U.S. EPR Final Safety Analysis Report Markups for Sections 6.2.1 and 6.2.2

6.2 Containment Systems

The U.S. EPR containment systems include the containment, the containment isolation system, and the containment combustible gas control system. These systems contain radionuclides released from the fuel during postulated accidents, preventing further release to the balance of the plant and the environment, and limit the accumulation of combustible gases generated during the accident.

The design basis accidents (DBA) for the containment systems are defined as the most limiting events with respect to design limits within a spectrum of postulated loss of coolant accidents (LOCA) and secondary system pipe ruptures. DBA mitigation depends upon the high reliability of these containment systems. This section provides the design criteria, design features, and evaluations that demonstrate that these systems will function within their specified limits.

6.2.1 Containment Functional Design

The U.S. EPR Reactor Building consists of a cylindrical reinforced concrete outer Shield Building, a cylindrical post-tensioned concrete inner Containment Building with a steel liner, and an annular space between the two buildings. The Shield Building protects the Containment Building from external hazards.

The containment is designed to withstand the environmental and dynamic effects associated with both normal plant operation and postulated accidents (GDC 4).

The containment instrumentation is capable of monitoring variables and systems over their anticipated ranges for all normal operations, for anticipated operational occurrences, and for accident conditions as appropriate to safety, including those variables and systems that can affect the containment and its associated systems. Appropriate controls maintain these variables and systems within prescribed operating ranges (GDC 13).

The containment and its associated systems establish a barrier against the uncontrolled release of radioactivity to the environment, and incorporate sufficient margin in their design so that conditions important to safety are not exceeded for as long as postulated accident conditions require (GDC 16).

The containment is segregated into two zones delineating areas that are accessible during normal operation from those that are inaccessible. Equipment rooms immediately surrounding the Reactor Coolant System (RCS) are isolated from the rest of the containment during normal operation. Beyond this inner region, personnel access can be allowed for certain maintenance tasks. Separation is provided by structures and closed portals to minimize radiation exposure in the accessible areas. During power operation, the inaccessible areas inside containment (the “equipment space”) experience higher temperatures than the accessible areas because they are

exposed to the hot walls of the nuclear steam supply system. The cooler, accessible areas are the "service space."

In the event of an accident, communication is established between the two zones by opening dampers and foils, thereby transforming the containment into a single convective volume. This transformation into a single convective volume is performed by the CONVECT system, which equalizes pressure between the containment compartments and promotes efficient mixing of the atmosphere by establishing a global convective pathway. The CONVECT system of convection foils, rupture foils, and mixing dampers is part of the combustible gas control system (CGCS).

The containment is designed so that the CONVECT system, in conjunction with recirculation features built into the in-containment refueling water storage tank (IRWST) and re-alignment of the emergency core cooling system (ECCS) system to the hot legs, will rapidly reduce the containment pressure and temperature following a LOCA. These systems maintain the containment pressure and temperature at acceptably low levels (GDC 38). As a result, the containment can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any LOCA (GDC 50).

The containment is provided with the means for monitoring the reactor containment atmosphere, spaces containing components for recirculation of LOCA fluids, effluent discharge paths, and the plant environs for radioactivity that may be released during normal operations, including anticipated operational occurrences, and from postulated accidents (GDC 64).

The containment conforms to the functional requirements of 10 CFR part 50, Appendix K, which defines acceptable evaluation models and calculation of minimum containment pressure for evaluating ECCS capability, specifically for sources of heat during the LOCA and containment pressure control requirements. Refer to Section 15.6.5 for compliance with 10 CFR part 50, Appendix K requirements.

Section 6.2.1.1 addresses those aspects of containment design and evaluation that relate to its accident mitigation functions. Containment performance during refueling operations and reduced primary inventory conditions are discussed in Section 6.2.1.1.1, and the disposition of GL 88-17 for the U.S. EPR design is provided in Section 5.4.7.2.1 and in Table 15.0-60. Section 3.8 provides a physical description of the containment and presents the design criteria relating to construction techniques, static loads, and seismic loads.

6.2.1.1 Containment Structure

6.2.1.1.1 Design Bases

The containment's structures, systems, and components (SSC) that are important to safety are designed to withstand the environmental and dynamic effects associated with both normal plant operation, including maintenance and testing, and postulated accidents. The environmental effects include the temperatures, pressures, and fluids encountered during normal and accident conditions. The dynamic effects include those arising from in-plant equipment failures or accidents, including missiles, pipe whipping, and fluid discharge, as well as those resulting from events and conditions outside the containment (e.g., tornadoes, earthquake, or aircraft impact).

The containment and its associated systems are designed to be a leaktight barrier against the release of radioactivity to the environment and are designed to remain functional during a DBA. By meeting these performance requirements, including requirements for access openings and penetrations of the structure and its internal compartments, the containment is designed to accommodate the calculated pressures and temperatures resulting from a LOCA without exceeding its designed leakage limits. It can do so with margin for extra energy sources and degraded engineered safety features (ESF), and using conservative calculational methods.

The radiological consequences of the DBA are presented in Section 15.0.3. The containment, containment systems, and ESF act to limit the release of radioactive material subsequent to a DBA, so that the release does not exceed the limits specified in 10 CFR 52.47(a)(2)(iv).

Containment design calculations assume the following for an RCS pipe rupture:

- The postulated rupture occurs concurrently with the worst single active failure.
- The systems used to mitigate the consequences of a postulated pipe rupture are protected against dynamic effects, including the effects of missiles, pipe whipping, and fluid discharge, that may result from equipment failures and from events and conditions outside the nuclear power unit subject to design loadings from a safe shutdown earthquake.
- The offsite electrical power system is evaluated to provide the most limiting condition for each postulated break, for example, a loss of offsite power (LOOP) or no LOOP.
- The building doors that are non-safety are conservatively not allowed to open during postulated pipe ruptures.
- Discharge coefficients (Cd) and backpressure values are assumed, so as to produce the most limiting condition for each postulated break.

- Multiple pipe breaks do not occur simultaneously or consecutively.

The postulated RCS pipe ruptures are listed in Table 6.2.1-1—Loss of Coolant Accidents, and are described in Section 6.2.1.3. Section 6.2.1.3.1 provides the mass and energy release data for the LOCA.

Containment design calculations assume the following events occur for a secondary system pipe rupture:

- The postulated pipe rupture occurs with the worst single active failure of the main steam isolation valve (MSIV) for the MSLB.
- The offsite electrical power system is assumed to be available for the continued operation of the reactor coolant pumps (RCP) to maximize the primary to secondary heat transfer.
- The building doors that are non-safety related are conservatively not allowed to open during postulated pipe ruptures.
- Multiple pipe breaks do not occur simultaneously or consecutively.

The postulated secondary pipe ruptures are listed in Table 6.2.1-2—Main Steam Line Breaks and are discussed in Section 6.2.1.4. Section 6.2.1.4.3.2 discusses the mass and energy release data for the MSLB.

The analyses of the primary and secondary pipe ruptures for the U.S. EPR design employ a multi-volume GOTHIC model to examine the long-term containment response. The model includes a mesh-style nodalization of the containment dome region to ensure that the potential for thermal stratification was adequately addressed.

Containment overpressurization events during refueling operations and reduced primary inventory conditions are mitigated by residual heat removal (RHR) system design features as discussed in Section 5.4.7. These features prevent a loss of decay heat removal and do not result in a challenge to containment closure. Technical Specifications, Chapter 16, addresses containment integrity during fuel movement.

The loads on the internal structures are calculated using the differentials between the maximum calculated subcompartment pressures and 14.7 psia, the pressure of the containment atmosphere at the time of peak subcompartment pressure. These subcompartment pressures are specified conservatively for the analyses discussed in Section 6.2.1.2.

The U.S. EPR design does not have an automatic containment spray system or containment air coolers for DBA mitigation. Thus, the U.S. EPR design is not susceptible to inadvertent actuation of those systems, or the potential for damage because of the rapid reduction of the containment internal pressure that would result

from such an inadvertent actuation. The severe accident heat removal system (SAHRS) described in Section 19.2, includes a manually-actuated containment spray system dedicated to severe accident mitigation. This system is not used for DBAs. Because the SAHRS must be manually aligned and manually actuated, it is not subject to a single failure that could cause inadvertent actuation of containment spray, thereby eliminating the need to analyze for this event.

Containment heat removal is performed by recirculation of the reactor coolant from the IRWST, through the low-head safety-injection (LHSI) heat exchangers, to the RCS, and through the break back to the IRWST. The LHSI is part of the safety injection system (SIS) discussed in Section 6.3. The effects of the containment heat removal function of the LHSI heat exchangers are included in the determination of the containment pressure and temperature response discussed in Sections 6.2.1.3 and 6.2.1.4. The containment design evaluation considers the most limiting single failures for the SIS in the development of the long-term model for containment pressure and temperature response.

The principal parameters affecting postaccident pressure reduction are the heat absorbed by the heat sinks inside the containment and the heat transferred to the containment sumps, which are contained in the IRWST. A conservative amount of heat sink material has been calculated, and its heat absorption capability has been considered in the containment design evaluation discussed in Section 6.2.1.1.3.

The amount of heat transferred through the containment wall and dome to the outside atmosphere is determined to be insignificant as the transport time exceeds 24 hours. Therefore, this is neglected from the analytical models described in Sections 6.2.1.3 and 6.2.1.4.

Heat is transferred from the containment to the outside environment during an accident via the LHSI heat exchangers, which are cooled by the component cooling water system (CCWS). The CCWS is cooled by the essential service water system (ESWS). The ESWS is described in Section 9.2.1, and the CCWS is described in Section 9.2.2. Limiting single failures of the LHSI heat exchangers cooling chain are considered in the development of the long-term model for containment temperature and pressure response. The capabilities of the LHSI heat exchangers are provided in Table 6.2.1-3—LHSI Heat Exchanger Data.

To meet the containment safety design basis of limiting the release of radioactive material from a DBA LOCA to acceptable limits, the containment pressure is required to be reduced to less than 50 percent of the peak containment pressure within 24 hours after the LOCA. Chapter 15 discusses the analysis of the offsite radiological consequences of the accident and provides the basis for the containment depressurization rate.

The determination and evaluation of the minimum containment pressure transient are addressed in Section 6.2.1.5.

6.2.1.1.2 Design Features

The principal containment design features impacting the post accident pressure and temperature response are the IRWST, the CONVECT system and passive heat sinks inside the containment.

The function of the IRWST is to provide a large reserve of borated water. It is the safety-related source of water for emergency core cooling in the event of a LOCA, and is a source of water for containment cooling and for core melt cooling in the event of a severe accident. The IRWST contains a minimum of 500,000 gallons of borated water and is maintained at a temperature between 60°F and 122°F. The IRWST resides at the lowest point in the containment, and drain paths allow water discharged from the RCS to drain into the IRWST.

Containment heat removal is accomplished by recirculation of cooled IRWST water injected into the RCS where the ECCS absorbs residual energy. The heated ECCS returning to the IRWST is subsequently cooled by LHSI heat exchangers.

The CONVECT system, consisting of rupture and convection foils in the steam generator equipment room ceiling and mixing dampers in the wall between the lower accessible area and the IRWST air space, transforms the two-room containment into a one-room containment. A steel framework at the upper boundary of the steam generator equipment rooms, houses rupture and convection foils with a combined opening area of 855 ft^2.

Large break LOCA (LBLOCA) and small break LOCA (SBLOCA) events establish different requirements for flow cross sectional area which is achieved by the different system components. For the LBLOCA, the full cross sectional area (855 ft^2) is used to limit the pressure peak. As a consequence of low mass and energy release during a SBLOCA event, the opening of all the rupture foils may not occur. For effective steam distribution in the containment, a minimum free-flow cross-sectional area of 480 ft^2 is fulfilled by the convection foils alone.

Eight fail-safe-open mixing dampers, with a total free flow cross-sectional area of 64 ft^2, connect the IRWST air space to the lowest accessible room. These open passively via spring tension on loss of power in fail-safe mode. They can also be opened and closed manually.

The passive heat sinks inside the primary containment consist of all painted and unpainted concrete, steel structures and liner for the containment shell and IRWST surfaces. The IRWST heat sinks are exposed to the water in the pool. The remaining

heat sinks are exposed to the containment atmosphere. These areas are approximately the same temperature as the containment ambient temperature during normal plant operation. The list of passive heat sinks in the U.S. EPR Containment and their parameters are listed in Table 6.2.1-4—Containment Heat Sink Inventory. Selected heat sinks were not included in the containment pressure-temperature analysis for conservatism. The minimum heat sink surface area for Tier 1, Section 2.1.1.1 is 64,998 m^2 or 699,633 ft^2.

The design pressure of the containment is 62 psig. Calculated containment pressures, based on the conservative analyses, are described in Sections 6.2.1.3 and 6.2.1.4.

The functional capability and frequency of operation of the systems provided to maintain the containment and subcompartment atmospheres within prescribed pressures, temperatures, and humidity limits during normal operation are discussed in Section 9.4.7.

6.2.1.1.3 Design Evaluation

Containment and subcompartment design parameters are provided in Table 6.2.1-5—Containment Initial and Boundary Conditions, and Table 6.2.1-4. The general arrangement drawings for the reactor containment are provided in Section 3.8.1. The structural design of the containment and the subcompartments, as well as the applicable codes, standards and guides that apply to the design of the containment structure, are addressed in Section 3.8. The structural design considers the effects of postulated piping ruptures, as discussed in Section 3.6.

The severity of the temperature rise and pressure peak resulting from a LOCA or MSLB depends upon the nature, size, and location of the postulated rupture. The U.S. EPR containment is designed to contain the energy released from the RCS in the event of a LOCA or from the steam generator (SG) during an MSLB.

In the case of a LOCA, reactor coolant at the primary system temperature is the source of the mass and energy released into the containment. A portion of the coolant is converted to steam and will remain as steam if its enthalpy is sufficient. Coolant released from the primary system causes an increase in containment steam mass, which in turn increases pressure and temperature.

Following a postulated LBLOCA, the rupture foils burst open to join the accessible and inaccessible parts of the containment building. In addition, the mixing dampers open to enable atmospheric circulation within the whole containment. These combined measures establish a global atmospheric natural convection loop within the containment. In the case of the SBLOCA, the convection foils open along with the mixing dampers to enable atmospheric circulation within the whole containment.

The blowdown pressure rise is limited by the free volume of the containment. The containment pressure rises until pressure between the primary system and the containment equalizes, and flow through the break decreases to an equilibrium value.

Following blowdown, the water vapor condenses on the containment heat sinks located throughout the Containment Building, and the saturated water drains along the intermediate floors, grates, stairwells, and walls to the heavy floor of the Containment Building. Curbed grates in the heavy floor drain directly to the IRWST, which in turn creates a fully-developed recirculation path from the IRWST to the reactor pressure vessel through the LHSI heat exchangers. Manual re-alignment of the LHSI to the hot legs suppresses core steaming and the long-term pressure peak is limited by the steam condensation on the passive heat sinks of the containment. The spectrum of postulated LOCA accidents analyzed is provided in Table 6.2.1-1.

In the case of the MSLB, the CONVECT system again allows atmospheric circulation within the whole containment via the rupture foils and the mixing dampers. The affected SG quickly depressurizes leading to full isolation of the main steam and main feedwater systems. A failure of a Main Steam Isolation Valve (MSIV) allows the faulted SG to completely blowdown into the containment. Additional feedwater (MFW or EFW) injected in the faulted SG vaporizes and is released to containment. The spectrum of postulated MSLB accidents analyzed is provided in Table 6.2.1-2. The analyses are terminated when the faulted SG empties and all sources of feedwater to the faulted SG are isolated.

The analytical model and computer code designed to predict containment pressure and temperature responses following the accidents are described in this section. A summary of the predictions for LOCAs is listed in Table 6.2.1-6, Table 6.2.1-7, and Table 6.2.1-8, and for MSLBs in Table 6.2.1-9.

Table 6.2.1-6, Table 6.2.1-7, and Table 6.2.1-8 present fifty-one separate cases for LOCA analysis for three postulated break locations. Thirty-eight cases are analyzed using a simple single-node containment model to evaluate the effects of maximum and mainimum ECCS flow, break discharge coefficients, and single failures to establish the limiting scenarios for the multi-node analysis. For the LOCA, the limiting containment pressure occurs during the blowdown phase of a double-ended guillotine break in the RCS hot leg piping, with the worst single failure being the loss of one ESF train with an additional ESF train being out service for maintenance.

Table 6.2.1-9 lists forty-three cases for the MSLB, with five break sizes ranging from the double-ended guillotine break to the 0.1 square foot break area, and power levels from 100 percent to 0 percent of rated thermal power (RTP). The peak containment pressure results from the assumed double-ended guillotine MSLB with a failure of one MSIV at 20 percent RTP.

The requirements of 10 CFR part 50, Appendix K, Part I.A list the required features of the evaluation models for sources of heat during the LOCA. For the heat sources of 10 CFR part 50, Appendix K, it must be assumed that the reactor has been operating continuously at a power level at least 1.02 times rated thermal power to allow for instrumentation error. The assumed power level may be decreased provided the proposed alternative value has been demonstrated to account for uncertainties of power level with a lower instrumentation error. The core power is measured using a secondary side-heat balance with feedwater flow rate. A heat balance measurement uncertainty of approximately 0.5 percent of rated thermal power, or 1.005, is applicable to the core power for the U.S. EPR design. This value is achieved with the use of an ultrasonic flow meter for the feedwater flow rate. This value is consistent with the assumption used in the safety analysis in Section 15.0.0.3.1.

The heat removal due to safety injection system/residual heat removal (SIS/RHR) system operation is simulated in the GOTHIC Version 7.2b computer code by specifying heat exchanger input values from Table 6.2.1-3. The GOTHIC heat exchanger model was benchmarked against heat exchanger performance data to provide a conservative representation.

Table 6.2.1-5 lists the initial containment conditions, based on the range of the normal expected conditions within the containment, with consideration given to maximizing the calculated peak containment pressure. Selection of these conditions is described in Analysis of Containment Response to Postulated Pipe Ruptures Using GOTHIC. (Reference 1)

The highest calculated containment pressure is produced by a hot leg break LOCA with the single active failure of one train of ECCS. A summary of the results of the containment pressure and temperature analyses for the spectrum of postulated LOCAs is listed in Table 6.2.1-6, Table 6.2.1-7, and Table 6.2.1-8, and for MSLBs in Table 6.2.1-9.

The IRWST is located near the basement floor of the Containment Building. The tank contains a minimum of 500,000 gallons of borated water and is maintained at a temperature between 60°F and 122°F. For the most limiting DBA, the IRWST temperature remains within the limit that supports continuous operation of the safety injection pumps to mitigate the consequences of the accident. The operation of the safety injection pumps provides the necessary cooling to limit containment temperature and pressure within design requirements. A graph illustrating IRWST temperature versus time is presented in Figure 6.3-7.

The SIS has four accumulators to provide water to the RCS in the event of a LOCA. The accumulators' non-condensable cover gas (nitrogen) and the mass and energy release rates of the accumulators are included in the short-term model, and are supplied as input boundary conditions to the forcing functions in the long-term

GOTHIC model. The nitrogen is assumed to enter the containment starting at time zero and is completely released at time 20 seconds, although the actual release of the nitrogen does not occur until the accumulators' liquid empties into the RCS loops. The calculations require that the nitrogen gas be assigned a temperature value. Since the nitrogen is stored within the accumulators above the water volume, the gas expands as the water drains from the accumulator into the RCS. The expansion results in polytrophic (pV^n) cooling. The cooled gas flows from the accumulators through the RCS piping, and to the containment atmosphere, where it mixes with the RCS coolant, causing the nitrogen temperature to rise to the RCS coolant temperature. Since the RCS is depressurizing through the break, the RCS temperature would be lower than the normal operating temperatures. A bounding value of 565.5°F is assigned to the nitrogen. This value corresponds to the RCS cold leg temperature. This conservative assumption is applied with all break locations.

The long-term system behavior during various LOCAs has been evaluated to verify the ability of the SIS/RHR system to keep the reactor vessel flooded and maintain the containment within design conditions following a LOCA. This evaluation is based on the conservative predictions of the performance of the ESF consistent with the single failures assumed for each accident analyzed.

After a DBA, the conditions in containment are measured by post-accident monitoring instrumentation described in Section 7.5.

6.2.1.2 Containment Subcompartments

6.2.1.2.1 Design Basis

The containment internal compartments protect against dynamic effects, including the effects of missiles, pipe whipping, and fluid discharge, that result from equipment failures and from events and conditions outside the containment. The containment internal compartments designed to accommodate the effects of environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs (GDC 4).

The reactor containment structure design, including access openings and penetrations, allows the containment internal compartments to accommodate the calculated pressure and temperature conditions resulting from any LOCA. The design must withstand these conditions without exceeding the design leakage rate requirement (GDC 50).

Subcompartments within containment can withstand the transient differential pressures of a postulated pipe breaks. The subcompartment walls are challenged by the differential pressures resulting from a postulated break in a high-energy line break (HELB) within individual compartments. These rooms are arranged to allow venting

of HELBs to prevent differential pressures from reaching the structural limits of compartment walls.

Fluid systems are considered high energy when, during normal plant conditions, the systems are operated or maintained under conditions where either or both of the following criteria are met:

- Operating temperature exceeds 200°F.
- Operating pressure exceeds 275 psig.

Fluid systems are considered moderate-energy systems when operated at the above conditions for 2 percent or less of the time the systems are in operation, or for less than 1 percent of the plant operation time.

For the U.S. EPR design, the leak before break (LBB) concept is applied (Section 3.6.3) to preclude the need to design components, piping, and supports for the structural dynamic effects of postulated large or double-ended primary system pipe ruptures equal to the pressurizer surge line area or larger. The LBB concept also precludes the need to consider double-ended steam line ruptures in the structural design of the steam system components and supports.

6.2.1.2.2 Design Features

The general arrangement drawings for the reactor containment are provided in Section 3.8.1. These drawings form the basis of the subcompartment analysis models. Simplified drawings illustrating the model used for the containment subcompartment analyses are provided in this section.

The subcompartments identified to undergo the highest concentrated loading conditions, such as nuclear steam supply system (NSSS) supports, are selected for determination of the differential pressures across the supporting walls. The combination of the NSSS concentrated loads and the subcompartment differential pressure creates critical loading scenarios on the supporting structural elements. These elements are then labeled as critical sections for the Reactor Building interior structures. Appendix 3E presents the Reactor Building critical sections and the structural evaluations associated with them.

Subcompartments adjacent to critical sections are evaluated based on the mass and energy flux from each high-energy line in the compartment (Table 6.2.1-10). Subcompartments without high-energy lines are omitted from further analyses.

The U.S. EPR principal containment subcompartment design parameters are provided in Table 6.2.1-11, Table 6.2.1-12, Table 6.2.1-13, and Table 6.2.1-14, which include the free volume and vent area for each critical subcompartment along with the

neighboring subcompartment volumes. The vent paths considered in the subcompartment analysis include open doors, grates, and through-wall openings. The effects of vent areas that become available after the occurrence of a postulated pipe break (e.g., blowout panels, hinged doors, collapsing insulation) are specifically noted and conservatively treated.

6.2.1.2.3 Design Evaluation

High-energy lines identified for the critical subcompartments are compared based on the full-power operating conditions. The mass flux from the postulated double-ended pipe rupture is then calculated using the Homogeneous Equilibrium Model (HEM). With the cross-sectional area for each of the high-energy lines known, the energy flux is calculated. The highest energy flux for each critical subcompartment will be selected for subsequent subcompartment analyses. These are listed in Table 6.2.1-15, Table 6.2.1-16, and Table 6.2.1-17.

The HEM model was used for the HELBs presented in Table 6.2.1-15 with the exception of the pipe breaks inside the RCP and SG cavities (identified as rooms 30UJA15-006, 30UJA23-004 and 30UJA29-004). The mass and energy release data for these breaks were calculated using the system analysis code CRAFT2 and are presented in Table 6.2.1-16 and Table 6.2.1-17. The GOTHIC computer code is used to determine the differential pressure across subcompartment walls. The calculation of the pressure load uses aspects of the NRC-approved GOTHIC containment methodology pertinent to subcompartment pressure response in the Containment Response Topical Report (Reference 1). The suitability of the GOTHIC computer code to calculate differential pressures has been demonstrated in various experimental verifications.

A multi-node GOTHIC model is used as the analysis tool for conducting the subcompartment analysis because it utilizes the modeling of individual regions or subcompartments and connects them hydraulically by junctions or flow paths. The subcompartments' rooms have been logically grouped together based on whether the rooms or regions experience gas flows significant enough to be considered well mixed.

Adjacent subcompartments with sufficient openings create a free exchange of gas flows between subcompartments and are grouped together into a lumped node. Subcompartments that include critical walls are separated from the lumped node and modeled as a single subcompartment or critical room node (Figure 6.2.1-1 through Figure 6.2.1-4). This re-nodalization is performed so that the magnitude of the initial peak or blowdown peak inside the critical room of interest is captured.

Each of the critical rooms, represented by a single node, was re-nodalized in the circumferential direction, into four nodes so that the initial peaks or blowdown peaks inside the various critical rooms are fully captured. These nodalization sensitivity

studies showed that the pressure response generally varied by less than 1 psi as a result of more rigorous nodalization.

The HEM model in GOTHIC for air-steam-water mixtures is elected for the junctions connected to the blowdown volume. The critical flow regime is expected to exist, if at all, in the junctions connected to the blowdown volume. The compressibility option is actuated for the flow paths connected to the blowdown volume. The compressibility option has the effect of slightly increasing the loss coefficient because of increased density of upstream fluid when pressure drop across the junction becomes large. By selecting the HEM model for the flow paths connected to the blowdown volume, 100 percent droplet entrainment effects for these flow paths are captured.

The analysis approach is to inject the mass and energy release from the HELB into the relevant containment node that comprises the critical room or section that is exposed to the HELB. Initial conditions (e.g., containment pressure, temperature, relative humidity) at the receiving node and surrounding nodes are imposed to maximize the resultant differential pressure across the affected node. The axial effect is accounted for by injecting the mass and energy release at the elevation where the high energy line is located within the node.

The design pressure transients generated from postulated pipe breaks presented in Table 6.2.1-15 and Figure 6.2.1-5 through Figure 6.2.1-9 for the identified critical sections are designed for as shown in Appendix 3E. The results of these evaluations show that the critical sections can withstand the applied loads, including the subcompartment pressures, and remain within allowable limits. The structural load calculations apply a factor of 1.4 to the peak pressure predictions from this analysis prior to their use as inputs in the design of the structures of interest.

6.2.1.3 Mass and Energy Release Analyses for Postulated Loss of Coolant Accidents

The containment pressure response to a LOCA in a U.S. EPR is similar to that of a conventional Pressurized Water Reactor (PWR) with a large dry containment. However, containment sprays are not an engineered safety feature used to mitigate the containment pressure response in the U.S. EPR design. Termination of a LOCA event is achieved by quenching core region steaming with pumped safety injection. Following steam quench, hot liquid leaving the reactor coolant system drains to the IRWST, which is attached to an LHSI heat exchanger cooling chain providing the ultimate heat sink.

For the U.S. EPR design, the spectrum of LOCA breaks analyzed includes a range of cold leg pump discharge, cold leg pump suction, and hot leg breaks, ranging from a three-inch SBLOCA up to the largest postulated double-ended guillotine break. The double ended guillotine break of a large RCS pipe is the most limiting event for the

purposes of containment pressure because it adds the greatest mass and energy to containment in the shortest period of time.

From the perspective of the reactor coolant system, the course of an LBLOCA is divided into five phases characterized by distinct phenomena:

1. Blowdown.
2. Refill.
3. Reflood.
4. Post-reflood.
5. Decay heat.

During the blowdown phase, there is a rapid depressurization of the RCS, and the RCS and containment pressures eventually equalize. The coolant flowrate from the RCS to containment varies depending upon the nature, size, and location of the break. Core cooling during this phase is accomplished by film boiling heat transfer from the surface of fuel rods. Because film boiling is inadequate to remove the heat contained within the fuel and the decay heat generated by the core, the fuel temperature increases.

As the RCS pressure falls below the pressure within the SIS accumulators, check valves open and water is added to the RCS. As long as there is a pressure gradient between the RCS and containment, water from the accumulators is entrained in the steam exiting through the pipe break. The SIS water cools the steam, and some of it condenses and remains within the primary system. The resulting condensation increases the core coolant flow velocities, and this begins to slow the rise in the fuel rod cladding temperature.

Coolant released from the primary system causes an increase in containment steam mass, which in turn increases pressure and temperature. In response to the initial pressure wave and increase in temperature, rupture and convection foils located above the U.S. EPR equipment rooms (i.e., compartments containing the steam generators and reactor coolant pumps) open, exposing the released mass and energy to the full containment volume. Mixing dampers located low in the containment, on the walls separating the containment's accessible area and the IRWST air space, also open to complete a flow circuit that allows the air/steam mixture to circulate. Containment pressure rises until pressure between the primary system and the containment equalizes. This is considered the end of the blowdown phase.

Following blowdown, a refill period occurs where the SIS provides sufficient liquid to fill the reactor vessel lower head and plenum regions. Within the reactor pressure vessel (RPV), residual steam and hot wall effects generate steam in the lower plenum.

Some of this steam escapes through the break. The speed with which the lower plenum refills depends on the total coolant delivery rate, the steam/water interfacial interactions, and the break size and location. The refill phase ends when the water level reaches the core inlet elevation.

During the next phase, reflood, the water level rises from the bottom to the top of the reactor core. Simultaneous gravity-driven reflooding of the core and the interaction of cold ECCS water (both MHSI and LHSI) with steam in the cold legs and downcomer cause both manometric- and condensation-driven oscillations in flow rate and pressure. High reflood rates from accumulator discharge rapidly drive water toward the hot fuel surface, producing steam. As the steam expands, the water is pushed away from the fuel surface. The gravity head of the water in the downcomer pushes back on the steam, returning coolant to the core where the resident steam can condense. These manometric oscillations slowly dampen as the quench front progresses through the core. Separately, steam leaving the core and traveling through the intact cold legs meets subcooled accumulator and safety injection coolant, and the subsequent condensation of the steam decreases the local pressure, which impacts delivery rates into the reactor vessel.

If the pipe rupture is in one of the RCS hot legs, the saturated steam and water mixture exits the break directly into the containment. If the pipe rupture is in one of the RCS cold legs, the two-phase mixture may travel through the SGs, absorb more energy from the secondary side fluid, and become superheated before exiting to the containment. This reflood phase ends once the mixture reaches a level sufficient to quench the core. At this point, the fuel cladding temperature approaches the temperature of the fluid, and both temperatures approach the saturation temperature corresponding to the containment pressure.

The post-reflood phase begins following core quench. LHSI coolant temperatures rise as the LHSI heat exchanger counters the increase in the IRWST temperature as hot water leaves the RCS and flows back into this source for LHSI. Nucleate boiling heat transfer in the core produces a two-phase mixture that rises above the core, into the upper plenum, hot legs, and steam generators. For cold leg breaks, the bulk of the remaining fluid sensible heat in the secondary-side of the steam generators is removed by the two-phase mixture residing in the steam generator tubes. This causes superheated steam to exit the steam generator primary side. The remaining RCS structure sensible heat is released to the circulating coolant and delivered to the containment during this LBLOCA phase. For hot leg breaks, heat removal from these sources can still occur; however, the break location in the hot leg causes a significant bypass of coolant away from the steam generators and intact loop piping.

Subsequent steam flow through the remaining RCS piping is sufficient to keep the piping clear of accumulating liquid, including the horizontal segment approaching the reactor coolant pump suction (i.e., crossover leg). This steam and water mixture is

carried to the break location as in the reflood phase, but in a manner described as a "boiling pot." When steam flow decreases to a level at which it no longer can prevent the filling of the crossover leg, the post-reflood phase ends.

Like the post-reflood phase, the decay heat phase is characterized as a simple "boiling pot" in which decay heat is the only significant heat source remaining in the RCS. In contrast to the post-reflood phase, it is expected that fluid flow through the RCS loops is significantly reduced by lower steam generation coming from the core and the formation of loop seals in the horizontal piping segment near the reactor coolant pump suction.

For the U.S. EPR design, a manual re-alignment of at least 75 percent of the LHSI from the cold leg to the hot leg injection location takes place early in this final LBLOCA phase (about 60 minutes after the initiating event). This re-alignment serves both as a mechanism for removing core decay heat, leading to complete steam suppression, and for maintaining core boron concentrations below the threshold concentration for precipitation.

Mass and energy releases are impacted in two ways by re-alignment of SI: coolant mixing in the upper plenum and core region and condensation efficiency between steam flows and safety injection in the hot legs and upper plenum. With regard to steam condensation, this phenomenon reduces the overall steam flow through the loops to the break. Safety injection water penetrates the upper plenum and the periphery of the core below the hot leg nozzle, providing emergency core coolant. During this later LBLOCA phase, the hot-leg break is mitigated, such that the reduction in LHSI from the possible loss of one train to the break is not penalizing to containment pressure (or fuel cladding temperatures). In addition, there is efficient ECCS mixing since the colder safety injection coolant falls along the core periphery before flowing back up through hotter fuel assemblies.

A break in the hot leg piping is shown to produce the highest containment pressure. A double-ended guillotine break of this pipe allows the initial RCS mass and energy to enter the containment early in the transient, before the passive heat sinks of the containment can effectively absorb the energy addition. Once the reflood phase begins, the mass and energy release decreases and the building heat sinks begin to reduce the pressure As break size decreases, the mass and energy release slows, but residence time increases. This allows additional energy to be transferred from the core and SGs.

The limiting break configuration for the hot leg break scenarios includes a double-ended guillotine break with minimum available safety injection with offsite power available. Figure 6.2.1-10,Figure 6.2.1-11, Figure 6.2.1-12, and Figure 6.2.1-13 provide the short- and long-term pressure and temperature results for the limiting hot leg scenarios. The temperature profile corresponds to the temperature in the equipment

room where the break occurs. Figure 6.2.1-36 shows the temperature profiles in the dome region at various elevations. This figure shows that thermal stratification does not occur in the long term. Figure 6.2.1-37 provides temperature profiles in rooms below the dome. The rate of pressure increase is proportional to the rate at which the energy is added. The mass and energy release model is set up to maximize the heat removal from the RCS, in particular the core region and SG. Steps have been taken to delay departure from nucleate boiling (DNB), for example, to maximize the heat transfer from the fuel to the RCS fluid. The liquid in the RCS may have an opportunity to gain additional heat depending on the transit time and path it takes to reach the break. The additional energy also affects the containment pressure. The initial stored energy of the RCS fluid, the rate at which the fluid is expelled, and any heat that the fluid gains as it traverses the system to the break determines the containment pressure response for a LOCA in the hot leg.

After the blowdown phase for the hot leg breaks, the RCS is essentially in pressure equilibrium with the containment. As the system begins to refill, the mass and energy effluent to containment decreases. It is at this point that the containment heat sinks are able to absorb the energy that has been added to containment and the pressure begins to decrease. Accumulator injection quickly quenches the core, expelling the stored energy to containment. Thereafter, the energy addition to containment due to core boiling is only that caused by decay heat. While the SIS injects into the cold legs, little flow travels through the SGs to the break. Manual re-alignment of a majority of the LHSI from the cold leg to the hot leg injection location reduces the amount of ECCS available for core cooling as the realigned LHSI spills on the floor. Containment pressure starts to increase until the MHSI and remaining LHSI can completely suppress the production of steam.

Figure 6.2.1-10 through Figure 6.2.1-13 show the trends of containment pressure increase during the blowdown phase. At the end of the blowdown phase, the containment pressure peaks and begins to decrease until re-alignment of the LHSI from the cold leg to the hot legs. A blowdown peak of 69.7 psia occurs at 26.6 seconds. Following ECCS re-alignment, the containment pressure begins rise until the remaining LHSI and the MHSI still injecting in the cold leg can suppress core steam production. The post-reflood peak of 48.0 psia occurs at 7900 seconds; the containment pressure continues to decrease, reaching 34.8 psia by the end of the analysis at 24 hours.

A break in the cold leg pump suction piping does not produce the limiting blowdown peak pressure of the containment. The resistance of the pumps delays the blowdown as compared to the hot leg break scenarios, and the RCS depressurizes at a slower rate compared to the hot leg break. As a result, the accumulator injection is delayed compared to the hot leg break. After blowdown, the accumulators and pumped safety injection begin to quench the core, removing its stored energy. As the quench front builds, the break effluent stabilizes, allowing the containment heat sinks time to

absorb the energy in containment and reduce the pressure. During the reflood phase of the event, steam generated in the core superheats. It approaches saturated conditions as the core water level increases. Steam from the core traverses the SG, absorbing additional energy from the secondary system. As a result, the energy content of the break effluent increases beyond the capacity of the containment heat structures, and the containment pressure begins to rise again. A reduction in the steam flow from the decreasing decay heat allows the crossover legs to begin to fill and form loop seals. The most penalizing condition occurs when the three intact loops no longer provide a vent path to the break such that steam from the core flows to the containment by a path that circumvents cold ECCS injection water . This condition causes a further increase in the containment pressure until the manual switchover of at least 75 percent of the LHSI to the hot legs. The limiting break configuration for the cold leg pump suction break scenario is a double-ended guillotine break with minimum safety injection supplied to the two cross-connected intact loops with no LOOP. Figure 6.2.1-14 through Figure 6.2.1-17 provide the pressure and temperature results for the most limiting cold leg pump suction scenarios. The temperature profile corresponds to the temperature in the equipment room area where the break occurs. Figure 6.2.1-38 shows the temperature profiles in the dome region at various elevations. This figure demonstrates that thermal stratification does not occur in the long term. Figure 6.2.1-39 shows the temperature profiles in different rooms below the dome area.

A blowdown peak of 66.44 psia occurs at 28.0 seconds. The containment pressure begins rise following refill until ECCS injecting in the hot legs can suppress core steam production. The post-reflood peak of 69.27 psia occurs at 3600 seconds when at least 1720 gpm of each of the available LHSI trains is aligned to the hot legs. The containment pressure continues to decrease, reaching 32.0 psia by the end of the analysis at 24 hours.

A break in the cold leg pump discharge piping produces the lowest peak containment pressure. The blowdown phase is similar in duration to the cold leg pump suction break and produces a similar containment pressure response. . However, the reflood and post-reflood phases of the cold leg pump discharge event are less limiting than the pump suction break. Unlike the pump suction break, coolant delivery to the loop seal piping segment is significantly reduced because of a weir in the U.S. EPR reactor coolant pump design rising above the top of the cold leg piping. As a result, the formation of loop seals is not likely until after re-alignment of the LHSI to the hot legs. The steam that goes through the intact loop must pass pumped injection locations on the way to the reactor vessel (RV) downcomer and through the break. As a result of the condensation on the safety injection fluid, the effluent through the RV side of the break has a lower enthalpy.

The limiting break configuration for the cold leg pump discharge break scenario is a double-ended guillotine break with minimum available SIS and no postulated LOOP.

Figure 6.2.1-18 through Figure 6.2.1-21 provide the pressure and temperature results for the limiting cold leg pump discharge scenarios. The temperature profile corresponds to the temperature in the equipment room area where the break occurs. Figure 6.2.1-40 shows the temperature profiles in the dome region at various elevations. This figure shows that there is adequate mixing in the dome region following the LOCA accident; therefore, thermal stratification does not occur. Figure 6.2.1-41 shows the temperature profiles in different rooms below the dome area. A blowdown peak of 65.44 psia occurs at 23.9 seconds. The containment pressure rises following refill until ECCS suppresses core steam production. The post-reflood peak of 68.4 psia occurs at 1860 seconds, and the containment pressure continues to decrease, reaching 32.6 psia by the end of the analysis at 24 hours.

The U.S. EPR LOCA analyses examine a spectrum of breaks and include variations in the SIS flow, offsite power availability, and pipe break size and configuration. In addition, sensitivity studies evaluate the smaller breaks to confirm that sufficient vent area between the equipment area and the accessible area exists. For these smaller breaks, the rupture foils in the CONVECT system are conservatively deactivated in the GOTHIC model and venting is delayed until the containment temperature at the pressure equalization ceiling (PEC) exceeds the temperature setpoint of the convection foils. The break location studies include a break of the pressurizer surgeline inside the pressurizer compartment to confirm venting from the pressurizer compartment to the accessible space is adequate. Critical parameters for the six safety-related doors credited in this analysis are included in Table 6.2.1-18.

6.2.1.3.1 Mass and Energy Release Data

Blowdown mass and energy release data are presented in Table 6.2.1-19 through Table 6.2.1-21 for the limiting cases at each of the three break locations analyzed. The mass and energy at break in the above tables represent both short-term and long-term releases. For the short-term period, the phasic mass and energy release on both sides of the breaks (vessel side and steam generator side) are presented. For the long-term period, mass and energy releases are calculated internally by the GOTHIC with one break junction representing RCS connection to containment. As a result, only one set of data (RV side) is provided.

To maximize the containment peak pressure and temperature, the U.S. EPR LBLOCA and SBLOCA analyses use conservative assumptions that maximize the mass and energy released from the RCS to the containment atmosphere. These assumptions maximize the primary system inventory and the heat into the RCS, and also maximize transfer of mass and energy into the containment. In addition, the analyses assume that doors between different rooms in the containment remain closed during the entire transient. To provide conservatism, the computer models:

- Maximize the initial reactor power level.

- Maximize the pressurizer volume (thereby increasing primary system inventory).
- Minimize the rate of power decrease.
- Maximize the reactor decay heat.
- Maximize the heat transfer from the secondary system into the primary system.

Table 6.2.1-22—Input Summary for Mass and Energy Release provides a summary of the initial conditions for the calculation of the mass and energy release.

