.66	1.52	8.82	15.28	2.05	0	0	2.05
114	44	57		×	18.39	1.52	5.45	10.53	2.05	0	0	2.05
115	45	49		×	35.85	4.69	6.86	18.85	0.7	0	0	0.7
116	46	50		×	66.39	4.69	9.22	22.18	0.7	0	0	0.7
117	47	51		×	68.75	4.69	9.21	22.16	0.7	0	0	0.7
118	48	52		×	36.25	4.69	7.50	19.75	2.0	0	0	0.7

				Total	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.05	2.05	2.05	2.05
			ient K	Contraction	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0
			Loss Coeffic	Expansion	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0
Description	(u			Turning and Obstruction	0	0	0	0	2.0	2.0	2.0	2.0	0	0	0	0	2.05	2.05	2.05	2.05
t Vent Path	/n conditio		Friction	Length (ft)	19.88	15.60	22.66	17.95	19.05	22.34	23.43	20.80	19.90	15.60	22.67	17.95	12.72	16.01	18.23	14.47
ompartmen	not shutdow		Hydraulic	Diameter (ft)	3.98	4.52	6.31	6.13	4.24	6.57	7.34	5.48	3.06	3.49	5.73	5.51	4.24	6.57	8.15	5.48
nerator C	just after h		Inertia	Lengtn (ft)	16.57	13.00	18.88	14.96	6.64	6.64	6.64	6.64	16.58	13.00	18.89	14.96	3.47	3.47	3.95	3.47
Steam Ge	tine break (Area	(ft^2)	30.70	33.79	52.71	50.67	21.50	47.30	53.73	24.98	20.08	23.37	43.47	41.30	21.50	47.30	62.19	24.98
ble 6.3-12	(16B) guillot	iber 55	on of Vent Flow	Unchoked	×	×	×	×	×	×		×	Х	Х			Х	Х		×
Ta	twater line 4(ft ²)	olume num	Descriptic Path	Choked							Х				Х	Х			Х	
	: Feec	on : V	No.	То	50	52	51	52	53	54	22	99	54	56	55	56	57	57	57	57
	ik Type ik Area	ak locati	Volume	From	49	49	50	51	49	50	51	52	53	53	54	55	53	54	55	56
	D. Brea Brea	Brea	Vent	Path No.	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134

Table	e 6.3-13 Mass and E Compartme	nergy Release ent Peak Press	e Rates for Steam Gene sure Analyses	erator
D. Break Ty	pe : Feed Water line	e(16B) guillotin	e break (Just after he	ot shutdown
conditio	n)	(, G	,	
Break Are	ea : 2.234(ft ²)			
Break loc	ation : Volume numbe	r 55		
Time (s)	SG side	•	Feedwater Pum	ps side
	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)
0	0	563.377	0	438.168
0.002	6852.31	562.321	960.818	438.15
0.004	10389.3	563.381	1795.73	438.15
0.006	10322.8	563.375	2516.12	438.117
0.008	10209.1	563.363	3132.05	438.071
0.01	10100.6	563.35	3652.45	438.013
0.02	9634	563.289	5082.04	437.612
0.03	9300.21	563.232	5100.2	437.139
0.04	9067.21	563.185	4305.39	436.701
0.05	8854.64	563.151	3209.74	436.351
0.06	8773.26	563.131	3077.81	436.1
0.07	8773.73	563.122	4194.29	436.138
0.08	8816.92	563,121	5027.55	436.139
0.09	8875.75	563,123	5653.94	436.14
0.1	8933.99	563.127	6124.8	436.142
0.12	9023.2	563.135	6744.8	436.145
0.14	9083.53	563.143	7095.08	436.149
0.16	9119.9	563.149	7292.93	436.153
0.18	9136.61	563.154	7404.64	436.156
0.2	9138.5	563.157	7467.66	436.16
0.22	9131.94	563.159	7503.18	436.164
0.24	9122	563.16	7523.14	436.168
0.26	9111.69	563.16	7534.32	436.172
0.28	9102.44	563.161	7540.53	436.176
0.3	9094.63	563.161	7543.94	436.179
0.32	9088.15	563.162	7545.76	436.183
0.34	9082.76	563.162	7546.68	436.187
0.36	9078.21	563.162	7547.1	436.191
0.38	9074.31	563.163	7547.23	436.195
0.4	9070.92	563.163	7547.21	436.198
0.42	9067.93	563.163	7547.16	436.202
0.44	9065.3	563.164	7547.07	436.206
0.46	9062.96	563.164	7546.96	436.21
0.48	9060.89	563.164	7546.83	436.213
0.5	9059.06	563.164	7546.68	436.217
0.6	9052.62	563.165	7545.79	436.236
0.7	9049.15	563.165	7544.74	436.254
0.8	9047.26	563.165	7543.64	436.272

Table	e 6.3-13 Mass and E Compartme	nergy Release ent Peak Press	e Rates for Steam Gene sure Analyses	erator									
D. Break Ty	pe : Feed Water line	e(16B) guillotin	e break (Just after ho	ot shutdown									
conditio	n)												
Break Are	ea : 2.234(ft²)												
Break loc	ation : Volume numbe	r 55											
Time (s)	SG side)	Feedwater Pum	ps side									
Mass Release Rate Enthalpy Mass Release Rate Enthalpy													
	(lbm/s)	(BTU/lbm)	(lbm/s)	(BTU/lbm)									
0.9	9046.25	563.165	7542.52	436.291									
1	9045.71	563.165	7541.39	436.308									






Figure 6.3-4 Nodalization scheme for Steam Generator compartment analysis

Figure 6.3-5 Nodalization scheme for Steam Generator compartment analysis



Figure 6.3-6 Nodalization diagram for Steam Generator compartment analysis







Figure 6.3-8 Short term mass and energy release data for SG compartment RHR pump inlet line break (2/2)



Figure 6.3-9 Pressure transient at the peak pressure node in SG compartment RHR pump inlet line break



Figure 6.3-10 Short term mass and energy release data for SG compartment RHR pump outlet line break (1/2)



Figure 6.3-11 Short term mass and energy release data for SG compartment RHR pump outlet line break (2/2)



Figure 6.3-12 Pressure transient at the peak pressure node in SG compartment RHR pump outlet line break



Figure 6.3-13 Short term mass and energy release data for SG compartment Feedwater line break (SG side, full power operating condition) (1/2)



Figure 6.3-14 Short term mass and energy release data for SG compartment Feedwater line break (SG side, full power operating condition) (2/2)



Figure 6.3-15 Short term mass and energy release data for SG compartment Feedwater line break (Feedwater pump side, full power operating condition) (1/2)



Figure 6.3-16 Short term mass and energy release data for SG compartment Feedwater line break (Feedwater pump side, full power operating condition) (2/2)



Figure 6.3-17 Pressure transient at the peak pressure node in SG compartment (Feedwater line break, Full power operating condition)