The blowdown phase mass and energy release rates are calculated by the thermal-hydraulic analysis code, RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis (Reference 3). The NRC has reviewed and approved this code as meeting the requirements of 10 CFR part 50, Appendix K for pressurized water reactors with recirculating SGs. These 10 CFR part 50, Appendix K methods limit the energy transfer from the fuel elements to the RCS fluid to maximize the cladding temperature. While this approach is appropriate for analyses pursuant to 10 CFR 50.46, it is not sufficient for the calculation of mass and energy release rates for containment analyses. Therefore, the method is modified to maximize core heat removal to maximize the containment temperature and pressure response following a LOCA. This adjustment of the method from the 10 CFR part 50, Appendix K requirements is consistent with NUREG-0800 and ANSI/ANS-56.4. This adjusted model is used to calculate the mass and energy released to containment from the beginning of the long-term cooling phase, or time of core quench.

Post-reflood mass and energy release rates are referred to as long-term LOCA and are determined by the GOTHIC Version 7.2b computer code, as presented in Section 6.2.1.1.3, using the model described in Section 6.2.1.3.4.

6.2.1.3.2 Energy Sources

The sources of stored and generated energy used in all of the LOCA analyses include:

- Reactor power.
- Decay heat.
- Stored energy in the core.
- Stored energy in the RCS fluid and metal, including the reactor vessel and internals.
- Metal-water reaction energy.

- Stored energy in the secondary system, including the SG tubing and secondary water.

The initial reactor power level for the analyses is the RTP level plus an appropriate calorimetric uncertainty. Reactivity components are chosen to provide a conservative insertion of negative reactivity. An appropriate initial stored energy in the core is obtained by using a conservatively high initial fuel temperature. The RCS metal is modeled accurately with respect to its size, location, and composition. The SG secondary side metal mass that is in contact with RCS fluid is also explicitly modeled, and the code includes appropriate computation of the heat transfer across the SG tubes. The energy addition due to the metal-water reaction is calculated based on the same correlation (Baker-Just) specified in the approved 10 CFR part 50, Appendix K method.

6.2.1.3.3 Description of Short-Term Mass and Energy Release Model

A description of the RELAP5/MOD2-B&W model used to determine the mass and energy released from the RCS during the blowdown phase of a postulated LOCA is provided in BWNT Loss-of-Coolant Accident Evaluation Model for Recirculating Steam Generator Plants (Reference 2) and RELAP5/MOD2-B&W. All significant correlations are discussed in these reports.

The short-term break flow is calculated using the Moody critical flow model, which conservatively over-predicts the discharge rate in comparison to experimental data. The thermal energy equations in RELAP5-BW are expressed in terms of phasic internal energies. Therefore, a kinetic energy term is explicitly added to the energy release model in GOTHIC to capture the total energy contribution to the containment.

After the blowdown phase, the reactor vessel lower plenum is refilled by the ECCS. For LOCA mass and energy release rate calculations, a conservative refill period is one that is minimized to advance the heat transfer from the fuel elements to the fluid in the core.

The IRWST pool in the U.S. EPR is designed to be cooled and mixed by recirculating water through the heat exchanger of the RHR system. The containment analysis conservatively assumes there is no heat transfer between the containment vapor and IRWST liquid regions for the entire transient.

The transition between the short-term model and the long-term model is determined by the formation of loop seals for the cold leg pump suction breaks or the initiation of hot leg injection for the cold leg pump discharge and hot leg breaks.

6.2.1.3.4 Description of Long-Term Mass and Energy Release Model

Once the core is quenched, the LBLOCA proceeds into the long-term cooling phase of the analysis (post-reflood and decay heat phases). Reactor vessel coolant is in a quasi-steady-state condition, characterized by the vessel level recovered to the RCS loop nozzle elevations and the ECCS injection maintaining the core covered so that core decay heat and sensible heat are being removed. The long-term mass and energy releases are modeled in GOTHIC by adding a node to represent the RCS, and decay heat and sensible heat were modeled by the code as multiple heater components.

GOTHIC models are provided for the IRWST recirculation, the emergency core cooling function of the ECCS (SIS/RHR pumps and RHR heat exchangers), and containment heat removal by steam condensation/convection on the containment passive heat sinks.

The long-term sources of energy are:

- Core decay heat.
- Primary system fluid stored energy.
- Primary system passive metal stored energy (including core metal stored energy).
- Secondary system stored energy (fluid + metal).
- Safety injection pump heat addition.

The final temperature of the secondary fluid and metal is forced to be equal to or less than the saturation temperature in the containment at 24 hours. The release of the secondary stored energy continues until the total energy is transferred to the containment. The treatment of each of these sources in the long-term GOTHIC model is described in "Applicability of AREVA NP Containment Response Evaluation Methodology to the U.S. EPR for Large Break LOCA Analysis" (Reference 15).

In the long-term phase, the majority of LHSI discharge is switched over to the hot legs sixty minutes following the break to terminate core steaming. Re-alignment of LHSI to hot legs might recover an LHSI train that otherwise is delivered directly to the break if it is located in the cold leg pump discharge piping.

This injected water flows into the upper plenum, partially condensing any steam in the region. The cooler safety injection water then falls as a plume into the core and passes through several peripheral fuel assemblies located below the hot leg nozzles, suppressing steaming from these fuel assemblies.

As this water falls into the core, much of it traverses into the adjacent fuel assemblies and reduces boiling in these adjacent assemblies. The result is vigorous circulation in

the core that reduces and eventually suppresses net steaming from the core. The water that is not drawn into the adjacent assemblies continues down into the lower plenum. The warmed safety injection water leaves the RCS via a path leading into the lower head, the downcomer, and to the cold leg break location.

6.2.1.3.5 Single Failure Analysis

The effect of single failures of system components on the mass and energy releases is included in these LOCA analyses. For cases where offsite power is unavailable, the failures considered include the failure of one emergency diesel generator that causes the loss of one complete train of ESF equipment, failure of a component in the CONVECT system to open, and the failure of safety-related doors in the pressurizer compartment. For cases where offsite power is available, the failure of the emergency diesel generator is replaced by the failure of a LHSI train, including the pump and associated heat exchanger.

An additional analysis is performed to show that allowing non-safety doors to open following a DBA does not have an adverse affect on the circulation patterns in the containment.

6.2.1.3.6 Metal-Water Reaction

The exothermic metal-water reaction is calculated using the Baker-Just correlation, as specified in 10 CFR part 50, Appendix K.

6.2.1.3.7 Energy Inventories

Inventories of the energy transferred from the primary and secondary systems to the containment, as well as the energy remaining in the primary and secondary systems for the limiting cold leg pump suction break, is provided in Table 6.2.1-23.

6.2.1.3.8 Additional Information Required for Confirmatory Analysis

System parameters and hydraulic characteristics needed to perform confirmatory analysis are provided in Table 6.2.1-22 and Figure 6.2.1-22 through Figure 6.2.1-33.

6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary Pipe Ruptures inside Containment

Secondary pipe ruptures inside a reactor containment structure can produce significant releases of high energy fluid to the containment environment, producing high containment temperatures and pressures. Reactor trip is actuated automatically on high rate of SG pressure decrease, low SG pressure, or high containment pressure.

Engineered safety functions that mitigate the MSLB event are main steam isolation and main feedwater isolation. Isolation of the main steam lines prevents inventory

from the three intact steam generators from exiting the break. Isolation of the main feedwater system limits the mass introduced to the faulted steam generator. Actuation of emergency feedwater can be a benefit or detriment depending on the break size and is discussed in Section 6.2.1.4.1.3.

The rapid depressurization of the faulted steam generator increases the heat transfer across the steam generator tubes and can cause a severe cooldown of the reactor coolant system. Due to the negative moderator temperature coefficient and negative Doppler temperature coefficient, the cooldown of the reactor coolant system might be sufficient to insert positive reactivity in excess of the inserted control rod shutdown worth, thereby leading to a post-reactor trip return to criticality.

The mass and energy release following a secondary pipe rupture depends upon the configuration of the plant's main steam system, main feedwater system, the containment design, the plant operating conditions, and the size of the pipe rupture. This section describes the methods used to determine the containment response to these conditions.

The general plant system response is similar for all secondary system pipe ruptures. However, the MSLB always produces the limiting mass and energy release rate for a secondary pipe rupture because of three important factors:

1. Break size.
2. Integrated energy.
3. Break effluent conditions.

The SG Main Feedwater (MFW) nozzle has an ID of 1.453 ft or an area of 1.658 ft^2, which is greater than the integral flow restrictor at the steam generator exit nozzle (1.4 ft^2). However, the critical flow area for a Main Feedwater Line Break (MFWLB) is determined by the MFW ring area of 0.916 ft^2. The break spectrum selected for evaluating the MSLB envelopes the MFWLB. This provides a limiting sequence of events for both break locations.

The integrated energy of the break fluid is always greater for an MSLB than the MFWLB. Once the SG tubes uncover during an MSLB, any additional feedwater injected into the SG prior to complete isolation of the feedwater system absorbs energy from the primary system. This additional energy is deposited directly in containment as the SG inventory flashes and exits the break at the steam nozzle. In the case of an MFWLB, any MFW that is injected into the containment through the break does not have an opportunity to acquire additional primary system energy. Thus, the integrated energy for an MSLB is always greater than that of the MFWLB.

The break effluent for an MSLB progresses from single-phase steam to two-phase mixture, and then back to a single-phase vapor release. The MFWLB event initially produces liquid discharge, then progresses to a two-phase release and, finally, to a single-phase steam discharge. Regardless of the break effluent progression, both scenarios cause the complete blowdown of a single steam generator, as well as additional main feedwater, either to the containment (MFWLB) or to the SG (MSLB), until terminated.

Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB lists the scenarios analyzed to determine the limiting case (i.e., highest containment pressures and temperatures.) The scenarios include an evaluation of potential single active failures. The main feedwater (MFW) system includes redundant isolation valves, which preclude an over-feeding failure. In all scenarios, isolation of the MFW system uses the longest delay time and the slowest isolation valve closure time. These scenarios use the Diffusion Layer Model for condensation and the default option for revaporization. This enables the GOTHIC code to calculate the fraction of condensate that is revaporized.

Containment pressure and temperature response to an MSLB depends upon the amount of break effluent that enters the containment atmosphere as steam, and whether that steam is saturated or superheated. During the depressurization of the SG, two phenomena can reduce the steam contribution by forcing liquid effluent into the containment. The first is the entrainment of liquid drops that are swept out the break because of the high steam velocities. The analytical models are biased to reduce the amount of entrained liquid that exits the SG. Any entrained liquid that exits the break is conservatively converted to steam in the analysis. The second is the rapid voiding of the SG that causes a liquid level swell that extends to the break location. This causes the discharge of saturated liquid. The swelling of liquid mixture level to the steam outlet nozzle, and subsequent discharge at the break, is caused by void formation or flashing in the liquid regions of the SG.

The containment response analyses are based on mass and energy released from the MSLB and include the effects of superheated steam. Smaller breaks require an iterative process for determining the reactor protection system response time to execute a reactor trip signal. The analytical trip setpoint for the ESF actuation system for containment pressure is 4.0 psig plus an additional 0.5 psig uncertainty. An additional 1.3 second delay for the high-containment pressure signal applies to all breaks, so that the time required for the reactor trip is conservative.

6.2.1.4.1 Significant Parameters Affecting Steam Line Break Mass and Energy Releases

A number of important system design, plant operation, and rupture event parameters affect the containment response to secondary side events. For each of these, there are four major factors that influence the mass and energy release following an MSLB:

- SG fluid inventory.
- Primary-to-secondary heat transfer.
- Protective system operation.
- State of the secondary system fluid blowdown.

These factors are addressed in the following descriptions of how the important plant parameters impact containment response to secondary-side rupture events.

6.2.1.4.1.1 Plant Power Level

MSLBs are postulated to occur with the plant in operating conditions ranging from hot zero power (HZP) to 100 percent RTP. The mass of water in the SG decreases with increasing power level. Therefore, an MSLB occurring at a low power level generally produces a greater total mass release to the containment than one occurring at 100 percent RTP. However, because of greater primary system stored energy, increased heat transfer in the SGs, and the additional energy generation in the nuclear fuel, the energy released to the containment from postulated breaks that occur during power operation may be greater than the energy released with the plant at HZP. Additionally, steam pressure and the dynamic conditions in the SGs change with increasing power, and these have significant influence on both the blowdown rate and the amount of moisture entrained in the fluid that exits during the MSLB sequence. Because of these opposing effects of power level on mass and energy release, HZP and power levels spanning the operating range are analyzed.

6.2.1.4.1.2 Main Feedwater System Design

The rapid depressurization following an MSLB can cause a large volume of water to be added to the SGs by the MFW system. Therefore, the MFW lines have isolation valves that close rapidly to limit feedwater addition during the event. The MFW piping layout downstream of these isolation valves impacts the event because it affects the volume of liquid in the feedwater piping that can enter the SGs. As the SG pressure decreases, the fluid in this MFW piping flashes into steam and provides additional secondary fluid to exit the rupture. The feedwater volume and duration of flow influence the SG blowdown in three ways:

- The rapid addition increases the amount of entrained water in large break cases by lowering the bulk quality of the SG inventory.
- The water entering the SG is subcooled, so it decreases the steam pressure reducing the flowrate out of the break.
- The increased flow causes an increase in the heat transfer rate from the primary-to-secondary system, resulting in greater energy release out the break.

These are competing effects on the total mass and energy release during a MSLB, so bounding conditions are provided in all MSLB scenarios. During periods of entrainment (i.e., the entrainment of water and steam exiting the rupture), the break energy is set to the energy of saturated steam. The MFW system includes isolation valves and control valves that close upon receipt of an isolation signal, terminating MFW flow. The MSLB analysis examines the single failure of a MFW isolation valve, a MFW control valve, failure of the MFW pumps to trip, and the failure of an MSIV, in order to determine the most limiting scenario.

6.2.1.4.1.3 Emergency Feedwater System Design

Actuation of the emergency feedwater system (EFWS) during an MSLB increases the SG mass available for release to containment. The temperature of the emergency feedwater is low compared to the temperature of the SG inventory. The EFWS water cools the SG steam inventory, which decreases the driving pressure of the break flow. At the same time, the EFWS water absorbs heat from the SG tubes and other metal structures. This provides an additional transport mechanism for energy to the containment.

In a large double-ended guillotine break, the peak containment pressure and temperature occur early in the transient. Therefore, the introduction of cool EFWS water decreases the driving pressure of the break flow, thereby slightly reducing peak containment pressure and temperature. In small split-break events, the peak containment pressure and temperature occur much later. The additional mass and energy released to containment over time due to the EFWS water increases peak containment temperature and pressure. Because of these competing effects, EFWS has only a small influence on MSLB containment temperature and pressure response.

Emergency feedwater is initiated on either low SG level or a safety injection signal coincident with LOOP. However, the LOOP is not credited during this event, so in the MSLB analysis, the emergency feedwater actuation only occurs on low SG level. The MSLB analysis model does not consider SG level, so emergency feedwater activation is conservatively assumed to occur coincident with reactor trip. Upon activation, the time required for the EFW pump to reach full flow is conservatively modeled as 1 second, at which time full EFW flow is delivered to the SG.

Emergency feedwater flow depends on the discharge pressure. However, MSLB analysis does not consider this, so the analysis assumes the highest possible flow to the SGs.

The emergency feedwater system isolates on high level in the SG. Since SG level is not modeled, isolation of the emergency feedwater is assumed to occur by operator action 30 minutes after the start of the event. Because peak containment pressure and temperature occur before 30 minutes, emergency feedwater flow is available for the duration of the analysis.

6.2.1.4.1.4 Postulated Break Size, Type, and Location

Releases are analyzed for five MSL breaks: the double-ended guillotine break and break sizes of 1.0, 0.7, 0.52 and 0.3 square feet in area. Each of the break sizes are analyzed at seven initial power levels. Additional sensitivities of very small break sizes are performed only at low power to confirm the limiting break size is identified. These sensitivity studies are performed because the affected SG still has significant inventory at the time of EFWS isolation at 30 minutes.

Each SG is equipped with a flow orifice that limits the effective area for the MSLB. Although the area of the main steam line is 4.1 ft^2, the effective break area after main steam isolation is no greater than the flow restrictor throat area of 1.4 square feet.

Break location affects steam-line blowdown by virtue of the pressure losses that occur in the length of piping between the SG and the break location. The effect of the pressure loss is to reduce the effective break area seen by the SG. This reduces the rate of blowdown, but it does not significantly change the total release of energy to the containment. Therefore, piping pressure drop from the affected SG to the break location is ignored in all analyses. Because the location of the break within containment can affect the containment temperature and pressure response, break locations are analyzed in both the accessible and inaccessible areas.

6.2.1.4.1.5 Availability of Offsite Power

The U.S. EPR design does not have a containment spray system or containment fan coolers as part of the engineered safety features that would be delayed if there was a LOOP. Therefore, offsite power is assumed to be available, and the mass and energy released from the break are maximized due to continued operation of the reactor coolant pumps. The energy transferred from the reactor coolant system to the SGs, with continued operation of the MFW and EFW pumps, maximizes the SG inventories available for release to containment.

6.2.1.4.1.6 Safety System Failures

The most severe single active failure is the failure of an MSIV on the main steam line of the affected steam generator. An MSIV failure would provide additional fluid that is released to the containment via the break. This fluid comes from the blowdown of all the steam piping between the break location and the isolation valves in the intact loops. This single failure is more severe than the failure of an MSIV on an intact loop due to the volume of the steam line that is isolated. Furthermore, this single failure is more severe than the failure of an isolation valve in the main feedwater system because of the redundancy of the valves in the main feedwater system.

6.2.1.4.1.7 Steam Generator Reverse Heat Transfer and Reactor Coolant System Metal Heat Capacity

Following isolation of the intact SGs, energy is transferred to the containment building via the primary coolant. As the steam from the SG enters containment, the reduction in secondary side pressure creates a cooling effect on the primary system. Heat transfer occurs as the temperature of the primary coolant flowing in the SG tubes falls below the bulk temperature of the intact SGs. With an MSLB, this energy is available to be transferred to the SG.

Similarly, the sensible heat of primary system heated structures must be considered, including the:

- Reactor coolant piping.
- Reactor pressure vessel.
- Reactor coolant pumps.

Heat from these components is transferred to the primary coolant as the cooldown progresses. During an MSLB, this energy is available to be transferred to the SGs. The effects of both the reactor coolant system metal and the reverse SG heat transfer are included in the containment response analyses.

The RELAP5/MOD2-B&W computer code incorporates a full spectrum of heat transfer modes, including single-phase convection, nucleate boiling, critical heat flux, transition film boiling, film boiling, and condensation. The appropriate heat transfer correlation is determined by RELAP5/MOD2-B&W for each heat conductor in the model based on the calculated thermodynamic conditions at each time step.

6.2.1.4.2 Description of Blowdown Model

A description of the RELAP5/MOD2-B&W model used to determine the mass and energy released during the blowdown phase of a postulated MSLB is provided in B&W Safety Analysis Methodology for Recirculating Steam Generator Plants (Reference 5)

and the RELAP5 Topical Report (Reference 3). Significant correlations are discussed in these reports.

Figure 6.2.1-42 presents the results of the SG pressure blowdown of the limiting MSLB case. Figure 6.2.1-43 and Figure 6.2.1-44 present the integrated break mass and integrated break energy. Integrated break mass and energy increase rapidly upon initiation of the event. The rate of mass and energy release to containment decreases as the SG blows down. Since no EFW is conservative for the limiting case, the integrated mass and energy release to containment remains constant after SG blowdown.

6.2.1.4.3 Containment Response Analysis

The containment response to postulated MSLBs was analyzed with GOTHIC Version 7.2b (see Section 6.2.1.1.3). The containment model was developed in accordance with the Containment Response Topical Report (Reference 1).

6.2.1.4.3.1 Initial Conditions

The initial conditions used in the GOTHIC model are provided in Section 6.2.1.1.3.

6.2.1.4.3.2 Mass and Energy Release Data

Table 6.2.1-24—MSLB Mass and Energy Release Data presents the mass and energy release data used to determine the containment pressure and temperature responses for the limiting MSLB, a double-ended guillotine break of the main steam line at 20% RTP concurrent with the single active failure of the MSIV on the faulted SG steam line. A break location sensitivity study showed that a break in the accessible space outside the SG towers produces the most limiting containment pressure.

Feedwater isolation for the full and partial double-ended guillotine breaks depends on signals generated by the ESF instrumentation. The feedwater flow rates used in the analyses credit the longest isolation valve stroke time of 40 seconds. Valve leakage is not considered in the analyses because it is bounded by the emergency feedwater injection. Table 6.2.1-25—MSLB Reactor Trip and Isolation Signal Summary presents the reactor trip, isolation trips, and foil opening trip times for each MSLB case analyzed.

6.2.1.4.3.3 Containment Pressure and Temperature Results

Figure 6.2.1-34 and Figure 6.2.1-35 provide the containment pressure and temperature results for the most limiting MSLB scenario. Table 6.2.1-9 summarizes the results of the cases analyzed.

The worst single active failure for the MSLB is the loss of the MSIV on the main steam line of the affected steam generator. Because the U.S. EPR design includes redundant

safety-related feedwater isolation valves, the failure of the main feedwater isolation valve is not specifically analyzed. However, as an additional conservatism, the MFW valve with the longest stroke time is used for isolation. Feedwater flow is credited from the beginning of the transient until the isolation valve is fully closed.

The RELAP5 model used for this purpose includes a partial representation of the main feedwater system. The piping downstream of the control and isolation valves is included in the RELAP5 model. Some, but not all, of the piping upstream of the control and isolation valves is modeled explicitly. Consistent with the description in Section 6.2.1.4.1.2 this model allows injection of additional feedwater into the steam generator resulting from flashing or swelling of the water contained in the unisolated section of the main feedwater piping.

The loss of one MSIV is assumed for the spectrum of break sizes and power levels analyzed. As illustrated in Table 6.2.1-9, a full double-ended guillotine break of the main steam line in the accessible space outside the SG towers at 20 percent RTP produces a peak pressure of 66.4 psia. This is less than the design pressure of 62.0 psig. This case represents the peak calculated containment pressure for the spectrum of breaks analyzed.

The calculated containment vapor temperature exceeds the saturation temperature for some cases for a short period of time. While the analyses show the vapor space is superheated, the containment walls and structures are not. The primary mode of heat transfer during this time period is condensation on the building surfaces. Therefore, the building surface temperature is no greater than the saturation temperature at building design pressure of 62 psig, or 309.1°F. Figure 6.2.1-35 shows that the analysis predicts that the containment vapor temperature is above the saturation temperature for approximately two minutes.

6.2.1.5 Minimum Containment Pressure Analysis for Performance Capability Studies on Emergency Core Cooling System

6.2.1.5.1 Mass and Energy Release Data

Containment pressure calculations are performed by the ICECON module within S-RELAP5 code. ICECON is a variant to the CONTEMPT containment code series. The RLBLOCA methodology treats containment pressure as a statistically-varied parameter with a random sampling of the containment volume. The tabular mass and energy release data are not explicitly generated because they are part of the internal code calculations at each time step. The mathematical models that calculate the mass and energy releases to the containment are described in Section 15.6 and conform to the realistic ECCS evaluation models of 10 CFR 50.46(a)(1)(i).

6.2.1.5.2 Initial Containment Internal Conditions

The initial values for the containment conditions are representative of 100 percent rated thermal power, and are a pressure of 14.7 psia and temperature of 59°F. The outside atmospheric temperature of 20°F and relative humidity of 100 percent are assumed and modeled within the ICECON module, which also assumes an outside atmospheric temperature of 20°F and a relative humidity of 100 percent. Inside the containment, the IRWST water temperature is expected to be at the containment temperature of 59°F, but could range as high as 122°F, which is the Technical Specification maximum value for IRWST temperature. The RLBLOCA methodology uses the value of 122°F.

6.2.1.5.3 Other Parameters

The containment pressure varies, and the RLBLOCA methodology determines it by sampling the containment volume. The nominal or best-estimate value of the containment volume is 2.888×10^6 ft^3. The upper-estimate value for the containment volume is 3.645×10^6 ft^3 and represents the empty volume of the containment dome and cylinder and also neglects the volume displaced by the internal walls and structures. This latter value is conservative because a lower containment backpressure results in the highest calculated peak cladding temperature.

Heat transfer between the IRWST water and containment vapor is treated in a conservative manner. First, the IRWST is assumed to be well mixed so the liquid temperature at the interface between the IRWST water and the containment vapor space is the bulk liquid temperature. This neglects heating of the surface water and maximizes the temperature differential for heat transfer. Second, structures that reduce the exposed surface of the IRWST are neglected. Other simplifications are included that effectively double the IRWST surface area available for heat transfer. Water spillage rates from the accumulator in the broken loop are determined as part of the core reflooding calculation, and are included in the containment code calculational model. The passive heat sinks and thermo-physical properties were derived in accordance with Branch Technical Position 6-2, "Minimum Containment Pressure Model for PWR ECCS Performance Evaluation."

6.2.1.6 Tests and Inspections

Refer to Section 3.8.1.7 and Section 3.8.2.7 for testing and inspection requirements for the containment structure. Refer to Section 6.2.6 for the containment leakage rate testing program, and Section 6.6 for inservice inspection of ASME Class 2 and 3 components. Containment testing and inspections are also included in the Technical Specifications (Chapter 16).

6.2.1.7 Instrumentation Requirements

Refer to Section 7.3 for engineered safety features instrumentation. Refer to Section 12.3.4 for radiation monitoring instrumentation.

Next File

Table 6.2.1-1—Loss of Coolant Accidents
Sheet 1 of 3

Case	Break Location	Break Type[7]	Cd	Single Failure	ECCS	Offsite Power Configuration	Back Pressure
1	Hot Leg	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia
2	Hot Leg	DEG	1.0	1 Train ECCS	Min	LOOP	60 psia
3	Hot Leg	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
4	Hot Leg	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
5	Hot Leg	DEG	0.8	1 Train ECCS	Min	LOOP	60 psia
6	Hot Leg	DEG	0.6	1 Train ECCS	Min	LOOP	60 psia
7	Hot Leg	Split	0.8	1 Train ECCS	Min	LOOP	60 psia
7A	Hot Leg	DEG	1.0	1 Train ECCS	Min	LOOP	14.7 psia
7C	Hot Leg	Split	1.0	1 Train ECCS	Min	LOOP	14.7 psia
8	Pump Suction	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia
9	Pump Suction	DEG	1.0	1 Train ECCS	Min	LOOP	60 psia
10	Pump Suction	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
10B	Pump Suction	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
11	Pump Suction	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
12	Pump Suction	DEG	0.8	1 Train ECCS	Min	No LOOP	60 psia
13	Pump Suction	DEG	0.6	1 Train ECCS	Min	No LOOP	60 psia
14	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
14B	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	14.7 psia
14C	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	76.7 psia
14D [1]	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
14E	Pump Suction	Split	1.0	1 Train ECCS	Min	No LOOP	14.7 psia
15	Pump Discharge	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia

Table 6.2.1-1—Loss of Coolant Accidents
Sheet 2 of 3

Case	Break Location	Break Type[7]	Cd	Single Failure	ECCS	Offsite Power Configuration	Back Pressure
16	Pump Discharge	DEG	1.0	1 Train ECCS	Min	LOOP	60 psia
17	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
18	Pump Discharge	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
19 [2]	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
20 [3]	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
21	Pump Discharge	DEG	0.8	1 Train ECCS	Min	No LOOP	60 psia
22	Pump Discharge	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
23	Pump Discharge	Split	0.6	1 Train ECCS	Min	No LOOP	60 psia
24	Pump Discharge	DEG	0.6	1 Train ECCS	Min	No LOOP	60 psia
25	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
26	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	14.7 psia
27	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	76.7 psia
28 [1]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
29 [4]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
30 [5]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
31 [6]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
32	Hot Leg	DEG	1.0	1 Train ECCS [13]	Min	No LOOP	Note 8
33	Pump Suction	DEG	1.0	1 Train ECCS [9]	Min	No LOOP	Note 8
34	Pump Suction	DEG	1.0	1 Train ECCS [10]	Min	No LOOP	Note 8
35	Case not used						
36	Pump Suction	DEG	1.0	1 Train ECCS [10, 15]	Min	No LOOP	Note 8

Table 6.2.1-1—Loss of Coolant Accidents
Sheet 3 of 3

Case	Break Location	Break Type[7]	Cd	Single Failure	ECCS	Offsite Power Configuration	Back Pressure
37	Pump Suction	DEG	1.0	1 Train ECCS[10, 12]	Min	No LOOP	Note 8
38	Pump Suction	DEG	1.0	1 Train ECCS [10]	Min	LOOP	Note 8
39	Pump Suction	DEG	1.0	1 Train ECCS [10, 11]	Min	No LOOP	Note 8
40	Pump Suction	DEG	1.0	1 Train ECCS [10, 11, 13]	Min	No LOOP	Note 8
41	Pump Discharge	DEG	1.0	1 Train ECCS [9, 11, 13]	Min	No LOOP	Note 8
42	Pump Discharge	0.5 ft^2 (9 in)	1.0	1 Train ECCS	Min	LOOP	Note 8
43	Pump Discharge	0.1963 ft^2 (6 in)	1.0	1 Train ECCS	Min	LOOP	Note 8
44	Pump Discharge	0.491 ft^2 (3 in)	1.0	1 Train ECCS	Min	LOOP	Note 8
45	Hot Leg	0.491 ft^2 (3 in)	1.0	1 Train ECCS	Min	LOOP	Note 8
46	Hot Leg	0.491 ft^2 (3 in)	1.0	1 Train ECCS [14]	Min	LOOP	Note 8

Notes:

1. Increased IRWST Temperature to 248°F.
2. Based on Case 17 with the percentage of LHSI to the intact loop to be 0%.
3. Based on Case 17 with the percentage of LHSI to the intact loop to be 25%.
4. Based on Case 25 with instantaneous feedwater isolation.
5. Long-Term LOCA Run Based on Case 25.

6. Increased IRWST Temperature to 170°F.
7. DEG = double-ended guillotine.
8. Containment pressure used in the M&E calculation matched the predicted GOTHIC pressure profile.
9. Two available ECCS trains aligned to one intact loop and one broken loop.
10. Two available ECCS trains aligned two intact loops.
11. Partial Cooldown not credited.
12. RCP anti-rotation device not credited.
13. All Containment doors remain closed.
14. Rupture foils assumed to remain closed
15. Hot leg nozzle gap remains open during reflood.

Table 6.2.1-2—Main Steam Line Breaks
Sheet 1 of 2

Case	Power Level (RTP)	Break Type[1]	Size	Single Failure	Offsite Power Configuration
1	100%	DEG	1.4 ft^2	MSIV	Available
2	100%	Split	1.0 ft^2	MSIV	Available
3	100%	Split	0.7 ft^2	MSIV	Available
4	100%	Split	0.52 ft^2	MSIV	Available
5	100%	Split	0.3 ft^2	MSIV	Available
6	80%	DEG	1.4 ft^2	MSIV	Available
7	80%	Split	1.0 ft^2	MSIV	Available
8	80%	Split	0.7 ft^2	MSIV	Available
9	80%	Split	0.52 ft^2	MSIV	Available
10	80%	Split	0.3 ft^2	MSIV	Available
11	60%	DEG	1.4 ft^2	MSIV	Available
12	60%	Split	1.0 ft^2	MSIV	Available
13	60%	Split	0.7 ft^2	MSIV	Available
14	60%	Split	0.52 ft^2	MSIV	Available
15	60%	Split	0.3 ft^2	MSIV	Available
16	50%	DEG	1.4 ft^2	MSIV	Available
17	50%	Split	1.0 ft^2	MSIV	Available
18	50%	Split	0.7 ft^2	MSIV	Available
19	50%	Split	0.52 ft^2	MSIV	Available
20	50%	Split	0.3 ft^2	MSIV	Available
21	40%	DEG	1.4 ft^2	MSIV	Available
22	40%	Split	1.0 ft^2	MSIV	Available
23	40%	Split	0.7 ft^2	MSIV	Available
24	40%	Split	0.52 ft^2	MSIV	Available
25	40%	Split	0.3 ft^2	MSIV	Available
26	20%	DEG	1.4 ft^2	MSIV	Available
26(A)	20%	DEG[2]	1.4ft^2	MSIV	Available
26(B)	20%	DEG [2, 3]	1.4ft^2	MSIV	Available
27	20%	Split	1.0 ft^2	MSIV	Available
28	20%	Split	0.7 ft^2	MSIV	Available

Table 6.2.1-2—Main Steam Line Breaks
Sheet 2 of 2

Case	Power Level (RTP)	Break Type[1]	Size	Single Failure	Offsite Power Configuration
29	20%	Split	0.52 ft^2	MSIV	Available
30	20%	Split	0.3 ft^2	MSIV	Available
31	0%	DEG	1.4 ft^2	MSIV	Available
32	0%	Split	1.0 ft^2	MSIV	Available
33	0%	Split	0.7 ft^2	MSIV	Available
34	0%	Split	0.52 ft^2	MSIV	Available
35	0%	Split	0.3 ft^2	MSIV	Available
35(A)	0%	Split[3]	0.3 ft^2	MSIV	Available
36	0%	Split	0.2 ft^2	MSIV	Available
37	0%	Split	0.15 ft^2	MSIV	Available
38	0%	Split	0.1 ft^2	MSIV	Available
39	0%	Split	0.01 ft^2	MSIV	Available
40	0%	Split	0.005 ft^2	MSIV	Available

Notes:

1. DEG = double-ended guillotine.
2. No EFW supplied to broken SG.
3. Break located in the accessible space outside the SG towers.

Table 6.2.1-3—LHSI Heat Exchanger Data

Parameter	Analytical Inputs
No. of shell side passes	1
Number of tube side passes	1 (U-Tube Design)
No. of tubes	1088
Tube material	Austenitic steel (stainless steel)
Tube thickness	0.04 in
Total tube side flow area	1.311 ft^2
Tube internal diameter	0.47 in
Tube outer diameter	0.55 in
Shell outer diameter	3.9 ft
Shell wall thickness	0.71 in
Tube side fouling resistance	1.70×10^{-4} (ft^2-hr-°F/BTU)
Shell side fouling resistance	2.84×10^{-4} (ft^2-hr-°F/BTU)
CCW flow rate at inlet of RHRS heat exchanger	608.5 lb_m/s
CCW temperature at inlet of RHRS heat exchanger	113 °F
Total tube side surface area (total inside surface area of tubes)	4751.5 ft^2
Total shell side surface area (total outside surface area of tubes)	5560.3 ft^2
Overall heat transfer coefficient	444.9 (BTU/ft^2-hr-°F)

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 1 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
	Containment Wall with Steel Liner	0.0002	0	0.006	0.003	1.222	9177
1	Access to RB annulus	0.0002	0	0.006	0.003	1.306	77.56
2	Lower annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	151.24
3	Lower annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	151.24
4	Hot piping to RB annulus	0.0002	0	0.006	0.003	1.306	178.38
5	Middle annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	1140.81
6	Middle annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.3055	1269.38
7	Access to RB annulus	0.0002	0	0.006	0.003	1.306	65.95
8	Middle annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	130.42
9	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	517.31
10	Upper annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	330.64
11	Upper annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	330.64
12	Staircase (south) to RB annulus	0.0002	0	0.006	0.003	1.306	43.7
13	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.3	2309.5
14	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1	2480
	IRWST Vertical Wall (in contact with IRWST)	0	0	0.004	0	1.404	669
1	Spreading rooms to IRWST	0	0	0.004	0	1.2	42.06
2	IRWST to SG blowdown (LCQ) HX etc.	0	0	0.004	0	0.3	19.66
3	IRWST to components	0	0	0.004	0	0.8	37.96
4	IRWST to elevator	0	0	0.004	0	0.74	2.08
5	IRWST to lower annulus rooms L1 & 2	0	0	0.004	0	1.5	560

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 2 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
6	IRWST to hot piping	0	0	0.004	0	1.5	6.88
	IRWST Vertical Wall (to Containment Atmosphere)	0.0004	0	0	0	1.404	669
1	Spreading rooms to IRWST	0.0004	0	0	0	1.2	42.06
2	IRWST to SG blowdown (LCQ) HX etc.	0.0004	0	0	0	0.3	19.66
3	IRWST to components	0.0004	0	0	0	0.8	37.96
4	IRWST to elevator	0.0004	0	0	0	0.74	2.08
5	IRWST to lower annulus rooms L1 & L2	0.0004	0	0	0	1.5	560
6	IRWST to hot piping	0.0004	0	0	0	1.5	6.88
	IRWST horizontal wall (Heavy Floor)	0.001	0	0	0	1.434	547
1	IRWST to SG blowdown (LCQ) HX etc.	0.001	0	0	0	1	64.64
2	IRWST to components	0.001	0	0	0	0.8	46.56
3	IRWST to lower equipment rooms L1	0.001	0	0	0	1.5	78.8
4	IRWST to lower equipment rooms L2	0.001	0	0	0	1.5	139.2
5	IRWST to lower equipment rooms L3	0.001	0	0	0	1.5	139.2
6	IRWST to lower equipment rooms L4	0.001	0	0	0	1.5	78.8
	IRWST Horizontal Wall (IRWST Ceiling)	0	0	0.004	0	1.5	436
1	IRWST to lower equipment rooms L1	0	0	0.004	0	1.5	78.8
2	IRWST to lower equipment rooms L2	0	0	0.004	0	1.5	139.2
3	IRWST to lower equipment rooms L3	0	0	0.004	0	1.5	139.2
4	IRWST to lower equipment rooms L4	0	0	0.004	0	1.5	78.8
	IRWST Basemat	0	0	0.004	0	4	590

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 3 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
1	IRWST to ground	0	0	0.004	0	4	590
	Building Basemat (Excluding IRWST)	0.001	0	0	0	4.0	720
1	Spreading rooms to ground	0.001	0	0	0	4.0	175
2	Access area to ground	0.001	0	0	0	4.0	80
3	SIS pipe penetrations to ground (To SB 1&2)	0.001	0	0	0	4.0	144
4	SIS pipe penetrations to ground (To SB 3&4)	0.001	0	0	0	4.0	142
5	Fuel Building penetrations to ground	0.001	0	0	0	4.0	172
6	Elevator shaft penetrations to ground	0.001	0	0	0	4.0	6.72
	Vertical wall to accessible space	0.0004	0	0	0	0.39	8342
1	access to elevator	0.0004	0	0	0	0.1	52.34
2	lower annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	12.54
3	lower annulus rooms L1 & 2 to access	0.0004	0	0	0	0.1	14.08
4	lower annulus rooms L3 & 4 to access	0.0004	0	0	0	0.1	27.56
5	lower annulus rooms L1 & 2 to hot piping	0.0004	0	0	0	0.15	20.8
6	lower annulus rooms L3 & 4 to hot piping	0.0004	0	0	0	0.15	20.8
7	middle annulus rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.15	362.82
8	middle annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	178.94
9	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.1322	186.96
10	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.25	190.24
11	middle annulus rooms L1 & 2 to access	0.0004	0	0	0	0.1	17.8
12	middle annulus rooms L3 & 4 to access	0.0004	0	0	0	0.1	16.38
13	Internal wall in middle annulus rooms L3 & 4	0.0004	0	0	0	0.25	203.96

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 4 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
14	middle annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.15	229.12
15	middle annulus rooms L3 & 4 to staircase (north)	0.0004	0	0	0	0.15	223.08
16	middle annulus rooms L1 & 2 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.7132	365.38
17	Internal wall in middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	28.28
18	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.755	47.6
19	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4443	105.12
20	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.7	156.32
21	middle annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.5	25.2
22	middle annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.5	102.74
23	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	35.3
24	middle annulus rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	350.76
25	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.15	80.34
26	upper annulus rooms L3 & 4 to staircase (north)	0.0004	0	0	0	0.15	110.26
27	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.5	16.32
28	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	123.1
29	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.5	13.68
30	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.65	14.4
31	lower & upper dome L1, 2, 3 & 4 to staircase (south)	0.0004	0	0	0	0.15	58.22

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 5 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
32	Internal wall in upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	14.04
33	upper annulus rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.15	29.62
34	upper annulus rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.5	31.48
35	Internal wall in upper annulus rooms L3 & 4	0.0004	0	0	0	0.15	200.28
36	Internal wall in lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.44115	541.32
37	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.25	29.92
38	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.25	25.08
39	Internal wall in upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	37.68
40	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	26.04
41	SG blowdown (LCQ) HX etc. to elevator	0.0004	0	0	0	0.4	8.32
42	SG blowdown (LCQ) HX etc. to access	0.0004	0	0	0	0.1	37.19
43	SG blowdown (LCQ) HX etc. to lower annulus rooms L1 & 2	0.0004	0	0	0	0.4	5.02
44	SG blowdown (LCQ) HX etc. to lower annulus rooms L3 & 4	0.0004	0	0	0	0.15	5.12
45	Components to hot piping	0.0004	0	0	0	0.5	77.08
46	Components to hot piping	0.0004	0	0	0	0.15	9.28
47	lower equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	60.19
48	lower equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	178.12
49	lower equipment rooms L1 to components	0.0004	0	0	0	0.2742	30.19

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 6 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
50	lower equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	174.71
51	lower equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	177.35
52	lower equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	201.09
53	surge line, below to elevator	0.0004	0	0	0	0.4779	44.6
54	Components to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	35.02
55	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	12.46
56	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.43975	9.11
57	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.3	6.76
58	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.4	33.44
59	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.15	17.01
60	surge line, below to access	0.0004	0	0	0	0.4	48.55
61	reactor cavity to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	42.23
62	surge line, below to staircase (north)	0.0004	0	0	0	0.6	28.68
63	surge line, below to elevator	0.0004	0	0	0	0.6	12.12
64	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	14.14
65	reactor cavity to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	16.8
66	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	23.04
67	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	56.65
68	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	114.61

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 7 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
69	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	128.02
70	middle equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	157.44
71	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	138.92
72	surge line, below to staircase (north)	0.0004	0	0	0	0.5	34.46
73	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	29.64
74	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.275	42.08
75	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	26.3
76	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.15	8.4
77	PZR to staircase (north)	0.0004	0	0	0	0.5	39.12
78	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.10695	79.38
79	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.10965	86.6
80	PZR to middle annulus rooms L3 & 4	0.0004	0	0	0	0.5	42.7
81	PZR to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	32.31
82	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
83	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4423	316.84

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 8 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
84	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	277.91
85	upper equipment rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.5	16.4
86	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	43.19
87	upper equipment rooms L3 & 4 to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	227.72
88	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	29.77
89	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4431	321.22
90	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
91	PZR to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	47.59
92	PZR to upper annulus rooms L1 & 2	0.0004	0	0	0	0.4	66.57
93	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	15.09
94	PZR to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	17.48
	Vertical wall to non-accessible space	0.0004	0	0	0	0.501	11032
1	spreading rooms to components	0.0004	0	0	0	0.6	91.12
2	spreading rooms to components	0.0004	0	0	0	0.25	91.4
3	spreading rooms to lower equipment rooms L4	0.0004	0	0	0	0.27265	41.92
4	spreading rooms to components	0.0004	0	0	0	0.4	25.18
5	Internal wall in SG blowdown (LCQ) HX etc.	0.0004	0	0	0	0.25	12.64

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 9 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
6	RPV pit to SG blowdown (LCQ) HX etc.	0.0004	0	0	0	1.36	5.2
7	Internal wall in components	0.0004	0	0	0	0.25365	299.32
8	RPV pit to components	0.0004	0	0	0	1.36	105.6
9	Internal wall in components	0.0004	0	0	0	0.2	46.9
10	lower equipment rooms L1 to RPV pit	0.0004	0	0	0	1.01135	65.1
11	lower equipment rooms L2 to RPV pit	0.0004	0	0	0	1.0228	61.42
12	RPV pit to lower equipment rooms L3	0.0004	0	0	0	1.0228	61.42
13	RPV pit to lower equipment rooms L4	0.0004	0	0	0	1.0212	63.48
14	RPV pit to surge line, below	0.0004	0	0	0	0.82845	26.88
15	lower equipment rooms L1 to lower equipment rooms L4	0.0004	0	0	0	0.25	30.96
16	lower equipment rooms L2 to surge line, below	0.0004	0	0	0	0.4564	154.18
17	lower equipment rooms L3 to surge line, below	0.0004	0	0	0	0.44975	174.86
18	lower equipment rooms L4 to components	0.0004	0	0	0	0.25	7.46
19	lower equipment rooms L4 to components	0.0004	0	0	0	0.6	34.4
20	Internal wall in surge line, below	0.0004	0	0	0	0.25	154.68
21	Internal wall in components	0.0004	0	0	0	0.4	26.66
22	lower equipment rooms L1 to reactor cavity	0.0004	0	0	0	0.6	68.24
23	lower equipment rooms L2 to reactor cavity	0.0004	0	0	0	0.6	30.48
24	reactor cavity to lower equipment rooms L3	0.0004	0	0	0	0.6	30.48
25	reactor cavity to lower equipment rooms L4	0.0004	0	0	0	0.6	65.2
26	Internal wall in reactor cavity	0.0004	0	0	0	0.6	21.74

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 10 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
27	reactor cavity to surge line, below	0.0004	0	0	0	0.6	164.8
28	middle equipment rooms L1 to reactor cavity	0.0004	0	0	0	0.6	569.6
29	middle equipment rooms L2 to reactor cavity	0.0004	0	0	0	0.6	255.12
30	reactor cavity to middle equipment rooms L3	0.0004	0	0	0	0.6	250.64
31	reactor cavity to middle equipment rooms L4	0.0004	0	0	0	0.6	572.64
32	reactor cavity to PZR	0.0004	0	0	0	0.6	132.54
33	Internal wall in equipment rooms L1	0.0004	0	0	0	0.5	84.46
34	lower equipment rooms L1 to lower equipment rooms L2	0.0004	0	0	0	0.5	168.92
35	Internal wall in lower equipment rooms L2	0.0004	0	0	0	0.5	175.48
36	lower equipment rooms L2 to reactor cavity	0.0004	0	0	0	0.4	25.2
37	Internal wall in lower equipment rooms L3	0.0004	0	0	0	0.5	175.48
38	lower equipment rooms L3 to lower equipment rooms L4	0.0004	0	0	0	0.5	168.92
39	Internal wall in lower equipment rooms L4	0.0004	0	0	0	0.5	168.92
40	lower equipment rooms L4 to middle equipment rooms L4	0.0004	0	0	0	0.6	83.78
41	Internal wall in surge line, below	0.0004	0	0	0	0.4	163.86
42	reactor cavity to surge line, below	0.0004	0	0	0	0.25	29.62
43	reactor cavity to surge line, below	0.0004	0	0	0	0.4	17
44	Internal wall in middle equipment rooms L1	0.0004	0	0	0	0.5	127.08
45	middle equipment rooms L1 to middle equipment rooms L2	0.0004	0	0	0	0.75105	62.14

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 11 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
46	Internal wall in middle equipment rooms L2	0.0004	0	0	0	0.5	126.28
47	middle equipment rooms L2 to surge line, below	0.0004	0	0	0	0.4	110.16
48	Internal wall in middle equipment rooms L3	0.0004	0	0	0	0.5	126.48
49	middle equipment rooms L3 to surge line, below	0.0004	0	0	0	0.4	114
50	middle equipment rooms L3 to middle equipment rooms L4	0.0004	0	0	0	0.75155	61.94
51	Internal wall in middle equipment rooms L4	0.0004	0	0	0	0.5	127.52
52	surge line, below to PZR	0.0004	0	0	0	0.275	176.42
53	Internal wall in middle equipment rooms L1	0.0004	0	0	0	0.6	76.72
54	middle equipment rooms L1 to middle equipment rooms L2	0.0004	0	0	0	0.5	61.8
55	middle equipment rooms L2 to PZR	0.0004	0	0	0	0.4	17.84
56	middle equipment rooms L3 to PZR	0.0004	0	0	0	0.4	85
57	middle equipment rooms L3 to middle equipment rooms L4	0.0004	0	0	0	0.5	61.8
58	Internal wall in middle equipment rooms L4	0.0004	0	0	0	0.6	71.04
59	Internal wall in PZR	0.0004	0	0	0	0.4	50.76
60	Internal wall in upper equipment rooms L1 & 2	0.0004	0	0	0	0.4535	226.34
61	Internal wall in upper equipment rooms L3 & 4	0.0004	0	0	0	0.4535	226.34
62	upper equipment rooms L3 & 4 to PZR	0.0004	0	0	0	0.25	102
63	SG blowdown (LCQ) HX etc. to elevator	0.0004	0	0	0	0.4	8.32
64	SG blowdown (LCQ) HX etc. to access	0.0004	0	0	0	0.1	37.19

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 12 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
65	SG blowdown (LCQ) HX etc. to lower annulus rooms L1 & 2	0.0004	0	0	0	0.4	5.02
66	SG blowdown (LCQ) HX etc. to lower annulus rooms L3 & 4	0.0004	0	0	0	0.15	5.12
67	Components to hot piping	0.0004	0	0	0	0.5	77.08
68	Components to hot piping	0.0004	0	0	0	0.15	9.28
69	lower equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	60.19
70	lower equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	178.12
71	lower equipment rooms L1 to components	0.0004	0	0	0	0.2742	30.19
72	lower equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	174.71
73	lower equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	177.35
74	lower equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	201.09
75	surge line, below to elevator	0.0004	0	0	0	0.4779	44.6
76	Components to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	35.02
77	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	12.46
78	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.43975	9.11
79	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.3	6.76
80	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.4	33.44
81	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.15	17.01
82	surge line, below to access	0.0004	0	0	0	0.4	48.55

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 13 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
83	reactor cavity to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	42.23
84	surge line, below to staircase (north)	0.0004	0	0	0	0.6	28.68
85	surge line, below to elevator	0.0004	0	0	0	0.6	12.12
86	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	14.14
87	reactor cavity to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	16.8
88	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	23.04
89	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	56.65
90	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	114.61
91	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	128.02
92	middle equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	157.44
93	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	138.92
94	surge line, below to staircase (north)	0.0004	0	0	0	0.5	34.46
95	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	29.64
96	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.275	42.08
97	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	26.3
98	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.15	8.4
99	PZR to staircase (north)	0.0004	0	0	0	0.5	39.12
100	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.10695	79.38

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 14 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
101	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.10965	86.6
102	PZR to middle annulus rooms L3 & 4	0.0004	0	0	0	0.5	42.7
103	PZR to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	32.31
104	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
105	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4423	316.84
106	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	277.91
107	upper equipment rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.5	16.4
108	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	43.19
109	upper equipment rooms L3 & 4 to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	227.72
110	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	29.77
111	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4431	321.22
112	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
113	PZR to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	47.59
114	PZR to upper annulus rooms L1 & 2	0.0004	0	0	0	0.4	66.57
115	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	15.09

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 15 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
116	PZR to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	17.48
	Horizontal wall (floor/ceiling) to accessible space	0.001	0	0	0	0.318	8056
1	Internal wall in access	0.001	0	0	0	0.3	23.94
2	lower annulus rooms L1 & 2 to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	595.74
3	lower annulus rooms L3 & 4 to middle annulus rooms L3 & 4	0.001	0	0	0	0.3	756.3
4	staircase (south) to hot piping	0.001	0	0	0	0.3	32.22
5	middle annulus rooms L1 & 2 to hot piping	0.001	0	0	0	0.3	286.54
6	middle annulus rooms L3 & 4 to hot piping	0.001	0	0	0	0.3	250
7	Internal wall in middle annulus rooms L1 & 2	0.001	0	0	0	0.25	560.4
8	Internal wall in middle annulus rooms L3 & 4	0.001	0	0	0	0.25	498.8
9	Internal wall in middle annulus rooms L3 & 4	0.001	0	0	0	0.14925	782.62
10	middle annulus rooms L1 & 2 to middle annulus rooms L3 & 4	0.001	0	0	0	0.95	36.6
11	access to staircase (north)	0.001	0	0	0	0.25	48.4
12	middle annulus rooms L1 & 2 to access	0.001	0	0	0	0.25	47
13	middle annulus rooms L3 & 4 to access	0.001	0	0	0	0.25	52.2
14	Internal wall in middle annulus rooms L1 & 2	0.001	0	0	0	0.15	719.68
15	Internal wall in lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.15	17.38
16	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	167

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 16 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
17	middle annulus rooms L1 & 2 to staircase (south)	0.001	0	0	0	0.5	40.82
18	middle annulus rooms L3 & 4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	366.08
19	middle annulus rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	335.16
20	middle annulus rooms L1 & 2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	84.26
21	Internal wall in upper annulus rooms L1 & 2	0.001	0	0	0	0.25	359
22	Internal wall in upper annulus rooms L3 & 4	0.001	0	0	0	0.25	430
23	Internal wall in upper annulus rooms L1 & 2	0.001	0	0	0	0.5	132
24	upper annulus rooms L1 & 2 to staircase (south)	0.001	0	0	0	0.25	98.1
25	lower & upper dome L1, 2, 3 & 4 to staircase (north)	0.001	0	0	0	0.25	29
26	lower & upper dome L1, 2, 3 & 4 to elevator	0.001	0	0	0	0.15	13.44
27	upper annulus rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	224
28	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	132
29	Components to hot piping	0.001	0	0	0	0.3	11.3
30	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	9.55
31	Components to staircase (south)	0.001	0	0	0	0.3	7.75
32	Components to middle annulus rooms L3 & 4	0.001	0	0	0	0.26235	27.1
33	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.95	23.7
34	Components to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.95	26.4

Table 6.2.1-4—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
35	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.6	490.84
36	middle equipment rooms L1 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	69.8
37	middle equipment rooms L2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	6.78
38	middle equipment rooms L3 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	17.08
39	middle equipment rooms L4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	35.88
40	middle equipment rooms L1 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	47.8
41	middle equipment rooms L4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	24.51
42	PZR to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	12.88
43	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	32
44	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	34
45	PZR to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	60
	Horizontal wall (floor/ceiling) to non-accessible space	0.001	0	0	0	0.439	3068
1	spreading rooms to components	0.001	0	0	0	0.7	463.72
2	spreading rooms to components	0.001	0	0	0	0.15	33.4
3	Internal wall in components	0.001	0	0	0	0.7	26.8

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 18 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
4	surge line, below to SG blowdown (LCQ) HX etc.	0.001	0	0	0	0.3	273.84
5	lower equipment rooms L4 to components	0.001	0	0	0	0.3	138.48
6	lower equipment rooms L1 to components	0.001	0	0	0	0.3	81.14
7	Internal wall in components	0.001	0	0	0	0.3	165.68
8	RPV pit to reactor cavity	0.001	0	0	0	0.3	76
9	lower equipment rooms L1 to reactor cavity	0.001	0	0	0	0.6	44.4
10	lower equipment rooms L2 to reactor cavity	0.001	0	0	0	0.68	5.4
11	lower equipment rooms L3 to surge line, below	0.001	0	0	0	0.88	5.4
12	reactor cavity to lower equipment rooms L4	0.001	0	0	0	0.6	56
13	Internal wall in surge line, below	0.001	0	0	0	0.3	226.4
14	reactor cavity to surge line, below	0.001	0	0	0	0.68	17.2
15	reactor cavity to components	0.001	0	0	0	0.6	34.2
16	lower equipment rooms L4 to middle equipment rooms L4	0.001	0	0	0	0.15	61.78
17	Internal wall in surge line, below	0.001	0	0	0	0.15	218
18	reactor cavity to surge line, below	0.001	0	0	0	0.15	17.38
19	middle equipment rooms L3 to PZR	0.001	0	0	0	0.5	9.48
20	Internal wall in PZR	0.001	0	0	0	0.5	80.48
21	Internal wall in upper equipment rooms L3 & 4	0.001	0	0	0	0.15	4.4
22	Internal wall in PZR	0.001	0	0	0	0.25	90.8
23	Components to hot piping	0.001	0	0	0	0.3	11.3
24	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	9.55

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 19 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
25	Components to staircase (south)	0.001	0	0	0	0.3	7.75
26	Components to middle annulus rooms L3 & 4	0.001	0	0	0	0.26235	27.1
27	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.95	23.7
28	Components to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.95	26.4
29	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.6	490.84
30	middle equipment rooms L1 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	69.8
31	middle equipment rooms L2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	6.78
32	middle equipment rooms L3 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	17.08
33	middle equipment rooms L4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	35.88
34	middle equipment rooms L1 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	47.8
35	middle equipment rooms L4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	24.51
36	PZR to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	12.88
37	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	32
38	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	34
39	PZR to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	60
	Thick steel	0.0002	0.04	0	0	0	2470

Table 6.2.1-4—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
1	Components to hot piping	0.0002	0.3	0	0	0	8
2	lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0.05	0	0	0	57
3	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0388	0	0	0	1942.8
4	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0371	0	0	0	462
	Medium steel	0.0002	0.0086	0	0	0	13230
1	Internal steel in components	0.0002	0.0086	0	0	0	23.72
2	Internal steel in IRWST	0.0002	0.0086	0	0	0	59.8
3	Internal steel in SG blowdown (LCQ) HX etc.	0.0002	0.0086	0	0	0	2.54
4	Internal steel in access	0.0002	0.0086	0	0	0	44.99
5	Internal steel in lower annulus rooms L3 & 4	0.0002	0.0086	0	0	0	37.64
6	Internal steel in hot piping	0.0002	0.0086	0	0	0	35.31
7	Internal steel in lower annulus rooms L1 & 2	0.0002	0.0086	0	0	0	36.47
8	Internal steel in lower equipment rooms L3	0.0002	0.0086	0	0	0	398.32
9	Internal steel in lower equipment rooms L4	0.0002	0.0086	0	0	0	432.57
10	Internal steel in lower equipment rooms L1	0.0002	0.0086	0	0	0	432.57
11	Internal steel in lower equipment rooms L2	0.0002	0.0086	0	0	0	398.32
12	Internal steel in middle annulus rooms L3 & 4	0.0002	0.0086	0	0	0	1928.98
13	Internal steel in middle annulus rooms L1 & 2	0.0002	0.0086	0	0	0	1790.91
14	Internal steel in surge line, below	0.0002	0.0086	0	0	0	48.78
15	Internal steel in middle equipment rooms L3	0.0002	0.0086	0	0	0	926.23
16	Internal steel in middle equipment rooms L4	0.0002	0.0086	0	0	0	881.02
17	Internal steel in middle equipment rooms L1	0.0002	0.0086	0	0	0	881.02

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 21 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
18	Internal steel in middle equipment rooms L2	0.0002	0.0086	0	0	0	926.23
19	Internal steel in PZR	0.0002	0.0086	0	0	0	11.84
20	Internal steel in upper equipment rooms L3 & 4	0.0002	0.0086	0	0	0	818.35
21	Internal steel in upper equipment rooms L1 & 2	0.0002	0.0086	0	0	0	818.35
22	Internal steel in upper annulus rooms L3 & 4	0.0002	0.0086	0	0	0	40.2
23	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0086	0	0	0	2194.65
24	Internal steel in upper annulus rooms L1 & 2	0.0002	0.0086	0	0	0	57.34
25	Internal steel in staircase (south)	0.0002	0.0086	0	0	0	4.29
	Thin steel	0.0002	0.0015	0	0	0	8640
1	Internal steel in components	0.0002	0.0015	0	0	0	26.76
2	Internal steel in IRWST	0.0002	0.0015	0	0	0	67.5
3	Internal steel in SG blowdown (LCQ) HX etc.	0.0002	0.0015	0	0	0	4.3
4	Internal steel in access	0.0002	0.0015	0	0	0	60.84
5	Internal steel in lower annulus rooms L3 & 4	0.0002	0.0015	0	0	0	50.93
6	Internal steel in hot piping	0.0002	0.0015	0	0	0	47.78
7	Internal steel in lower annulus rooms L1 & 2	0.0002	0.0015	0	0	0	49.36
8	Internal steel in lower equipment rooms L3	0.0002	0.0015	0	0	0	192.5
9	Internal steel in lower equipment rooms L4	0.0002	0.0015	0	0	0	209.05
10	Internal steel in lower equipment rooms L1	0.0002	0.0015	0	0	0	209.05
11	Internal steel in lower equipment rooms L2	0.0002	0.0015	0	0	0	192.5
12	Internal steel in middle annulus rooms L3 & 4	0.0002	0.0015	0	0	0	1671.17
13	Internal steel in middle annulus rooms L1 & 2	0.0002	0.0015	0	0	0	1606.45

Table 6.2.1-4—Containment Heat Sink Inventory
Sheet 22 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
14	Internal steel in surge line, below	0.0002	0.0015	0	0	0	109.56
15	Internal steel in middle equipment rooms L3	0.0002	0.0015	0	0	0	454.34
16	Internal steel in middle equipment rooms L4	0.0002	0.0015	0	0	0	427.97
17	Internal steel in middle equipment rooms L1	0.0002	0.0015	0	0	0	428.09
18	Internal steel in middle equipment rooms L2	0.0002	0.0015	0	0	0	454.31
19	Internal steel in PZR	0.0002	0.0015	0	0	0	16.03
20	Internal steel in upper equipment rooms L3 & 4	0.0002	0.0015	0	0	0	415.34
21	Internal steel in upper equipment rooms L1 & 2	0.0002	0.0015	0	0	0	415.34
22	Internal steel in upper annulus rooms L3 & 4	0.0002	0.0015	0	0	0	54.4
23	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0015	0	0	0	1392.85
24	Internal steel in upper annulus rooms L1 & 2	0.0002	0.0015	0	0	0	77.6
25	Internal steel in staircase (south)	0.0002	0.0015	0	0	0	5.8
				Cumulative Available Surface Area			67,646 (728,136 ft²)
				Minimum Surface Area			64,998 (699,633 ft²)

Table 6.2.1-5—Containment Initial and Boundary Conditions

Item	Parameter	Analytical Value	
1	Containment Free Volume	2,754,237 ft³ 78,000 m³	
2	Initial IRWST Water Volume	50,996 ft³ 1444 m³	
3	Initial IRWST Water Temperature	122°F 50°C	
4	Initial Containment Pressure	15.96 psia 1.1 bar	
5	Initial Containment Temperature	**Service Compartments**	**Equipment Compartments**
		86°F	131°F
		30°C	55°C
6	Initial Relative Humidity	≤30%	
7	Outside or Ambient Temperature	Insulated boundary condition to maximize containment temperature and pressure	

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Table 6.2.1-6—Containment Response to Hot Leg Breaks

Variable	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 7A	Case 7C	Case 32	Case 45[4]	Case 46[4,5]
Short Term Analysis Results												
Peak Pressure (psia)	66.45	66.45	65.80	65.80	65.60	65.51	66.53	66.69	66.26	69.7	46.82	46.63
Time of Peak Pressure (s)	32.0	32.0	24.0	24.0	25.0	28.0	25.0	31.0	22.0035	26.6	12010	12000
Peak Vapor Temp. (°F)[6]	273.708	273.708	272.842	272.841	272.575	272.457	273.821	273.031	273.46	311.8	254.9	254.9
Time of Peak Vapor Temp. (s)	32.0	32.0	24.0	24.0	25.0	27.0	25.0	31.0	22.0035	23.3	11910	11930
Long Term Analysis Results												
Peak Pressure (psia)	-	-	-	-	-	-	-	-	-	48.0	-	-
Time of Peak Pressure (s)	-	-	-	-	-	-	-	-	-	7900	-	-
Peak Vapor Temp. (°F)[6]	-	-	-	-	-	-	-	-	-	311.8	-	-
Time of Peak Vapor Temp. (s)	-	-	-	-	-	-	-	-	-	23.3	-	-
Case Description												
Break Configuration[1]	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=0.8	DEG, Cd=0.6	DES, Cd=0.8	DEG, Cd=1.0	DES, Cd=1.0	DEG Cd=1.0	0.0491 ft^2 (3 in)	0.0491 ft^2 (3 in)
ECCS	Max	Min	Min	Max	Min	Min	Min	Min	Min	Min	Min	Min
Pressure (psia)	60.0	60.0	60.0	60.0	60.0	60.0	60.0	14.7	14.7	Note 3	Note 3	Note 3
IRWST Temp. (°F)	122	122	122	122	122	122	122	122	122	122	122	122

Notes:

1. DEG = double-ended guillotine; DES = double-ended split
2. Cases 1–7C are based on a single-node containment model for short-term analysis. Case 32 was analyzed with a multi-node subdivided containment model to identify the limiting long-term peak pressure.
3. Containment pressure used in the M&E energy calculation matched the predicted GOTHIC pressure profile.
4. Cases 45–46 are SBLOCA analyses are included for the development of EQ profiles.
5. Rupture foils assumed to remain closed.
6. Peak vapor temperature listed is located in the break room.

Table 6.2.1-7—Containment Respone Cold Leg Pump Suction Breaks

Variable	Case 8	Case 9	Case 10	Case 10B	Case 11	Case 12	Case 13	Case 14	Case 14B	Case 14C	Case 14D	Case 14E	Case 33	Case 34	Case 36	Case 37	Case 38	Case 39	Case 40
Short Term Analysis Results																			
Peak Pressure(psia)	64.6	64.6	65.8	65.8	65.8	66.0	65.9	66.3	66.3	66.2	66.4	66.5	64.02	64.02	64.13	64.04	63.31	64.2	66.44
Time of Peak Pressure (s)	36.0	36.0	38.0	38.0	38.0	39.0	40.0	40.0	40.0	40.0	41.0	40.0	27.73	27.73	27.43	27.93	27.93	28.03	27.98
Peak Vapor Temp. (°F)[4]	271.2	271.2	272.8	272.9	272.8	273.0	273.0	273.5	273.6	273.4	273.6	273.7	326.2	314.5	309.2	317.6	309.2	308.0	314.7
Time of Peak Vapor Temp. (s)	35.0	35.0	38.0	38.0	38.0	39.0	40.0	40.0	40.0	40.0	40.0	40.0	100.04	75.04	75.04	110.04	80.04	150.04	70.09
Long Term Analysis Results																			
Peak Pressure(psia)	-	-	-	-	-	-	-	-	-	-	-	-	63.72	67.05	66.99	67.32	67.11	66.72	69.27
Time of Peak Pressure (s)	-	-	-	-	-	-	-	-	-	-	-	-	3600	3600	3600	3600	3600	3600	3600
Peak Vapor Temp. (°F)[4]	-	-	-	-	-	-	-	-	-	-	-	-	326.2	314.5	309.2	317.6	309.2	308.0	314.7
Time of Peak Vapor Temp. (s)	-	-	-	-	-	-	-	-	-	-	-	-	100.04	75.04	75.04	110.04	80.04	150.04	70.09
Case Description																			
Break Configuration[1]	DEG, Cd=1	DEG, Cd=1	DEG, Cd=1	DEG, Cd=1	DEG, Cd=1	DEG, Cd=0.8	DEG, Cd=0.6	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=1	DEG Cd=1.0	DEG Cd=1.0	DEG Cd=1.0	DEG Cd=1.0	DEG Cd=1.0	DEG Cd=1.0	DEG Cd=1.0
ECCS	Max	Min	Min	Min	Max	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
Pressure (psia)	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	14.7	76.7	60	14.7	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
IRWST Temp. (°F)	122	122	122	122	122	122	122	122	122	122	248	122	122	122	122	122	122	122	122

Notes:

1. DEG = double-ended guillotine; DES = double-ended split
2. Cases 8–14E are based on a single-node containment model for short-term analysis. Cases 33 through 40 were analyzed with a multi-node subdivided containment model to identify the limiting long-term peak pressure.
3. Containment pressure used in the M&E energy calculation matched the predicted GOTHIC pressure profile.
4. Peak vapor temperature listed is located in the break room.

Table 6.2.1-8—Containment Response Cold Leg Pump Discharge Breaks

Variable	Case 15	Case 16	Case 17	Case 18	Case 19	Case 20	Case 21	Case 22	Case 23	Case 24	Case 25	Case 26	Case 27	Case 28	Case 29	Case 30	Case 31	Case 41	Case 42[4]	Case 43[4]	Case 44[4]
Short Term Analysis Results																					
Peak Pressure(psia)	63.77	63.77	63.69	63.69	63.69	63.69	63.82	64.30	63.41	63.92	64.85	65.17	64.91	64.95	64.98	65.37	65.38	65.44	63.52	61.99	49.21
Time of Peak Pressure (s)	24	24	25	25	25	25	26	25	27	28	24	25	24	25	25	24	25	23.92	1790	6131	7000
Peak Vapor Temp. (°F)[5]	270.04	270.04	269.93	269.93	269.93	269.93	270.11	270.77	269.53	270.24	271.52	271.96	271.61	271.66	271.71	272.24	272.25	344.9	291.8	277.4	258.5
Time of Peak Vapor Temp. (s)	24	24	25	25	25	25	26	25	27	28	24	25	24	25	24	24	25	80	1230	6849	7000
Long Term Analysis Results																					
Peak Pressure(psia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68.4	-	-	-
Time of Peak Pressure (s)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1860	-	-	-
Peak Vapor Temp. (°F)[5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	344.9	-	-	-
Time of Peak Vapor Temp. (s)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-
Case Description																					
Break Configuration[1]	DEG C_d=1	DEG C_d=1	DEG C_d=1	DEG C_d=1	DEG C_d=1	DEG C_d=1	DEG C_d=.8	DES C_d=.8	DES C_d=.6	DEG C_d=.6	DES C_d=1	DES C_d=1	DES C_d=1	DES C_d=1	DES C_d=1	DES C_d=1	DES C_d=1	DEG Cd=1	0.5 ft^2 (9 in)	0.1963 ft^2 (6 in)	0.0491 ft^2 (3 in)
ECCS	Max	Min	Min	Max	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
Pressure (psia)	60	60	60	60	60	60	60	60	60	60	60	14.7	76.7	60	60	60	60	Note 3	Note 3	Note 3	Note 3
IRWST Temp. (°F)	122	122	122	122	122	122	122	122	122	122	122	122	122	248	122	122	170	122	122	122	122

Notes:

1. DEG = double-ended guillotine; DES = double-ended split
2. Cases 15–31 are based on a single-node containment model for short-term analysis. Case 41 was analyzed with a multi-node subdivided containment model to identify the limiting long-term peak pressure.
3. Containment pressure used in the M&E energy calculation matched the predicted GOTHIC pressure profile.
4. Cases 42–44 are SBLOCA analyses are included for the development of EQ profiles.
5. Peak vapor temperature listed is located in the break room.

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Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB
Sheet 1 of 2

Description	Time of Peak Pressure (s)	Peak Pressure (psia)	Time of Peak Temperature (s)	Peak Temperature (°F)
100 % Power Cases				
DEG[1]	56.0	54.8	28.0	406.9
1.0 ft^2 split	180.0	55.8	180.0	376.2
0.7 ft^2 split	300.0	55.4	275.0	388.8
0.52 ft^2 split	380.0	55.9	365.0	388.0
0.3 ft^2 split	1800.0	57.5	610.0	395.4
80 % Power Cases				
DEG[1]	80.0	56.0	28.0	410.6
1.0 ft^2 split	185.0	56.6	57.0	377.6
0.7 ft^2 split	300.0	56.1	255.0	388.2
0.52 ft^2 split	420.0	56.6	400.0	387.1
0.3 ft^2 split	1800.0	58.3	670.0	401.2
60 % Power Cases				
DEG[1]	41.0	58.0	26.0	418.0
1.0 ft^2 split	210.0	56.2	165.0	388.8
0.7 ft^2 split	300.0	56.4	265.0	388.4
0.52 ft^2 split	420.0	56.9	385.0	389.0
0.3 ft^2 split	1800.0	58.5	670.0	403.6
50 % Power Cases				
DEG[1]	39.1	58.9	26.1	420.8
1.0 ft^2 split	240.0	56.4	96.0	381.7
0.7 ft^2 split	340.0	56.7	280.0	388.1
0.52 ft^2 split	440.0	57.0	405.0	386.3
0.3 ft^2 split	1800.0	58.6	762.0	400.7
40 % Power Cases				
DEG[1]	39.1	59.8	26.1	423.3
1.0 ft^2 split	240.0	56.7	80.0	382.3
0.7 ft^2 split	340.0	56.9	285.0	387.4
0.52 ft^2 split	1800.0	57.1	420.0	384.4

Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB
Sheet 2 of 2

Description	Time of Peak Pressure (s)	Peak Pressure (psia)	Time of Peak Temperature (s)	Peak Temperature (°F)
0.3 ft^2 split	1800.0	58.9	740.0	403.0
20 % Power Cases				
DEG[1]	38.5	62.1	26.1	427.3
DEG[2]	34.1	62.7	26.1	428.5
DEG[2, 3]	18.15	66.4	18.1	479.5
1.0 ft^2 split	210.1	58.3	82.1	384.6
0.7 ft^2 split	340.0	58.0	320.0	382.8
0.52 ft^2 split	1800.0	58.4	500.0	380.9
0.3 ft^2 split	1800.0	59.6	950.0	391.5
0 % Power Cases				
DEG[1]	41.5	60.4	2.0	401.1
1.0 ft^2 split	220.0	60.4	45.1	390.3
0.7 ft^2 split	340.0	60.0	325.0	377.5
0.52 ft^2 split	1800.0	59.9	580.0	377.4
0.3 ft^2 split	1800.0	61.5	1140.0	389.7
0.3 ft^2 split[3]	1800.0	59.0	1080.0	325.0
0.2 ft^2 split	1980.0	62.2	1980.0	382.7
0.15 ft^2 split	2540.0	59.3	2540.0	375.0
0.1 ft^2 split	3700.0	54.5	3700.0	364.0
0.01 ft^2 split	1800.0	21.4	1770.0	196.4
0.005 ft^2 split	1800.0	19.2	1800.0	167.5

Notes:

1. DEG = double-ended guillotine.
2. No EFW supplied to broken SG.
3. Break located in the accessible space outside the SG towers.

Table 6.2.1-10—Critical Subcompartments in Containment

Room Name (30UJA)	Room Description	System Name (Pipe Name)	Operating Pressure (psia)	Operating Temperature (°F)	NPS (in)	Accident Pressure (psia)
11 - 004	SG Loop 2	SIS/RHR (JJNA20 BR001)	2250.0	625.7	10	20.80
11 - 006	RCP Loop 3	CVCS (KBA35 BR002)	2324.0	512.3	4	*
11 - 027	SI valves Loop 3	SIS/RHR (JNG33 BR001)	814.7	140	12	16.90
15 - 004	SG Loop 2	CVCS (KBA34 BR019)	2324.0	512.3	3	*
15 - 006	RCP Loop 3	SIS/RHR(JNG33 BR007)	2250.0	563.4	10	29.02
18 - 004	SG Loop 2	SG Blowdown (LCQ10 BR012)	1144.3	561.0	2	*
23 - 004	SG Loop 2	FW(LAB70 BR005)	1131.2	446.3	20	28.36
29 - 004	SG Loop 2	FW(LAB70 BR005)	1131.2	446.3	20	31.07
29 - 019	Pressurizer Cavity	RCS (JEF10 BR004)	2250.0	653.0	6	17.82
34 - 004	SG Loop 2	SG (JEA20 BR302)	1123.0	559.0	1	*
34 - 019	Pressurizer Relief Valve Cavity	RCS (JEF10 BR004)	2250.0	653.0	6	18.59

Table 6.2.1-11—Free Volume and Vent Path Hydraulic Data for RCP Cavity (30UJA15-006)

Volume Data		Free Volume (ft^3)	From Elev. (ft)	To Elev. (ft)
Node No.	Room Code (See Arrangement Drawings) (30UJA)			
31	15-006	3208.2	15.22	24.08
Connecting Nodes				
2	04-003	52400.9	-22.47	0
8	11-001	2932.2	-20.67	24.41
10	11-006, 11-007, 15-007	21091.4	4.92	30.77
11	11-008, 11-009, 15-008, 15-009	25541.6	4.92	30.77
12	18-006, 18-007, 23-006, 23-007	35311.1	24.08	64.8
13	18-008, 18-009, 23-008, 23-009, 23-018, 23-031,	41082.43	24.08	64.8
22	11-015, 11-016, 11-027, 11-028, 11-032, 15-015, 15-016, 18-015, 18-016, 23-015, 23-016	176396.75	4.92	63.98

Vent Path No.	Node No.		Vent Area (ft^2)	Inertia Length (ft)	Form Loss Factor	Opening Type (Required ?P)	Delay Time (s)
	From	To					
Vent Path Data							
7	2	10	53.82	17.1	1.5	N/A	N/A
35	8	10	17.761	18.3	1.5	N/A	N/A
39	10	11	430.57	30.0	1.5	N/A	N/A
40	10	13	32.29	30.2	1.5	N/A	N/A
41	10	12	447.79	33.3	1.5	N/A	N/A
42	10	22	28.42	41.6	1.5	Door (1.45 psid)	Remains closed
43	10	22	47.15	41.6	1.5	Door (8.071 psid)	Remains closed
97	8	31	17.76	13.5	1.5	N/A	N/A
98	31	12	274.70	24.8	1.5	N/A	N/A
99	31	22	29.064	36.8	1.5	Door (8.071 psid)	Remains closed
100	10	31	241.12	17.4	1.5	N/A	N/A

Table 6.2.1-12—Free Volume and Vent Path Hydraulic Data for SG Cavity (30UJA23-004)

Volume Data		Free Volume (ft^3)	From Elev. (ft)	To Elev. (ft)
Node No.	Room Code (See Arrangement Drawings) (30UJA)			
31	23-004	10797.5	45.28	64.8
Connecting Nodes				
4	11-004, 11-005, 15-004, 15-005	24299.7	4.92	30.77
5	18-002, 18-003, 23-002, 23-003, 23-017, 23-020	39785.3	24.08	64.8
6	18-004, 18-005, 23-005	27666.56	24.08	63.98
7	29-003, 29-004, 29-005, 34-003, 34-004, 34-005	37032.5	63.98	103.51
9	15-001, 15-017, 15-024	50948.6	24.41	60.53
21	11-013,14, 21, 25, 26, 31 15-13, 14, 20, 21, 25 18-13, 14 23-13, 14, 42	171746.58	4.92	63.98

Vent Path No.	Node No.		Vent Area (ft^2)	Inertia Length (ft)	Form Loss Factor	Opening Type (Required ΔP)	Delay Time (s)
	From	To					
Vent Path Data							
20	4	6	722.5	32.9	1.5	N/A	N/A
24	5	6	468.46	28.8	1.5	N/A	N/A
28		7	258.34	39.7	1.5	N/A	N/A
29	31	9	5.17	30.5	1.5	N/A	N/A
30	6	21	78.58	41.0	1.5	Door (7.252 psid)	Remains Closed
97	5	31	378.9	27.4	1.5	N/A	N/A
98	31	7	271.91	29.5	1.5	N/A	N/A
99	6	31	340.15	29.7	1.5	N/A	N/A
100	31	6	132.62	24.9	1.5	N/A	N/A

Table 6.2.1-13—Free Volume and Vent Path Hydraulic Data for SG Cavity (30UJA29-004)

Volume Data		Free Vol. (ft^3)	From Elev. (ft)	To Elev. (ft)
Node No.	Room Code (See Arrangement Drawings) (30UJA)			
31	29-004	5140.0	64.8	79.07
Connecting Nodes				
5	18-002, 18-003, 23-002, 23-003, 23-017, 23-020	39785.3	24.08	64.8
6	18-004, 18-005, 23-005	38464.1	24.08	63.98
7	29-003, 29-, 04, 29-005, 34-003, 34-004, 34-005	37032.5	63.98	103.51
16	23-019, 23-041, 29-019, 34-019	18921.6	49.11	91.86
23	29-014, 29-018, 34-014, 34-018	80170.9	63.98	93.5
25	15-023, 29-013, 29-016, 34-104, 34-108, 40-001	1579198.53	20.67	188.68

Vent Path No.	Node No.		Vent Area (ft^2)	Inertia Length (ft)	Form Loss Factor	Opening Type (Required ΔP)	Delay Time (s)
	From	To					
Vent Path Data							
25	5	7	271.19	40.1	1.5	N/A	N/A
28	6	7	258.342	40.1	1.5	N/A	N/A
31	7	16	10.76	24.7	1.5	N/A	N/A
32	7	25	318.62	103.8	1.5	Door (0.6962 psid)	Remains Closed
33	7	23	43.06	40.3	1.5	Door (1.45 psid)	Remains Closed
34	7	25	43.06	103.8	1.5	Door (7.252 psid)	Remains Closed
97	6	31	271.905	27.5	1.5	N/A	N/A
98	7	31	265,02	23.7	1.5	N/A	N/A
99	31	7	21.53	23.7	1.5	N/A	N/A
100	31	7	185.36	26.9	1.5	N/A	N/A

Table 6.2.1-14—Free Volume and Vent Path Hydraulic Data for PZR Cavities (30UJA29-019 and UJA34-019)

Volume Data		Free	From	To
Node No.	Room Code (See Arrangement Drawings) (30UJA)	Volume (ft^3)	Elev. (ft)	Elev. (ft)
31	29-019	5347.0	67.91	81.56
32	34-019	4415.6	83.2	91.86
Connecting Nodes				
7	29-003, 29-, 04, 29-005, 34-003, 34-004, 34-005	37032.5	63.98	103.51
14	29-006, 29-007, 29-008, 34-006, 34-007, 34-008	37032.49	63.98	103.51
15	11-018, 11-019, 15-018, 15-019, 18-018, 18-019	40696.1	4.92	49.11
16	23-019, 23-041	9158.9	49.11	65.29
21	11-13, 14, 21, 25, 26, 31, 15-13, 14, 20, 21, 25, 18-13, 14, 23-13, 14, 42	171746.58	4.92	63.98
24	29-015, 29-022, 34-015, 34-022	63922.87	63.98	93.5

Vent Path No.	Node No.		Vent Area (ft^2)	Inertia Length (ft)	Form Loss Factor	Opening Type (Required ?P)	Delay Time (s)
	From	To					
Vent Path Data							
31	7	31	10.76	25.2	1.5	N/A	N/A
52	14	32	26.91	26.6	1.5	N/A	N/A
56	15	16	71.69	30.2	1.5	N/A	N/A
61	16	21	43.06	39.7	1.5	Door (1.450 psid)	Remains Closed
62	32	24	21.53	34.6	1.5	Door (1.450 psid)	Remains Closed
63	31	24	21.53	33.2	1.5	Door (7.252 psid)	Remains Closed
97	16	31	21.529	14.9	1.5	N/A	N/A
98	31	32	21.529	11.2	1.5	N/A	N/A

Table 6.2.1-15—High Energy Lines in Critical Subcompartments

Room Name (30 UJA)	Pipe Name	Pressure (psia)	Temp. (°F)	Pipe ID (in)	Enthalpy (BTU/lb_m)	Mass Flux (lb_m/ft^2- s)	CSA (ft^2)	Energy Flux (MMBTU/hr)
11 - 004	JNA20 BR001	2250	625.7	8.5	651.8	15831.9	0.394	14.638101×10^3
11 - 006	KBA35 BR002	2324.0	512.3	3.438	501.7042	16233.5300	0.0645	3.7803532×10^3
11 - 027	JNG33 BR001	814.7	140.0	11.376	110.0	22292.1	0.706	12.4618588×10^3
15 - 004	KBA34 BR019	2324.0	512.3	2.624	501.7042	16233.5300	0.0376	2.2021571×10^3
15 - 006	JNG33 BR007	2250.0	563.4	8.500	See Table 6.2.1- 16			
18 - 004	LCQ10 BR012	1144.3	561.0	1.687	563.5935	3657.1790	0.0155	2.303574×10^2
23 - 004	LAB70 BR005	1131.2	446.3	17.000	See Table 6.2.1- 17			
29 - 004	LAB70 BR005	1131.2	446.3	17.000	See Table 6.2.1- 17			
29 - 019	JEF10 BR004	2250.0	653.0	5.187	1116.8417	2968.1370	0.1467	3.5024176×10^3
34 - 004	JEA20 BR302	1123.0	559.0	0.815	1187.7103	1384.4530	0.0036	4.28908×10^1
34 - 019	JEF10 BR004	2250.0	653.0	5.187	1116.8417	2968.1370	0.1467	3.5024176×10^3