Figure 6.3-18 Short term mass and energy release data for SG compartment Feedwater line break (SG side, just after hot shutdown condition) (1/2)



Figure 6.3-19 Short term mass and energy release data for SG compartment Feedwater line break (SG side, just after hot shutdown condition) (2/2)



Figure 6.3-20 Short term mass and energy release data for SG compartment Feedwater line break (Feedwater pump side, just after hot shutdown condition) (1/2)



Figure 6.3-21 Short term mass and energy release data for SG compartment Feedwater line break (Feedwater pump side, just after hot shutdown condition) (2/2)



Figure 6.3-22 Pressure transient at the peak pressure node in SG compartment (Feedwater line break, just after hot shutdown condition)

6.4 Pressurizer Subcompartment

6.4.1 Modeling and nodalization sensitivity study

(a) Nodal description

The pressurizer compartment consists of nearly a rectangular chimney including the pressurizer, supports, pipes, etc. and two openings to the containment atmosphere at the top and an opening to steam generator compartment at the bottom.

The nodalization scheme for the pressurizer compartment pressure analysis is shown in Figure 6.4-1 to Figure 6.4-3. The pressurizer compartment is azimuthally divided into 4 sectors, and vertically divided into 11 sectors. The vertical nodal boundaries are basically at the location of flow obstructions (grating) or geometry changes. The GOTHIC nodalization diagram for the pressurizer compartment analysis is shown in Figure 6.4-4. A total 45 nodes, including the containment atmosphere node, are used for the pressurizer compartment analyses. To calculate conservative pressure differential across the pressurizer walls, the pressure of containment atmosphere is assumed the constant at 0.0 psig.

The description and geometric parameters for each node are summarized in Table 6.4-1. The free volume of each node was estimated by subtracting the obstructed volume from the room volume. The obstructed volume was estimated the volume of main components with margin to assure minimum free volume. This assumption generates conservative results.

(b) Nodalization sensitivity study

A sensitivity study analysis was performed to confirm the validity of nodalization scheme. For the nodalization diagram described above, the horizontal segmentations were removed. Specifically the pressurizer compartment was modeled as total 11 nodes. The nodalization scheme for sensitivity study is shown in Figure 6.4-5. The results of sensitivity analysis are shown in Figure 6.4-15. This sensitivity study result demonstrates that the selected nodalization has sufficient nodes to calculate the peak pressure difference in postulated pipe breaks inside the pressurizer compartment.

(c) Vent path description

The vent path connection diagram is shown in Figure 6.4-4. Geometric and hydraulic parameters for each vent path are summarized in Table 6.4-2. Vent paths P6 and P7 run from pressurizer compartment to the containment atmosphere. Vent path P5 runs from pressurizer compartment to the C-loop SG compartment. To obtain conservative results, all vent paths were connected to containment atmosphere node.

The flow area of each vent path is conservatively estimated considering the flow obstruction by main components, including margin. The friction length is conservatively estimated considering the length of expected flow line plus margin. The loss coefficient is conservatively estimated considering the effect of obstruction, contraction and expansion.

6.4.2 Short term mass and energy release data

High energy pipes penetrating the pressurizer compartment are the pressurizer surge line, pressurizer relief line, and pressurizer spray line. The pressurizer surge line is LBB-qualified and no break is assumed. For the relief line (ID=6.813 inch) and the spray line (ID=5.187 inch), LBB are not applicable and breaks in these lines are considered.

(a)Pressurizer spray line break

A guillotine break of the spray line was assumed. The analysis was performed using M-RELAP5 code which is the small break LOCA analysis code of the US-APWR. Nodalization of reactor coolant system for short term mass and energy release is basically same as the small break LOCA analysis.

The break mass and energy flow from the pressurizer side was calculated as the single end pipe break connecting to pressurizer vapor space. The break flow from the cold leg side was calculated as the single end pipe break connecting to the cold leg. The mass and energy release data for pressurizer compartment analyses is the sum of sources.

The resultant short term mass and energy release data in shown in Table 6.4-3. and the transient of break mass flow rate and enthalpy are shown in Figure 6.4-6 to Figure 6.4-9.

(b) Pressurizer relief line break

A guillotine break at the relief line was assumed. The analysis was performed using M-RELAP5 code which is the small break LOCA analysis code of the US-APWR. Nodalization of reactor coolant system for short term mass and energy release is basically same as the small break LOCA analysis.

The break flow from the pressurizer relief tank side was assumed zero because the relief tank is not pressurized. The only the break mass and energy flow is from the pressurizer side break and is calculated by using the M-RELAP5 code.

The resultant short term mass and energy release data are shown in Table 6.4-6 and the transient of break mass flow rate and enthalpy are shown in Figure 6.4-11 and Figure 6.4-12.

6.4.3 Calculated pressure responses

(a) Pressurizer spray line break

The pressurizer spray line runs from top of the pressurizer compartment to the bottom of the compartment. Pipe breaks at various locations were analyzed. The worst case for break location was in node V3.

The calculated peak pressure was 6.92 psig at the break node V3. The pressure transient at V3 is shown in Figure 6.4-10. The design pressure for all nodes in pressurizer compartment is 14 psig and the calculated peak pressure is much less than the design pressure.

(b) Pressurizer relief line break

The pressurizer relief line runs from top of the pressurizer to the top of the compartment. Pipe breaks at various locations were analyzed. The worst case break location was in node V39.

The calculated peak pressure was 2.47 psig at the break node V39. The pressure transient at V39 is shown in Figure 6.4-13. The design pressure for all nodes in pressurizer compartment is 14 psig and the calculated peak pressure is much less than the design pressure.

		able 6.4-1 A. Break	Pressur Type : Pres Bre Break lo	izer comp surizer spr ak Area : (ocation : Vo	artment N ay line(6E 0.14674(ft blume nur	Vodal De () guillotir (2) nber 3	scription le break		
Volume	:	Heiaht	Free	Initia	al Conditic	su	Calculated	Design	Maroin
No.	Description	(ft)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Dift. (psid)	(%)
-	Bottom of pressurizer compartment; EL=58"-5'	7.67	365	120	14.7	0	6.54	14	53.3
2	Bottom of pressurizer compartment; EL=58"-5'	7.67	365	120	14.7	0	6.73	14	51.9
с	Bottom of pressurizer compartment; EL=58"-5'	7.67	439	120	14.7	0	6.92	14	50.6
4	Bottom of pressurizer compartment; EL=58"-5'	7.67	439	120	14.7	0	6.51	14	53.5
2	EL=66"-1'	10.00	498	120	14.7	0	6.56	14	53.2
9	EL=66"-1'	10.00	498	120	14.7	0	6.77	14	51.6
7	EL=66"-1'	10.00	595	120	14.7	0	6.85	14	51.1
8	EL=66"-1'	10.00	595	120	14.7	0	6.56	14	53.1
6	EL=76"-1' (grating floor)	6.83	348	120	14.7	0	6.48	14	53.7
10	EL=76"-1' (grating floor)	6.83	348	120	14.7	0	6.43	14	54.1
11	EL=76"-1' (grating floor)	6.83	414	120	14.7	0	6.39	14	54.3
12	EL=76"-1' (grating floor)	6.83	414	120	14.7	0	6.50	14	53.6
13	EL=82"-11'	6.83	348	120	14.7	0	6.52	14	53.4
14	EL=82"-11'	6.83	348	120	14.7	0	6.46	14	53.9
15	EL=82"-11'	6.83	414	120	14.7	0	6.45	14	54.0
16	EL=82"-11'	6.83	414	120	14.7	0	6.52	14	53.4
17	EL=89"-9' (grating floor)	6.83	348	120	14.7	0	6.38	14	54.5
18	EL=89"-9' (grating floor)	6.83	348	120	14.7	0	6.29	14	55.1
19	EL=89"-9' (grating floor)	6.83	414	120	14.7	0	6.29	14	55.1
20	EL=89"-9' (grating floor)	6.83	414	120	14.7	0	6.38	14	54.4