Table 6.2.1-16—Mass and Energy Release Data (RCP Cavity Sheet 1 of 2

Time (s)	Mass flow Rate (lb_m/s)	Energy Flow Rate (BTU/s)	Enthalpy (BTU/lb_m)
0.000	0.00	0.00E+00	0.00
0.004	6126.72	3.32E+06	541.36
0.008	9383.54	5.07E+06	539.96
0.012	10657.90	5.76E+06	540.86
0.016	10596.60	5.73E+06	540.80
0.020	10815.80	5.85E+06	540.95
0.024	11546.70	6.25E+06	541.51
0.028	11227.80	6.08E+06	541.25
0.032	11558.60	6.26E+06	541.53
0.036	12987.10	7.05E+06	542.78
0.040	13873.50	7.54E+06	543.59
0.044	13424.20	7.29E+06	543.15
0.048	13254.10	7.20E+06	543.00
0.052	13286.00	7.21E+06	543.03
0.056	12962.00	7.03E+06	542.73
0.060	12792.40	6.94E+06	542.58
0.064	12242.50	6.64E+06	542.09
0.068	11695.00	6.33E+06	541.63
0.072	12014.00	6.51E+06	541.90
0.076	12611.50	6.84E+06	542.42
0.080	13002.00	7.06E+06	542.77
0.084	12962.40	7.04E+06	542.73
0.088	12699.60	6.89E+06	542.49
0.092	12305.70	6.67E+06	542.15
0.096	12006.90	6.51E+06	541.89
0.100	12158.00	6.59E+06	542.02
0.117	11851.40	6.42E+06	541.76
0.133	12705.30	6.89E+06	542.52
0.150	12637.90	6.86E+06	542.47
0.167	11692.50	6.33E+06	541.65
0.183	11526.20	6.24E+06	541.52
0.200	11912.40	6.45E+06	541.84

Table 6.2.1-16—Mass and Energy Release Data (RCP Cavity Sheet 2 of 2

Time (s)	Mass flow Rate (lb_m/s)	Energy Flow Rate (BTU/s)	Enthalpy (BTU/lb_m)
0.217	11471.80	6.21E+06	541.48
0.233	11039.60	5.97E+06	541.13
0.250	10967.30	5.93E+06	541.07
0.267	10968.00	5.93E+06	541.07
0.283	11011.90	5.96E+06	541.11
0.300	10869.00	5.88E+06	541.01
0.317	10608.70	5.74E+06	540.81
0.333	10660.70	5.77E+06	540.85
0.350	10439.50	5.64E+06	540.69
0.367	10115.00	5.47E+06	540.46
0.383	9926.03	5.36E+06	540.33
0.400	9788.35	5.29E+06	540.23
0.417	9690.09	5.23E+06	540.16
0.433	9923.69	5.36E+06	540.33
0.450	10153.30	5.49E+06	540.49
0.467	10022.10	5.42E+06	540.40
0.483	9971.50	5.39E+06	540.36

Table 6.2.1-17—Mass and Energy Release Data (SG Cavity)
Sheet 1 of 2

Time (s)	Mass flow Rate (lb_m/s)	Energy Flow Rate (BTU/s)	Enthalpy (BTU/lb_m)
0.000	0.00	0.00E+00	0.00
0.004	4313.62	1.88E+06	435.57
0.008	23269.80	1.02E+07	437.21
0.012	43239.00	1.90E+07	439.58
0.016	42334.50	1.86E+07	440.53
0.020	41588.90	1.84E+07	441.49
0.024	42730.80	1.89E+07	443.04
0.028	40484.20	1.80E+07	443.48
0.032	42311.30	1.88E+07	445.27
0.036	40084.00	1.79E+07	445.67
0.040	41547.20	1.86E+07	447.35
0.044	39986.10	1.79E+07	447.97
0.048	40510.00	1.82E+07	449.35
0.052	40050.30	1.80E+07	450.36
0.056	39489.20	1.78E+07	451.33
0.060	39713.90	1.80E+07	452.61
0.064	38570.70	1.75E+07	453.35
0.068	39292.30	1.79E+07	454.87
0.072	38115.50	1.74E+07	455.61
0.076	38390.50	1.75E+07	456.95
0.080	37564.60	1.72E+07	457.84
0.084	37416.00	1.72E+07	459.02
0.088	37273.90	1.72E+07	460.25
0.092	36450.50	1.68E+07	461.17
0.096	36674.80	1.70E+07	462.55
0.100	35618.30	1.65E+07	463.36
0.117	35260.70	1.64E+07	466.24
0.133	34516.00	1.62E+07	469.96
0.150	33790.60	1.60E+07	473.46
0.167	33114.40	1.58E+07	476.85
0.183	32511.90	1.56E+07	480.14
0.200	31899.90	1.54E+07	483.27

Table 6.2.1-17—Mass and Energy Release Data (SG Cavity)
Sheet 2 of 2

Time (s)	Mass flow Rate (lb_m/s)	Energy Flow Rate (BTU/s)	Enthalpy (BTU/lb_m)
0.217	31235.80	1.52E+07	486.18
0.233	30678.10	1.50E+07	488.94
0.250	30264.30	1.49E+07	491.54
0.267	29799.50	1.47E+07	493.88
0.283	29339.00	1.46E+07	496.04
0.300	29012.10	1.45E+07	498.13
0.317	28693.10	1.43E+07	500.10
0.333	28325.20	1.42E+07	501.94
0.350	28019.00	1.41E+07	503.68
0.367	27730.00	1.40E+07	505.30
0.383	27448.90	1.39E+07	506.80
0.400	27194.90	1.38E+07	508.20
0.417	26926.30	1.37E+07	509.48
0.433	26663.00	1.36E+07	510.69
0.450	26423.40	1.35E+07	511.86
0.467	26194.00	1.34E+07	512.98
0.483	25975.70	1.34E+07	514.06

Table 6.2.1-18—List of U.S. EPR Safety Related Doors

Door #	From Room #	To Room #	Burst Pressure	Vent Area
07D4004B	UJA07-013	UJA07-018	1.45 psid +20%	5.92 ft^2
11D4003B	UJA11-014	UJA11-018	2.90 psid +20%	28.63 ft^2
11D4004B	UJA11-015	UJA11-018	2.90 psid +20%	28.63 ft^2
18D4002B	UJA18-014	UJA18-018	2.90 psid +20%	21.64 ft^2
23D4002B	UJA23-042	UJA23-019	2.90 psid +20%	21.85 ft^2
23D4015B	UJA23-014	UJA23-042	1.45 psid +20%	5.92 ft^2

1. Doors open into the “From” room.

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 1 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0.000	2298.5	0.0	1212.4	0.0	410.0	2298.2	0.0	1197.0	0.0	600.0
0.0001	2339.8	0.0	1212.4	1000.0	510.0	2231.8	0.0	1197.0	1000.0	600.0
0.125	1611.6	2760.0	1162.7	50341.0	632.3	1334.4	5283.2	1199.0	36226.0	575.2
0.250	1941.0	2605.6	1161.5	51434.0	629.7	1013.9	6086.4	1219.2	32798.0	546.1
0.375	1524.5	3266.4	1167.3	47468.0	625.3	904.3	6637.6	1241.9	28321.0	505.9
0.500	1703.3	3380.8	1169.8	46960.0	619.2	787.0	7456.0	1289.1	26154.0	463.8
0.625	1408.4	3937.6	1167.9	47035.0	617.1	738.2	7128.8	1304.3	26177.0	447.6
0.750	1538.2	4120.0	1175.9	43629.0	609.5	757.9	6454.4	1287.8	26232.0	446.7
0.875	1514.2	4517.6	1191.8	43131.0	603.0	718.5	5827.2	1267.7	23994.0	452.9
1.000	1475.5	4442.4	1194.7	41715.0	607.5	670.3	5152.0	1257.9	22482.0	458.2
1.125	1422.7	4548.0	1192.7	39689.0	612.1	765.6	4938.4	1254.3	21936.0	458.8
1.250	1401.1	5285.6	1192.9	36898.0	610.1	683.5	4900.8	1255.1	21575.0	456.4
1.375	1293.5	6414.4	1198.4	33790.0	602.7	680.6	5226.4	1259.7	21639.0	444.9
1.500	1333.2	7839.2	1210.2	32921.0	572.2	667.8	4741.6	1257.1	20881.0	447.6
1.625	1285.3	7992.0	1213.8	32965.0	566.1	626.0	4837.6	1256.1	21076.0	447.2
1.750	1273.8	8128.8	1215.5	31890.0	562.3	591.5	5116.8	1264.2	21865.0	433.9
1.875	1233.4	8228.0	1218.2	31211.0	557.8	603.5	5018.4	1263.9	21990.0	432.8
2.000	1231.3	8180.8	1220.0	30962.0	554.1	598.4	4977.6	1264.5	21988.0	431.4

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 2 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
2.125	1197.9	8017.6	1220.8	31022.0	551.5	596.3	4935.2	1264.3	21794.0	430.3
2.250	1200.4	7792.8	1220.8	31246.0	549.6	580.9	4876.0	1263.5	21353.0	429.8
2.375	1172.8	7536.0	1220.5	31526.0	548.2	578.3	4803.2	1261.7	20745.0	429.5
2.500	1174.9	7272.0	1220.0	31798.0	547.0	597.7	4392.0	1256.8	19545.0	438.0
2.625	1152.3	7029.6	1219.6	32071.0	546.1	646.5	4619.2	1257.9	19227.0	431.4
2.750	1153.7	6812.8	1219.0	32260.0	545.2	533.8	4253.6	1252.1	17835.0	437.0
2.875	1131.8	6614.4	1218.8	32420.0	544.2	622.2	4174.4	1251.5	17343.0	437.9
3.000	1133.8	6444.8	1218.4	32551.0	543.2	513.8	4114.4	1249.5	16728.0	438.1
3.125	1111.1	6314.4	1218.2	32583.0	542.3	517.4	4085.6	1241.0	16186.0	445.7
3.250	1119.1	6231.2	1218.3	32590.0	541.3	511.7	3938.4	1234.5	16863.0	453.9
3.375	1095.3	6152.0	1218.2	32520.0	540.3	503.9	4057.6	1235.4	16777.0	453.1
3.500	1088.5	6152.0	1220.2	32265.0	537.4	547.5	3789.6	1253.8	16014.0	455.9
3.625	1084.2	6301.6	1224.2	32221.0	532.9	520.0	3582.4	1261.4	14988.0	456.1
3.750	1076.4	6291.2	1224.8	32114.0	531.7	471.3	3544.8	1264.4	14204.0	458.9
3.875	1069.2	6264.0	1224.5	31970.0	530.9	457.3	3476.8	1266.2	13754.0	457.8
4.000	1062.1	6226.4	1224.5	31840.0	530.3	532.8	3476.8	1261.9	13278.0	455.1
4.125	1055.6	6184.0	1224.2	31719.0	529.8	510.1	3443.2	1266.0	13256.0	456.4
4.250	1049.8	6133.6	1223.6	31623.0	529.6	516.9	3498.4	1263.8	13152.0	452.0
4.375	1044.2	6070.4	1223.2	31570.0	529.4	465.3	3431.2	1265.6	12808.0	453.2

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 3 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
4.500	1039.0	6008.8	1222.9	31538.0	529.0	446.5	3414.4	1267.2	12855.0	453.5
4.625	1034.4	5949.6	1222.8	31539.0	528.5	440.5	3425.6	1264.4	12558.0	450.2
4.750	1028.9	5888.8	1222.6	31548.0	528.0	441.2	3405.6	1266.3	12092.0	449.7
4.875	1023.9	5832.8	1222.6	31543.0	527.3	479.1	3372.8	1268.1	11856.0	448.7
5.000	1018.7	5789.6	1222.7	31522.0	526.7	428.2	3353.6	1264.4	12011.0	446.7
5.125	1013.2	5764.8	1222.8	31453.0	525.9	418.3	3284.8	1259.8	11861.0	448.6
5.250	1007.0	5764.0	1223.1	31316.0	525.0	483.5	3320.0	1261.5	11746.0	446.4
5.375	1001.7	5793.6	1223.5	31126.0	524.0	462.6	3236.0	1262.9	11922.0	447.0
5.500	994.8	5855.2	1224.1	30798.0	523.0	445.8	3335.2	1262.9	11765.0	444.6
5.625	987.8	5924.8	1224.8	30470.0	521.7	477.3	3364.8	1260.0	11822.0	443.2
5.750	981.1	5980.8	1225.7	30190.0	520.2	466.6	3247.2	1264.7	11508.0	446.0
5.875	974.0	6038.4	1226.5	29877.0	518.9	457.8	3307.2	1261.2	11432.0	441.0
6.000	966.4	6113.6	1227.3	29502.0	517.5	454.7	3300.0	1265.7	10911.0	442.3
6.125	959.0	6194.4	1228.1	29106.0	516.1	401.8	3469.6	1261.1	10646.0	431.7
6.250	951.3	6268.8	1229.1	28714.0	514.6	437.9	3345.6	1255.5	10006.0	436.8
6.375	943.3	6337.6	1229.9	28337.0	513.1	402.4	3298.4	1261.5	10247.0	439.5
6.500	935.3	6399.2	1231.0	27975.0	511.4	447.9	3275.2	1266.1	9798.4	440.0
6.625	927.7	6451.2	1231.9	27657.0	509.7	423.1	3335.2	1265.5	9735.2	436.8
6.750	920.0	6481.6	1233.1	27399.0	508.0	412.0	3704.8	1269.9	9250.4	411.1

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 4 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
6.875	912.6	6492.8	1234.0	27199.0	506.3	408.6	3958.4	1275.3	8906.4	383.7
7.000	904.7	6488.8	1235.0	27034.0	504.6	394.2	3950.4	1274.8	8610.4	383.2
7.125	895.2	6496.8	1235.9	26815.0	502.6	400.3	3956.0	1278.0	8465.6	381.3
7.250	885.6	6537.6	1237.2	26464.0	500.4	392.4	3886.4	1275.9	8026.4	384.6
7.375	875.7	6600.8	1238.7	26042.0	498.2	385.8	3817.6	1273.0	7569.6	388.6
7.500	866.2	6677.6	1240.5	25598.0	495.7	383.0	3800.8	1272.0	7114.4	389.1
7.625	831.9	6819.2	1249.5	24354.0	487.0	362.2	3826.4	1272.5	6655.2	386.8
7.750	804.7	7878.4	1268.5	21973.0	472.5	355.9	3882.4	1276.5	6108.8	376.3
7.875	816.3	8268.0	1289.0	22826.0	464.9	354.9	3880.0	1275.0	5619.2	376.0
8.000	805.4	8031.2	1289.3	23678.0	464.6	333.4	3864.8	1277.8	5282.4	373.1
8.125	794.6	7896.0	1288.6	23736.0	463.8	316.3	3997.6	1293.0	4428.8	357.6
8.250	785.0	7800.0	1288.2	23559.0	462.5	309.0	3924.0	1299.8	4639.2	351.2
8.375	775.6	7720.8	1288.2	23300.0	461.2	307.2	3871.2	1298.7	4594.4	351.7
8.500	766.5	7652.0	1288.1	23000.0	459.8	297.4	3799.2	1296.0	4358.4	350.0
8.625	757.7	7598.4	1288.0	22639.0	458.4	297.3	3763.2	1296.2	4208.0	350.0
8.750	750.2	7560.8	1288.1	22210.0	457.1	291.6	3709.6	1296.2	4025.6	347.5
8.875	739.8	7507.2	1288.6	21837.0	455.4	288.0	3648.8	1291.2	3878.4	348.1
9.000	734.7	7340.0	1289.3	22174.0	453.4	286.1	3628.0	1294.5	3774.4	347.0
9.125	722.1	7194.4	1288.9	22391.0	452.3	280.0	3580.8	1294.8	3646.4	344.7

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 5 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.250	709.2	7133.6	1288.1	21757.0	450.9	276.0	3524.0	1292.3	3597.6	344.6
9.375	696.3	7130.4	1287.8	20752.0	449.0	273.1	3487.2	1291.5	3489.6	343.7
9.500	682.7	7133.6	1288.2	19633.0	446.7	270.0	3450.4	1290.9	3408.8	342.4
9.625	669.0	7118.4	1288.6	18574.0	444.2	267.2	3416.0	1290.5	3304.8	341.4
9.750	658.2	7080.8	1289.0	17724.0	441.5	264.1	3382.4	1289.9	3196.0	340.5
9.875	645.2	6984.0	1289.5	17373.0	439.2	261.0	3349.6	1289.4	3065.6	339.8
10.000	630.6	6893.6	1288.7	16736.0	437.0	259.2	3319.2	1288.6	2936.8	338.9
10.125	616.8	6840.8	1288.6	15836.0	434.7	256.5	3276.0	1285.5	3021.6	339.5
10.250	603.1	6799.2	1288.4	14895.0	432.3	259.3	3245.6	1282.9	2813.6	339.7
10.375	589.6	6742.4	1288.3	14026.0	429.7	258.4	3205.6	1279.7	2604.0	340.7
10.500	579.8	6660.8	1288.7	13401.0	427.1	248.1	3192.8	1278.7	2259.2	340.9
10.625	566.1	6527.2	1288.9	13168.0	424.5	248.3	3175.2	1280.3	2185.6	337.5
10.750	549.5	6406.4	1288.4	12583.0	421.9	240.7	3152.8	1280.3	1870.4	336.9
10.875	535.2	6308.0	1288.3	11812.0	418.9	238.5	3120.8	1278.1	1816.8	337.3
11.000	521.4	6218.4	1288.4	10993.0	415.9	235.4	3084.8	1280.1	1655.2	335.7
11.125	507.4	6126.4	1288.0	10230.0	413.1	234.0	3066.4	1275.4	1542.4	336.6
11.250	493.0	6016.8	1287.5	9565.6	410.4	230.1	3036.0	1275.8	1263.2	337.0
11.375	477.1	5852.8	1288.4	9107.2	406.5	227.2	3018.4	1273.1	1052.0	337.3
11.500	462.6	5698.4	1288.6	8712.0	402.8	221.3	2964.8	1272.6	831.2	337.4

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 6 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.625	446.9	5532.0	1288.5	8304.8	399.2	215.9	2906.4	1269.9	670.4	336.9
11.750	435.3	5371.2	1289.2	7898.4	395.3	209.3	2835.2	1267.0	530.4	337.7
11.875	422.5	5241.6	1289.1	7452.8	391.9	204.7	2728.0	1266.1	479.2	335.9
12.000	410.2	5124.0	1288.1	6993.6	389.4	198.4	2646.4	1264.9	448.8	334.0
12.125	396.2	4964.8	1288.3	6669.6	386.1	193.2	2568.0	1263.8	427.2	331.5
12.250	385.1	4804.8	1288.7	6418.4	382.0	189.5	2492.8	1262.6	416.0	330.5
12.375	374.1	4702.4	1287.4	6052.0	379.7	184.6	2421.6	1261.3	419.2	327.8
12.500	364.0	4599.2	1286.2	5642.4	377.7	180.5	2355.2	1260.3	428.0	326.1
12.625	352.5	4460.8	1286.7	5393.6	374.3	177.4	2292.8	1259.9	438.4	324.1
12.750	343.3	4344.8	1286.0	5171.2	371.3	173.6	2238.4	1258.5	448.8	322.4
12.875	330.2	4215.2	1284.6	4889.6	369.0	170.6	2188.0	1257.5	459.2	320.7
13.000	309.9	3946.4	1286.3	4777.6	363.5	168.1	2138.4	1256.9	471.2	318.8
13.125	307.6	3790.4	1284.4	4797.6	359.0	165.8	2096.8	1256.3	474.4	317.7
13.250	293.6	3696.8	1281.6	4712.8	358.1	163.4	2057.6	1254.4	461.6	317.1
13.375	275.1	3441.6	1281.6	4459.2	353.5	161.6	2026.4	1253.9	440.0	316.4
13.500	273.7	3323.2	1281.7	4420.8	348.2	159.3	2000.0	1253.0	401.6	316.2
13.625	268.4	3292.8	1279.2	4331.2	347.7	155.1	1947.2	1251.0	347.2	316.7
13.750	255.4	3203.2	1277.8	4092.8	347.2	150.6	1884.8	1249.4	308.0	315.0
13.875	243.2	2992.0	1280.2	4016.0	341.1	145.7	1807.2	1247.6	273.6	313.8

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 7 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
14.000	228.3	2786.4	1278.2	3909.6	335.5	140.3	1725.6	1245.0	237.6	313.5
15.000	201.3	2526.1	1256.1	3522.8	340.7	105.0	1350.1	1243.0	177.8	305.3
16.000	161.6	2008.2	1242.0	2407.1	327.1	88.0	884.8	1250.5	120.9	296.6
17.000	144.3	1736.6	1237.4	1264.8	316.5	76.6	608.8	1243.6	56.5	282.1
18.000	131.8	1487.9	1238.5	819.2	308.4	70.0	425.2	1237.7	23.8	276.0
19.000	115.0	1321.8	1224.6	536.8	303.8	67.2	235.8	1265.5	1.9	277.9
20.000	117.5	1195.9	1224.3	328.6	299.7	65.8	151.4	1268.9	0.2	320.0
21.000	122.8	1256.8	1225.3	194.3	298.8	65.0	20.6	1275.3	0.0	320.0
22.000	138.6	1452.1	1232.7	179.3	303.8	66.0	5.7	1271.6	0.0	320.0
23.000	137.5	1638.0	1237.1	147.7	308.6	65.4	5.7	1277.2	0.1	320.0
24.000	134.5	1440.3	1226.6	1789.2	310.8	64.4	0.0	1277.2	0.0	320.0
25.000	127.3	1283.0	1221.7	3177.2	310.9	64.5	0.0	1277.2	0.0	320.0
26.000	121.3	1074.0	1217.0	4732.6	309.4	63.8	0.0	1277.2	0.0	320.0
27.000	118.0	983.0	1221.2	4345.3	300.6	62.9	0.0	1277.2	0.0	320.0
28.000	106.5	881.1	1219.7	4656.0	295.5	62.3	0.0	1277.2	0.0	320.0
29.000	99.4	713.1	1215.3	5237.3	291.0	61.2	0.0	1277.2	0.0	320.0
30.000	98.2	773.9	1210.3	3363.9	291.0	60.8	0.0	1277.2	0.0	320.0
31.000	97.1	631.0	1207.4	4242.6	288.0	60.6	0.0	1277.2	0.0	320.0
32.000	88.3	533.7	1203.3	4526.3	286.5	60.6	0.0	1277.2	0.0	320.0

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 8 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
33.000	84.6	454.9	1199.7	4208.3	282.7	63.3	0.0	1277.2	0.0	320.0
34.000	78.6	364.5	1195.3	4109.5	280.9	65.9	2.3	1287.0	0.0	320.0
35.000	79.7	302.5	1192.6	3718.5	277.1	65.8	5.4	1281.5	0.0	320.0
36.000	74.8	260.6	1191.8	4048.0	275.6	65.8	4.8	1283.3	0.0	320.0
37.000	73.2	223.7	1190.9	4018.3	274.3	65.7	6.5	1276.3	0.0	320.0
38.000	73.5	211.9	1188.6	3430.2	273.1	65.6	5.1	1284.7	0.0	320.0
39.000	71.5	203.3	1187.2	3203.6	272.5	65.5	5.4	1287.4	0.0	320.0
40.000	71.3	193.5	1186.6	2862.2	272.6	65.5	3.5	1266.3	0.0	320.0
42.500	68.5	170.6	1188.7	1824.0	270.7	64.8	0.4	1287.5	0.0	320.0
45.000	67.9	92.1	1184.7	2913.2	269.7	65.0	0.0	1287.5	0.0	320.0
47.500	68.4	68.4	1183.3	3378.7	269.6	59.7	1.0	1264.0	0.0	320.0
50.000	67.8	50.2	1180.9	3953.1	269.3	53.1	0.0	1264.0	0.0	320.0
55.000	68.2	26.7	1180.5	4592.4	266.8	49.4	0.0	1264.0	0.0	320.0
60.000	64.0	11.4	1175.0	3194.4	263.6	41.5	0.0	1264.0	0.0	320.0
65.000	63.6	1.8	1180.6	71.8	263.6	31.4	0.0	1264.0	0.0	320.0
70.000	67.2	27.2	1183.2	1856.7	266.9	59.4	78.2	1225.3	7.6	269.6
75.000	67.4	103.6	1183.3	3863.8	269.2	63.6	33.1	1240.6	1.8	236.1
80.000	65.0	132.5	1182.5	2131.3	267.5	41.3	43.3	1219.9	3.1	268.4
85.000	64.2	142.0	1180.8	1314.2	266.5	44.6	82.3	1241.8	2.0	250.0

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
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Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
90.000	63.5	103.1	1181.0	2058.7	266.2	59.9	26.6	1245.8	0.8	245.0
95.000	62.2	93.2	1179.1	937.3	264.9	45.7	0.0	1245.8	0.0	245.0
100.00	62.3	90.6	1179.8	906.9	264.6	60.5	29.6	1263.6	0.2	240.0
110.00	62.5	103.3	1179.4	866.8	264.5	58.2	0.0	1263.6	0.0	240.0
120.00	61.6	115.7	1179.8	986.4	264.6	61.1	42.4	1264.3	0.1	120.0
130.00	61.3	86.9	1180.0	1448.2	264.3	55.3	30.3	1262.3	0.0	120.0
140.00	62.6	91.5	1179.5	1212.1	263.9	58.5	0.0	1262.3	0.0	120.0
150.00	62.2	113.6	1179.5	1172.4	264.0	58.0	0.0	1262.3	0.0	120.0
170.00	61.8	133.7	1179.9	1095.8	264.0	57.6	0.0	1262.3	0.0	120.0
190.00	60.9	127.1	1179.8	943.7	263.4	54.9	0.0	1262.3	0.0	120.0
210.00	61.0	109.9	1179.5	764.7	262.7	57.6	0.0	1262.3	0.0	120.0
230.00	60.1	112.4	1178.9	781.7	262.8	54.7	0.0	1262.3	0.0	120.0
250.00	59.7	124.1	1179.8	881.8	262.6	55.7	0.0	1262.3	0.0	120.0
270.00	59.2	116.3	1178.9	862.3	262.1	53.8	0.0	1262.3	0.0	120.0
290.00	59.9	103.0	1178.3	741.2	261.5	54.8	0.0	1262.3	0.0	120.0
310.00	58.9	94.6	1179.1	710.9	261.1	54.9	0.0	1262.3	0.0	120.0
330.00	58.3	99.6	1178.3	820.3	261.1	53.6	0.0	1262.3	0.0	120.0
350.00	58.5	88.6	1177.8	586.9	260.3	54.8	0.0	1262.3	0.0	120.0
370.00	58.8	98.6	1177.8	652.9	260.2	53.1	0.0	1262.3	0.0	120.0

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 10 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
390.00	57.3	97.1	1178.2	911.0	260.2	53.0	0.0	1262.3	0.0	120.0
430.00	57.4	83.0	1178.4	640.8	259.3	53.0	0.0	1262.3	0.0	120.0
470.00	57.0	75.6	1178.0	523.7	258.7	51.4	0.0	1262.3	0.0	120.0
510.00	56.4	83.0	1178.2	606.8	258.4	51.3	0.0	1262.3	0.0	120.0
550.00	56.3	80.9	1177.4	570.0	257.9	52.1	0.0	1262.3	0.0	120.0
590.00	55.9	79.8	1176.9	565.0	257.4	51.5	0.0	1262.3	0.0	120.0
630.00	55.4	74.7	1177.2	708.0	257.1	49.5	0.0	1262.3	0.0	120.0
670.00	55.2	76.8	1177.7	727.7	256.8	49.9	0.0	1262.3	0.0	120.0
710.00	54.9	75.3	1177.0	605.6	256.3	48.8	0.0	1262.3	0.0	120.0
750.00	54.4	71.8	1176.3	617.8	256.0	49.0	0.0	1262.3	0.0	120.0
790.00	54.4	71.3	1176.5	648.2	255.6	48.5	0.0	1262.3	0.0	120.0
830.00	53.8	68.7	1176.0	703.8	255.3	48.5	0.0	1262.3	0.0	120.0
870.00	53.6	63.4	1176.2	589.8	254.8	47.9	0.0	1262.3	0.0	120.0
910.00	53.2	62.8	1176.3	645.4	254.6	47.9	0.0	1262.3	0.0	120.0
950.00	53.2	61.1	1175.5	691.6	254.2	47.5	0.0	1262.3	0.0	120.0
990.00	52.9	45.8	1176.8	705.3	254.0	47.2	0.0	1262.3	0.0	120.0
1030.0	53.1	47.2	1175.9	530.5	253.4	46.4	0.0	1262.3	0.0	120.0
1167.0	52.4	43.1	1176.5	589.6	253.2	45.7	0.0	1262.3	0.0	120.0
1200.0	52.0	54.9	1175.1	584.4	252.7	49.1	2.7	1287.8	0.0	120.0

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 11 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1300.0	51.4	59.3	1174.4	635.3	252.3	44.6	9.1	1231.9	0.5	258.0
1400.0	50.9	33.6	1174.7	431.0	251.8	45.1	0.0	1231.9	0.0	258.0
1500.0	50.4	14.5	1175.5	715.3	250.3	47.1	20.4	1259.0	0.1	360.0
1600.0	50.1	5.5	1185.3	1355.5	240.2	46.1	37.8	1256.0	0.6	233.3
1700.0	49.7	0.0	1185.3	593.9	213.6	47.6	1.0	1282.0	0.0	233.3
1800.0	49.5	0.0	1185.3	612.2	233.6	45.7	9.9	1269.2	0.0	233.3
1900.0	49.1	0.0	1185.3	849.3	238.4	45.4	0.0	1269.2	0.0	233.3
2000.0	48.8	0.0	1185.3	914.6	245.4	44.7	0.0	1269.2	0.0	233.3
2100.0	48.4	0.0	1185.3	879.8	238.6	44.3	0.0	1269.2	0.0	233.3
2200.0	48.1	0.0	1185.3	815.1	230.5	44.1	0.0	1269.2	0.0	233.3
2300.0	47.9	0.0	1185.3	827.7	225.5	43.8	0.0	1269.2	0.0	233.3
2400.0	47.6	0.0	1185.3	819.5	221.2	43.5	0.0	1269.2	0.0	233.3
2500.0	47.3	0.0	1185.3	809.8	217.1	43.2	0.0	1269.2	0.0	233.3
2600.0	47.0	0.0	1185.3	828.0	214.5	42.9	0.0	1269.2	0.0	233.3
2700.0	46.7	0.0	1185.3	821.3	211.3	42.6	0.0	1269.2	0.0	233.3
2800.0	46.4	0.0	1185.3	823.2	208.4	42.3	0.0	1269.2	0.0	233.3
2900.0	46.2	0.0	1185.3	838.2	206.2	42.1	0.0	1269.2	0.0	233.3
3000.0	45.6	0.0	1185.3	1128.2	202.2	42.8	3.9	1262.8	0.0	233.3
3100.0	45.7	0.0	1185.3	806.2	188.9	42.3	0.0	1262.8	0.0	233.3

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 12 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
3200.0	45.5	0.0	1185.3	818.2	199.1	42.0	0.0	1262.8	0.0	233.3
3300.0	45.3	0.0	1185.3	812.9	207.9	41.8	0.0	1262.8	0.0	233.3
3400.0	45.1	0.0	1185.3	814.7	204.1	41.5	0.0	1262.8	0.0	233.3
3500.0	44.9	0.0	1185.3	820.9	199.3	41.3	0.0	1262.8	0.0	233.3
3600.0	44.7	0.0	1185.3	822.1	196.6	41.1	0.0	1262.8	0.0	233.3
Begin Long-Term Release (Total Break Flow)[2]										
3640	Note 3	50.1	1171.1	313.2	240.6	-	-	-	-	-
3660	Note 3	50.5	1171.1	312.3	240.8	-	-	-	-	-
3680	Note 3	50.7	1171.2	311.8	240.9	-	-	-	-	-
3700	Note 3	50.6	1171.2	311.3	241.1	-	-	-	-	-
3900	Note 3	48.8	1171.6	312.9	242.2	-	-	-	-	-
4100	Note 3	48.1	1171.8	314	243	-	-	-	-	-
4301	Note 3	46.9	1172	315.1	243.7	-	-	-	-	-
4501	Note 3	45.7	1172.2	316.3	244.2	-	-	-	-	-
4701	Note 3	44.5	1172.4	317.7	244.7	-	-	-	-	-
4901	Note 3	43.1	1172.5	318.8	245.1	-	-	-	-	-
5101	Note 3	42	1172.6	319.9	245.4	-	-	-	-	-
5301	Note 3	41	1172.7	320.9	245.7	-	-	-	-	-
5501	Note 3	40.1	1172.8	321.8	246	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 13 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
5702	Note 3	39.2	1172.8	322.7	246.2	-	-	-	-	-
5902	Note 3	38.4	1172.9	323.6	246.4	-	-	-	-	-
6102	Note 3	37.6	1172.9	324.4	246.6	-	-	-	-	-
6302	Note 3	36.9	1173	325.1	246.7	-	-	-	-	-
6502	Note 3	36.2	1173	325.8	246.9	-	-	-	-	-
6702	Note 3	35.6	1173.1	326.4	247	-	-	-	-	-
6902	Note 3	34.9	1173.1	327.1	247.1	-	-	-	-	-
7102	Note 3	34.3	1173.1	327.7	247.2	-	-	-	-	-
7303	Note 3	33.8	1173.2	328.2	247.3	-	-	-	-	-
7503	Note 3	33.3	1173.2	328.8	247.4	-	-	-	-	-
7703	Note 3	32.8	1173.2	329.3	247.5	-	-	-	-	-
7903	Note 3	32.4	1173.2	329.8	247.6	-	-	-	-	-
8103	Note 3	26.9	1173.2	335.1	247.5	-	-	-	-	-
8303	Note 3	26.5	1173.2	335.5	247.4	-	-	-	-	-
8503	Note 3	26.1	1173.2	335.9	247.3	-	-	-	-	-
8703	Note 3	25.7	1173.1	336.3	247.2	-	-	-	-	-
8903	Note 3	25.4	1173.1	336.6	247.1	-	-	-	-	-
9103	Note 3	25.1	1173.1	337	247	-	-	-	-	-
9304	Note 3	24.8	1173	337.3	246.9	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 14 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9504	Note 3	24.5	1173	337.6	246.8	-	-	-	-	-
9704	Note 3	24.2	1173	337.9	246.8	-	-	-	-	-
9904	Note 3	23.9	1173	338.2	246.7	-	-	-	-	-
10104	Note 3	23.6	1172.9	338.5	246.6	-	-	-	-	-
10304	Note 3	23.4	1172.9	338.7	246.5	-	-	-	-	-
10504	Note 3	23.2	1172.9	338.9	246.5	-	-	-	-	-
10704	Note 3	23	1172.9	339.1	246.4	-	-	-	-	-
10904	Note 3	22.8	1172.9	339.3	246.3	-	-	-	-	-
11104	Note 3	22.6	1172.8	339.5	246.3	-	-	-	-	-
11304	Note 3	22.4	1172.8	339.7	246.2	-	-	-	-	-
11505	Note 3	22.2	1172.8	339.9	246.2	-	-	-	-	-
11705	Note 3	22.1	1172.8	340.1	246.2	-	-	-	-	-
11905	Note 3	21.9	1172.8	340.3	246.1	-	-	-	-	-
12105	Note 3	21.7	1172.8	340.5	246.1	-	-	-	-	-
12305	Note 3	21.5	1172.8	340.7	246	-	-	-	-	-
12505	Note 3	21.3	1172.8	340.9	246	-	-	-	-	-
12705	Note 3	21.1	1172.7	341.1	246	-	-	-	-	-
12905	Note 3	20.9	1172.7	341.3	245.9	-	-	-	-	-
13105	Note 3	20.7	1172.7	341.5	245.9	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 15 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
13306	Note 3	20.6	1172.7	341.7	245.8	-	-	-	-	-
13506	Note 3	20.4	1172.7	341.9	245.8	-	-	-	-	-
13706	Note 3	20.2	1172.7	342	245.8	-	-	-	-	-
13906	Note 3	20	1172.7	342.2	245.7	-	-	-	-	-
14106	Note 3	19.8	1172.7	342.4	245.7	-	-	-	-	-
14306	Note 3	19.6	1172.7	342.6	245.7	-	-	-	-	-
14506	Note 3	19.5	1172.6	342.8	245.6	-	-	-	-	-
14706	Note 3	19.3	1172.6	343	245.6	-	-	-	-	-
14906	Note 3	19.1	1172.6	343.1	245.6	-	-	-	-	-
15107	Note 3	18.9	1172.6	343.3	245.5	-	-	-	-	-
15307	Note 3	18.8	1172.6	343.5	245.5	-	-	-	-	-
15507	Note 3	18.6	1172.6	343.7	245.4	-	-	-	-	-
15707	Note 3	18.4	1172.6	343.8	245.4	-	-	-	-	-
15907	Note 3	18.2	1172.6	344	245.4	-	-	-	-	-
16107	Note 3	18.1	1172.5	344.2	245.3	-	-	-	-	-
16307	Note 3	17.9	1172.5	344.4	245.3	-	-	-	-	-
16507	Note 3	17.7	1172.5	344.5	245.2	-	-	-	-	-
16708	Note 3	17.5	1172.5	344.7	245.2	-	-	-	-	-
16908	Note 3	17.4	1172.5	344.9	245.1	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 16 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
17108	Note 3	17.2	1172.5	345.1	245.1	-	-	-	-	-
17308	Note 3	17	1172.5	345.2	245	-	-	-	-	-
17508	Note 3	16.9	1172.4	345.4	245	-	-	-	-	-
17708	Note 3	16.7	1172.4	345.6	244.9	-	-	-	-	-
17908	Note 3	16.5	1172.4	345.7	244.9	-	-	-	-	-
18109	Note 3	16.3	1172.4	345.9	244.8	-	-	-	-	-
18309	Note 3	16.2	1172.4	346.1	244.8	-	-	-	-	-
18509	Note 3	16	1172.4	346.2	244.7	-	-	-	-	-
18709	Note 3	15.8	1172.3	346.4	244.6	-	-	-	-	-
18909	Note 3	15.7	1172.3	346.6	244.6	-	-	-	-	-
19109	Note 3	15.5	1172.3	346.7	244.5	-	-	-	-	-
19309	Note 3	15.4	1172.3	346.9	244.5	-	-	-	-	-
19510	Note 3	15.2	1172.3	347.1	244.4	-	-	-	-	-
19710	Note 3	15	1172.2	347.2	244.3	-	-	-	-	-
19910	Note 3	14.9	1172.2	347.4	244.3	-	-	-	-	-
20110	Note 3	14.7	1172.2	347.5	244.2	-	-	-	-	-
20310	Note 3	14.6	1172.2	347.6	244.1	-	-	-	-	-
20510	Note 3	14.5	1172.2	347.7	244.1	-	-	-	-	-
20710	Note 3	14.4	1172.1	347.8	244	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
Sheet 17 of 18

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
20910	Note 3	14.3	1172.1	347.9	243.9	-	-	-	-	-
21110	Note 3	14.2	1172.1	348	243.9	-	-	-	-	-
21311	Note 3	14.2	1172.1	348.1	243.8	-	-	-	-	-
21511	Note 3	14.1	1172.1	348.2	243.8	-	-	-	-	-
21711	Note 3	14	1172	348.3	243.7	-	-	-	-	-
21911	Note 3	13.9	1172	348.4	243.6	-	-	-	-	-
22111	Note 3	13.8	1172	348.5	243.6	-	-	-	-	-
22311	Note 3	13.7	1172	348.6	243.5	-	-	-	-	-
22511	Note 3	13.6	1172	348.7	243.5	-	-	-	-	-
22711	Note 3	13.5	1172	348.8	243.4	-	-	-	-	-
22911	Note 3	13.4	1171.9	348.9	243.4	-	-	-	-	-
23112	Note 3	13.3	1171.9	349	243.3	-	-	-	-	-
23312	Note 3	13.2	1171.9	349.1	243.2	-	-	-	-	-
23512	Note 3	13.1	1171.9	349.2	243.2	-	-	-	-	-
23712	Note 3	13	1171.9	349.3	243.1	-	-	-	-	-
23912	Note 3	12.9	1171.8	349.4	243.1	-	-	-	-	-
24112	Note 3	12.8	1171.8	349.5	243	-	-	-	-	-
26113	Note 3	11.8	1171.6	350.5	242.4	-	-	-	-	-
30116	Note 3	10	1171.2	352.4	241.1	-	-	-	-	-

Table 6.2.1-19—Mass and Energy Results for the Limiting Hot Leg Break
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Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
34118	Note 3	8.8	1170.8	353.6	239.7	-	-	-	-	-
36119	Note 3	8.2	1170.6	354.2	239.1	-	-	-	-	-
40122	Note 3	7	1170.2	355.5	237.8	-	-	-	-	-
44124	Note 3	6.3	1169.8	356.3	236.5	-	-	-	-	-
46125	Note 3	5.9	1169.6	356.7	236	-	-	-	-	-
50128	Note 3	5.1	1169.3	357.5	234.8	-	-	-	-	-
54131	Note 3	4.6	1168.9	358.1	233.8	-	-	-	-	-
56132	Note 3	4.3	1168.8	358.4	233.3	-	-	-	-	-
60135	Note 3	3.8	1168.5	359	232.4	-	-	-	-	-
64137	Note 3	3.4	1168.2	359.4	231.5	-	-	-	-	-
66138	Note 3	3.2	1168.1	359.6	231.1	-	-	-	-	-
70141	Note 3	2.8	1167.8	360.1	230.3	-	-	-	-	-
74144	Note 3	2.5	1167.6	360.4	229.6	-	-	-	-	-
76145	Note 3	2.4	1167.5	360.6	229.3	-	-	-	-	-
80148	Note 3	2.1	1167.3	360.9	228.7	-	-	-	-	-
84151	Note 3	1.8	1167.1	361.2	228.1	-	-	-	-	-
86352	Note 3	1.2	1166.9	361.9	227.6	-	-	-	-	-
86400	Note 3	1.2	1166.9	361.9	227.6	-	-	-	-	-

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy releases at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results occurs at 3600 seconds. Post 3600 seconds the mass and energy results were calculated internally by the GOTHIC code.
3. The RCS upstream pressure is equal to containment pressure over this interval

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 1 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0	2246.8	0	1212.4	0	410	2247.9	0	1197	0	480
0.0001	2158	0	1212.4	1000	420	2321.2	0	1197	1000	480
0.125	653.1	2903.2	1212.1	23792.8	489	997.6	1182.4	1196.7	37972.8	544.3
0.250	665	2443.2	1207.8	25724.8	501.9	1083.4	659.2	1195.1	40866.4	550.5
0.375	712.3	2280.8	1207.2	27094.4	511.9	1091.9	428	1190.4	41798.4	557
0.500	701.3	2308.8	1206.6	27215.2	512.1	1088.7	608.8	1193.2	41406.4	556.9
0.625	698.1	2277.6	1206.7	27007.2	512.9	1085.1	797.6	1193	40998.4	556.5
0.750	694.3	2254.4	1207.2	26844	513.3	1081.3	1003.2	1192.7	40535.2	556
0.875	690.1	2229.6	1206.9	26669.6	513.6	1074.6	1229.6	1193.5	39994.4	555.3
1.000	693.2	2228	1206.6	26671.2	513.8	1064.2	1496.8	1194.4	39304	554.1
1.125	692.3	2228	1206.9	26702.4	513.8	1048.6	1811.2	1195.1	38426.4	552.3
1.250	688.8	2208.8	1206	26616	514	1028.6	2168.8	1196.1	37353.6	549.6
1.375	683.7	2173.6	1206.6	26444	514.4	1008.8	2528.8	1197.4	36232	546.7
1.500	678.2	2135.2	1206.1	26228.8	514.8	996.2	2849.6	1198.4	35246.4	544.2
1.625	673	2097.6	1206.1	26016	515.2	987.4	3110.4	1199.4	34475.2	542.8
1.750	668.1	2064	1206.1	25818.4	515.5	982.2	3334.4	1199.7	33856	541.9
1.875	663.3	2032	1206	25623.2	515.9	973.1	3544	1200.4	33188.8	540.8
2.000	658.9	2003.2	1205.7	25438.4	516.2	961.6	3744	1201	32484	539.5

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 2 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
2.125	654.6	1976	1206.2	25267.2	516.4	945.1	3869.6	1201.1	31600	539.3
2.250	650	1950.4	1205.7	25088	516.7	930.8	3840.8	1200.8	30601.6	543.2
2.375	645.2	1924	1205.4	24898.4	516.9	914.4	3804	1200.3	29323.2	548.9
2.500	640.6	1896.8	1205.9	24705.6	517.2	838.9	4165.6	1200.4	27171.2	547.7
2.625	636	1872.8	1205.4	24516.8	517.4	742	5300	1210.5	22241.6	516.3
2.750	631.6	1850.4	1205	24331.2	517.7	717	5652.8	1215.2	20720.8	501.2
2.875	627.4	1828.8	1205.1	24149.6	517.9	689.9	5850.4	1217.2	19059.2	496.1
3.000	623.5	1809.6	1205.3	23975.2	518.1	661.2	6013.6	1219.3	17371.2	491.2
3.125	619.7	1793.6	1204.9	23807.2	518.3	636.2	6187.2	1221.4	15436.8	486.2
3.250	616.1	1780	1204.3	23640	518.5	615.9	6292	1223	13659.2	482
3.375	613	1772.8	1205	23484	518.6	596	6305.6	1224.2	12392.8	478.2
3.500	609.3	1788.8	1204.6	23327.2	518.1	580.3	6276.8	1225.3	11615.2	474.5
3.625	605.6	1811.2	1204.4	23165.6	517.5	566.5	6220.8	1226	11131.2	471.4
3.750	601.7	1836.8	1204.1	22991.2	516.7	555.7	6118.4	1226.3	10938.4	468.9
3.875	597.9	1863.2	1204.6	22814.4	516	547.1	6010.4	1226.3	10893.6	466.8
4.000	594.4	1892	1204.4	22641.6	515.2	539.1	5904	1226.3	10944	464.9
4.125	591.1	1921.6	1205	22472.8	514.5	530.5	5808.8	1226.5	11060.8	463
4.250	588	1954.4	1204.5	22306.4	513.7	524.9	5722.4	1226.5	11196	461.4
4.375	585.2	1986.4	1204.9	22147.2	513	518.8	5644.8	1226.4	11324	460

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 3 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
4.500	582.5	2020	1205.1	21995.2	512.4	512.4	5560	1226.5	11457.6	458.7
4.625	579.9	2055.2	1205.2	21840.8	511.7	505.4	5482.4	1226.4	11453.6	457.1
4.750	577.6	2092	1205	21690.4	511	497.1	5424.8	1226.5	11238.4	455.2
4.875	576.8	2124	1205.5	21565.6	510.6	497.1	5369.6	1226.6	11328.8	454.3
5.000	571.4	2157.6	1205.2	21391.2	510.1	496.5	5322.4	1226.3	11577.6	454.2
5.125	561.5	2210.4	1205.8	21001.6	508.4	493.7	5276	1226.1	11693.6	453.7
5.250	550.4	2274.4	1206	20525.6	506.1	490.8	5233.6	1226.1	11713.6	453.1
5.375	519	3112	1212.4	20048.8	480.8	486.9	5186.4	1225.9	11720.8	452.2
5.500	503.3	3748.8	1217.2	19062.4	455.8	484.4	5136.8	1226	11772.8	451.4
5.625	490.6	3764.8	1218	18312	452	481.8	5086.4	1225.8	11891.2	450.7
5.750	481.8	3786.4	1218.2	17797.6	449.6	481.4	5040	1225.5	12076.8	450.4
5.875	475.4	3808	1218.8	17404.8	447.9	479.9	4993.6	1225.4	12310.4	450.1
6.000	467.8	3826.4	1219.2	17020	446.3	479.4	4948.8	1225.2	12512.8	449.8
6.125	459.8	3842.4	1219.6	16602.4	444.5	477.7	4912	1225.1	12652	449.5
6.250	452.3	3858.4	1220.1	16178.4	442.7	477.2	4880.8	1225	12759.2	449.2
6.375	444.8	3875.2	1220.4	15760	440.9	475.9	4854.4	1224.9	12848	448.9
6.500	437.4	3890.4	1221.1	15336	439.1	475.7	4833.6	1224.7	12918.4	448.7
6.625	430.5	3909.6	1221.3	14912.8	437.4	474.6	4816	1224.7	12968	448.6
6.750	423.9	3934.4	1221.9	14458.4	435.7	474.3	4802.4	1224.8	12996.8	448.4

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 4 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
6.875	415.7	3978.4	1222.6	13911.2	434.1	473	4794.4	1224.5	12994.4	448.2
7.000	403.3	4024.8	1223.4	13104.8	431.5	472.2	4790.4	1224.7	12950.4	447.9
7.125	394.1	4061.6	1224.6	12305.6	428.7	470.5	4792	1224.9	12860	447.7
7.250	388.8	4084	1225	11803.2	426.9	469.7	4800	1224.8	12749.6	447.4
7.375	383.8	4092	1225.6	11448.8	425.7	467.2	4805.6	1225.1	12613.6	447
7.500	379	4096	1225.8	11108.8	424.4	465.3	4810.4	1225.2	12448	446.5
7.625	375.1	4096.8	1226.3	10804	423.2	461.9	4813.6	1225.5	12248.8	445.9
7.750	371.5	4096.8	1226.6	10561.6	422.2	459	4816	1225.6	12024.8	445.1
7.875	366.5	4086.4	1226.6	10308	421.1	454.9	4812.8	1225.8	11804	444.3
8.000	362.2	4065.6	1227	10088.8	419.8	451.8	4802.4	1225.9	11613.6	443.5
8.125	358.9	4048	1227.1	9926.4	418.7	448	4786.4	1226.2	11465.6	442.6
8.250	355.6	4028.8	1227.2	9800.8	417.8	445.7	4769.6	1226.2	11356.8	441.9
8.375	351.1	4005.6	1227.3	9652.8	416.7	442.9	4752.8	1226.3	11280	441.2
8.500	349.8	3986.4	1227.1	9554.4	415.7	441.3	4738.4	1226.2	11225.6	440.7
8.625	347.8	3972	1227.4	9498.4	415.2	439.2	4725.6	1226.4	11168.8	440.3
8.750	346.1	3954.4	1227.5	9513.6	414.8	437.4	4718.4	1226.5	11063.2	439.7
8.875	343.4	3929.6	1227.3	9490.4	414.1	434.2	4720	1226.6	10824.8	439.1
9.000	343.4	3915.2	1227.1	9463.2	413.6	430.6	4729.6	1226.8	10431.2	438.4
9.125	339.1	3896	1227.4	9422.4	413.1	427.3	4744.8	1227.4	10024	437.4

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 5 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.250	335.6	3864.8	1227.1	9316.8	411.9	421.7	4762.4	1227.5	9588	436.5
9.375	333	3841.6	1227.4	9233.6	411	412.7	4746.4	1228	9242.4	435.1
9.500	330	3823.2	1227.6	9122.4	410.2	422	4801.6	1227.9	9263.2	436
9.625	326.6	3809.6	1227.4	8957.6	409.2	422.8	4798.4	1228	9304.8	436.2
9.750	323.1	3801.6	1227.7	8720.8	408.2	417.4	4820	1228.6	8960	435.5
9.875	319.8	3796	1227.9	8458.4	407.2	413.3	4803.2	1228.6	8724	434.3
10.000	316.8	3788	1228.4	8217.6	406.2	409.5	4783.2	1228.7	8543.2	433.3
10.125	313.1	3776.8	1228.4	7983.2	405.2	405.6	4761.6	1228.8	8378.4	432.3
10.250	310.1	3765.6	1228.7	7716.8	404.2	401.8	4732.8	1229.1	8243.2	431.3
10.375	307.5	3755.2	1228.6	7516.8	403.4	398.1	4702.4	1229.1	8133.6	430.3
10.500	305.2	3737.6	1228.8	7401.6	402.5	394.2	4672	1229.2	8032.8	429.3
10.625	302.7	3719.2	1228.9	7320.8	401.9	390.5	4640	1229.1	7941.6	428.2
10.750	300.1	3698.4	1229	7204	401	386.9	4608	1229.3	7861.6	427.2
10.875	297.7	3683.2	1228.9	7058.4	400.2	383.4	4576	1229.3	7784.8	426.3
11.000	295.5	3670.4	1229.1	6880.8	399.4	379.8	4543.2	1229.3	7714.4	425.2
11.125	293.5	3661.6	1229	6691.2	398.8	376.4	4511.2	1229.3	7643.2	424.3
11.250	291.4	3648	1229.4	6485.6	398.1	372.8	4480	1229.5	7560.8	423.4
11.375	289.8	3638.4	1229.3	6254.4	397.5	369.2	4449.6	1229.5	7473.6	422.3
11.500	288.5	3628.8	1229.3	6054.4	397	365.6	4419.2	1229.5	7381.6	421.3

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 6 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.625	286.7	3620	1229.2	5889.6	396.5	362.1	4389.6	1229.6	7283.2	420.3
11.750	284.3	3608.8	1229.4	5735.2	395.8	358.6	4360	1229.5	7189.6	419.3
11.875	282.2	3597.6	1229.4	5595.2	395	355.1	4328	1229.8	7104	418.3
12.000	280.1	3584.8	1229.7	5464.8	394.4	351.8	4297.6	1229.6	7031.2	417.3
12.125	278.1	3572	1229.6	5338.4	393.7	348.5	4264.8	1229.9	6966.4	416.3
12.250	276.1	3556	1229.8	5226.4	393	345.3	4232.8	1229.6	6907.2	415.4
12.375	274.3	3540	1229.7	5133.6	392.4	342.2	4200	1229.7	6856	414.4
12.500	272.6	3524	1229.8	5050.4	391.8	339.1	4169.6	1229.6	6800	413.5
12.625	270.8	3508.8	1229.5	4970.4	391.1	336.1	4139.2	1229.7	6742.4	412.6
12.750	269	3491.2	1229.9	4887.2	390.5	333.2	4109.6	1229.6	6688	411.7
12.875	267.5	3476.8	1229.5	4794.4	389.9	330.2	4079.2	1229.8	6632	410.8
13.000	266.2	3463.2	1229.8	4688.8	389.4	327.3	4050.4	1229.5	6577.6	409.8
13.125	264.4	3448.8	1229.7	4576	388.9	324.5	4020.8	1229.7	6527.2	409
13.250	261.6	3424.8	1229.5	4460	388	321.4	3992	1229.5	6474.4	408.1
13.375	258.7	3393.6	1229.8	4374.4	387	318	3958.4	1229.5	6413.6	407
13.500	255.2	3356	1229.2	4360.8	385.9	314.3	3923.2	1229.7	6340.8	405.9
13.625	251.8	3311.2	1229.5	4392	384.4	310.3	3888	1229.5	6236	404.7
13.750	250.1	3282.4	1229.3	4357.6	383.5	306.4	3852.8	1229.8	6106.4	403.4
13.875	249.7	3274.4	1229.1	4254.4	383.2	302.9	3823.2	1229.7	5976.8	402.3

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 7 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
14.000	247.4	3261.6	1229.3	4099.2	382.7	299.4	3794.4	1229.7	5855.2	401.1
14.125	245.2	3248	1229.2	3928	381.8	295.3	3759.2	1229.9	5735.2	399.9
14.250	243.6	3236	1229.4	3747.2	381.1	291.2	3717.6	1230	5628.8	398.5
14.375	242.2	3228.8	1229.2	3576.8	380.6	287.5	3680	1229.7	5536	397.1
14.500	240.7	3212.8	1229.5	3370.4	380	283.9	3642.4	1229.8	5455.2	396
14.625	239.5	3196.8	1229.3	3192.8	379.6	280	3596.8	1229.6	5439.2	394.7
14.750	237.4	3175.2	1229.1	3073.6	378.8	276.7	3541.6	1229.5	5525.6	393.3
14.875	234.7	3146.4	1228.8	3021.6	377.9	273	3492	1229.3	5653.6	392.1
15.000	230.8	3105.6	1228.9	3028	376.5	270	3456	1229.4	5729.6	390.9
15.250	224.4	3043.6	1228.8	3092.8	374.5	266.4	3422.4	1229.3	5650	389.7
15.750	214.8	2943	1228.3	3098.6	371.2	261.3	3411.4	1229.4	4933.8	388.3
16.250	224.3	2791.6	1227.1	3121	368.4	254.9	3402.8	1229.9	3735	386.3
16.750	229.6	2510.4	1221.2	3252	376.4	246.1	3318	1229.4	3024.6	383.6
17.250	237.1	2043.6	1213.2	4951.8	379.6	236.3	3191.4	1228.8	2633.8	379.8
17.750	239.6	1702.6	1209	6776	379	225.8	3057.4	1228.2	2359	375.8
18.250	235.6	1510.8	1207.3	7842	377.9	218.2	2937	1227.6	2201.6	371.9
18.750	225.4	1351.8	1206	8110.4	373.8	214.4	2863.2	1227.2	1941.4	369.5
19.250	215.3	1172.8	1204.5	8310.6	368.6	213.7	2805.4	1226.3	1605.4	368.3
19.375	213	1074.4	1203.8	8428.8	365.6	213.5	2769.6	1225.6	1400.8	368.2

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 8 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
19.500	210.8	1039.2	1203.1	8464.8	364.5	213	2757.6	1225.4	1332.8	367.7
21.500	165.1	829.8	1201.2	8385.8	354.1	192.5	2618.9	1222.2	630.5	368
22.750	144.9	469.7	1196	9079.9	334	196	2281.9	1218.9	317.5	357.5
24.000	119.8	335.9	1194.1	9434	324.4	154.7	1877.8	1218.5	16.1	348.2
25.250	89.7	173.8	1188.6	9242.2	301.7	115.9	1482.2	1218.2	64.8	322.1
26.500	83.3	78.6	1183.9	9690.7	289.4	104.2	1267.2	1210.4	107	310.8
27.750	74.6	45.6	1183.7	10270.3	287	89.5	1052.5	1237.2	31.1	314
28.375	72.6	18.7	1184.9	9561.4	267.8	82.3	914.7	1244.2	24.6	310.1
29.000	72.8	13.3	1182.8	8925	261.5	78	791	1244.2	1.4	274.3
29.625	68.3	9.9	1181.7	7667.8	256.2	71.4	615	1240	2.6	275.8
35.0	60.3	1.6	1199.4	7183.5	247.3	65.4	547.6	1223.5	29.2	281.3
47.5	60.6	0	1199.4	2146.9	224.3	64.8	155.8	1234.9	5.9	270.2
60.0	63.1	0	1199.4	5175.5	192.6	64.5	348.1	1208.7	41.7	269.2
72.5	63.6	20	1179.9	4337.3	207.4	64.6	337.3	1204.5	48.5	268.5
85.0	62.3	162.9	1179.3	346.2	265.9	63.1	328.3	1201.9	51.9	267.6
97.5	60.9	126.1	1179.3	300.2	264.4	61.2	256	1207.3	33.3	265.3
110.0	60.8	108.1	1178.7	208	263.4	61.5	218.2	1217.8	20.3	264.9
122.5	61.4	120	1178.1	210.4	263.7	62.4	238.1	1210.8	36.3	265.2
135.0	61.5	127.8	1179.1	364.4	264.5	62.4	298.9	1208.3	38.9	266.2

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 9 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
147.5	61.9	136.3	1179.4	287.8	264.7	63	302.6	1216.8	25.5	266.2
170.0	62.3	139.1	1178.8	302.6	265.1	63.5	315.2	1201.3	60.2	267.3
195.0	62.4	130.8	1178.9	342.5	265.3	63	302.5	1187.6	106.4	267.1
220.0	62.5	112.2	1178.3	334.3	265	62.2	211.7	1181.1	212.8	265.4
245.0	61.9	84.4	1178.9	345	264.5	61.7	170.4	1180.3	181.7	264.8
270.0	61.1	80.3	1179.5	271.9	264.3	61.6	140	1179.6	202	264.3
295.0	61.5	72.8	1178.5	311.6	264.1	61.5	130.4	1178.4	224.4	264.2
320.0	61.4	83.2	1180.7	143.2	264	61.3	114.5	1178.4	200.9	264
345.0	61.6	73.7	1178.8	204	264	61.4	101.8	1178.9	261.4	263.8
370.0	61.3	68.6	1178.4	270.8	263.9	61.3	108.3	1178.3	298.8	263.8
395.0	61.3	62.5	1179	222.8	263.8	61.1	94.6	1178.6	219	263.7
420.0	61.2	53.6	1179.9	278.1	263.6	61	86.4	1178	271.6	263.6
445.0	60.8	46.5	1179	359	263.3	60.9	90.5	1178.4	299.2	263.5
470.0	60.8	46.8	1178.7	300.9	263.1	60.8	85.8	1177.5	241	263.2
495.0	60.6	39.4	1179.3	338.3	262.7	60.6	80.9	1177.9	267.6	263.1
520.0	60.4	31.6	1179.5	394.9	261.9	60.5	82	1177.7	277.9	263
545.0	60.2	25	1178.6	409.7	260.8	60.4	84.6	1177.8	250.1	262.9
570.0	60.6	13.5	1173.6	1111	239.2	60.3	83.9	1177.9	232	262.8
595.0	60	22.2	1184.7	72.7	262.5	60.1	82.1	1178	85.2	262.5

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 10 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
620.0	59.9	25.3	1181.9	93.6	261.3	60	59.8	1177.2	45.4	262
645.0	59.9	14.5	1177.8	784.5	238.9	60	71.4	1177.8	294.4	262.3
670.0	59.7	14.7	1179.9	560.1	247.6	59.9	80.7	1177.1	153.7	262.3
695.0	59.6	23.3	1179.4	257.2	259.7	59.7	66.8	1176.7	162.9	262.1
720.0	59.5	15.5	1173.9	411.1	258	59.7	67.4	1177.5	257.8	262
745.0	59.4	11.6	1176	438	256.3	59.6	71	1177.2	277.4	261.9
770.0	59.4	12	1180.8	424.4	256.8	59.5	70.7	1177.1	263.5	261.8
795.0	59.3	10.6	1182.4	450.9	256.2	59.4	68.1	1176.9	246.7	261.7
820.0	58.6	11.4	1182.6	442.4	254.3	59.4	68.6	1178.1	232.6	261.6
845.0	59.2	5.1	1178.4	1109.5	233.4	59.4	72.3	1177	179.2	261.6
870.0	57.7	1.7	1145.9	891.2	226.2	59.3	60.2	1177.5	20.2	262.1
895.0	58.5	5.7	1178.4	397.6	235	59.3	51.4	1178.3	18.6	261.8
940.0	39.3	10.9	1173.7	344.9	247.2	59.2	57.3	1177.3	88.9	261.5
990.0	57.6	19	1191	860.6	226.4	59.2	68.5	1177.2	210.6	261.4
1040	59	6.6	1171.8	719.7	234.4	59.2	70.9	1177.9	99.3	261.4
1090	58.9	11	1184.5	449.8	232.4	59.1	59.7	1176.5	78.5	261.2
1140	54.6	12.6	1179	761.4	228.3	59.1	57.6	1177.6	163.5	261.2
1187	58.5	1.4	1140.7	664.5	238	58.9	61.2	1177.7	53.3	261.1
1200	58.6	2.9	1198.6	27.5	260.2	58.9	44.2	1179	0.3	263.3

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 11 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1220	Note 3	106.6	1178.5	0	265.4	-	-	-	-	-
1240	Note 3	106.3	1178.5	0	265.5	-	-	-	-	-
1260	Note 3	105.9	1178.5	0	265.6	-	-	-	-	-
1280	Note 3	105.4	1178.6	0	265.7	-	-	-	-	-
1300	Note 3	105.0	1178.6	0	265.8	-	-	-	-	-
1400	Note 3	102.7	1178.7	0	266.1	-	-	-	-	-
1500	Note 3	100.5	1178.8	0	266.5	-	-	-	-	-
1600	Note 3	98.2	1178.9	0	266.8	-	-	-	-	-
1700	Note 3	95.9	1179	0	267.2	-	-	-	-	-
1800	Note 3	93.6	1179.1	0	267.5	-	-	-	-	-
1900	Note 3	91.4	1179.1	0	267.8	-	-	-	-	-
2000	Note 3	89.1	1179.2	0	268	-	-	-	-	-
2100	Note 3	88.1	1179.3	0	268.3	-	-	-	-	-
2200	Note 3	87.1	1179.4	0	268.6	-	-	-	-	-
2300	Note 3	86.1	1179.5	0	268.9	-	-	-	-	-
2400	Note 3	85.2	1179.5	0	269.1	-	-	-	-	-
2500	Note 3	84.2	1179.6	0	269.4	-	-	-	-	-
2600	Note 3	83.2	1179.7	0	269.7	-	-	-	-	-
2700	Note 3	82.3	1179.7	0	269.9	-	-	-	-	-

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 12 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
2800	Note 3	81.3	1179.8	0	270.2	-	-	-	-	-
2900	Note 3	80.3	1179.9	0	270.4	-	-	-	-	-
3000	Note 3	79.4	1180	0	270.7	-	-	-	-	-
3100	Note 3	78.7	1180	0	270.9	-	-	-	-	-
3200	Note 3	78.1	1180.1	0	271.2	-	-	-	-	-
3300	Note 3	77.4	1180.2	0	271.4	-	-	-	-	-
3400	Note 3	76.8	1180.2	0	271.6	-	-	-	-	-
3500	Note 3	76.1	1180.3	0	271.9	-	-	-	-	-
3520	Note 3	76.0	1180.3	0	271.9	-	-	-	-	-
3540	Note 3	75.9	1180.3	0	272	-	-	-	-	-
3560	Note 3	75.7	1180.3	0	272	-	-	-	-	-
3580	Note 3	75.6	1180.3	0	272.1	-	-	-	-	-
3600	Note 3	67.0	1180.3	0	272.1	-	-	-	-	-
3620	Note 3	41.2	1180.3	214.6	272	-	-	-	-	-
3640	Note 3	41.1	1180.3	214.7	271.9	-	-	-	-	-
3660	Note 3	41.0	1180.3	214.8	271.8	-	-	-	-	-
3680	Note 3	40.8	1180.3	214.8	271.8	-	-	-	-	-
3700	Note 3	40.7	1180.2	214.9	271.7	-	-	-	-	-
4100	Note 3	38.8	1180	215.9	270.7	-	-	-	-	-

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 13 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
4300	Note 3	38.3	1179.8	216	270.2	-	-	-	-	-
4701	Note 3	37.2	1179.6	216.7	269.4	-	-	-	-	-
5101	Note 3	34.9	1179.4	217.3	268.8	-	-	-	-	-
5301	Note 3	34.5	1179.3	217.5	268.5	-	-	-	-	-
6302	Note 3	32.8	1179	218.3	267.2	-	-	-	-	-
7302	Note 3	31.0	1178.7	219.1	266.3	-	-	-	-	-
8303	Note 3	29.5	1178.5	219.7	265.6	-	-	-	-	-
9303	Note 3	28.3	1178.4	220.3	265	-	-	-	-	-
10304	Note 3	27.4	1178.3	220.7	264.6	-	-	-	-	-
11304	Note 3	26.7	1178.2	221	264.3	-	-	-	-	-
12305	Note 3	26	1178.1	221.3	264.1	-	-	-	-	-
13305	Note 3	16.0	1177.8	226.3	263	-	-	-	-	-
14306	Note 3	15.0	1177.4	226.9	261.6	-	-	-	-	-
15307	Note 3	14.1	1177	227.5	260.3	-	-	-	-	-
16307	Note 3	13.2	1176.7	228	259.1	-	-	-	-	-
17308	Note 3	12.3	1176.3	228.5	257.9	-	-	-	-	-
18308	Note 3	11.5	1176	229	256.8	-	-	-	-	-
19309	Note 3	10.7	1175.7	229.5	255.7	-	-	-	-	-
20310	Note 3	10.0	1175.4	229.9	254.7	-	-	-	-	-

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 14 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
21310	Note 3	9.5	1175.1	230.1	253.6	-	-	-	-	-
22311	Note 3	9.1	1174.8	230.4	252.7	-	-	-	-	-
23311	Note 3	8.7	1174.5	230.6	251.7	-	-	-	-	-
24312	Note 3	8.2	1174.2	230.9	250.8	-	-	-	-	-
25313	Note 3	7.8	1174	231.1	249.9	-	-	-	-	-
26314	Note 3	7.4	1173.7	231.3	249.1	-	-	-	-	-
27314	Note 3	7.0	1173.4	231.6	248.2	-	-	-	-	-
28315	Note 3	6.6	1173.2	231.8	247.4	-	-	-	-	-
29316	Note 3	6.2	1172.9	232	246.6	-	-	-	-	-
30316	Note 3	5.8	1172.7	232.2	245.8	-	-	-	-	-
32318	Note 3	5.4	1172.2	232.4	244.3	-	-	-	-	-
34319	Note 3	4.9	1171.8	232.7	242.9	-	-	-	-	-
36321	Note 3	4.5	1171.4	232.9	241.5	-	-	-	-	-
38322	Note 3	4.0	1171	233.2	240.2	-	-	-	-	-
41323	Note 3	3.4	1170.4	233.5	238.4	-	-	-	-	-
44326	Note 3	3.0	1169.9	233.7	236.8	-	-	-	-	-
47328	Note 3	2.5	1169.4	234	235.2	-	-	-	-	-
50331	Note 3	2.1	1168.9	234.2	233.8	-	-	-	-	-
53333	Note 3	1.8	1168.5	234.4	232.5	-	-	-	-	-

Table 6.2.1-20—Mass and Energy Result for the Limiting Cold Leg Pump Suction Break
Sheet 15 of 15

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
56334	Note 3	1.5	1168.1	234.5	231.3	-	-	-	-	-
59337	Note 3	1.2	1167.8	234.7	230.2	-	-	-	-	-
62339	Note 3	1.0	1167.4	234.8	229.1	-	-	-	-	-
65342	Note 3	0.8	1167.1	234.9	228.2	-	-	-	-	-
68344	Note 3	0.6	1166.8	235.1	227.3	-	-	-	-	-
71346	Note 3	0.4	1166.6	235.2	226.5	-	-	-	-	-
76350	Note 3	0.1	1166.2	235.3	225.3	-	-	-	-	-
81353	Note 3	0.1	1165.4	235.4	222.8	-	-	-	-	-
86357	Note 3	0.1	1164.6	235.4	220.4	-	-	-	-	-
86400	Note 3	0.1	1164.6	235.4	220.4	-	-	-	-	-

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy releases at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results occurs at 1200 seconds. Post 1200 seconds the mass and energy results were calculated internally by the GOTHIC code
3. RCS upstream pressure equal to containment pressure over this interval.

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 1 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0	2356.7	0	1212.4	0	410	2357.1	0	1197	0	490
0.0001	2286	0	1212.4	1000	360	2429	0	1197	1000	490
0.130	1296.4	383.2	1191.9	51887.2	559.4	831.4	1784	1200.4	34859.2	533.3
0.250	1305.5	48	1177.3	59972	563.9	774.4	2544	1205.1	30890.4	509.1
0.380	1297.5	0	1177.3	60004	563.7	774.7	2615.2	1205.7	30582.4	507.1
0.500	1288.5	0	1177.3	59207.2	563.6	767.7	2642.4	1205.8	30344.8	506.5
0.630	1280.9	0	1177.3	58420	563.5	766	2660.8	1205.6	30116.8	506.4
0.750	1272.2	0	1177.3	57654.4	563.4	765.9	2672.8	1205.9	30001.6	506.9
0.880	1261.5	0	1177.3	56748.8	563.4	765.5	2690.4	1205.7	29875.2	507.5
1.000	1248.9	0	1177.3	55655.2	563.3	763.4	2702.4	1205.6	29683.2	508.4
1.130	1237.9	0	1177.3	54531.2	563.2	759.4	2700.8	1205.6	29404.8	509.6
1.250	1227.1	0	1177.3	53531.2	563.2	754.1	2683.2	1205.7	29048	511
1.380	1214.6	0	1177.3	52484	563.1	748.6	2654.4	1205.6	28641.6	512.7
1.500	1198.2	0	1177.3	51051.2	563.1	743.6	2625.6	1205.8	28244	514.6
1.630	1184.1	0	1177.3	49484.8	563	736.6	2594.4	1205.4	27771.2	516.5
1.750	1171.6	0	1177.3	48045.6	563	730.7	2566.4	1205	27320.8	518.6
1.880	1161.8	0	1177.3	46800	563	725	2544.8	1205	26872	520.6
2.000	1151.9	0	1177.3	45727.2	563.1	717.8	2532	1205	26420	522.6

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 2 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
2.130	1143	0	1177.3	44618.4	563.2	699.8	2547.2	1204.7	25688	523.3
2.250	1135.8	0	1177.3	43684.8	563.3	672	2646.4	1205.2	24564.8	520.5
2.380	1127.2	35.2	1187.7	43060	563.1	639.5	2786.4	1206.4	23223.2	515.5
2.500	1107.4	244.8	1192.2	42552.8	560.6	640.7	2952	1207.5	21952.8	509.2
2.630	1095.2	393.6	1191.2	42023.2	558.4	541.3	3709.6	1213.6	20182.4	478.3
2.750	1087.2	498.4	1191.7	41660.8	557	520.6	4083.2	1217.9	18614.4	460.3
2.880	1078.6	588	1194	41348.8	555.9	500.8	4091.2	1219.1	17686.4	455.5
3.000	1072.3	685.6	1192.9	41028	554.7	485.4	4103.2	1219.6	16895.2	451.6
3.130	1067.3	757.6	1193.5	40797.6	554	473.3	4124	1220.4	16207.2	448.5
3.250	1062.6	835.2	1193.7	40555.2	553.2	461.1	4166.4	1221.4	15480	445.9
3.380	1058.4	908.8	1193.8	40332.8	552.5	440.6	4232.8	1222.3	14365.6	442.2
3.500	1055.1	975.2	1193.8	40143.2	552	414.4	4295.2	1224.4	12706.4	436.4
3.630	1050.4	1050.4	1194	39922.4	551.5	398.5	4298.4	1225.9	11381.6	430.8
3.750	1048.2	1121.6	1194.5	39728.8	551	399.1	4307.2	1226.4	11001.6	429.2
3.880	1045.2	1188.8	1195	39549.6	550.6	400.2	4324.8	1226.3	10991.2	429.6
4.000	1040.1	1280.8	1194.7	39279.1	549.9	400.4	4328	1226.3	11000.8	429.7
4.130	1035.1	1369.6	1195.6	39023.2	549.3	400	4348	1226.5	10861.6	429.8
4.250	1027.2	1480	1195.6	38682.4	548.4	392.5	4394.4	1227.1	10097.6	428.9
4.380	1013.2	1638.4	1196.2	38130.4	546.6	382.8	4444.8	1227.9	8724.8	426.9

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 3 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
4.500	1001.7	1796.8	1196.7	37586.4	544.8	370.9	4516.8	1229.6	7356	423.9
4.630	987.5	1957.6	1197.5	36992.8	542.9	367.2	4571.2	1230.6	6162.4	421.9
4.750	972.8	2131.2	1198.4	36296	540.7	367.9	4616	1231	5152	421.8
4.880	958.4	2304.8	1198.8	35600.8	538.4	369.1	4676	1231.2	4256.8	421.8
5.000	941.6	2481.6	1199.8	34874.4	536.1	376.1	4723.2	1230.9	3418.4	423.2
5.130	921.2	2677.6	1201	34017.6	533.3	387.8	4765.6	1229.9	2656.8	425.3
5.250	899.6	2890.4	1201.8	33037.6	529.8	392.8	4798.4	1229.1	2003.2	427.6
5.380	890.5	3072	1202.7	32312	527.4	397.7	4802.4	1228.4	1492	429
5.500	878.6	3248.8	1203.3	31654.4	526	397.8	4764	1227.6	1179.2	429.4
5.630	870.1	3370.4	1203.4	30834.4	526.3	389.1	4688.8	1227.1	1097.6	428.1
5.750	863.3	3340.8	1203.1	30290.4	529.7	374.9	4590.4	1227.7	1220	424.9
5.880	851.7	3291.2	1203.3	29848	530.7	360.9	4482.4	1228.1	1468.8	421.1
6.000	842.7	3243.2	1203.3	29413.6	531.5	349	4376	1228.8	1772	417.3
6.130	834.1	3205.6	1203	28997.6	532.7	337.6	4278.4	1229	2080	414.3
6.250	824.2	3168.8	1202.8	28528	533.8	327.1	4201.6	1229.6	2374.4	410.9
6.380	817.6	3139.2	1202.6	28077.6	535	319.9	4132.8	1230	2630.4	408.2
6.500	817.6	3117.6	1202.8	28016	535.3	314	4072	1230.3	2840.8	406.4
6.630	803.7	3095.2	1202.9	27836	533.9	309.4	4027.2	1230.4	3012.8	404.6
6.750	793.4	3156.8	1202.9	27108.8	534.4	305.2	3987.2	1230.5	3142.4	403.3

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 4 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
6.880	784.6	3241.6	1203	26540.8	533.6	301.9	3942.4	1230.5	3228	402.1
7.000	777.8	3248	1203.5	26321.6	532.6	299.4	3907.2	1230.7	3282.4	401.2
7.130	769.7	3259.2	1203.6	26087.2	531.3	296.7	3876.8	1230.4	3305.6	400.3
7.250	762.6	3288.8	1204	25813.6	530	294.1	3844.8	1230.5	3302.4	399.4
7.380	754.9	3293.6	1204.4	25607.2	528.7	291.9	3817.6	1230.6	3283.2	398.6
7.500	745.9	3335.2	1204.4	25263.2	527.2	289.6	3791.2	1230.3	3248.8	397.8
7.630	737.3	3388	1205	24888	525.7	287.5	3764	1230.4	3201.6	397
7.750	729.5	3420	1205.6	24591.2	524.1	285.7	3740.8	1230.3	3142.4	396.4
7.880	721.2	3437.6	1205.6	24336	522.6	283.8	3719.2	1230.3	3068	395.8
8.000	711.8	3470.4	1205.9	23998.4	520.9	281.8	3696.8	1230.1	2980	395
8.130	702.7	3522.4	1206.4	23609.6	519	279.9	3673.6	1229.9	2880	394.4
8.250	693.9	3559.2	1206.7	23281.6	517.3	278.2	3650.4	1230.1	2775.2	393.8
8.380	683.2	3611.2	1207.4	22854.4	515.3	276.3	3625.6	1229.8	2668	393.2
8.500	641.2	3676	1207.6	22313.6	511.4	274.4	3596.8	1229.7	2560	392.4
8.630	639	3449.6	1208.6	22607.2	498.3	272.9	3568	1229.7	2447.2	391.7
8.750	612.9	3715.2	1210.4	21776	492.2	272.1	3544.8	1229.2	2332	391.2
8.880	582.3	4399.2	1216.9	19624.8	473.5	270.1	3522.4	1229	2217.6	390.8
9.000	569.4	4604	1218.4	18378.4	470.1	267.9	3489.6	1229	2108	390
9.130	560	4679.2	1219.2	17721.6	467.9	265	3451.2	1228.7	2015.2	389.1

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 5 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.250	551.3	4676.8	1219.7	17380.8	466.1	261.2	3407.2	1228.3	1960.8	387.8
9.380	543.5	4645.6	1220	17143.2	464.3	255.9	3354.4	1228.5	1961.6	386.1
9.500	534	4614.4	1220.2	16870.4	462.4	250	3296.8	1228.3	2012	384.1
9.630	523.8	4608.8	1220.7	16440	460.2	243.9	3234.4	1228.5	2094.4	382
9.750	515.5	4639.2	1221.1	15936.8	458.3	238.2	3174.4	1228.3	2196	379.6
9.880	505.7	4664.8	1221.9	15401.6	456.2	233.8	3117.6	1228.2	2300.8	377.6
10.000	495.9	4681.6	1222.4	14883.2	454.2	229.7	3065.6	1228.3	2396	376
10.130	490.3	4697.6	1223.2	14439.2	452.4	225.3	3020.8	1228	2470.4	374.4
10.250	481.3	4703.2	1223.4	14077.6	451	221.7	2979.2	1228.2	2521.6	372.7
10.380	474.7	4716.8	1223.9	13572.8	449	218.5	2941.6	1228.3	2552.8	371.3
10.500	467.4	4724	1224.4	13165.6	447.5	215.5	2906.4	1227.9	2569.6	370.1
10.630	461.9	4726.4	1224.8	12781.6	445.9	212.9	2873.6	1227.8	2579.2	368.9
10.750	456.5	4696	1225	12640.8	444.7	210.4	2842.4	1227.9	2577.6	367.8
10.880	449.9	4672.8	1225.2	12385.6	443.3	208.2	2815.2	1227.5	2564	366.7
11.000	444.5	4687.2	1225.8	11884	441.7	206.2	2788	1227.7	2533.6	366
11.130	440	4701.6	1226	11482.4	440.7	204.5	2764.8	1227.5	2492	365
11.250	435.3	4727.2	1226.5	10892.8	439.6	202.8	2743.2	1227.3	2434.4	364.4
11.380	432.3	4759.2	1227.1	10260.8	438.7	201.4	2721.6	1227.1	2365.6	363.7
11.500	427	4813.6	1227.5	9629.6	437.8	200.3	2702.4	1226.9	2289.6	363.1

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 6 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.630	422.1	4888	1228.6	8892.8	436.7	199.3	2683.2	1226.7	2208.8	362.5
11.750	419.3	4955.2	1229.3	8156	435.8	198.4	2664	1226.4	2124.8	362.1
11.880	417.4	5036.8	1230.1	7331.2	435.5	197.7	2644	1226.2	2040	361.6
12.000	420.7	5103.2	1230.4	6480	435.6	196.7	2625.6	1225.8	1952.8	361.3
12.130	420.8	5196	1230.7	5568.8	436.1	195.3	2609.6	1225.8	1863.2	360.7
12.250	425.7	5289.6	1231	4660	436.8	194.3	2595.2	1226	1768.8	360
12.380	429.8	5344.8	1230.7	3782.4	438.1	193.9	2584.8	1225.3	1660.8	359.9
12.500	428.7	5340	1230.2	3092	438.7	194.3	2574.4	1225.4	1536.8	359.6
12.630	413.6	5231.2	1230	3012	436.3	195.6	2562.4	1225.1	1391.2	360
12.750	394.9	5048.8	1230.4	3376.8	431.7	196.6	2551.2	1224.1	1234.4	360.4
12.880	375.9	4854.4	1230.9	3830.4	426.6	197.7	2539.2	1224.1	1068.8	360.7
13.000	359.8	4662.4	1231.2	4297.6	421.7	200.5	2524	1223	897.6	361.2
13.130	344.8	4453.6	1230.7	4812.8	417.3	202.6	2509.6	1222.3	728	362.2
13.250	331.7	4268.8	1230.7	5411.2	412.8	206.8	2492.8	1221.8	556.8	363.7
13.380	321.9	4092.8	1230.4	5982.4	409.4	211.4	2476.8	1220.3	392	364.3
13.500	313.5	3919.2	1229.1	6529.6	406.4	214.1	2451.2	1219.6	249.6	366.7
13.630	302.7	3772	1229.1	7044	403.1	215.6	2410.4	1218.3	136.8	366.5
13.750	294.6	3636	1228.7	7476.8	399.9	214	2368	1217.1	74.4	367.7
13.880	288.1	3504.8	1227.6	7794.4	397.3	211.2	2324.8	1216.8	48	366.7