	Ľ	able 6.4- 1 A. Break	Type : Pres Bre Bre Break lo	izer comp surizer spr sak Area : (ocation : Vo	artment h ay line(6B).14674(ft blume num	Jodal De) guillotin ²) 1ber 3	scription le break		
Volume	:	Heiaht	Free	Initia	al Conditio	su	Calculated	Design	Marain
No.	Description	(Ħ)	Volume (ft ³)	Temp. (dea F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Uiff. (psid)	(%)
21	EL=96"-7'	6.83	348	120	14.7) O	6.35	14	54.6
22	EL=96"-7'	6.83	348	120	14.7	0	6.32	14	54.9
23	EL=96"-7'	6.83	414	120	14.7	0	6.30	14	55.0
24	EL=96"-7'	6.83	414	120	14.7	0	6.36	14	54.6
25	EL=103"-5' (grating floor)	8.92	449	120	14.7	0	6.21	14	55.7
26	EL=103"-5' (grating floor)	8.92	449	120	14.7	0	6.17	14	55.9
27	EL=103"-5' (grating floor)	8.92	536	120	14.7	0	6.17	14	55.9
28	EL=103"-5' (grating floor)	8.92	536	120	14.7	0	6.21	14	55.7
29	EL=112"-4'	4.33	236	120	14.7	0	6.18	14	55.8
30	EL=112"-4'	4.33	236	120	14.7	0	6.18	14	55.8
31	EL=112"-4'	4.33	278	120	14.7	0	6.19	14	55.8
32	EL=112"-4'	4.33	278	120	14.7	0	6.15	14	56.0
33	EL=116"-8' (grating floor)	5.80	412	120	14.7	0	6.08	14	56.6
34	EL=116"-8' (grating floor)	5.80	412	120	14.7	0	6.12	14	56.3
35	EL=116"-8' (grating floor)	5.80	483	120	14.7	0	6.14	14	56.1
36	EL=116"-8' (grating floor)	5.80	483	120	14.7	0	6.07	14	56.7
37	Top of Pressurizer; EL=122"-5.6'	5.37	434	120	14.7	0	6.12	14	56.3
38	Top of Pressurizer; EL=122"-5.6'	5.37	434	120	14.7	0	6.08	14	56.6
39	Top of Pressurizer; EL=122"-5.6'	5.37	500	120	14.7	0	6.10	14	56.4
40	Top of Pressurizer; EL=122"-5.6'	5.37	500	120	14.7	0	6.07	14	56.7

	Maroin	(%)	55.8	56.9	57.0	56.7	I
	Design	Peak Press. Diff. (psid)	14	14	14	14	I
scription le break	Calculated	Peak Press. Diff. (psid)	6.19	6.04	6.02	6.06	ı
Vodal De : 3) guillotin P ²) mber 3	suc	Humid. (%)	0	0	0	0	0
artment N ay line(6E 0.14674(ft olume nur	al Conditic	Press. (psia)	14.7	14.7	14.7	14.7	14.7
zer comp surizer spr ak Area : (cation : Vc	Initia	Temp. (deg F)	120	120	120	120	120
1 Pressuri Type : Press Bre Break lo	Free	Volume (ft³)	839	839	696	696	2861000
Fable 6.4 - A. Break	Height	(ft)	9.83	9.83	9.83	9.83	120
	:	Description	Top of Pressurizer compartment; EL=127"-10' (grating floor)	Top of Pressurizer compartment; EL=127"-10' (grating floor)	Top of Pressurizer compartment; EL=127"-10' (grating floor)	Top of Pressurizer compartment; EL=127"-10' (grating floor)	Containment atmosphere
	Volume	No.	41	42	43	44	45

Subcompartment Analyses for US-APWR Design Confirmation

		1	<u> </u>		1	i —									1	i —	i —									1
			ŀ	lotal	1.5	1.5	1.5	1.5	1.95	0	0	0	0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	0
		fficient K	:	Contraction	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0
L		Loss Coet		Expansion	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0
h Descriptic	(B)		Turning and	Obstruction	0	0	0	0	0.45	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0
t Vent Pat	pray line(6 74(ft ²) t number 3	Eriction	Length	(ft)	15.53	11.14	11.14	17.45	9.24	10.60	10.60	10.60	10.60	15.53	11.14	11.14	17.45	19.66	19.66	20.48	20.48	15.53	11.14	11.14	17.45	8.21
ompartment	ressurizer S Area : 0.146 ion : Volume		Diameter	(ft)	3.68	6.81	6.81	4.14	4.12	6.86	6.86	7.45	7.45	4.05	7.72	7.72	4.56	6.86	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86
surizer Co	k Type : P Break / reak locati	Inortio	Length	(ft)	12.94	9.28	9.28	14.54	7.70	8.83	8.83	8.83	8.83	12.94	9.28	9.28	14.54	5.09	5.09	5.09	5.09	12.94	9.28	9.28	14.54	6.84
4-2 Pres	A. Brea B		Area	(11)	18.81	47.56	47.56	22.00	19.75	54.36	54.36	64.09	64.09	25.38	62.88	62.88	29.55	32.62	32.62	38.45	38.45	17.34	42.97	42.97	20.19	54.36
Table 6.4		ption of	ath Flow	Jnchoked	Х	×	Х	Х		Х	Х	Х	Х	Х	×	×	×	Х	Х	Х	Х	Х	Х	Х	Х	×
		Descri	Vent Pa	Choked I					Х																	
				To	2	4	З	4	45	5	9	7	8	9	ω	7	ω	6	10	11	12	10	12	11	12	13
		Volum		From	-	-	2	3	4	٦	2	3	4	2	5	9	7	5	9	2	8	6	6	10	11	6
		1/004	Path	No.	-	2	e	4	5	9	7	ω	6	10	1	12	13	14	15	16	17	18	19	20	21	22

					1																							1
				Total	0	0	0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	0	0	0	0	1.5	1.5	1.5	1.5	2 U
		fficient K		Contraction	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	C
u		Loss Coet		Expansion	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	C
h Descriptio	(B)		Turning and	Obstruction	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0	07
t Vent Pat	pray line(6 74(ft ²) • number 3	Eriotion		(ft)	8.21	8.21	8.21	15.53	11.14	11.14	17.45	17.76	17.76	18.59	18.59	15.53	11.14	11.14	17.45	8.21	8.21	8.21	8.21	15.53	11.14	11.14	17.45	19.01
ompartmen	ressurizer S Area : 0.146 ion : Volume		Diameter	(ft)	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86
surizer Co	Ik Type : P Break / reak locati		li enoth	(ff)	6.84	6.84	6.84	12.94	9.28	9.28	14.54	4.15	4.15	4.15	4.15	12.94	9.28	9.28	14.54	6.84	6.84	6.84	6.84	12.94	9.28	9.28	14.54	4.77
4-2 Pres	A. Brea B		Area	(ft ⁴)	54.36	64.09	64.09	17.34	42.97	42.97	20.19	32.62	32.62	38.45	38.45	17.34	42.97	42.97	20.19	54.36	54.36	64.09	64.09	17.34	42.97	42.97	20.19	32.62
Table 6.4		iption of	ath Flow	Unchoked	×	×	Х	Х	×	×	×	×	×	×	×	×	Х	Х	Х	Х	Х	×	×	×	Х	×	Х	×
		Descri	Vent P	Choked I																								
		oN a		Ъ	14	15	16	14	16	15	16	17	18	19	20	18	20	19	20	21	22	23	24	22	24	23	24	25
		Volum		From	10	11	12	13	13	14	15	13	14	15	16	17	17	18	19	17	18	19	20	21	21	22	23	21
		1/004	Path	No.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

	- 1			1		-	-		-	-			-		i			-	-	-		i				i	1
			Total	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.0
	fficient K		Contraction	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0
Ē	Loss Coet		Expansion	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	1.0
n Descriptio B)		Turning and	Obstruction	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0
t Vent Patl pray line(6 74(ft ²) number 3	Eriction	Lenath	(H)	19.01	19.83	19.83	15.53	11.14	11.14	17.45	7.96	7.96	7.96	7.96	15.53	11.14	11.14	17.45	17.29	17.29	18.18	18.18	16.34	12.30	12.30	18.58	6.70
mpartment ressurizer S Area : 0.146 on : Volume	Hvdraulic	Diameter	(ft)	6.86	7.45	7.45	3.95	7.37	7.37	4.44	6.86	6.86	7.45	7.45	3.20	5.13	5.13	3.51	8.04	8.04	8.67	8.67	4.39	6.46	6.46	4.70	8.04
surizer Cc k Type : P Break / reak locati	loartia	Lenath	(ft)	4.77	4.77	4.77	12.94	9.28	9.28	14.54	6.63	6.63	6.63	6.63	12.94	9.28	9.28	14.54	3.08	3.08	3.08	3.08	13.62	10.25	10.25	15.48	5.58
4-2 Pres A. Brea B		Area	(ft²)	32.62	38.45	38.45	22.63	56.07	56.07	26.35	54.36	54.36	64.09	64.09	11.00	27.25	27.25	12.80	42.62	42.62	49.96	49.96	20.52	42.27	42.27	22.94	71.04
Table 6.	iption of	ath Flow	Unchoked	×	Х	Х	Х	Х	Х	Х	×	Х	Х	×	×	Х	Х	Х	Х	Х	Х	×	Х	Х	Х	×	×
	Descri	Vent Pa	Choked I																								
	oN م		Ъ	26	27	28	26	28	27	28	29	30	31	32	30	32	31	32	33	34	35	36	34	36	35	36	37
	Volume		From	22	23	24	25	25	26	27	25	26	27	28	29	29	30	31	29	30	31	32	33	33	34	35	33
	Vant	Path	No.	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	99	67	68	69	70

			Total		1.0	1.0	1.0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.34	2.34
		ficient K	Contraction		0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
u		Loss Coet	Expansion		1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0
h Descriptio	(B)		Turning and	Ubstruction	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0.84	0.84
t Vent Pat	bray line(6 74(ft²)		Length	(11)	6.70	6.70	6.70	11.52	9.16	9.16	14.11	22.12	22.12	22.83	22.83	11.52	9.16	9.16	14.11	10.80	10.84
ompartmen	Area : 0.146		Diameter	(11)	8.04	8.67	8.67	6.42	7.37	7.37	6.55	9.31	9.31	9.81	9.81	8.82	10.71	10.71	9.07	4.19	4.98
surizer Co	Ik Type : P Break / reak locati		Length	(11)	5.58	5.58	5.58	9.60	7.63	7.63	11.76	4.60	4.60	4.60	4.60	9.60	7.63	7.63	11.76	9.00	9.03
t-2 Pres	A. Brea		Area (ft²)		71.04	83.26	83.26	42.93	63.06	63.06	45.17	52.01	52.01	59.34	59.34	78.67	115.54	115.54	82.76	20.75	32.78
Table 6.4		iption of	ath Flow	Unchoked	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х		
		Descr	Vent P	Choked																×	×
				0	38	39	40	38	40	39	40	41	42	43	44	42	44	43	44	45	45
				From	34	35	36	37	37	38	39	37	38	39	40	41	41	42	43	43	44
		1004	Path	.02	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87

Table 6	.4-3 Mass and Relea	se Rates for F	Pressurizer Compartme	ent Peak
	A Brook Type : Broo	ressure Analy	' Ses ino(6P) quillotino brook	
	A. Dieak Type . Fies Br	eak Area : 0.14	$4674(\text{ft}^2)$	
	CLG side	e	PZR side	
	020 010	5		
Time (s)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)
0.0	0	553.17	0	553.04
0.1	1600.1	548.339	3295.32	553.04
0.2	2006.11	550.733	3452	552.894
0.3	1966.72	551.529	3420.63	552.762
0.4	1929.23	551.594	765.924	1113.79
0.5	1907.49	551.538	750.243	1113.63
0.6	1896.45	551.493	744.831	1113.63
0.7	1891.79	551.471	742.468	1113.69
0.8	1890.68	551.466	740.672	1113.81
0.9	1891.53	551.472	738.839	1113.99
1.0	1893.14	551.483	736.888	1114.21
1.1	1895	551.495	734.873	1114.47
1.2	1896.65	551.508	732.72	1114.76
1.3	1897.9	551.518	730.477	1115.08
1.4	1898.62	551.526	728.163	1115.44
1.5	1898.74	551.531	725.721	1115.84
1.6	1898.32	551.534	723.224	1116.29
1.7	1897.37	551.534	720.879	1110.78
1.0	1090.94	551.532	717.57	1117.0
1.9	1801.08	551.529	718.88	1112.6
2.0	1880.63	551 522	710.00	1121 /3
2.1	1887.17	551 52	728.086	1121.43
2.2	1884 71	551 518	717 414	1120.00
2.0	1882.31	551 518	713 288	1120.00
2.5	1880.02	551 52	710.805	1120.92
2.6	1877.84	551.523	711.128	1121.27
2.7	1875.77	551.528	712.115	1121.75
2.8	1873.79	551.534	708.007	1122.02
2.9	1871.93	551.541	706.03	1122.2
3.0	1870.16	551.55	704.888	1122.5
3.1	1868.47	551.559	703.304	1122.8
3.2	1866.81	551.57	701.574	1123.09
3.3	1865.15	551.58	699.897	1123.38
3.4	1863.51	551.592	698.197	1123.68
3.5	1861.88	551.603	696.451	1123.99
3.6	1860.15	551.615	694.674	1124.29
3.7	1858.4	551.627	692.872	1124.61
3.8	1856.72	551.639	691.015	1124.92