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 7 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
14.000	282.6	3381.6	1227	8039.2	395.1	207.7	2284.8	1216.4	41.6	362.3
14.130	277.5	3280	1226.5	8200.8	393.1	204.3	2248	1215.9	40.8	362.4
14.250	272.5	3207.2	1225.8	8292.8	391.3	201.3	2212.8	1215.9	39.2	360
14.380	268.3	3149.6	1225.9	8309.6	389.7	198.7	2182.4	1216.1	38.4	360
14.500	264	3098.4	1225.5	8309.6	388.1	196.2	2156	1215.4	37.6	362.6
14.630	260.1	3052.8	1225.3	8283.2	386.6	194.1	2129.6	1215.4	35.2	355.5
14.750	256.3	3007.2	1225.2	8260.8	385.2	192.2	2104	1214.8	28.8	355.6
14.880	252.4	2964.8	1224.8	8227.2	383.7	190.2	2076	1215	20.8	352.3
15.000	248.2	2922.4	1224.9	8194.4	382.2	188.1	2048.8	1214.4	12.8	362.5
15.130	244.1	2879.2	1224.8	8188	380.6	185.7	2019.2	1214.8	8	352
15.250	240.1	2835.2	1224.4	8197.6	379.1	183.1	1991.2	1214.4	5.6	365.7
15.380	236.3	2788.8	1224.2	8215.2	377.5	180.3	1964	1214	7.2	346.7
15.500	232.9	2746.4	1224.3	8224.8	376.1	177.5	1937.6	1213.6	11.2	354.3
15.630	229.6	2706.4	1223.9	8216.8	374.7	174.5	1912.8	1213.6	18.4	347.8
15.750	226.3	2664.8	1223.5	8220.8	373.3	171.7	1889.6	1213.4	27.2	342.4
15.880	223	2616	1223.4	8262.4	372	169.1	1866.4	1213.8	34.4	347.9
16.000	219.8	2560.8	1223	8336.1	370.6	166.7	1844.8	1213.4	40	344
16.130	216.9	2508	1222.4	8396.8	369.2	164.7	1824	1212.9	42.4	344.2
16.250	214.2	2461.6	1222	8421.6	367.9	162.8	1802.4	1213.2	41.6	343.8

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 8 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
16.380	211.6	2420	1221.6	8434.4	366.8	161.3	1782.4	1213	38.4	342.5
16.500	208.8	2380	1221	8420.8	365.6	159.8	1762.4	1212.5	32.8	338.5
16.630	206.2	2344.8	1220.8	8380.8	364.4	158.4	1741.6	1212.2	24.8	347.1
16.750	203.4	2304	1220.5	8357.6	363.1	157.1	1720.8	1212	18.4	328.7
16.880	200.8	2261.6	1220	8344.8	361.9	155.7	1700	1211.6	10.4	338.5
17.000	198.4	2216.8	1219.8	8357.6	360.7	153.6	1675.2	1212.6	3.2	400
17.130	196.1	2180	1219	8366.4	359.6	151.3	1646.4	1214.9	5.6	308.6
17.250	193.6	2144	1218.7	8345.6	358.4	148.9	1617.6	1220.1	10.4	369.2
17.380	191.3	2112.8	1218.4	8322.4	357.3	147.2	1596.8	1220.4	12.8	340
17.500	189	2076.8	1218.4	8313.6	356.2	145.5	1580	1219.6	11.2	351.4
17.630	186.7	2042.4	1217.5	8305.6	355	143.2	1556.8	1223.1	15.2	347.4
17.750	184.3	2007.2	1217.6	8292.8	353.9	141.2	1528.8	1227.2	11.2	340
17.880	180.7	1980	1217.5	8291.2	352.5	139.2	1500.8	1230.4	3.2	340
18.000	221.3	1647.2	1209.8	7944	369.3	137.1	1476	1232	0	340
18.130	215	1608	1208.8	7776	370.6	135	1453.6	1232.8	0	340
18.250	217.4	1566.4	1208.2	7849.6	369.6	132.9	1430.4	1234.2	0	340
18.380	211.3	1530.4	1207.7	7874.4	368.6	131.1	1409.6	1234.8	0	340
18.500	213.2	1496.8	1207.5	7878.4	367.5	129.1	1390.4	1234.1	0	340
18.630	206.9	1464.8	1207.3	7869.6	366.5	127.7	1375.2	1231.1	0.8	80

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 9 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
18.750	207.4	1430.4	1206.8	7844	365.8	126.1	1360	1229.1	0	80
18.880	204.3	1399.2	1207	7876.8	364.3	124.3	1342.4	1228.8	0	80
19.000	202.3	1365.6	1206.1	7919.2	363	122.7	1324	1230.6	0	80
19.130	200.9	1335.2	1205.5	7942.4	361.9	120.7	1303.2	1233	0	80
19.250	194	1296	1205	8079.2	360.3	118.5	1276.8	1236.9	0	80
19.380	197	1230.4	1204.8	8129.6	357.7	117.2	1257.6	1239.6	0	80
19.500	192.3	1244	1205	8170.4	358.7	114.7	1237.6	1239.7	0	80
19.630	190.4	1168.8	1203.6	8230.4	355	113.7	1220	1237.4	0.8	40
19.750	188.8	1202.4	1204.8	8031.2	356.3	111.8	1211.2	1231.9	2.4	333.3
19.880	183.3	1135.2	1203.6	8021.6	352.5	110.2	1196.8	1227.9	8.8	334.5
20.000	184.7	1148.4	1203.5	7954.8	353.1	108	1189.2	1228.4	12.4	329
20.130	176.2	1100.8	1203.1	7828.8	350	106.4	1153.6	1234.2	13.6	322.4
20.250	178.7	1118.4	1204	7716.8	350.7	104.1	1129.6	1240.4	6.4	320
20.380	167.9	1068.8	1202.1	7687.2	347.3	102.2	1100	1242.2	0	320
20.500	173.7	1060	1203	7638.4	347	100.1	1081.6	1245.1	0	320
20.630	161.3	1032.8	1201.6	7580.8	344.8	98	1054.4	1245.2	0	320
20.750	168.3	996.8	1202.2	7553.6	342.9	96.5	1040.8	1244.9	0	320
20.880	159.1	999.2	1201.2	7463.2	342.3	94	1014.4	1244.6	0	320
21.000	161.8	928.8	1200.8	7483.2	338.2	92.7	996.8	1247.8	0	320

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 10 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
21.130	155.7	956.8	1200.8	7339.2	339.6	89.5	969.6	1248	0	320
21.250	151.3	870.4	1200.3	7404.8	333.9	88.7	948.8	1249.8	0	320
21.380	151.4	899.2	1199.6	7328	336.1	86	928	1251	0	320
21.500	141.8	848.8	1199.1	7399.2	332.3	85.6	896.8	1249.5	0	320
21.630	146.5	781.6	1198.4	7370.4	328.2	84.9	886.4	1250.8	0	320
21.750	140.6	824.8	1198.6	7208	330.7	83.3	852	1249.7	0	320
21.880	129.3	737.6	1197.7	7368.8	325.1	83	831.2	1247.4	0	320
22.000	139.5	719.2	1197.6	7376.8	325	82.2	819.2	1247.7	0	320
22.130	132.1	733.6	1197.5	7283.2	325.3	81.1	787.2	1247.9	0	320
22.250	127	633.6	1194.2	7378.4	319.8	81.1	773.6	1248.1	0	320
22.380	132.8	657.6	1196.3	7549.6	323	80.2	764.8	1245.6	0.8	120
22.500	123.9	644.8	1195.9	7515.6	322.1	79.5	754.8	1241	0.8	220
22.630	129.9	571.2	1194.8	7515.2	318.2	79.3	744.8	1225.4	3.2	270
22.750	126.6	600	1195.9	7604.8	320.9	78.7	741.6	1215.5	6.4	285
22.880	118.2	540.8	1193.6	7565.6	316.6	78.6	730.4	1211.5	9.6	290
23.000	127.4	533.6	1193.6	7655.2	317.2	78.3	728.8	1210.2	12	285.3
23.130	121	545.6	1194.4	7560.8	317.6	77.8	712.8	1207.5	14.4	275.6
23.250	113.8	486.4	1192.8	7568	312.7	77.9	710.4	1205.6	16.8	281.9
23.380	123.2	489.6	1194.2	7525.6	313.9	77.4	707.2	1204.8	17.6	287.3

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 11 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
23.500	115.9	504.8	1192.1	7474.4	314.4	77	686.4	1205.2	18.4	274.8
23.630	110.7	448.8	1192.9	7697.6	309.4	77.1	681.6	1205.4	16	292
23.750	107.1	410.4	1190.8	7908.8	305.8	76.9	676.8	1210.6	14.4	268.9
23.880	105.8	395.2	1190.1	7914.4	302.5	76.6	668	1211.1	11.2	291.4
24.000	104.2	394.4	1191.7	7684.8	300.4	76.4	658.4	1213	11.2	268.6
24.130	102.5	394.4	1189.3	7474.4	298.6	76.2	650.4	1213.6	9.6	296.7
24.250	101.1	392	1190.7	7280.8	297	75.9	642.4	1213.5	9.6	280
24.380	99.8	390.4	1188	7101.6	295.7	75.6	632.8	1214.5	9.6	263.3
24.500	98.5	385.6	1190.7	6944	294.5	75.2	620	1215.6	8	304
24.630	97.3	380	1187.9	6833.6	293.4	75	609.6	1216.9	8	276
24.750	95.9	370.4	1189.5	6755.2	292.2	74.7	597.6	1221.1	6.4	260
24.880	94.5	357.6	1187.8	6726.4	290.7	74.4	580.8	1230.1	3.2	260
25.000	93.1	342.4	1188.8	6728	289.2	74	561.6	1242.3	0	260
25.130	91.8	328	1186.7	6726.4	287.7	73.7	544.8	1250.4	0	260
25.250	90.3	312.8	1189.2	6718.4	286.1	73.3	528.8	1254.3	0	260
25.380	88.9	299.2	1187.2	6698.4	284.4	72.9	513.6	1258.9	0	260
25.500	87.6	286.4	1187.9	6653.6	282.7	72.6	503.2	1258	0	260
25.630	87	280	1188.3	6503.2	281.5	72.3	492	1258.3	0	260
25.750	80	252.8	1185.1	6176	280	71.9	479.2	1258	0	260

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 12 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
25.880	88.8	200.8	1180.9	6168	283.2	71.2	462.4	1257.4	0	260
26.000	99.6	247.2	1190.2	7485.6	296.4	70.3	431.2	1253.4	0	260
26.130	92	258.4	1187.4	6671.2	297.1	70.2	405.6	1249.1	0.8	40
26.250	86.5	224.8	1184.6	6318.4	290.6	70.4	417.6	1247.8	0	40
26.380	82.2	195.2	1183.6	6680.8	284	70.3	416	1254.2	0	40
26.500	79.2	169.6	1183	7064	275.5	70.1	410.4	1253.3	0	40
26.630	77	152.8	1184.1	7208	269.8	69.9	400	1259.4	0	40
26.750	75.8	144	1185.3	7275.2	266.5	69.7	389.6	1260.9	0	40
26.880	75.4	141.6	1183.7	7148	265.2	69.5	384.8	1255.6	0	40
27.000	75.2	144	1176.9	6892.8	265.1	69.3	379.2	1252.3	0	40
27.130	74.7	144.8	1182.3	6631.2	265	69.1	373.6	1241.6	0.8	80
27.250	74.1	144	1181.8	6416	264.4	68.9	367.2	1235	0.8	280
27.380	73.6	141.6	1187.3	6268.8	263.7	68.8	362.4	1235.7	1.6	320
27.500	73.3	140.8	1177.7	6132	263.2	68.8	360.8	1234.8	2.4	253.3
27.630	73.2	138.4	1186.6	6009.6	263.2	68.6	356.8	1235.2	1.6	320
27.750	73	137.6	1178.1	5918.4	263.4	68.5	350.4	1234.5	1.6	300
27.880	72.7	133.6	1185.1	5912	263.3	68.3	344.8	1229.5	2.4	253.3
28.000	72.4	128.8	1182.6	5952	263	68.2	340.8	1225.5	4.8	260
28.130	71.8	123.2	1179.7	6049.6	262.1	68.1	340.8	1217.8	8.8	261.8

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 13 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
28.250	71.4	117.6	1179.9	6150.4	261.1	68.1	340	1211.9	11.2	282.9
28.380	70.9	112	1182.9	6217.6	260.2	68	339.2	1212.5	12.8	265
28.500	70.4	108	1181.6	6278.4	259.1	68	336	1213.1	10.4	276.9
28.630	69.9	104	1185.2	6304	258	67.9	332	1219.9	7.2	262.2
28.750	69.4	101.6	1182.4	6327.2	256.8	67.9	324.8	1229.6	3.2	320
28.880	69	99.2	1186.5	6313.6	256	67.8	320.8	1236.3	2.4	240
29.000	68.5	98.4	1179.8	6259.2	255.2	67.7	315.2	1237.4	1.6	240
29.130	67.8	56	1188.6	5226.4	252.1	67.7	313.6	1234.3	1.6	260
29.250	74	79.2	1176.6	5440	255.1	67.5	312.8	1228	3.2	290
29.380	76.8	84	1191.6	8519.2	270.3	67.2	300.8	1217.4	7.2	262.2
29.500	74.3	86.4	1182.2	8248.8	276.4	67.4	301.6	1214.9	10.4	270.8
29.630	79	78.4	1172.2	6872.8	277.2	67.7	321.6	1210.7	14.4	275.6
29.750	83.1	90.4	1183	9381.6	283.2	67.8	332	1209.6	16	264
29.880	76	96	1192	7462.4	282.9	68.1	344	1208.4	16	272
30.0	82.7	110.5	1177.8	7080.8	282.4	67.7	344.3	1208.6	15.2	271.8
32.5	66.4	97	1186.1	7069.3	263.7	67	327.6	1217.1	9.2	272.4
35.0	67	59.2	1197.1	5303.7	246.8	64.8	251.2	1245.7	1.6	268.1
37.5	51.7	14.8	1180.9	3092.3	235.8	56.6	94.4	1275.6	0	268.1
40.0	28.8	0	1180.9	0	235.8	51.6	0	1275.6	0	268.1

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 14 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
42.5	33.9	0.2	1455	116.5	214.7	45.2	0	1275.6	0	268.1
45.0	25.4	0	1455	17.1	211.1	43.4	0	1275.6	0	268.1
47.5	50.5	0	1455	18.4	207	49.7	0	1275.6	0	268.1
50.0	59.6	0.6	1221.7	203.7	207.5	62.4	35.8	1394.6	0	268.1
52.5	59.1	8.8	1194.9	1154.4	214.7	62.2	109	1279.6	0	268.1
55.0	61.9	11.2	1185.7	2884.9	214.8	62.6	165.2	1256.7	0.1	380
57.5	59.8	6.5	1180	3837.6	214.9	62.6	156	1258.6	0.4	265
60.0	66.8	76.4	1201.9	3051.5	234.6	63	171.8	1259.5	0.1	210
62.5	66.2	267	1213.3	1013	267.6	62.8	205.9	1241.5	1.5	268.7
65.0	65.3	263.4	1246	798.6	267.7	62.6	205.3	1236.4	4.4	264.8
67.5	63.8	270.1	1199.6	398.8	267.3	62.2	174	1256.7	1.1	261.8
70.0	63.2	239.5	1221.8	242.4	266.5	61.9	148.7	1275.1	0	261.8
72.5	63	226	1210.2	209	265.9	61.8	139.8	1276.8	0	261.8
75.0	63	232.6	1214.2	182.5	265.9	61.7	142.1	1276.2	0	261.8
77.5	63.3	239.4	1213.5	209.8	265.9	61.7	146.2	1276.3	0	261.8
80.0	62.5	224.2	1223.2	262.4	265.8	61.4	141.8	1276.2	0	261.8
82.5	61.8	174.4	1237	214.2	263	61.1	114.1	1278.9	0	261.8
85.0	61.9	140.8	1213	268.8	262.2	61.1	106.4	1280.7	0	261.8
87.5	62.8	213.4	1211.2	396.9	265.6	61.2	143.9	1273.6	0	261.8

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 15 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
90.0	61.2	157.8	1224.5	472.6	262.4	60.8	118.2	1272.5	0	261.8
92.5	60.9	129.8	1232.1	334.1	257.2	60.6	94.3	1280.1	0	261.8
95.0	60.8	92.6	1226.2	307.4	249.8	60.4	77.8	1282.9	0	261.8
97.5	60.3	67.2	1208.3	270.7	253.1	60.3	68.7	1284.7	0	261.8
100.0	61.9	157.1	1208.5	241.5	261.6	60.7	112	1280.2	0	261.8
102.5	61.6	184.8	1209.1	201.7	263.6	60.6	122.1	1272.2	0	261.8
105.0	61.4	215.5	1209.7	229.8	264.7	60.6	134.4	1265	0	261.8
107.5	61.4	183.3	1213.2	157.2	263.4	60.6	116.6	1268.5	0	261.8
110.0	61.7	210.2	1213.6	182.2	264.4	60.7	130.2	1264.7	0	261.8
112.5	62	185.3	1210.9	206.7	263.5	60.8	124.4	1264.2	0	261.8
115.0	61.3	221.1	1215.9	199.3	264.9	60.6	137	1260.5	0	261.8
117.5	61.4	175.9	1222	157.8	263.3	60.7	112.1	1272.9	0	261.8
120.0	61.6	197.7	1213.2	176	264.1	60.8	123.1	1269	0	261.8
122.5	61.7	194.3	1214.1	160	263.9	60.8	121.6	1267.7	0	261.8
125.0	62.1	222	1214.4	188.1	264.8	60.9	135.8	1271.2	0	261.8
127.5	62.2	195.3	1210.8	218.4	264.2	60.9	126.6	1273.9	0	261.8
130.0	62.6	208.5	1213.4	539.2	265.6	61	144.6	1272.9	0	261.8
132.5	61	148.5	1227.8	374.6	262.1	60.7	111	1273.7	0	261.8
135.0	62	169.7	1207.2	242.3	263.3	60.9	110.8	1276.3	0	261.8

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 16 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
137.5	61.3	206.4	1212	201.6	264.7	60.9	129.5	1271.6	0	261.8
140.0	62.6	198	1208.7	264.4	264.6	61.1	127.2	1273.4	0	261.8
142.5	61.8	191.8	1208.6	230.2	264.4	60.9	124.5	1261.9	0	261.8
145.0	62.4	206.3	1209	235	264.8	61.1	127.8	1268.9	0	261.8
147.5	62	195.3	1210.1	237.3	264.4	61	129.4	1252.2	0	261.8
150.0	62.5	215.6	1209.5	246.6	265.1	61.2	133	1266	0	261.8
155.0	62.3	195.1	1207.7	261.1	264.7	61.2	126.5	1254.9	0.1	140
160.0	62.5	201.5	1209.5	228.4	264.7	61.2	128.8	1254.2	0	140
165.0	62.4	201.8	1209	236	264.9	61.3	131	1236.4	0.5	270
170.0	62.3	200.4	1208.1	224.9	264.8	61.3	131.4	1223.9	2.1	270
175.0	62	194.4	1211.5	177.6	264.5	61.2	121.8	1245	0.4	242.5
180.0	61.8	179.6	1211.4	163.8	263.9	61.2	109.8	1260.6	0	242.5
185.0	61.9	172.4	1211.2	158.6	263.6	61.3	111	1231.9	0.2	265
190.0	61.8	181.8	1202.5	157.9	264.1	61.3	111.3	1257.9	0	265
195.0	61.6	150.6	1209.8	136	262.3	61.2	93.8	1267.7	0	265
200.0	61.5	132.7	1209.6	123.8	260.4	61.2	85.9	1266.3	0	265
205.0	61.4	116.9	1207.7	112.1	258.2	61.2	75.8	1273.5	0	265
210.0	61.9	126.4	1209.1	125.3	259.7	61.4	82.2	1272.9	0	265
215.0	61.6	143.9	1208.3	147.5	262.2	61.3	93.7	1262.2	0	265

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 17 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
220.0	61.8	125	1207.4	121.3	259.7	61.4	81.1	1268.6	0	265
225.0	61.6	126.9	1208.3	122.5	259.9	61.4	82.8	1266.8	0	265
230.0	61.7	123.9	1208	119.5	259.6	61.4	80.9	1268.2	0	265
235.0	61.6	121.9	1208.6	117.9	259.4	61.3	79.6	1266.5	0	265
240.0	61.5	120.1	1208	115.7	259.2	61.4	78.7	1267.4	0	265
245.0	61.6	122	1208.7	118.7	259.4	61.4	79.8	1267.4	0	265
250.0	61.7	117.2	1208.2	113.4	258.7	61.4	77.7	1267	0	265
255.0	61.8	114.2	1205.9	135.1	258.9	61.5	78.2	1268.4	0	265
260.0	61.7	123	1205.7	143.7	259.9	61.5	81.8	1265.3	0	265
265.0	61.9	118.3	1204.6	149	259.3	61.6	78.5	1268.2	0	265
270.0	61.6	119.3	1206.1	141.7	259.4	61.5	79.9	1263	0	265
275.0	61.9	114.8	1204.3	144.7	258.7	61.6	76.7	1268	0	265
280.0	61.7	112.6	1206.2	114	258.6	61.5	74.8	1266.3	0	265
285.0	61.7	99	1204.8	102.3	256.2	61.6	67.6	1269.6	0	265
290.0	61.7	104.6	1206.1	105.9	257.1	61.6	70.3	1269	0	265
295.0	61.7	95	1204.4	95.7	256.6	61.6	65.8	1269.3	0	265
300.0	61.9	91.6	1203.7	94.1	256.3	61.7	64.4	1269.4	0	265
305.0	62	124.2	1206.6	145.6	261.1	61.7	84.8	1266.9	0	265
310.0	62.2	125.4	1205.5	151.8	260.6	61.8	83.2	1268.1	0	265

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 18 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
315.0	62	128.2	1208.9	122.4	260.4	61.7	84.4	1255.5	0	265
320.0	61.9	118.8	1207.4	114.5	259	61.8	78.6	1262.9	0	265
325.0	62	117.4	1207.9	114.5	258.6	61.8	77	1266.7	0	265
330.0	62	120.2	1206.9	121.6	259.4	61.8	77.6	1265.2	0	265
335.0	62.1	121.6	1208.1	118.6	259.5	61.8	77.5	1265.3	0	265
340.0	62.1	124.1	1208.7	116.6	259.7	61.9	78.5	1265.5	0	265
345.0	62.2	128.2	1209.1	119.4	260.3	61.9	80.3	1264.1	0	265
350.0	62.2	125.1	1209.1	114.1	259.9	61.9	78.9	1260.1	0	265
355.0	62.1	120	1207.9	111.4	259	61.9	76.1	1263.3	0	265
360.0	62.1	110.6	1207.4	103.6	257.6	61.9	70.3	1266	0	265
365.0	62.1	106.1	1206.9	101.9	256.8	61.9	68.1	1266.2	0	265
370.0	62.3	113.8	1207.4	110	258.1	62	70.4	1265.1	0	265
375.0	62.4	133.2	1209.3	123.9	261.3	62	82.6	1253.3	0	265
380.0	62.4	135.1	1210.2	121.1	261.3	62	84.2	1256.3	0	265
385.0	62.3	130.6	1209.5	116.5	260.8	62.1	80.7	1260.1	0	265
390.0	62.4	124.7	1209.3	112.8	259.6	62.1	77.2	1260.6	0	265
395.0	62.3	121.1	1208.2	110.8	259.2	62.1	74.1	1260.5	0	265
400.0	62.3	118.9	1208.4	110.2	259.1	62.1	72	1261	0	265
410.0	62.5	136.4	1210.1	122	261.5	62.2	82.4	1260.2	0	265

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 19 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
420.0	62.4	119.6	1208.4	106.9	259	62.2	73	1260.5	0	265
430.0	62.5	89.2	1204.1	85.8	255.5	62.4	54.6	1265.1	0	265
440.0	62.7	114.5	1207.6	107.9	259	62.4	66.2	1255.6	0	265
450.0	63	119.9	1208.3	110	259.5	62.7	70.9	1240.2	0	265
460.0	63	139.3	1218	245.8	262.8	62.7	85.5	1244.1	0.1	210
470.0	63.2	118.2	1225.9	240.7	259.1	62.9	76	1258	0	210
480.0	63	116.2	1231.1	210.9	259.7	62.9	73.7	1260.6	0	210
490.0	63.1	86.9	1243.6	94.2	257.4	62.9	54.3	1261	0	210
500.0	63.2	99	1208.9	176	259.2	63.1	61.5	1247.9	0	210
510.0	63.5	107.2	1205.2	205.3	258	63.2	65.8	1246.7	0	210
520.0	63.8	127.6	1205.7	204.7	261.5	63.4	72.8	1256.8	0	210
530.0	64.7	148	1223.2	443.2	263	63.6	101.9	1232.5	0.5	258
540.0	64.3	152	1218.6	392.9	264.1	63.7	102.6	1258	0	258
550.0	64.1	153.8	1204.1	245.3	265.4	63.7	93.4	1254.8	0	258
560.0	64.3	132.1	1210	204.6	262.1	63.8	78.4	1255.8	0	258
570.0	64.1	112.9	1209.5	206.1	259.5	63.8	67.9	1260	0	258
580.0	64.3	114	1205.5	226.8	259.9	64	69	1258.4	0	258
590.0	64.3	113.9	1203.2	180.9	260.2	64	70.2	1224.3	0.7	271.4
600.0	64.2	101	1208.2	195.4	258.8	64.1	63.2	1235.5	0.5	246

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 20 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
610.0	64.3	87.4	1204.7	182.1	257.6	64.2	53.2	1258.1	0	246
620.0	64.4	71.3	1200.7	127.2	255.6	64.3	45	1260	0	246
630.0	64.5	64.6	1198.7	124.9	256.1	64.4	42	1260.7	0	246
640.0	64.7	80.9	1201.4	152.7	256.6	64.6	47	1258.2	0	246
650.0	65.3	103.5	1212.3	297	258.4	64.9	65.8	1240.5	0	246
660.0	65.6	127.1	1214.2	512.1	262.5	65	87.8	1253.9	0.1	190
670.0	65.5	129.7	1218.3	471.7	261.9	65.1	91.7	1235.2	0.6	250
680.0	65.6	129.9	1203.9	302.1	263.3	65.2	81.8	1228	0.6	243.3
690.0	65.4	120.4	1203.4	182	262.2	65.2	71.1	1241	0.1	260
700.0	65.2	91.3	1220.8	139.6	256.6	65.3	53.8	1257.6	0	260
710.0	65.4	74.7	1199.9	166.1	257.6	65.4	45.7	1255.3	0	260
720.0	65.6	70.6	1200.1	115.7	256.9	65.5	42.2	1257.6	0	260
730.0	65.9	77.5	1206.2	201	255.9	65.8	49	1256.6	0	260
740.0	66.3	104.6	1215.5	499.1	258.5	65.9	75.8	1254.4	0	260
750.0	66.3	126.2	1226.9	476.6	262.3	66.1	87.2	1254.4	0	260
760.0	66.7	124.5	1227.6	423.4	261.3	66.2	85	1253.5	0	260
770.0	66.7	125.3	1217	346.7	261.1	66.3	83.5	1254	0	260
780.0	66.4	109.5	1203.8	200.9	259.8	66.3	68.9	1253.1	0	260
790.0	66.5	80.7	1207.4	133.8	258.7	66.4	47.3	1254.8	0	260

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 21 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
800.0	66.7	78.1	1219.9	220.1	256.3	66.5	46.3	1253.6	0	260
810.0	67	95.8	1231.2	500.6	246	66.6	67.1	1255	0	260
820.0	67	100	1232	340	247.1	66.6	63.2	1252.8	0	260
830.0	66.7	98.7	1230.3	313.3	247.7	66.7	67.1	1253.9	0	260
840.0	66.7	70.7	1199.7	132.7	258.2	66.7	44.6	1253	0	260
850.0	66.8	64.4	1198.9	112.8	258.8	66.7	39.1	1254.2	0	260
860.0	66.9	67.1	1196.7	106.5	259.3	66.8	41.3	1255.4	0	260
870.0	67.3	91.1	1219	336.5	254	67.1	58.6	1251.4	0	260
880.0	67.8	109.6	1222.8	791.9	259	67.1	97	1221.8	1.3	269.2
890.0	67.6	111.4	1226.3	542.9	258.3	67.2	93.1	1219.4	1.6	265.6
900.0	68.1	112.5	1223.1	637.8	262.5	67.3	94.9	1220.5	5.4	271.1
910.0	67.6	111	1230.2	339.2	258.1	67.3	82	1233.8	1.1	279.1
920.0	67.2	99.6	1225.7	156.5	258.8	67.2	78.1	1212.7	3.8	266.3
930.0	67.3	66.7	1228.4	58.3	258.9	67.2	51.5	1246.4	0	266.3
940.0	67.8	62.4	1219.1	267.5	254	67.3	47.3	1248.5	0	266.3
950.0	67.8	93.5	1225.3	514.9	254.1	67.6	72.9	1231.4	0.5	252
960.0	67.8	104.7	1224	632.8	252.1	67.7	80.1	1219.6	3.9	267.2
970.0	68	117.8	1218.9	753.6	259.4	67.7	120.8	1203.5	4.5	271.3
980.0	67.6	98	1226.9	157.9	255.3	67.6	78.4	1230.8	0	271.3

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 22 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
990.0	67.7	63.3	1223.3	77	257.3	67.7	66.4	1227.8	0	271.3
1000	67.7	48.5	1220.2	54.7	259.1	67.7	57.2	1231.2	0	271.3
1010	67.6	40.8	1218.4	50.6	259.1	67.7	51.3	1233.5	0	271.3
1020	67.7	47.7	1203.9	63.4	258.6	67.7	48.9	1230.2	0	271.3
1030	67.7	47.6	1194.7	80.5	260.2	67.7	44.1	1232.9	0	271.3
1040	67.7	54.7	1196.2	65.5	259.6	67.7	38.5	1235.6	0	271.3
1050	68	63.6	1208.3	143.6	254.6	67.8	38.3	1233.9	0	271.3
1060	68	85.6	1224.5	453.2	242.9	67.8	58.4	1223.8	0	271.3
1070	67.9	85.2	1223.8	604.7	246.6	67.9	84.8	1195.9	10.6	271.7
1080	67.8	80	1220.7	334.2	256.9	67.8	66.8	1222	0.1	140
1090	68	76.6	1221.9	240.5	248.7	67.8	71.3	1208.5	0.2	330
1100	67.8	62.3	1205.9	133.3	254.2	67.8	53.5	1219.7	0	330
1110	67.8	56.4	1194.4	101.7	261.2	67.8	45.3	1223.4	0	330
1120	67.9	49	1193.9	114.9	260.9	67.8	38.3	1224.9	0	330
1130	67.9	54.1	1196	128.3	262.9	67.8	36.5	1225	0	330
1140	68.1	76.7	1221.9	309.3	243.9	68	46.7	1223.7	0	330
1150	68.4	80.5	1221.3	644.8	250	67.9	63.7	1188.6	33.5	270.6
1160	68.3	89.2	1220.3	493.4	255.9	67.9	67.9	1200.5	39	270.9
1170	68.1	95.5	1221.5	379.9	258.3	68	67.2	1189.1	48.8	271

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 23 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1180	68.2	82.7	1223	251.7	255.8	68	64.5	1197.9	19.5	270.7
1190	68.7	81.7	1224.3	230.9	253	68	61.9	1184.1	55.9	270.7
1200	68.1	73.2	1222.4	114.2	255.8	68	57.5	1202.3	0.2	275
1250	66.1	50.5	1212.8	83.9	255.9	68	43.4	1197.1	4.4	268.6
1300	68.1	64	1195.8	378.4	249.7	68	46.9	1188.6	44	270.6
1350	68.1	53.9	1193.2	215.6	250.6	68.1	52.4	1184.4	28.6	271.2
1400	68.1	61.4	1196.4	272.5	243.9	68.1	47.4	1188.4	26.9	271.3
1450	68.2	60.3	1196.7	215.2	234.8	68.1	41.2	1185.8	23.8	270.8
1500	68.2	61.3	1197.1	230	227.1	68.1	38.9	1182.8	26.8	271
1550	68.1	60.3	1196.2	240.6	222.7	68.2	36.3	1184	35.6	270.9
1600	68.3	60.6	1195.2	245.3	219.6	68.2	35.7	1182.5	27.8	270.9
1650	68.3	58.1	1194.8	248.5	217.6	68.2	35.5	1182.5	27	270.9
1700	68.3	54.6	1194.2	261.9	215.4	68.3	37.7	1184	26.8	271
1750	68.4	54.5	1194.8	253.9	206	68.3	34.6	1183.3	20.3	270.5
1800	68.4	54	1193.9	274.1	212.5	68.3	31.7	1181.8	29.8	270.7
1850	68.4	49.3	1192.9	255.3	207	68.3	35	1184.1	31.5	271
1900	68.4	49.8	1192.7	266.4	205.1	68.4	30.3	1182.1	21.7	271.5
1950	68.5	38	1192	244.1	226.9	68.4	34.4	1181.3	46.6	271.3
2000	68.4	39.9	1191.9	306.2	203	68.4	37.8	1182.8	29	271.2

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 24 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
2050	68.4	34.7	1190.5	259.9	214.1	68.4	33.5	1182.6	34.2	271.3
2100	68.4	39.2	1190.2	285.3	215.4	68.3	32.7	1181.7	39.5	271.4
2150	68.3	33.4	1188.3	271.6	210.6	68.3	37.6	1183.1	34.5	271.1
2200	68.3	34.2	1190.6	284.8	214.2	68.3	36	1182.6	38.8	271
2250	67.9	35.5	1189.6	285.6	204.3	68.2	34.7	1183.5	32.3	271.3
2300	68.3	34.6	1190.7	275.7	208	68.1	34.2	1183.7	36.2	271
2350	68	17.9	1192.7	222	238.1	68.1	34.9	1181.4	40.6	270.7
2400	68	20.4	1189.5	405.3	222.9	68	31.2	1183.5	39	271.2
2450	68	28.6	1189.8	223.7	196.2	68	32.3	1182.9	18.5	270.5
2500	68	33.3	1187.4	337.7	204.9	67.9	37.7	1181	48.2	270.5
2550	67.9	31.2	1187.5	289.6	197.1	67.9	36.5	1183.2	27.2	270.4
2600	67.9	31	1186.9	276.6	194.8	67.9	33.8	1181.9	31.8	270.6
2650	67.9	32.6	1188.2	296.5	191.5	67.8	32.6	1182.4	37	270.5
2700	67.8	33.7	1188.3	299.2	194.3	67.8	31.7	1180.6	34.2	270.3
2750	67.8	30.8	1190.3	265.7	191.1	67.7	30.2	1183.4	31	270.8
2800	67.7	33	1188.5	297.7	190.4	67.7	27.5	1181.2	29.6	270.5
2850	67.7	33.4	1187.5	298.6	189.5	67.6	26.1	1179.9	28.1	270
2900	67.7	35.3	1187.9	302.6	190.2	67.6	23.6	1180.9	22.4	270.1
2950	67.6	35.8	1188.8	301.7	188.1	67.6	23.3	1184	19.2	270

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 25 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
3000	67.6	34.3	1190	290.3	187.9	67.5	24	1182.3	22.8	270.9
3050	67.5	34.5	1187.5	300.7	188	67.4	23.9	1182.4	26.6	269.9
3100	67.4	32.6	1187.3	285.1	185.5	67.3	24.7	1183.7	27.9	270.6
3150	67.3	34.9	1187.9	318.2	185.4	67.2	23.2	1183.3	25.9	270.2
3200	67.1	28.3	1185	221.3	190	67.1	29.2	1180.4	46.1	270.2
3250	67.1	29.8	1185	252.5	176	67	27.5	1179.3	47.9	270.1
3300	66.9	30.8	1186	311.5	179.2	66.9	26.9	1181.4	55.8	269.9
3350	66.9	18.2	1185	405.8	193.4	66.8	29.8	1181.5	48.1	269.5
3400	66.2	6.7	1191.2	359.8	219.8	66.7	29.7	1180.2	26.5	269.1
3450	66.6	6.1	1180.3	376	228.2	66.6	27.4	1183	0.5	268
3500	66.7	14.7	1180.6	260.9	212.3	66.5	26.8	1181.7	12.6	269.8
3550	66.4	18.3	1194.3	327	216.4	66.4	27.1	1179.3	36.2	269.3
3600	66.4	30.7	1191.4	423.4	228.1	66.3	23.5	1179.2	19.2	269.6
3620	Note 3	38.7	1179.4	217.7	268.8	-	-	-	-	-
3640	Note 3	39	1179.5	216.5	268.9	-	-	-	-	-
3660	Note 3	39.1	1179.5	216.3	269	-	-	-	-	-
3680	Note 3	39.2	1179.5	216.2	269	-	-	-	-	-
3700	Note 3	39.2	1179.5	216.2	269	-	-	-	-	-
4100	Note 3	36.6	1179.3	216.7	268.3	-	-	-	-	-

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 26 of 28

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
4300	Note 3	36.7	1179.2	217	267.9	-	-	-	-	-
4700	Note 3	34.7	1179	217.7	267.2	-	-	-	-	-
5101	Note 3	33.9	1178.8	218.2	266.7	-	-	-	-	-
5301	Note 3	33.6	1178.8	218.3	266.4	-	-	-	-	-
6301	Note 3	31.6	1178.4	219.2	265.2	-	-	-	-	-
7302	Note 3	29.9	1178.2	219.8	264.4	-	-	-	-	-
8302	Note 3	29	1178	220.2	263.8	-	-	-	-	-
9303	Note 3	28	1177.9	220.5	263.3	-	-	-	-	-
10304	Note 3	27.3	1177.8	220.8	263	-	-	-	-	-
11305	Note 3	26.8	1177.7	220.9	262.8	-	-	-	-	-
12305	Note 3	26.1	1177.7	221.2	262.7	-	-	-	-	-
13306	Note 3	25.3	1177.7	221.6	262.6	-	-	-	-	-
14306	Note 3	24	1177.6	222.4	262.4	-	-	-	-	-
15307	Note 3	14.1	1177.4	227.4	261.8	-	-	-	-	-
16308	Note 3	13.2	1177	227.9	260.3	-	-	-	-	-
17308	Note 3	12.3	1176.6	228.5	259	-	-	-	-	-
18309	Note 3	11.5	1176.3	229	257.8	-	-	-	-	-
19310	Note 3	10.7	1175.9	229.4	256.6	-	-	-	-	-
20310	Note 3	9.9	1175.6	229.8	255.5	-	-	-	-	-

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 27 of 28

Time (s)	Reactor Vessel Side of the Break					SG Side of the Break				
	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
21311	Note 3	9.5	1175.3	230.1	254.4	-	-	-	-	-
22312	Note 3	9	1175	230.4	253.4	-	-	-	-	-
23312	Note 3	8.6	1174.7	230.6	252.4	-	-	-	-	-
24313	Note 3	8.2	1174.4	230.9	251.5	-	-	-	-	-
25314	Note 3	7.7	1174.2	231.1	250.6	-	-	-	-	-
26314	Note 3	7.3	1173.9	231.4	249.7	-	-	-	-	-
27315	Note 3	6.9	1173.6	231.6	248.9	-	-	-	-	-
28316	Note 3	6.5	1173.4	231.8	248	-	-	-	-	-
29316	Note 3	6.1	1173.1	232	247.2	-	-	-	-	-
30317	Note 3	5.7	1172.9	232.2	246.4	-	-	-	-	-
32318	Note 3	5.3	1172.4	232.5	244.8	-	-	-	-	-
34320	Note 3	4.8	1172	232.7	243.4	-	-	-	-	-
36321	Note 3	4.4	1171.5	233	242	-	-	-	-	-
38322	Note 3	3.9	1171.1	233.2	240.7	-	-	-	-	-
41324	Note 3	3.3	1170.5	233.6	238.9	-	-	-	-	-
44326	Note 3	2.9	1170	233.8	237.2	-	-	-	-	-
47328	Note 3	2.5	1169.5	234	235.6	-	-	-	-	-
50330	Note 3	2	1169.1	234.3	234.2	-	-	-	-	-
53332	Note 3	1.8	1168.6	234.4	232.8	-	-	-	-	-

Table 6.2.1-21—Mass and Energy Results for the Limiting Cold Leg Pump Discharge Break
Sheet 28 of 28

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
56334	Note 3	1.5	1168.2	234.6	231.6	-	-	-	-	-
59336	Note 3	1.2	1167.9	234.7	230.5	-	-	-	-	-
62338	Note 3	0.9	1167.5	234.9	229.4	-	-	-	-	-
65340	Note 3	0.7	1167.2	235	228.5	-	-	-	-	-
68343	Note 3	0.5	1166.9	235.1	227.6	-	-	-	-	-
71345	Note 3	0.3	1166.7	235.2	226.8	-	-	-	-	-
76349	Note 3	0	1166.2	235.4	225.5	-	-	-	-	-
81352	Note 3	0	1165.4	235.4	223.1	-	-	-	-	-
86356	Note 3	0	1164.7	235.4	220.8	-	-	-	-	-
86400	Note 3	0	1164.7	235.4	220.8	-	-	-	-	-

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy releases at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results occurs at 3600 seconds. Post 3600 seconds, the mass and energy results were calculated internally by the GOTHIC code.
3. The RCS upstream pressure equal to containment pressure over this interval.