Table 6	4-3 Mass and Relea. P	ise Rates for F	Pressurizer Compartme	ent Peak
	A. Break Type : Pres Br	surizer Spray li eak Area : 0.14	ine(6B) guillotine break	
	CLG side	e	PZR side	
Time (s)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)
3.9	1855.07	551.652	689.13	1125.24
4.0	1853.43	551.666	687.215	1125.56
4.1	1851.79	551.68	685.279	1125.89
4.2	1850.13	551.694	683.333	1126.22
4.3	1848.47	551.709	681.364	1126.56
4.4	1846.8	551.725	679.265	1126.9
4.5	1845.13	551.742	677.216	1127.24
4.6	1843.38	551.759	675.176	1127.6
4.7	1841.68	551.776	673.195	1127.97
4.8	1840.03	551.795	670.931	1128.33
4.9	1838.35	551.815	668.663	1128.69
5.0	1836.69	551.836	666.523	1129.08

		Table 6.4 B. Brea	-4 Pressi k Type : Pr Break	urizer con ressurizer r Break Area clocation :	1partment relief line(8 a : 0.2452(Volume nu	t Nodal de 3B) guilloti (ft ²) umber 39	scription ne break		
Volume		Height	Free	Initi	ial Conditic	suc	Calculated	Design	Maroin
No.	Description	(ff)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
.	Bottom of pressurizer compartment; EL=58"-5'	7.67	365	120	14.7	0	2.43	14	82.6
N	Bottom of pressurizer compartment; EL=58"-5'	7.67	365	120	14.7	0	2.46	14	82.5
3	Bottom of pressurizer compartment; EL=58"-5'	7.67	439	120	14.7	0	2.46	14	82.5
4	Bottom of pressurizer compartment; EL=58"-5'	7.67	439	120	14.7	0	2.42	14	82.7
5	EL=66"-1'	10.00	498	120	14.7	0	2.42	14	82.7
9	EL=66"-1'	10.00	498	120	14.7	0	2.43	14	82.6
7	EL=66"-1'	10.00	595	120	14.7	0	2.43	14	82.6
8	EL=66"-1'	10.00	595	120	14.7	0	2.41	14	82.8
6	EL=76"-1' (grating floor)	6.83	348	120	14.7	0	2.42	14	82.7
10	EL=76"-1' (grating floor)	6.83	348	120	14.7	0	2.42	14	82.7
11	EL=76"-1' (grating floor)	6.83	414	120	14.7	0	2.42	14	82.7
12	EL=76"-1' (grating floor)	6.83	414	120	14.7	0	2.42	14	82.7

		Table 6.4 B. Brea	-4 Press i k Type : Pr Break	urizer con essurizer r Break Area	npartment relief line({ a : 0.2452 Volume nu	t Nodal de 3B) guilloti (ft²) umber 39	sscription ne break		
Volume		Height	Free	Initi	al Conditio	SUC	Calculated	Design	Maroin
No.	Description	(H)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
13	EL=82"-11'	6.83	348	120	14.7	0	2.41	14	82.8
14	EL=82"-11'	6.83	348	120	14.7	0	2.40	14	82.8
15	EL=82"-11'	6.83	414	120	14.7	0	2.41	14	82.8
16	EL=82"-11'	6.83	414	120	14.7	0	2.41	14	82.8
17	EL=89"-9' (grating floor)	6.83	348	120	14.7	0	2.42	14	82.7
18	EL=89"-9' (grating floor)	6.83	348	120	14.7	0	2.41	14	82.8
19	EL=89"-9' (grating floor)	6.83	414	120	14.7	0	2.41	14	82.8
20	EL=89"-9' (grating floor)	6.83	414	120	14.7	0	2.42	14	82.7
21	EL=96"-7'	6.83	348	120	14.7	0	2.40	14	82.8
22	EL=96"-7'	6.83	348	120	14.7	0	2.40	14	82.9
23	EL=96"-7'	6.83	414	120	14.7	0	2.40	14	82.9
24	EL=96"-7'	6.83	414	120	14.7	0	2.41	14	82.8
25	EL=103"-5' (grating floor)	8.92	449	120	14.7	0	2.40	14	82.8
26	EL=103"-5' (grating floor)	8.92	449	120	14.7	0	2.42	14	82.8
27	EL=103"-5' (grating floor)	8.92	536	120	14.7	0	2.41	14	82.8
28	EL=103"-5' (grating floor)	8.92	536	120	14.7	0	2.40	14	82.8
29	EL=112"-4'	4.33	236	120	14.7	0	2.41	14	82.8

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		Table 6.4 B. Brea	4 Press i ak Type : Pr Break	urizer com essurizer r Break Area	ipartment elief line(8 a : 0.2452 Volume nu	t Nodal de 3B) guilloti (ft ²) umber 39	scription ne break		
Volume		Height	Free	Initi	al Conditio	suc	Calculated	Design	Maroin
No.	Description	(tt)	Volume (ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
30	EL=112"-4'	4.33	236	120	14.7	0	2.41	14	82.8
31	EL=112"-4'	4.33	278	120	14.7	0	2.41	14	82.8
32	EL=112"-4'	4.33	278	120	14.7	0	2.40	14	82.8
33	EL=116"-8' (grating floor)	5.80	412	120	14.7	0	2.41	14	82.8
34	EL=116"-8' (grating floor)	5.80	412	120	14.7	0	2.41	71	82.8
35	EL=116"-8' (grating floor)	5.80	483	120	14.7	0	2.44	14	82.6
36	EL=116"-8' (grating floor)	5.80	483	120	14.7	0	2.41	14	82.8
37	Top of Pressurizer; EL=122"-5.6'	5.37	434	120	14.7	0	2.41	14	82.8
38	Top of Pressurizer; EL=122"-5.6'	5.37	434	120	14.7	0	2.41	14	82.8
39	Top of Pressurizer; EL=122"-5.6'	5.37	500	120	14.7	0	2.47	14	82.4
40	Top of Pressurizer; EL=122"-5.6'	5.37	500	120	14.7	0	2.41	14	82.8
41	Top of Pressurizer compartment; EL=127"-10' (grating floor)	9.83	839	120	14.7	0	2.40	14	82.9

Subcompartment Analyses for US-APWR Design Confirmation

Mitsubishi Heavy Industries, Ltd.

MUAP-07031-NP(R0)

Volume	Description	Table 6. B. Brex Height	L-4 Press ak Type : Pr Break Free Volume	urizer con essurizer I Break Are: location : Initi	npartmen relief line({ volume nu al Conditit	t Nodal de 3B) guilloti (ft ²) umber 39 ons	scription ne break Calculated	Design Desk Press Diff	Margin																	
No.		(ft)	(ft ³)	Temp. (deg F)	Press. (psia)	Humid. (%)	(psid)	(psid)	(%)																	
42	Top of Pressurizer compartment; EL=127"-10' (grating floor)	9.83	839	120	14.7	0	2.39	14	82.9																	
43	Top of Pressurizer compartment; EL=127"-10' (grating floor)	9.83	959	120	14.7	0	2.39	14	83.0																	
44	Top of Pressurizer compartment; EL=127"-10' (grating floor)	9.83	959	120	14.7	0	2.38	14	83.0																	
45	Containment atmosphere	120	2861000	120	14.7	0	ı	·	-																	
			Total	1.5	1.5	1.5	1.5	1.95	0	0	0	0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	0	0
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	ifficient K		Contraction	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0
u.	Loss Coe		Expansion	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0
h Descriptic otine break 9		Turning and	Obstruction	0	0	0	0	0.45	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0
nt Vent Pat ne(6B) guill 452(ft ²) e number 3	T	Length	(Ħ)	15.53	11.14	11.14	17.45	9.24	10.60	10.60	10.60	10.60	15.53	11.14	11.14	17.45	19.66	19.66	20.48	20.48	15.53	11.14	11.14	17.45	8.21	8.21
compartme rizer relief li k Area : 0.2 [,] ion : Volum	0:1-0-2-1-1-	Hydraulic Diameter	(ft)	3.68	6.81	6.81	4.14	4.12	6.86	6.86	7.45	7.45	4.05	7.72	7.72	4.56	6.86	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86	6.86
surizer C : Pressu Breal 'eak locat	0	Length	(Ħ)	12.94	9.28	9.28	14.54	7.70	8.83	8.83	8.83	8.83	12.94	9.28	9.28	14.54	5.09	5.09	5.09	5.09	12.94	9.28	9.28	14.54	6.84	6.84
I-5 Pres reak Type Br		Area	(_ <u>L</u> L)	18.81	47.56	47.56	22.00	19.75	54.36	54.36	64.09	64.09	25.38	62.88	62.88	29.55	32.62	32.62	38.45	38.45	17.34	42.97	42.97	20.19	54.36	54.36
Table 6.4 B. B	ption of	ath Flow	Unchoked	×	Х	Х	×	×	Х	×	×	×	Х	Х	Х	×	Х	×	Х	×	×	Х	×	×	Х	×
	Descri	Vent P	Choked																							
		le NO.	То	2	4	3	4	45	5	6	7	8	9	8	7	8	6	10	11	12	10	12	11	12	13	14
		NUION	From	-	٢	2	3	4	-	2	3	4	5	5	9	7	5	9	7	8	6	6	10	11	6	10
	1//	Path	No.	-	2	3	4	5	9	7	8	6	10	11	12	13	14	15	16	17	18	19	20	21	22	23

				1																							
			Total	0	0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	0	0	0	0	1.5	1.5	1.5	1.5	0.7	0.7
	fficient K		Contraction	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0
u.	Loss Coe		Expansion	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	0	0
h Descriptic otine break 9		Turning and	Obstruction	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7
nt Vent Pat l ne(6B) guillc 452(ff ²) e number 39		Length	(Ħ)	8.21	8.21	15.53	11.14	11.14	17.45	17.76	17.76	18.59	18.59	15.53	11.14	11.14	17.45	8.21	8.21	8.21	8.21	15.53	11.14	11.14	17.45	19.01	19.01
Compartme rizer relief li k Area : 0.24 tion : Volum		Hydraulic Diameter	(ft)	7.45	7.45	3.70	6.55	6.55	4.12	98.9	6.86	7.45	7.45	3.70	6.55	6.55	4.12	6.86	98.9	7.45	7.45	3.70	6.55	6.55	4.12	98.9	6.86
surizer (: Pressu Brea eak locai	0:1-0-1	Length	(ff)	6.84	6.84	12.94	9.28	9.28	14.54	4.15	4.15	4.15	4.15	12.94	9.28	9.28	14.54	6.84	6.84	6.84	6.84	12.94	9.28	9.28	14.54	4.77	4.77
1-5 Pres reak Type Br		Area	(H)	64.09	64.09	17.34	42.97	42.97	20.19	32.62	32.62	38.45	38.45	17.34	42.97	42.97	20.19	54.36	54.36	64.09	64.09	17.34	42.97	42.97	20.19	32.62	32.62
Table 6. 4 B. B	otion of	ith Flow	Jnchoked	X	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	×
	Descrip	Vent Pa	Choked I																								
		e NO.	То	15	16	14	16	15	16	17	18	19	20	18	20	19	20	21	22	23	24	22	24	23	24	25	26
	1/01/100	VOINT	From	11	12	13	13	14	15	13	14	15	16	17	17	18	19	17	18	19	20	21	21	22	23	21	22
	11	Path	No.	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

			Total	0.7	0.7	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.0	1.0
	fficient K		Contraction	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0	0
u	Loss Coet		Expansion	0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0
h Descriptic otine break 9		Turning and	Obstruction	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0	0
nt Vent Pat ne(6B) guill 452(ft ²) e number 3	T riotion	Length	(Ħ)	19.83	19.83	15.53	11.14	11.14	17.45	7.96	7.96	7.96	7.96	15.53	11.14	11.14	17.45	17.29	17.29	18.18	18.18	16.34	12.30	12.30	18.58	6.70	6.70
compartme rizer relief li k Area : 0.2 tion : Volum	- History	Hydraulic Diameter	(ft)	7.45	7.45	3.95	7.37	7.37	4.44	6.86	6.86	7.45	7.45	3.20	5.13	5.13	3.51	8.04	8.04	8.67	8.67	4.39	6.46	6.46	4.70	8.04	8.04
<mark>surizer C</mark> : Pressu Brea eak locat		Length	(ff)	4.77	4.77	12.94	9.28	9.28	14.54	6.63	6.63	6.63	6.63	12.94	9.28	9.28	14.54	3.08	3.08	3.08	3.08	13.62	10.25	10.25	15.48	5.58	5.58
1-5 Pres reak Type Br		Area	(LLI)	38.45	38.45	22.63	56.07	56.07	26.35	54.36	54.36	64.09	64.09	11.00	27.25	27.25	12.80	42.62	42.62	49.96	49.96	20.52	42.27	42.27	22.94	71.04	71.04
Table 6. 4 B. B	otion of	ith Flow	Jnchoked	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	×	×
	Descrip	Vent Pa	Choked I																								
		5 NO.	То	27	28	26	28	27	28	29	30	31	32	30	32	31	32	33	34	35	36	34	36	35	36	37	38
		VOINTIN	From	23	24	25	25	26	27	25	26	27	28	29	29	30	31	29	30	31	32	33	33	34	35	33	34
	110.04	Path	No.	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	20	71