Table 6.2.1-22—Input Summary for Mass and Energy Release

Parameter	Value
RCS Conditions	
Core Power	4612 MWt
Decay Heat	1.2*ANS71 (plus actinides)
Core Inlet Temperature	565.5°F
Total RCS Flow Rate	498932 gpm
Pressurizer	
PZR Liquid Level	59.7 span%
IRWST	
Liquid Temperature	122°F
Safety Injection Accumulators	
Liquid Volume	1236 – 1324.3 ft^3
Total Volume	1942.5 ft^3
Pressure	653 – 682 psia
Liquid Temperature	90.5°F

Table 6.2.1-23—Containment Energy Distribution for Cold Leg Pump Suction Break Energy (BTU)
Sheet 1 of 2

	Prior to LOCA (t=0 sec)	Peak Pressure (t=30 sec)	End of Reflood (t=150 sec)	GOTHIC Transition (t=1200 sec)	1 hr into recirculation	1 day into recirculation
Reactor Coolant Internal Energy	4.004E+08	2.081E+07	3.931E+07	4.130E+07	4.563E+07	3.750E+07
Accumulator Coolant Internal Energy	4.712E+07	3.278E+07	1.604E+05	1.604E+05	1.604E+05	1.604E+05
Energy Stored in RV internals	N/A (included in Pressurizer, Primary Piping, Valves and Pumps)					
Energy Stored in Core	2.933E+07	9.384E+06	3.167E+06	2.391E+06	3.699E+08 [1]	0.000E+00
Energy Generated During Shutdown from Decay Heat	0.000E+00	2.617E+05	3.756E+07	1.692E+08	3.721E+08	3.492E+09
Energy Stored in Pressurizer, Primary Piping, Valves, and Pumps	1.579E+08	1.443E+08	1.268E+08	9.469E+07	Included in Energy Stored in Core	
Energy Stored in SG Metals	1.291E+08	1.294E+08	1.265E+08	1.089E+08	Included in Energy Stored in Core	
Secondary Coolant Internal Energy in SG	2.529E+08	3.209E+08	3.400E+08	2.871E+08	Included in Energy Stored in Core	
Energy Content in RCB Atmosphere	3.060E+07	3.748E+08	3.538E+08	3.494E+08	3.948E+08	1.350E+08
Energy Content in RCB and Internals	0.000E+00 [2]	2.425E+07	7.813E+07	2.188E+08	3.847E+08	1.341E+09
Energy Content of Recirculation Intake Water (IRWST)	2.831E+08	3.729E+08	4.444E+08	5.445E+08	6.040E+08	6.007E+08
Energy Content of BWST Water	N/A (See Energy Content of Recirculation Intake Water (IRWST))					
Energy Removed by LHSI Heat Exchangers	N/A (For prior to long term transition see ΔQ of ECCS source)				6.090E+07 [3]	2.968E+09

Table 6.2.1-23—Containment Energy Distribution for Cold Leg Pump Suction Break Energy (BTU)
Sheet 2 of 2

	Prior to LOCA (t=0 sec)	Peak Pressure (t=30 sec)	End of Reflood (t=150 sec)	GOTHIC Transition (t=1200 sec)	1 hr into recirculation	1 day into recirculation
Energy Removed by Reactor Containment Building Fan Coolers	N/A to U.S. EPR					
SIS Pump Energy	0.000E+00	1.718E+02	1.720E+05	1.676E+06	5.112E+06	1.237E+08
RCP Energy	0.000E+00	8.617E+04	8.617E+04	8.617E+04	8.617E+04	8.617E+04
ΔQ of ECCS Source	0.000E+00	4.498E+01	1.302E+06	2.560E+07	2.560E+07	2.560E+07 [4]
Accumulator Nitrogen	0.000E+00	1.919E+06	1.919E+06	1.919E+06	1.919E+06	1.919E+06
Main Feedwater	0.000E+00	7.032E+07	1.141E+08	1.298E+08	1.298E+08	1.298E+08
Energy Balance						
Initial energy, Btu	1.330E+09	1.330E+09	1.330E+09	1.330E+09	1.330E+09	1.330E+09
Sum of Energy Added	0.000E+00	7.258E+07	1.539E+08	3.027E+08	5.090E+08	3.747E+09
Total 1	1.330E+09	1.403E+09	1.484E+09	1.633E+09	1.839E+09	5.078E+09
Final energy, Btu	1.330E+09	1.430E+09	1.512E+09	1.647E+09	1.799E+09	2.114E+09
Sum of Energy Removed	0.000E+00	4.498E+01	1.302E+06	2.560E+07	8.649E+07	2.994E+09
Total 2	1.330E+09	1.430E+09	1.514E+09	1.673E+09	1.886E+09	5.109E+09
Difference	0.000E+00	-2.656E+07	-2.933E+07	-3.986E+07	-4.626E+07	-3.075E+07

Notes:

1. This is the total sensible energy left in RCS metal and SG secondary side at 3600s.
2. The initial energy content in RCB and Internals is assumed to be zero.
3. LHSI heat exchanger heat removal after long term transition.

4. This is heat removed by RHR system prior to long term transition. It should be added to heat removed after transition (see Note 3) for total LHSI heat exchanger heat removal in 24 hours.

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 1 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
0.0	0.0	0.
0.002	5133.5	1130.8
1.0	9204.2	1227.2
2.0	11085.5	1229.5
3.0	12675.0	1226.5
4.0	13040.0	1224.9
5.0	13510.0	1221.0
6.0	13386.0	1212.0
7.0	12469.0	1212.6
8.0	11415.0	1218.1
9.0	10530.0	1216.3
10.0	9861.0	1214.8
11.0	9166.0	1214.5
12.0	8527.0	1214.9
13.0	8002.0	1215.1
14.0	7615.0	1215.6
15.0	7336.0	1216.5
16.0	7123.0	1217.6
17.0	6970.0	1218.2
18.0	6856.0	1218.6
19.0	6679.0	1219.3
20.0	6293.0	1220.9
21.0	5749.0	1222.8
22.0	5204.0	1225.0
23.0	4680.0	1226.9
24.0	4171.0	1228.0
25.0	3755.0	1229.0
26.0	3343.0	1229.4
27.0	2844.0	1229.6
28.0	2508.0	1228.9
29.0	2214.0	1229.0

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 2 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
30.0	1985.0	1228.2
31.0	1789.0	1227.5
32.0	1580.0	1226.0
33.0	1394.0	1225.3
34.0	1242.0	1223.8
35.0	1137.0	1222.5
36.0	1082.0	1221.8
37.0	1041.0	1221.9
38.0	983.0	1221.8
39.0	929.0	1221.7
40.0	876.0	1221.5
41.0	830.0	1220.5
42.0	787.0	1222.4
43.0	747.0	1220.9
44.0	705.0	1224.1
45.0	664.0	1221.4
46.0	625.0	1222.4
47.0	591.0	1221.7
48.0	561.0	1222.8
49.0	533.0	1223.3
50.0	509.0	1226.4
52.0	475.5	1224.0
54.0	427.5	1226.9
56.0	410.0	1226.8
58.0	417.0	1230.2
60.0	430.5	1230.0
62.0	452.0	1227.9
64.0	470.0	1227.7
66.0	481.5	1226.4
68.0	479.0	1224.4
70.0	466.0	1225.3
72.0	443.0	1224.6

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 3 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
74.0	413.5	1223.7
76.0	375.0	1222.7
78.0	336.5	1221.4
80.0	312.0	1222.8
82.0	313.5	1223.3
84.0	322.0	1222.1
86.0	325.0	1221.5
88.0	322.5	1221.7
90.0	308.5	1218.8
92.0	278.5	1219.0
94.0	273.0	1219.8
96.0	292.5	1222.2
98.0	310.5	1223.8
100.0	320.5	1221.5
105.0	276.8	1216.0
110.0	221.0	1215.4
115.0	200.8	1214.1
120.0	178.4	1219.7
125.0	154.2	1217.9
130.0	130.4	1223.9
135.0	112.2	1226.4
140.0	99.6	1224.9
145.0	90.2	1219.5
150.0	82.8	1222.2
155.0	76.4	1225.1
160.0	70.6	1223.8
165.0	64.2	1227.4
170.0	58.8	1227.9
175.0	49.4	1226.7
180.0	42.8	1229.0
185.0	39.6	1227.3
190.0	34.2	1239.8

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 4 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
195.0	28.8	1243.1
200.0	24.4	1254.1
205.0	21.8	1256.9
210.0	19.8	1262.6
215.0	18.2	1252.8
220.0	16.6	1265.1
225.0	15.2	1263.2
230.0	14.0	1257.1
235.0	12.8	1250.0
240.0	11.8	1254.2
245.0	11.0	1254.6
250.0	9.8	1265.3
255.0	9.2	1260.9
260.0	8.4	1261.9
265.0	3.8	1210.5
270.0	1.2	1333.3
275.0	1.6	1250.0
280.0	2.0	1200.0
285.0	2.2	1363.6
290.0	2.6	1230.8
295.0	3.0	1200.0
300.0	2.8	1285.7
305.0	3.0	1266.7
310.0	3.0	1266.7
315.0	3.0	1266.7
320.0	3.2	1187.5
325.0	2.8	1357.1
330.0	3.2	1187.5
335.0	2.8	1285.7
340.0	2.8	1214.3
345.0	2.6	1307.7
350.0	2.4	1333.3

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 5 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
355.0	2.6	1153.9
360.0	2.2	1363.6
365.0	2.2	1272.7
370.0	2.2	1272.7
375.0	2.2	1181.8
380.0	2.0	1200.0
385.0	1.8	1333.3
390.0	1.8	1222.2
395.0	1.6	1375.0
400.0	1.6	1250.0
405.0	1.6	1250.0
410.0	1.4	1285.7
415.0	1.4	1285.7
420.0	1.4	1285.7
425.0	1.2	1333.3
430.0	1.2	1333.3
435.0	1.2	1166.7
440.0	1.2	1166.7
445.0	1.0	1400.0
450.0	1.0	1400.0
455.0	1.0	1200.0
460.0	1.0	1200.0
465.0	1.0	1200.0
470.0	0.8	1500.0
475.0	1.0	1000.0
480.0	0.8	1500.0
485.0	0.8	1250.0
490.0	0.8	1250.0
495.0	0.8	1250.0
500.0	0.6	1666.7
510.0	0.8	1250.0
520.0	0.7	1285.7

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 6 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
530.0	0.8	1125.0
540.0	0.7	1428.6
550.0	0.7	1285.7
560.0	0.6	1333.3
570.0	0.7	1142.9
580.0	0.6	1333.3
590.0	0.8	1375.0
600.0	0.6	1166.7
610.0	0.6	1333.3
620.0	0.5	1400.0
630.0	0.5	1200.0
640.0	0.5	1400.0
650.0	0.6	1333.3
660.0	0.5	1400.0
670.0	0.5	1200.0
680.0	0.5	1200.0
690.0	0.4	1250.0
700.0	0.5	1200.0
710.0	0.4	1500.0
720.0	0.4	1500.0
730.0	0.5	1000.0
740.0	0.4	1500.0
750.0	0.4	1250.0
760.0	0.4	1250.0
770.0	0.4	1250.0
780.0	0.4	1250.0
790.0	0.3	1666.7
800.0	0.4	1250.0
810.0	0.4	1250.0
820.0	0.3	1666.7
830.0	0.4	1000.0
840.0	0.3	1333.3

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 7 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
850.0	0.4	1250.0
860.0	0.3	1333.3
870.0	0.3	1333.3
880.0	0.3	1333.3
890.0	0.3	1333.3
900.0	0.4	1250.0
910.0	0.3	1333.3
920.0	0.3	1333.3
930.0	0.5	1400.0
940.0	0.5	1200.0
950.0	0.3	1000.0
960.0	0.2	1500.0
970.0	0.2	1500.0
980.0	0.2	1500.0
990.0	0.2	1000.0
1000.0	0.2	1500.0
1010.0	0.2	1500.0
1020.0	0.2	1000.0
1030.0	0.2	1500.0
1040.0	0.2	1000.0
1050.0	0.2	1500.0
1060.0	0.1	2000.0
1070.0	0.2	1500.0
1080.0	0.2	1000.0
1090.0	0.2	1500.0
1100.0	0.2	1000.0
1110.0	0.2	1500.0
1120.0	0.2	1000.0
1130.0	0.2	1500.0
1140.0	0.2	1000.0
1150.0	0.2	1500.0
1160.0	0.1	2000.0

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 8 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
1170.0	0.2	1500.0
1180.0	0.2	1000.0
1190.0	0.2	1500.0
1200.0	0.2	1000.0
1210.0	0.2	1000.0
1220.0	0.1	3000.0
1230.0	0.2	1000.0
1240.0	0.2	1000.0
1250.0	0.2	1500.0
1260.0	0.1	2000.0
1270.0	0.2	1000.0
1280.0	0.2	1500.0
1290.0	0.2	1000.0
1300.0	0.2	1000.0
1310.0	0.2	1500.0
1320.0	0.1	2000.0
1330.0	0.2	1000.0
1340.0	0.2	1500.0
1350.0	0.2	1000.0
1360.0	0.1	2000.0
1370.0	0.2	1500.0
1380.0	0.2	1000.0
1390.0	0.1	2000.0
1400.0	0.2	1000.0
1410.0	0.2	1000.0
1420.0	0.1	3000.0
1430.0	0.2	1000.0
1440.0	0.2	1000.0
1450.0	0.2	1500.0
1460.0	0.1	2000.0
1470.0	0.2	1000.0
1480.0	0.2	1000.0

Table 6.2.1-24—MSLB Mass and Energy Release Data
Sheet 9 of 9

Time (s)	Break Mass Flow Rate (lb_m/s)	Break Energy[1] (BTU/lb_m)
1490.0	0.2	1500.0
1500.0	0.1	2000.0
1510.0	0.2	1000.0
1520.0	0.1	2000.0
1530.0	0.2	1000.0
1540.0	0.2	1000.0
1550.0	0.1	2000.0
1560.0	0.2	1500.0
1570.0	0.2	1000.0
1580.0	0.1	2000.0
1590.0	0.2	1000.0
1600.0	0.2	1000.0
1610.0	0.1	2000.0
1620.0	0.2	1500.0
1630.0	0.1	2000.0
1640.0	0.2	1000.0
1650.0	0.2	1000.0
1660.0	0.1	2000.0
1670.0	0.2	1000.0
1680.0	0.1	2000.0
1690.0	0.2	1000.0
1700.0	0.2	1000.0
1710.0	0.1	2000.0
1720.0	0.2	1500.0
1730.0	0.1	2000.0
1740.0	0.2	1000.0
1750.0	0.2	1000.0
1760.0	0.1	2000.0
1770.0	0.2	1000.0
1780.0	0.1	2000.0
1790.0	0.2	1000.0
1800.0	0.1	2000.0

Note:

1. The Average Liquid Enthalpy is reported for completeness. Since the Average Liquid Mass Flow Rate is zero, the liquid enthalpy is not considered in the analysis.

Table 6.2.1-25—MSLB Reactor Trip and Isolation Signal Summary
Sheet 1 of 4

100% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.7	HCP	7.2	HCP	9.5	HCP	12.2	HCP	19.5
Main Steam Isolation	SG ΔP	0.7	HCP	7.4	HCP	9.8	HCP	12.4	HCP	19.7
MFW Isolation	SG ΔP	0.9	HCP	7.4	HCP	9.8	HCP	12.4	HCP	19.7
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.02	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.9
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	50.7	Temp.	60.4	Temp.	70.9	Temp.	324.4
80% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.7	HCP	8.8	HCP	11.6	HCP	14.9	HCP	24.1
Main Steam Isolation	SG ΔP	0.7	HCP	9.0	HCP	11.8	HCP	15.1	HCP	24.3
MFW Isolation	SG ΔP	0.9	HCP	9.0	HCP	11.8	HCP	15.1	HCP	24.3
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.9
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	51.3	Temp.	61.5	Temp.	72.1	Temp.	333.1

Table 6.2.1-25—MSLB Reactor Trip and Isolation Signal Summary
Sheet 2 of 4

60% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.7	HCP	8.7	HCP	11.6	HCP	15.0	HCP	24.5
Main Steam Isolation	SG ΔP	0.7	HCP	8.9	HCP	11.8	HCP	15.2	HCP	24.7
MFW Isolation	SG ΔP	0.9	HCP	8.9	HCP	11.8	HCP	15.2	HCP	24.7
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.8
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	50.7	Temp.	60.7	Temp.	72.8	Temp.	343.8
50% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.7	HCP	8.7	HCP	11.8	HCP	15.2	HCP	25.0
Main Steam Isolation	SG ΔP	0.7	HCP	8.9	HCP	12.0	HCP	15.4	HCP	25.2
MFW Isolation	SG ΔP	0.9	HCP	8.9	HCP	12.0	HCP	15.4	HCP	25.2
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.8
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	50.2	Temp.	60.2	Temp.	74.0	Temp.	343.9

Table 6.2.1-25—MSLB Reactor Trip and Isolation Signal Summary
Sheet 3 of 4

40% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.7	HCP	8.8	HCP	12.0	HCP	15.5	HCP	25.7
Main Steam Isolation	SG ΔP	0.7	HCP	9.0	HCP	12.2	HCP	15.7	HCP	25.9
MFW Isolation	SG ΔP	0.8	HCP	9.0	HCP	12.2	HCP	15.7	HCP	25.9
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.8
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	49.8	Temp.	60.9	Temp.	72.9	Temp.	346.9
20% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.8	HCP	8.7	HCP	11.8	HCP	15.6	HCP	26.5
Main Steam Isolation	SG ΔP	0.8	HCP	8.9	HCP	12.0	HCP	15.9	HCP	26.7
MFW Isolation	SG ΔP	1.0	HCP	8.9	HCP	12.0	HCP	15.9	HCP	26.7
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.8
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	49.2	Temp.	58.9	Temp.	77.3	Temp.	348.8

Table 6.2.1-25—MSLB Reactor Trip and Isolation Signal Summary
Sheet 4 of 4

0% Power										
	DEG		1.0 ft^2		0.7 ft^2		0.52 ft^2		0.3 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	SG ΔP	0.8	HCP	8.0	HCP	10.9	HCP	14.9	HCP	26.3
Main Steam Isolation	SG ΔP	0.8	HCP	8.2	HCP	11.1	HCP	15.1	HCP	26.5
MFW Isolation	SG ΔP	0.9	HCP	8.2	HCP	11.1	HCP	15.1	HCP	26.5
Foil Opens Faulted SG	Press. and Temp.	0.01	Press. and Temp.	0.03	Press. and Temp.	0.04	Press. and Temp.	0.2	Press. and Temp.	0.8
Foil Opens Intact SG	Press. and Temp.	0.3	Temp.	45.2	Temp.	53.1	Temp.	61.8	Temp.	349.6
	0.2 ft^2		0.15 ft^2		0.1 ft^2		0.01 ft^2		0.005 ft^2	
	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)	Function	Time (sec)
Reactor Trip	HCP	41.3	HCP	56.0	HCP	85.2	HCP	1270.0	Did Not Occur	-
Main Steam Isolation	HCP	41.6	HCP	56.2	HCP	85.4	HCP	1270.2	Did Not Occur	-
MFW Isolation	HCP	41.6	HCP	56.2	HCP	85.4	HCP	1270.2	Did Not Occur	-
Foil Opens Faulted SG	Press. and Temp.	1.4	Press. and Temp.	1.9	Press. and Temp.	2.8	Press. and Temp.	24.5	Press. and Temp.	42.0
Foil Opens Intact SG	Temp.	368.4	Temp.	386.9	Temp.	427.8	Did Not Occur	-	Did Not Occur	-

Figure 6.2.1-1—RCP Cavity Nodalization Diagram (UJA15-006)

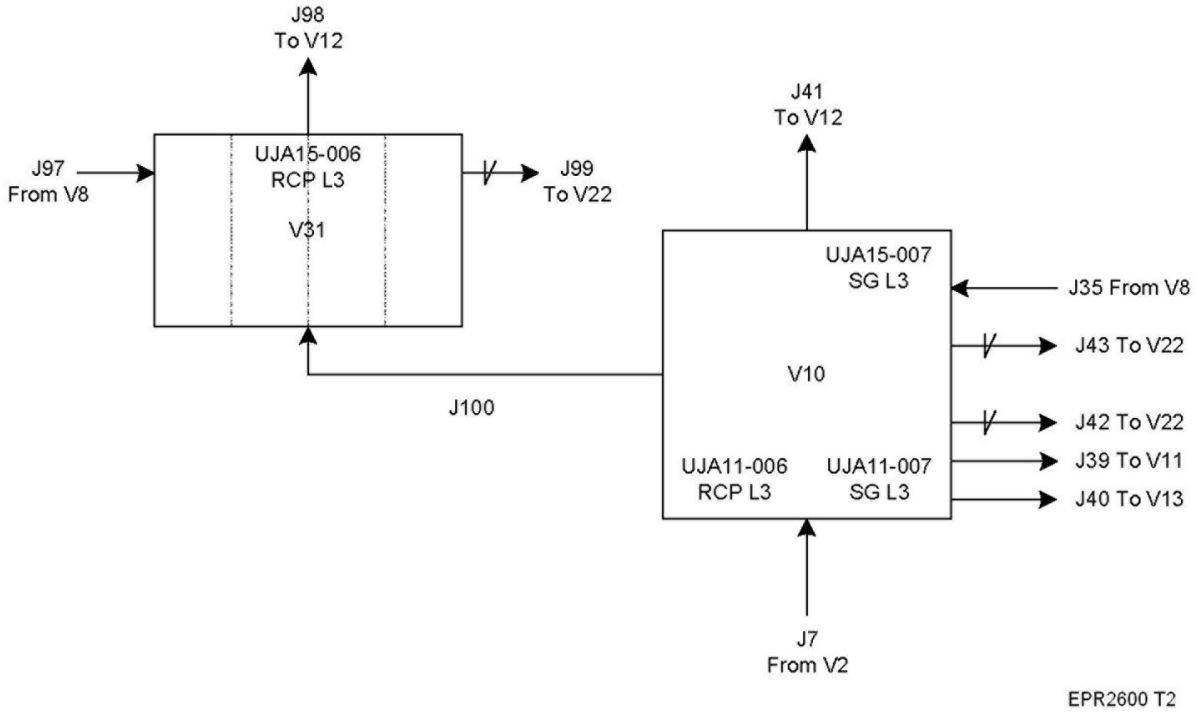

Figure 6.2.1-2—SG Cavity Nodalization Diagram (UJA23-004)

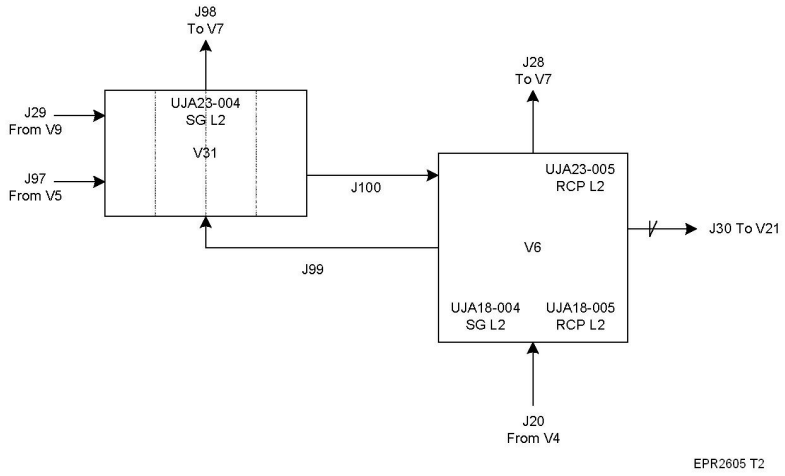

Figure 6.2.1-3—SG Cavity Nodalization Diagram (UJA29-004)

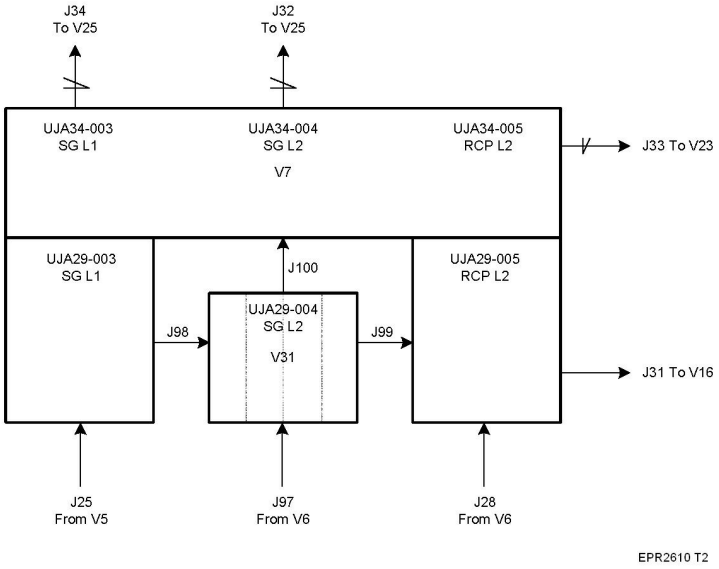

Figure 6.2.1-4—PZR Cavities Nodalization Diagram (30UJA29-019 and UJA34-019)

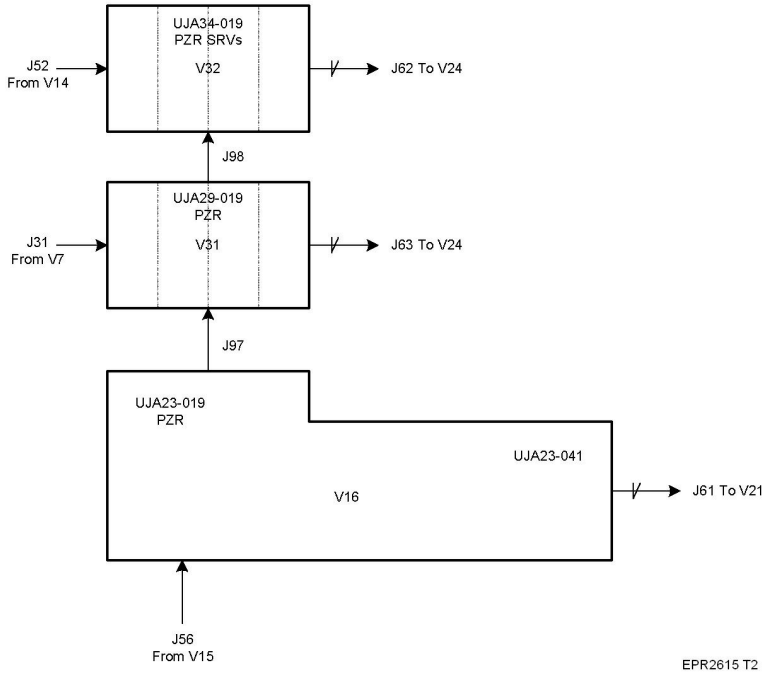

Figure 6.2.1-5—RCP Cavity Pressure vs. Time (UJA15-006)

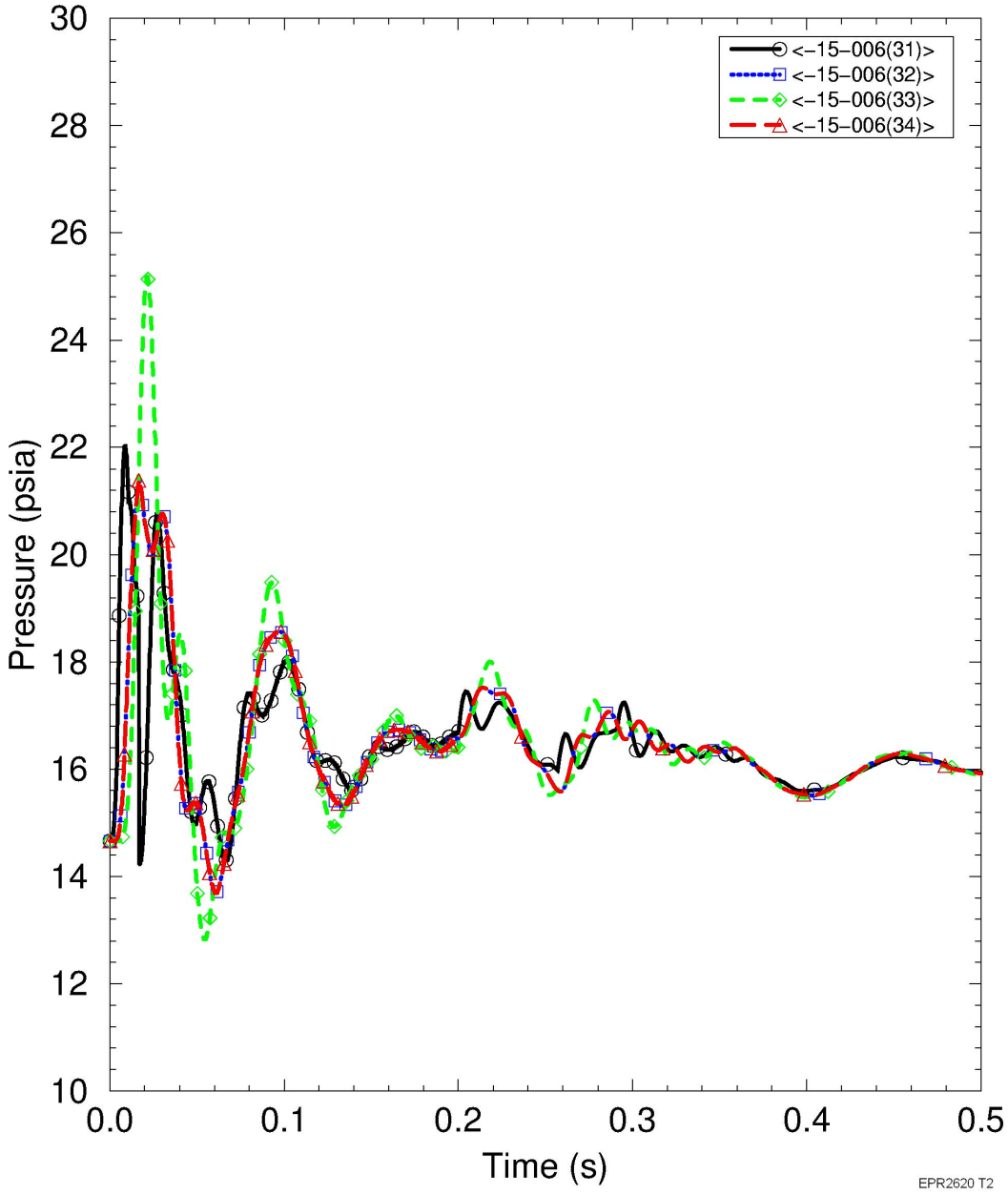

Figure 6.2.1-6—SG Cavity Pressure vs. Time (UJA23-004)

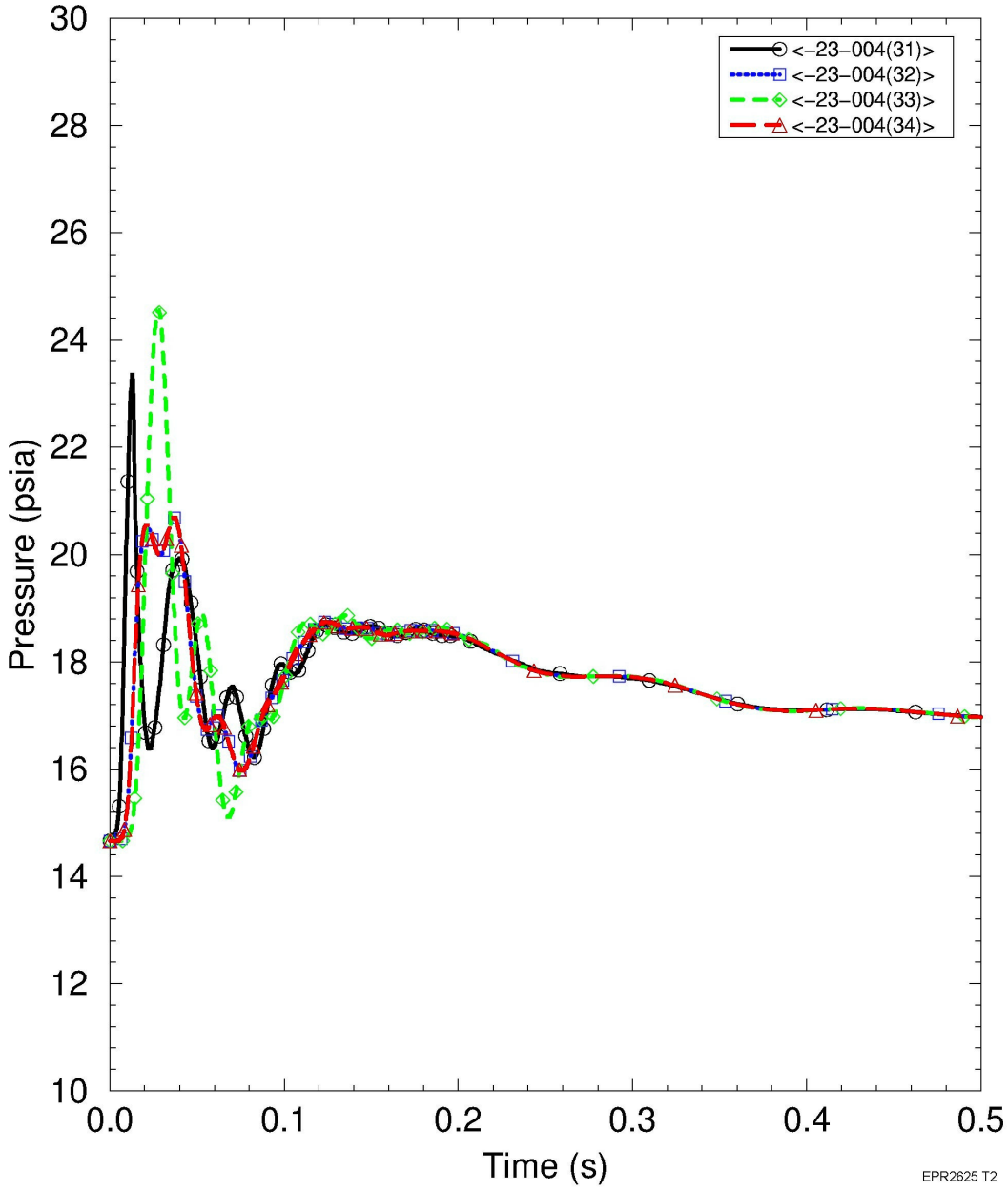

Figure 6.2.1-7—SG Cavity Pressure vs. Time (UJA29-004)

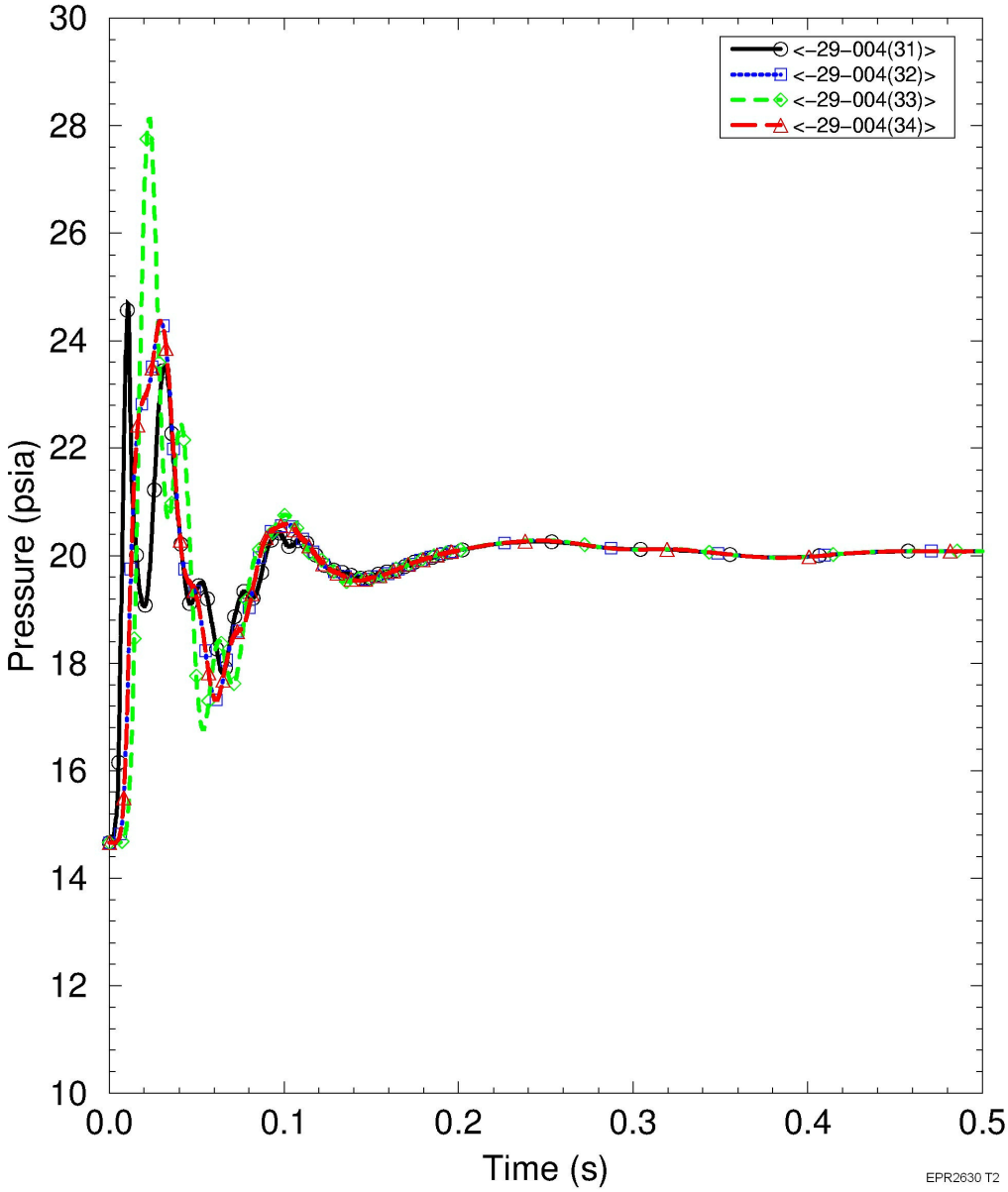

Figure 6.2.1-8—Pressurizer Cavity Pressure vs. Time (UJA29-019)

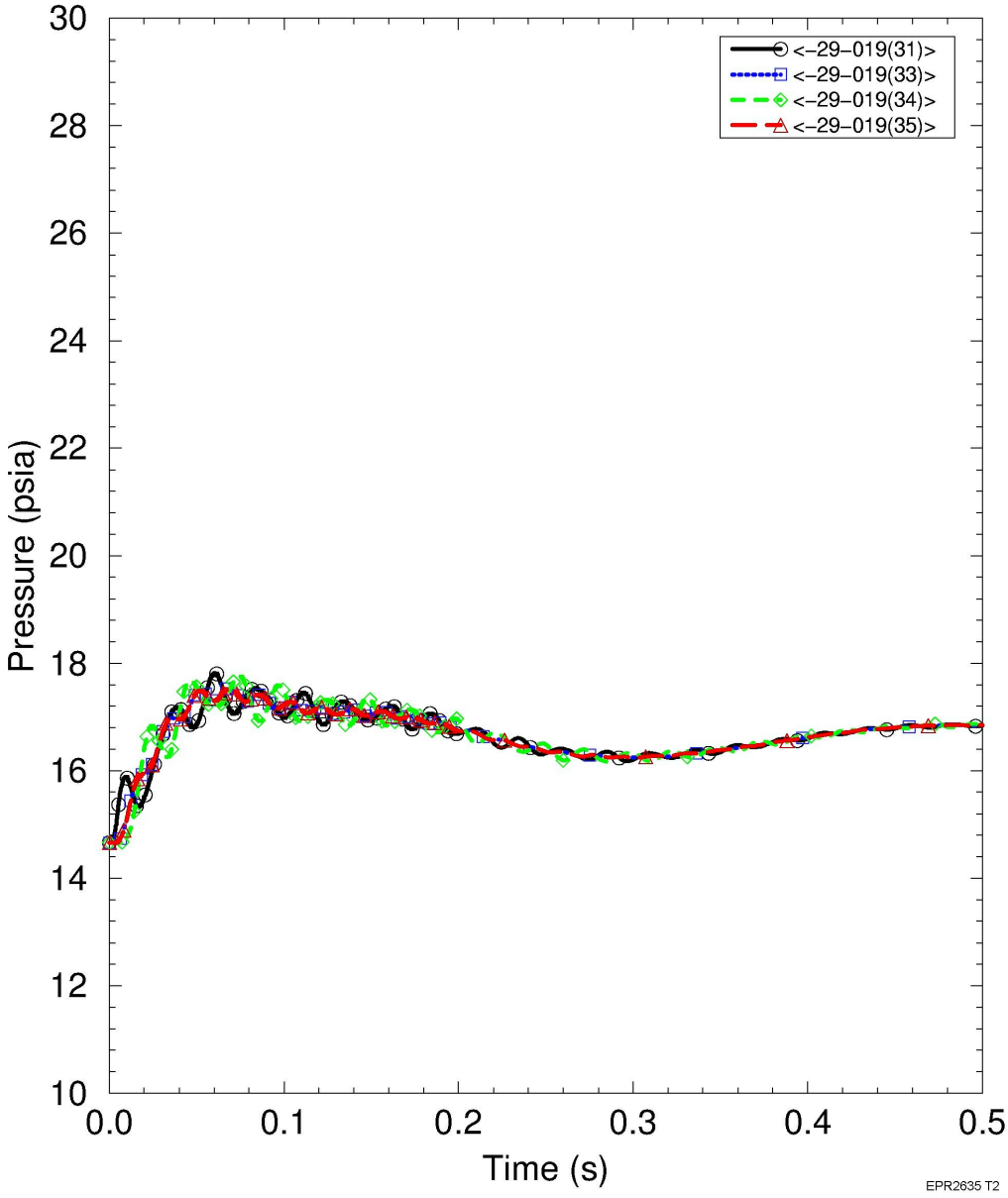

Figure 6.2.1-9—Pressurizer Cavity Pressure vs. Time (UJA34-019)