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			Total	1.0	1.0	1.5	1.5	1.5	1.5	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	2.34	2.34
	ficient K		Contraction	0	0	0.5	0.5	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
E	Loss Coet		Expansion	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	1.0
h Descriptic otine break		Turning and	Obstruction	0	0	0	0	0	0	0.7	0.7	0.7	0.7	0	0	0	0	0.84	0.84
nt Vent Patl ne(6B) guillc 452(ft ²) e number 39		Length	(Ħ)	6.70	6.70	11.52	9.16	9.16	14.11	22.12	22.12	22.83	22.83	11.52	9.16	9.16	14.11	10.80	10.84
Compartme rizer relief li k Area : 0.2 tion : Volum	- : - : - : -	Hydraulic Diameter	(ft)	8.67	8.67	6.42	7.37	7.37	6.55	9.31	9.31	9.81	9.81	8.82	10.71	10.71	9.07	4.19	4.98
surizer C : Pressu Breal eak locat		Length	(ff)	5.58	5.58	9.60	7.63	7.63	11.76	4.60	4.60	4.60	4.60	9.60	7.63	7.63	11.76	9.00	9.03
I-5 Pres reak Type Br		Area	(LLI)	83.26	83.26	42.93	63.06	63.06	45.17	52.01	52.01	59.34	59.34	78.67	115.54	115.54	82.76	20.75	32.78
Table 6.4 B. B	ption of	ath Flow	Unchoked	×	×	×	×	Х	×	×	×	Х	Х	×	Х	Х	×	×	X
	Descri	Vent Pa	Choked																
		le NO.	To	39	40	38	40	39	40	41	42	43	44	42	44	43	44	45	45
	1/01	voluit	From	35	36	37	37	38	39	37	38	39	40	41	41	42	43	43	44
		Path	No.	72	73	74	75	76	77	78	62	80	81	82	83	84	85	86	87

Table 6.4-6 M	ass and Release Rates for Pressu	rizer Compartment Peak
B Br	Pressure Analyses	guillotine break
D. DI	Break Area : 0 2452(ft ²	
	Break location : Volume num	, ber 39
Time (s)	Mass Release Rate (Ibm/s)	Enthalpy (BTU/lbm)
0.0	0	1114.35
0.1	1256.17	1114.35
0.2	1326.07	1113.96
0.3	1275.48	1113.53
0.4	1240.16	1113.23
0.5	1233.33	1113.28
0.6	1226.4	1113.31
0.7	1221.06	1113.53
0.8	1216.62	1113.85
0.9	1210.88	1114.24
1.0	1205.73	1114.69
1.1	1200.24	1115.16
1.2	1194.76	1115.67
1.3	1189.36	1116.2
1.4	1229.29	1117.89
1.5	1231.69	1118.88
1.6	1194.66	1118.09
1.7	1191.56	1118.22
1.8	1181.79	1118.34
1.9	1180.8	1118.76
2.0	1174.85	1119.06
2.1	1167.41	1119.31
2.2	1172.98	1120.04
2.3	1154.24	1120.08
2.4	1156.23	1120.82
2.5	1148.86	1121.33
2.6	1144.06	1121.92
2.7	1138.77	1122.5
2.8	1133.07	1123.08
2.9	1126.84	1123.64
3.0	1120.88	1124.24
3.1	1113.96	1124.84
3.2	1107.65	1125.49
3.3	1101.38	1126.17
3.4	1095.26	1126.88
3.5	1089.52	1127.61
3.6	1084.04	1128.37
3.7	1078.77	1129.13
3.8	1073.75	1129.88
3.9	1068.86	1130.62
4.0	1064.09	1131.33
4.1	1059.46	1132.01

Table 6.4-6 Mas B. Brea	s and Release Rates for Press Pressure Analyses k Type : Pressurizer relief line(8 Break Area : 0.2452(Break location : Volume nu	surizer Compartment Peak B) guillotine break (ft ²) umber 39
Time (s)	Mass Release Rate (lbm/s)	Enthalpy (BTU/lbm)
4.2	1054.95	1132.66
4.3	1050.55	1133.28
4.4	1046.25	1133.88
4.5	1042.04	1134.45
4.6	1037.91	1135
4.7	1033.85	1135.53
4.8	1029.86	1136.04
4.9	1025.92	1136.53
5.0	1022.04	1137.02

	Table 6.4-7 Pres	surizer co C Break	Tvne : Pres	t Nodal D surizer sp	escription	n (nodali: 3) quillotin	zation sensitivity e break	r study)	
			Break lo	eak Area : cation : V	0.14674(i olume nur	ft ²) nber 3			
Volume		Height	Free	Initi	ial Conditi	suo	Calculated	Design	Mardin
No.	Description	(H)	Volume (ft³)	Temp. (deg F)	Press. (psia)	Humid. (%)	Peak Press. Diff. (psid)	Peak Press. Diff. (psid)	(%)
-	Bottom of pressurizer compartment; EL=58"-5'	7.67	1609	120	14.696	0	6.60	71	52.9
2	EL=66"-1	10.00	2186	120	14.696	0	6.65	71	52.5
с	EL=76"-1' (grating floor)	6.83	1525	120	14.696	0	6.52	71	53.4
4	EL=82"-11	6.83	1525	120	14.696	0	6.56	71	53.1
5	EL=89"-9' (grating floor)	6.83	1525	120	14.696	0	6.39	71	54.4
9	ET=96"-7'	6.83	1525	120	14.696	0	6.34	71	54.7
7	EL=103"-5' (grating floor)	8.92	1969	120	14.696	0	6.10	71	56.4
∞	EL=112"-4'	4.33	1338	120	14.696	0	6.17	71	55.9
6	EL=116"-8' (grating floor)	5.80	1791	120	14.696	0	6.14	71	56.2
10	Top of Pressurizer; EL=122"-5.6'	5.37	1868	120	14.696	0	6.11	71	56.4
11	Top of Pressurizer compartment; EL=127"-10' (grating floor)	9.83	3597	120	14.696	0	6.05	14	56.8
12	Containment atmosphere	120.0	2861000	120	14.696	0	I	-	ı

Subcompartment Analyses for US-APWR Design Confirmation

			Total	1.95	0.0	0.7	0.0	0.7	0.0	0.7	1.0	0.7	1.0	0.7	2.34	2.34
study)	ficient K		Contraction	0.5	0	0	0	0	0	0	0	0	0	0	0.5	0.5
sensitivity :	Loss Coel		Expansion	1.0	0	0	0	0	0	0	1.0	0	1.0	0	1.0	1.0
odalization otine break		Turning and	Obstruction	0.45	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0.84	0.84
e(6B) guill- 74(ft ²) number 3	Friction	Length	(Ħ)	17.96	10.60	23.88	8.21	21.99	8.21	23.24	96'.2	22.80	6.70	36.78	17.89	17.86
t path desc zer spray lin vrea : 0.146 on : Volume	Hvdraulic	Diameter	(ft)	4.12	9.86	9.86	9.86	9.86	9.86	9.86	9.86	11.94	11.94	19.70	4.98	4.19
ment Ven : Pressuriz Break A eak locati	Inertia	Length	(Ħ)	14.97	8.83	5.09	6.84	4.15	6.84	4.77	6.63	3.08	5.58	4.60	14.91	14.88
r compart reak Type Bi		Area	(11)	19.75	236.91	142.15	236.91	142.15	236.91	142.15	236.91	185.16	308.60	222.69	32.78	20.75
ressurize C. Bı	ption of	ath Flow	Unchoked		Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	×
е 6.4-8 Р	Descri	Vent Pa	Choked I	×												
Table	e No.		To	12	2	с	4	5	9	7	8	6	10	11	12	12
	Volume		From	-	٢	2	3	4	5	9	7	8	6	10	11	11
	Vent	Path	No	-	2	e	4	2	9	7	8	6	10	11	12	13

	Marain	(%)	81.1	81.2	81.3	81.4	81.5	81.7	81.6	81.6	81.6	81.6	81.9	I
study)	Design	Peak Press. Diff. (psid)	4	14	14	14	14	14	14	14	14	14	14	ı
zation sensitivity e break	Calculated	Peak Press. Uiff. (psid)	2.64	2.63	2.62	2.60	2.60	2.57	2.58	2.58	2.58	2.58	2.54	I
i (nodali z) guillotin ber 10	su	Humid. (%)	0	0	0	0	0	0	0	0	0	0	0	0
scription ef line(8B) \rea : ume num	Il Conditio	Press. (psia)	14.696	14.696	14.696	14.696	14.696	14.696	14.696	14.696	14.696	14.696	14.696	14.696
: Nodal De surizer reli Break / ation : Vol	Initia	Temp. (deg F)	120	120	120	120	120	120	120	120	120	120	120	120
Type : Press Break loc	Free	Volume (ft ³)	1609	2186	1525	1525	1525	1525	1969	1338	1791	1868	3597	2861000
surizer co C. Break	Heiaht	(ft)	7.67	10.00	6.83	6.83	6.83	6.83	8.92	4.33	5.80	5.37	9.83	120.0
Table 6.4-9 Pres	: (Description	Bottom of pressurizer compartment; FI =58"-5'	EL=66"-1	EL=76"-1' (grating floor)	EL=82"-11	EL=89"-9' (grating floor)	EL=96"-7'	EL=103"-5' (grating floor)	EL=112"-4'	EL=116"-8' (grating floor)	Top of Pressurizer; EL=122"-5.6'	Top of Pressurizer compartment; EL=127"-10' (grating floor)	Containment atmosphere
	Volume	No.	-	2	ო	4	5	9	7	∞	6	10	11	12

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		Total	1.95	0.0	0.7	0.0	0.7	0.0	0.7	1.0	0.7	1.0	0.7	2.34	2.34
udy)	ficient K	Contraction	0.5	0	0	0	0	0	0	0	0	0	0	0.5	0.5
ensitivity st	Loss Coef	Expansion	1.0	0	0	0	0	0	0	1.0	0	1.0	0	1.0	1.0
alization se le break		Turning and Obstruction	0.45	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0.84	0.84
iption (nod 8B) guillotin umber 10	Friction	(ff)	17.96	10.60	23.88	8.21	21.99	8.21	23.24	7.96	22.80	6.70	36.78	17.89	17.86
Path Descr er relief line(eak Area : 1 : Volume n	Hydraulic Diamotor	(ft)	4.12	9.86	9.86	9.86	9.86	9.86	9.86	9.86	11.94	11.94	19.70	4.98	4.19
ment Vent Pressurize Bu ak locatior	Inertia	(ff)	14.97	8.83	5.09	6.84	4.15	6.84	4.77	6.63	3.08	5.58	4.60	14.91	14.88
· compart r eak Type : Bre	Area	(ft²)	19.75	236.91	142.15	236.91	142.15	236.91	142.15	236.91	185.16	308.60	222.69	32.78	20.75
ressurizer C. Br	iption of ath Flow	Unchoked	×	×	×	×	×	×	×	Х	Х	×	Х	×	Х
e 6.4-10 F	Descri Vent P	Choked													
Tabl	, No.	To	12	2	ო	4	5	9	7	8	6	10	11	12	12
	Volume	From	~	٢	2	3	4	5	9	7	8	6	10	11	11
	Vent	No.	Ţ	2	e	4	2	9	7	8	6	10	11	12	13

for US-APWR E	Desigr	n Conf	irm	atio	on		
		Total	1.95	0.0	0.7	0.0	0.7
	¥	action	5	_	_		

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Figure 6.4-3 Nodalization scheme for pressurizer compartment analysis



Figure 6.4-4 Nodalization Diagram for Pressurizer Compartment Analysis

Figure 6.4-5 Nodalization scheme for pressurizer compartment sensitivity analysis about nodalization



















Figure 6.4-10 Pressure transient at the peak pressure node (V3) in pressurizer compartment (Pressurizer spray line break)



Figure 6.4-11 Short term mass and energy release data for pressurizer compartment Pressurizer relief line break (1/2)







Figure 6.4-13 Pressure transient at the peak pressure node (V39) in pressurizer compartment (Pressurizer relief line break)



Figure 6.4-14 Pressure transient at the break node in sensitivity study about nodalization (Pressurizer spray line break)



Figure 6.4-15 Pressure transient at the break node in sensitivity study about nodalization (Pressurizer relief line break)

7.0 Conclusions

The calculated peak differential pressures during the pipe break transients for each subcompartment were compared favorably to the allowable structural design differential pressures. This comparison demonstrates that the subcompartment walls withstand the peak differential pressures during postulated breaks of any high-pressure line within any subcompartment.

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