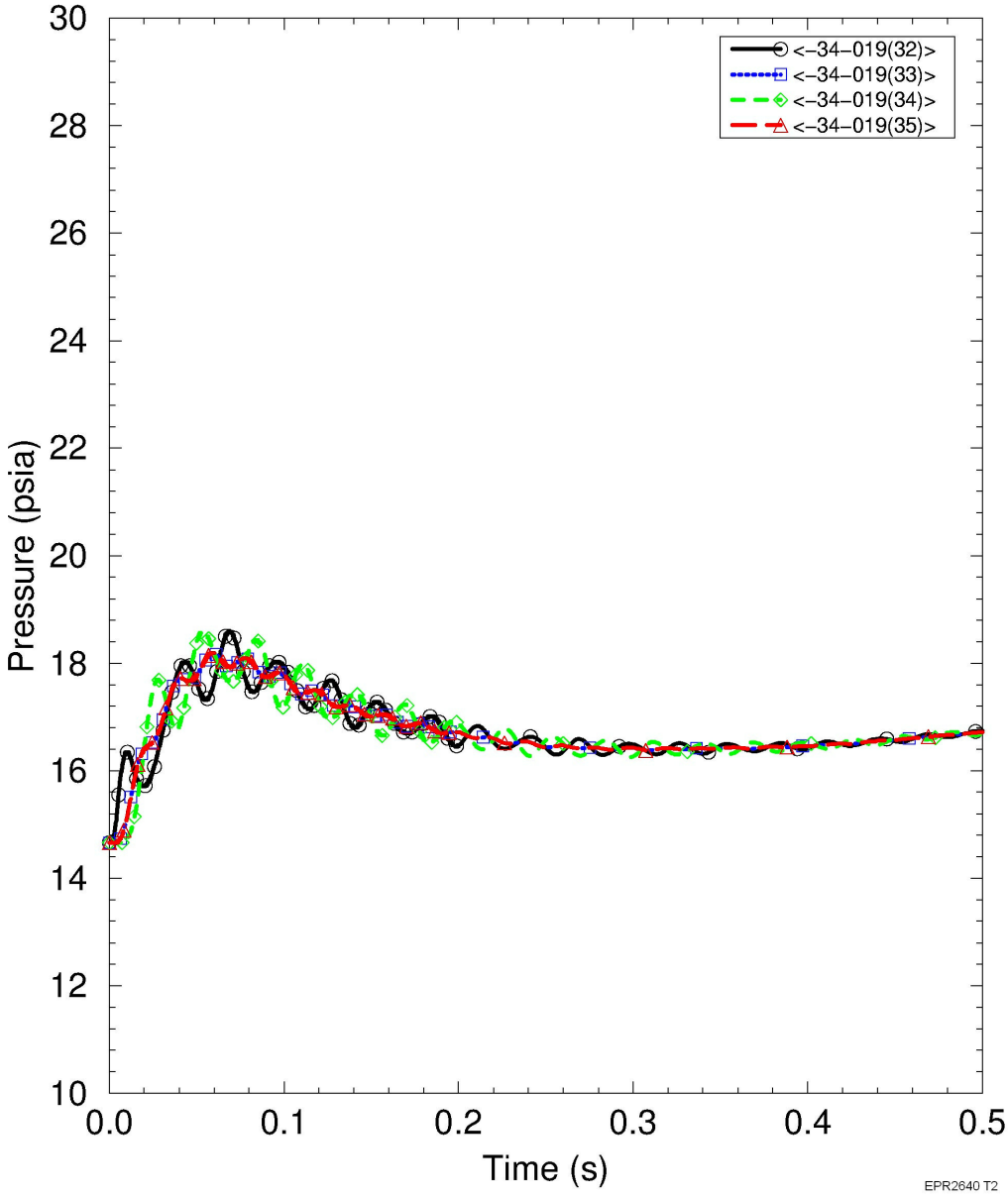

Figure 6.2.1-10—LOCA Containment Pressure vs. Time (HL Break)

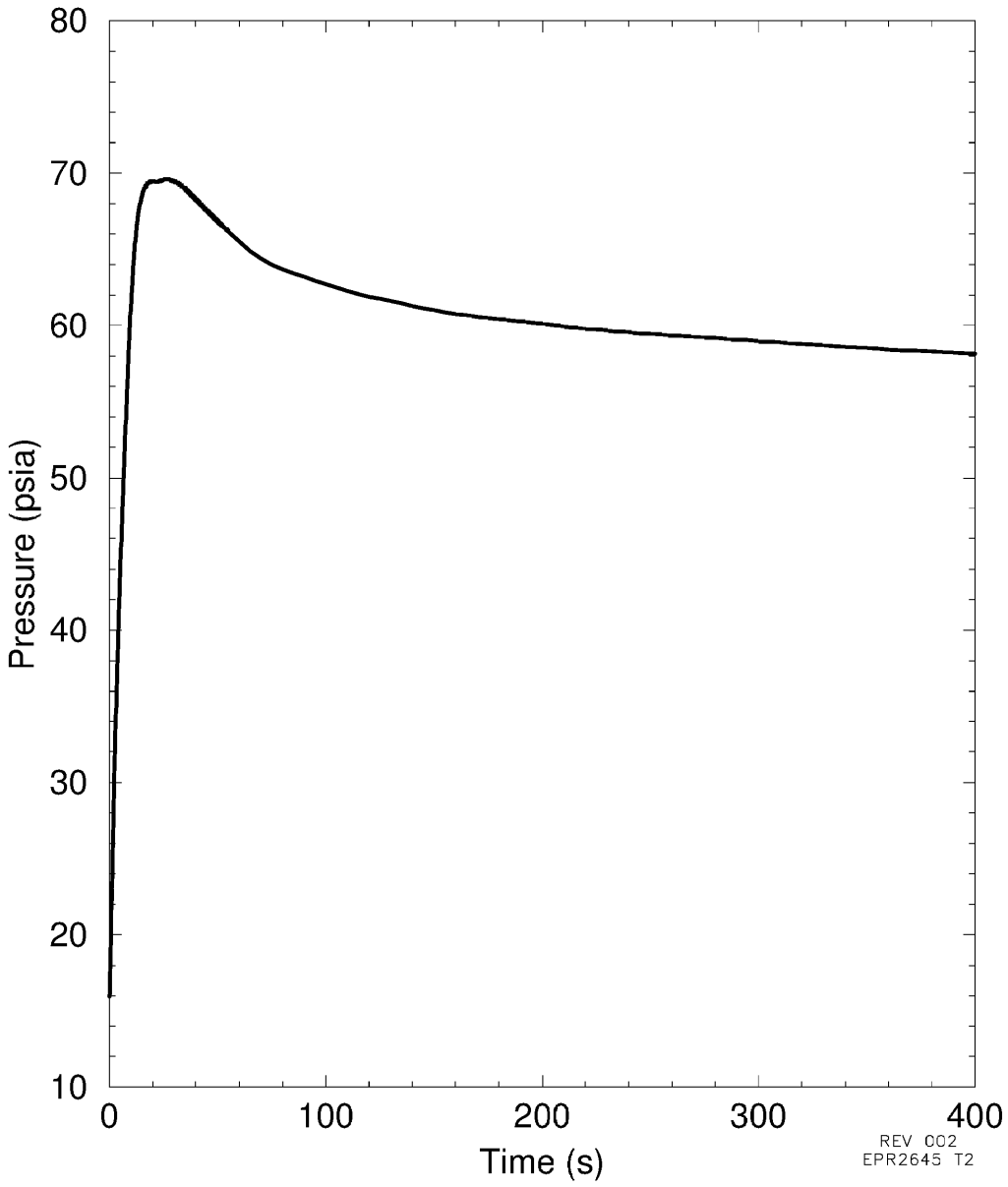

Figure 6.2.1-11—LOCA Containment Temperature vs. Time (HL Break)

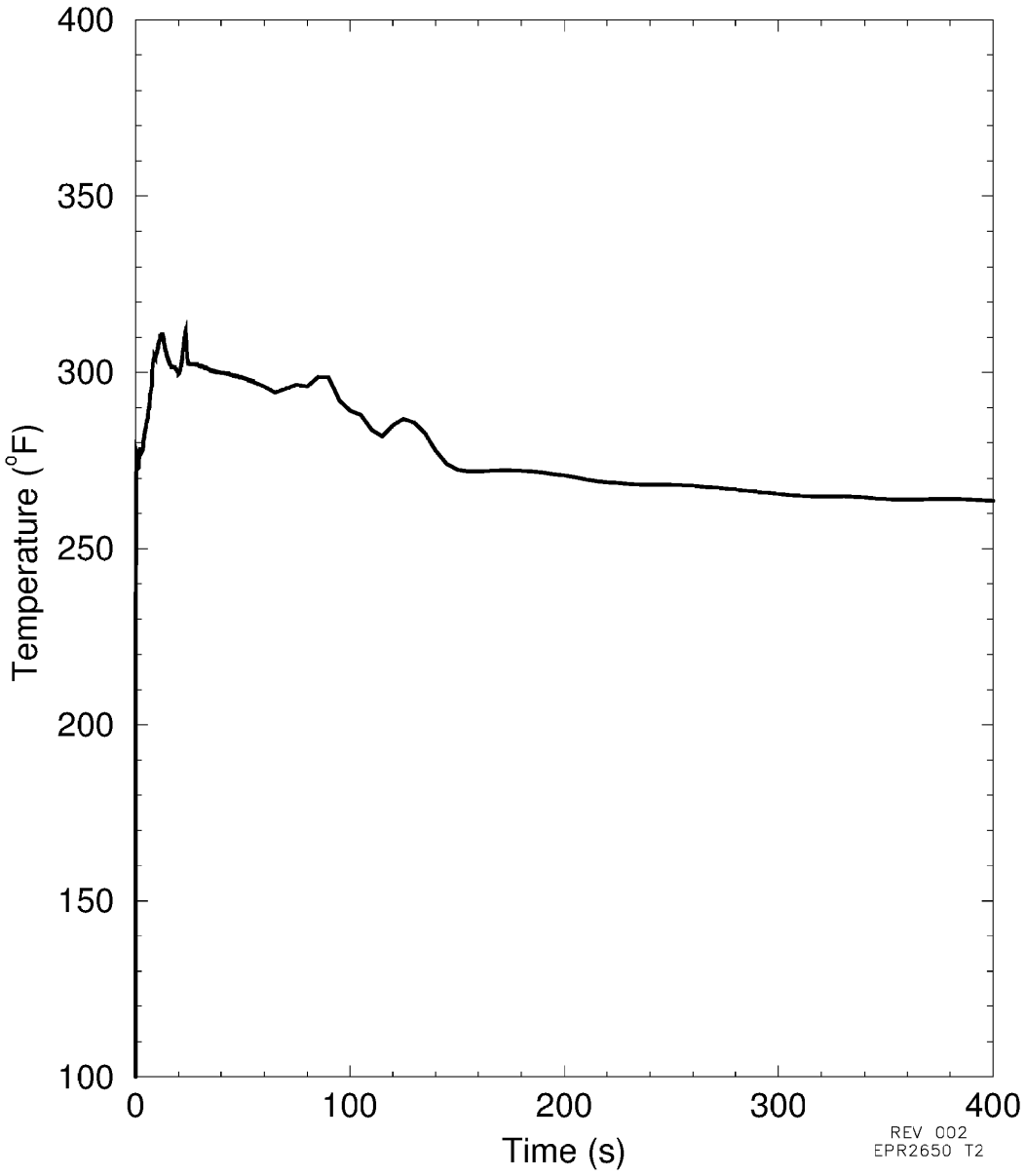

Figure 6.2.1-12—LOCA Containment Pressure vs. Time (HL Break Long-term)

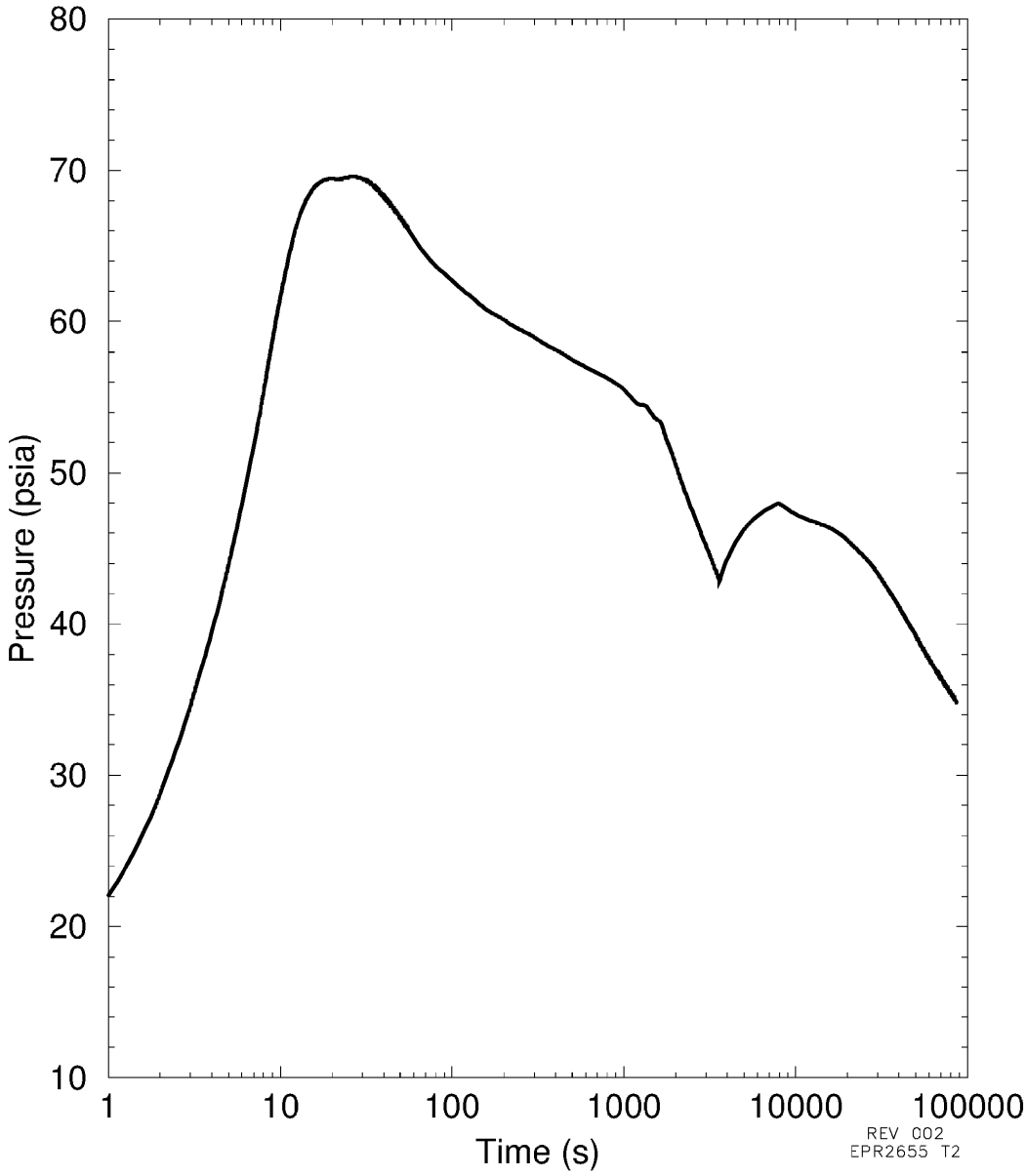

Figure 6.2.1-13—LOCA Containment Temperature vs. Time (HL Break Long-term)

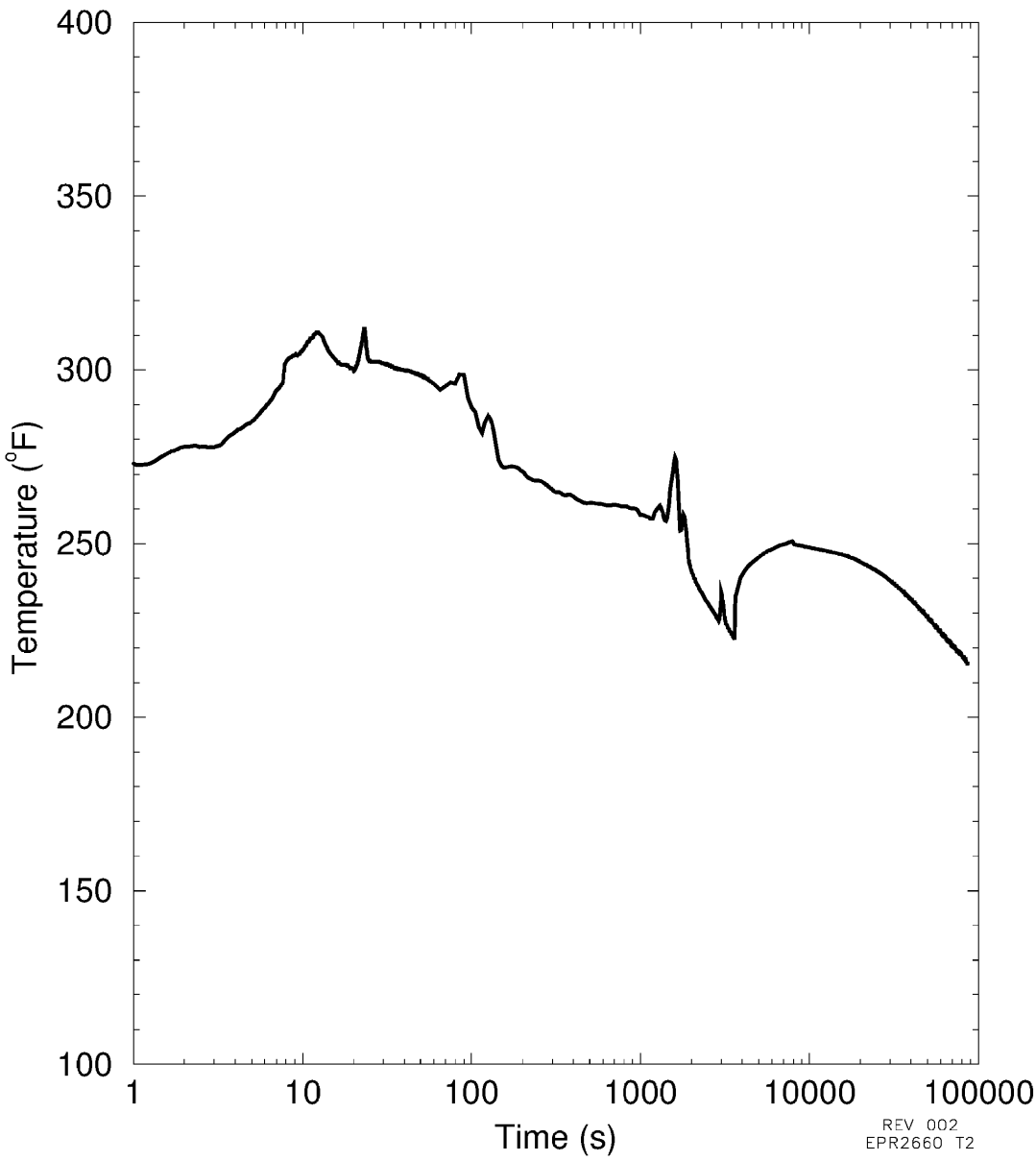

Figure 6.2.1-14—LOCA Containment Pressure vs. Time (CLPS Break)

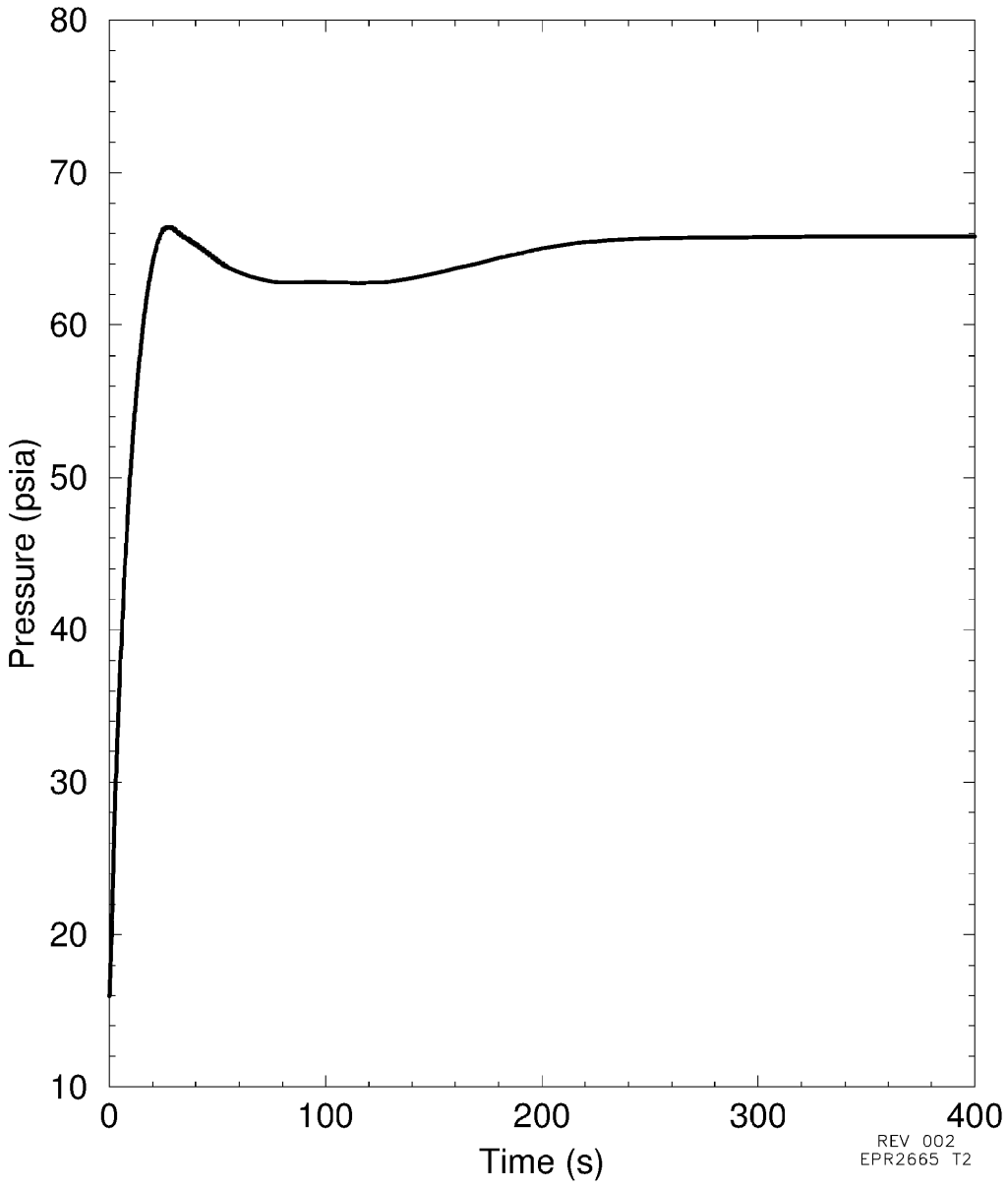

Figure 6.2.1-15—LOCA Containment Temperature vs. Time (CLPS Break)

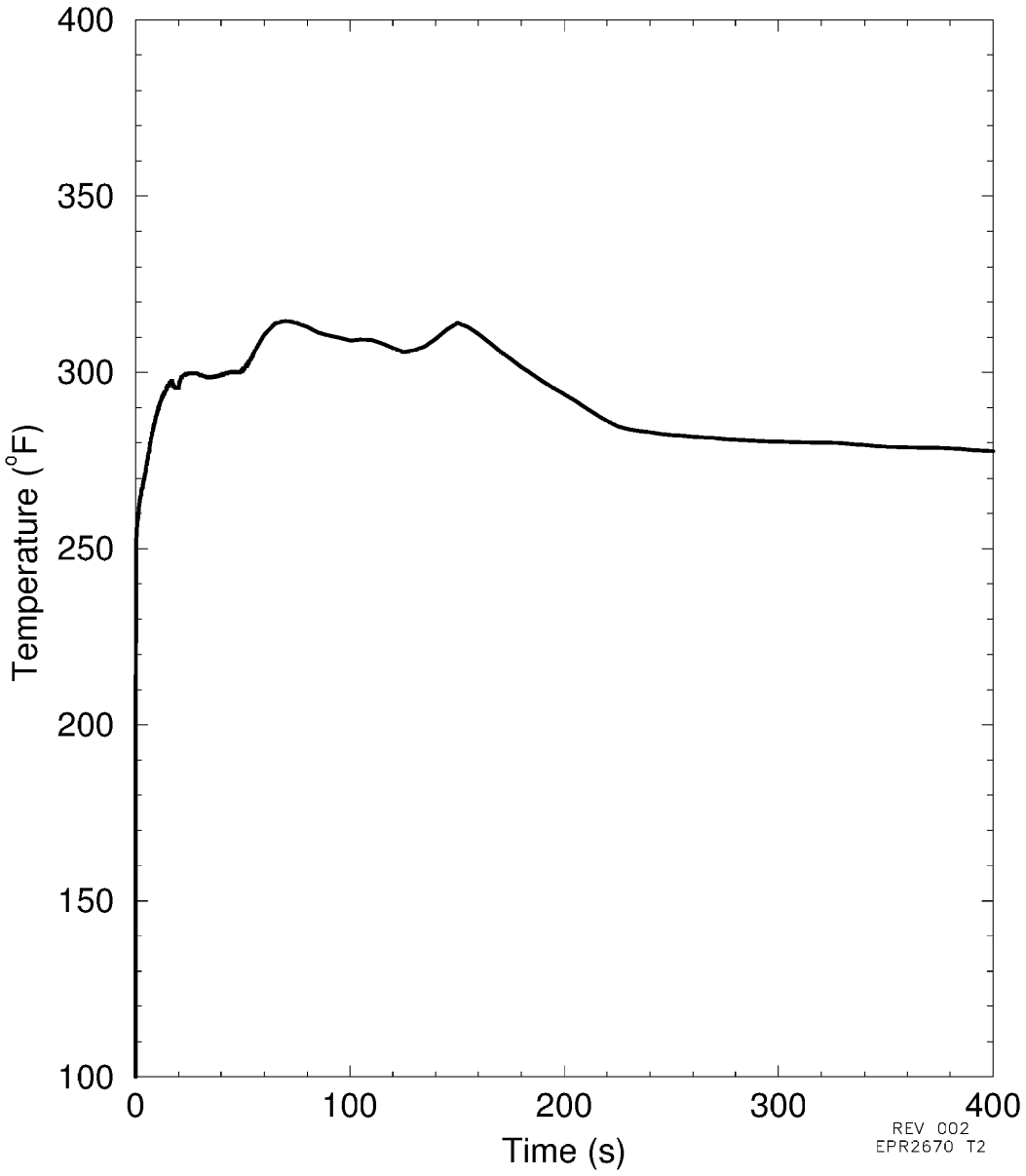

Figure 6.2.1-16—LOCA Containment Pressure vs. Time (CLPS Break Long-term)

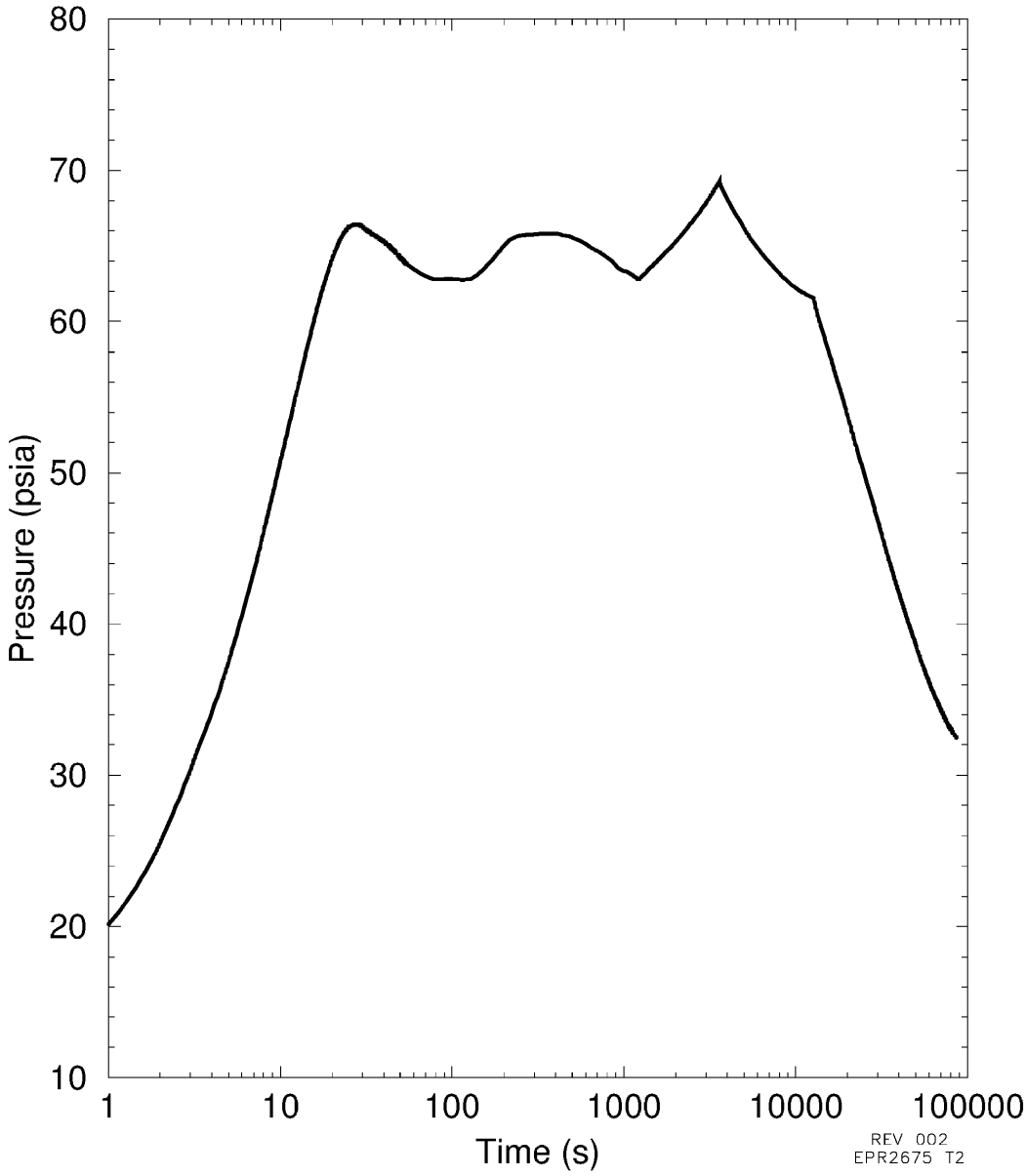

Figure 6.2.1-17—LOCA Containment Temperature vs. Time (CLPS Break Long-term)

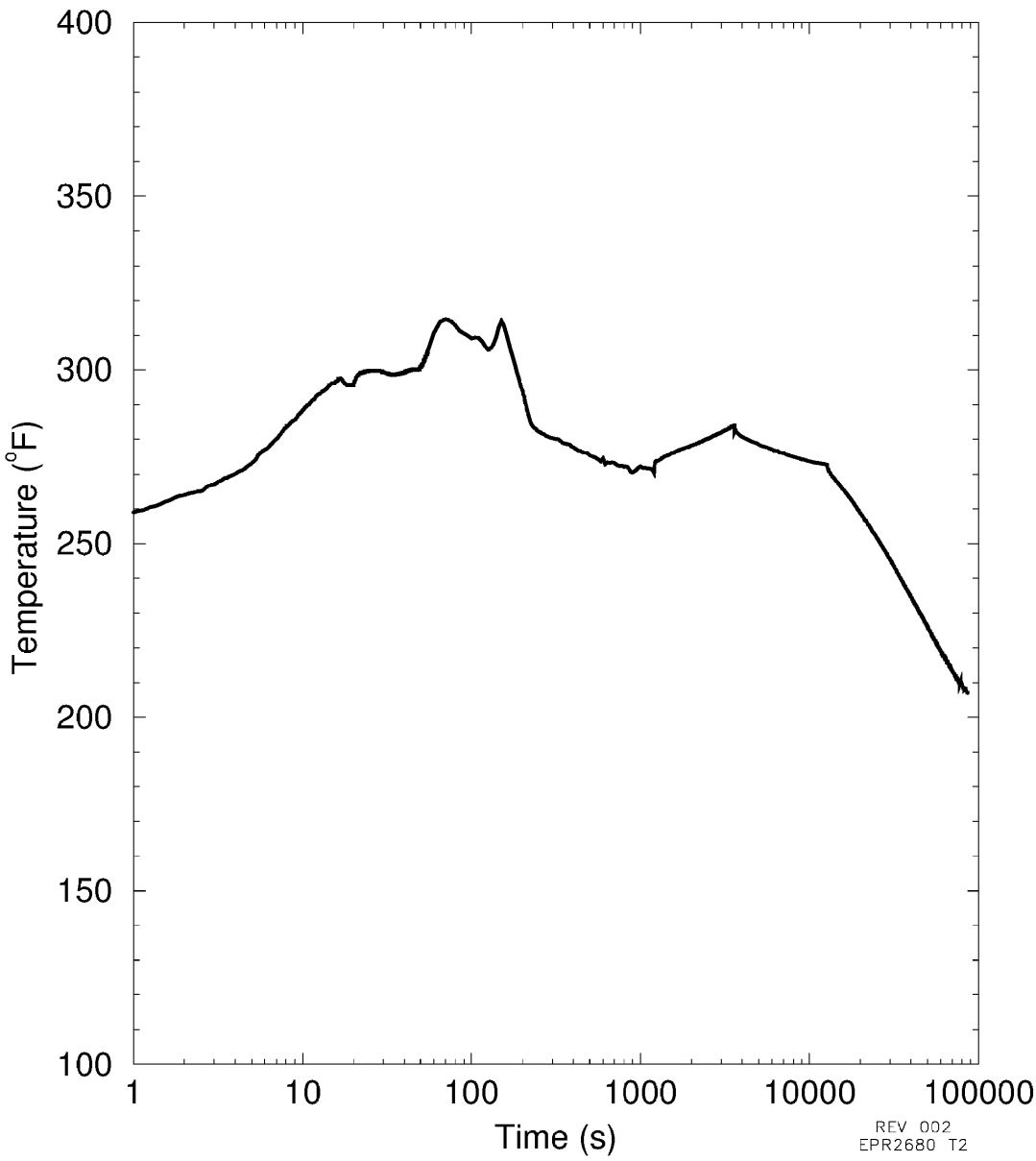

Figure 6.2.1-18—LOCA Containment Pressure vs. Time (CLPD Break)

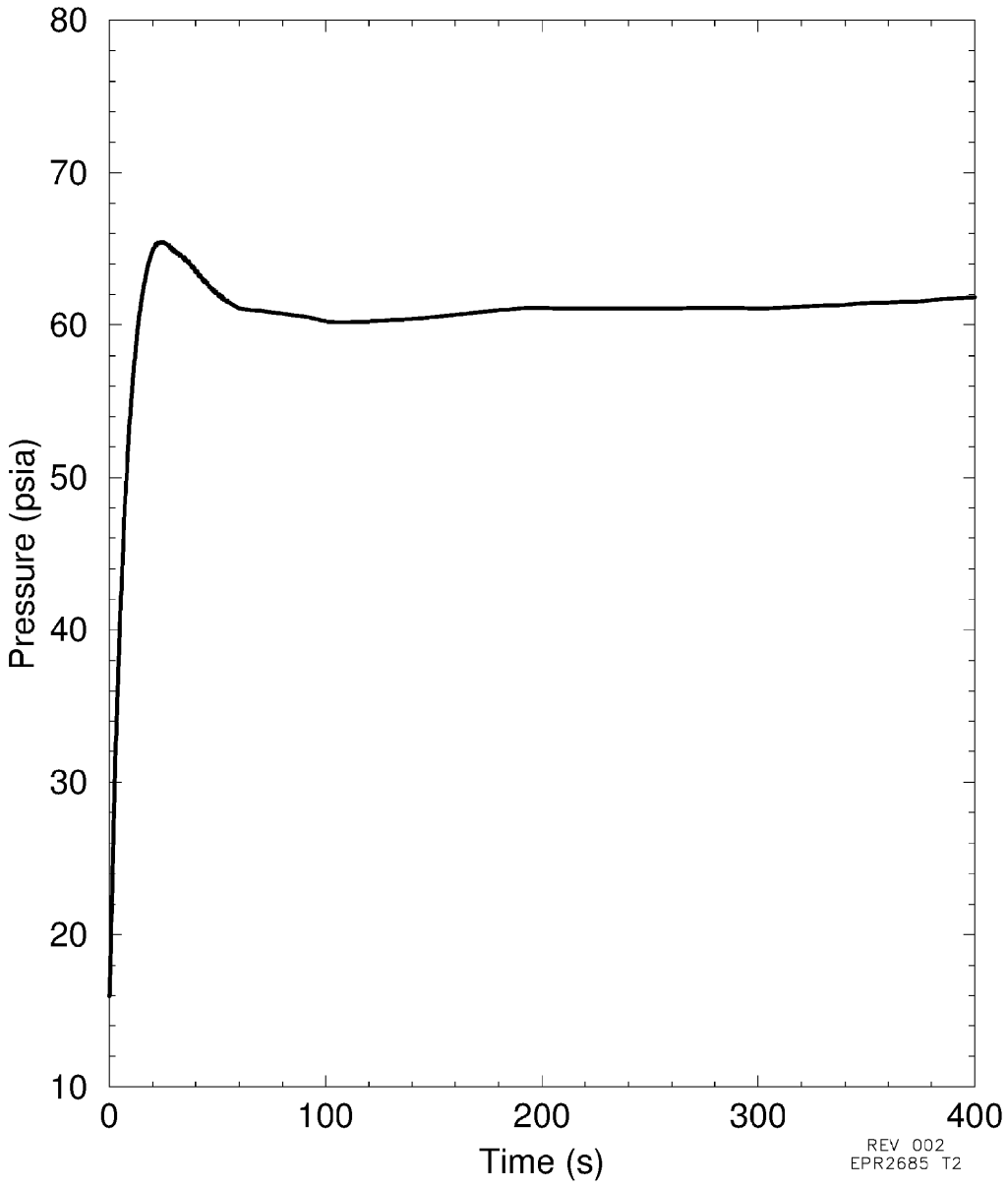

Figure 6.2.1-19—LOCA Containment Temperature vs. Time (CLPD Break)

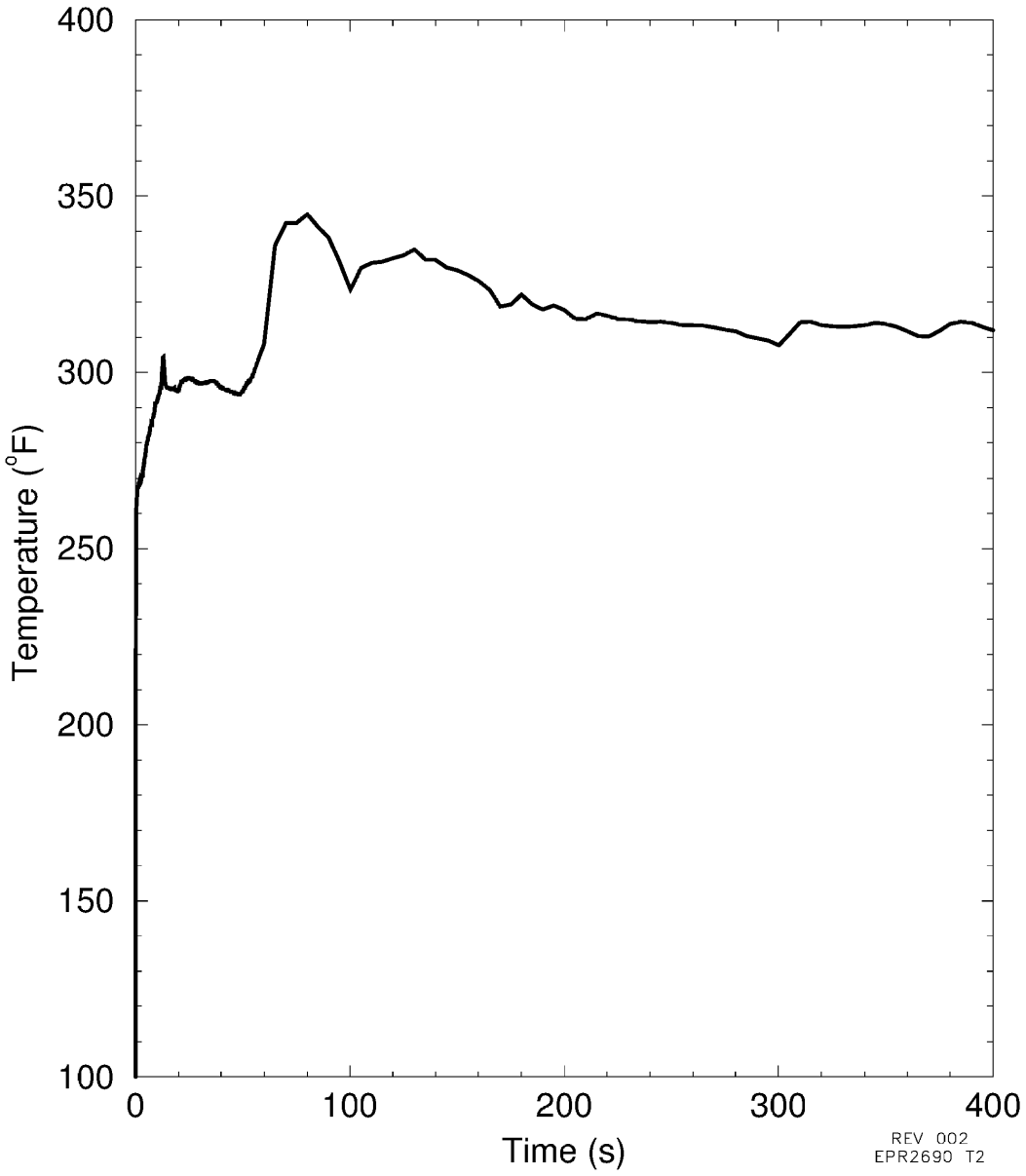

Figure 6.2.1-20—LOCA Containment Pressure vs. Time (CLPD Break Long-Term)

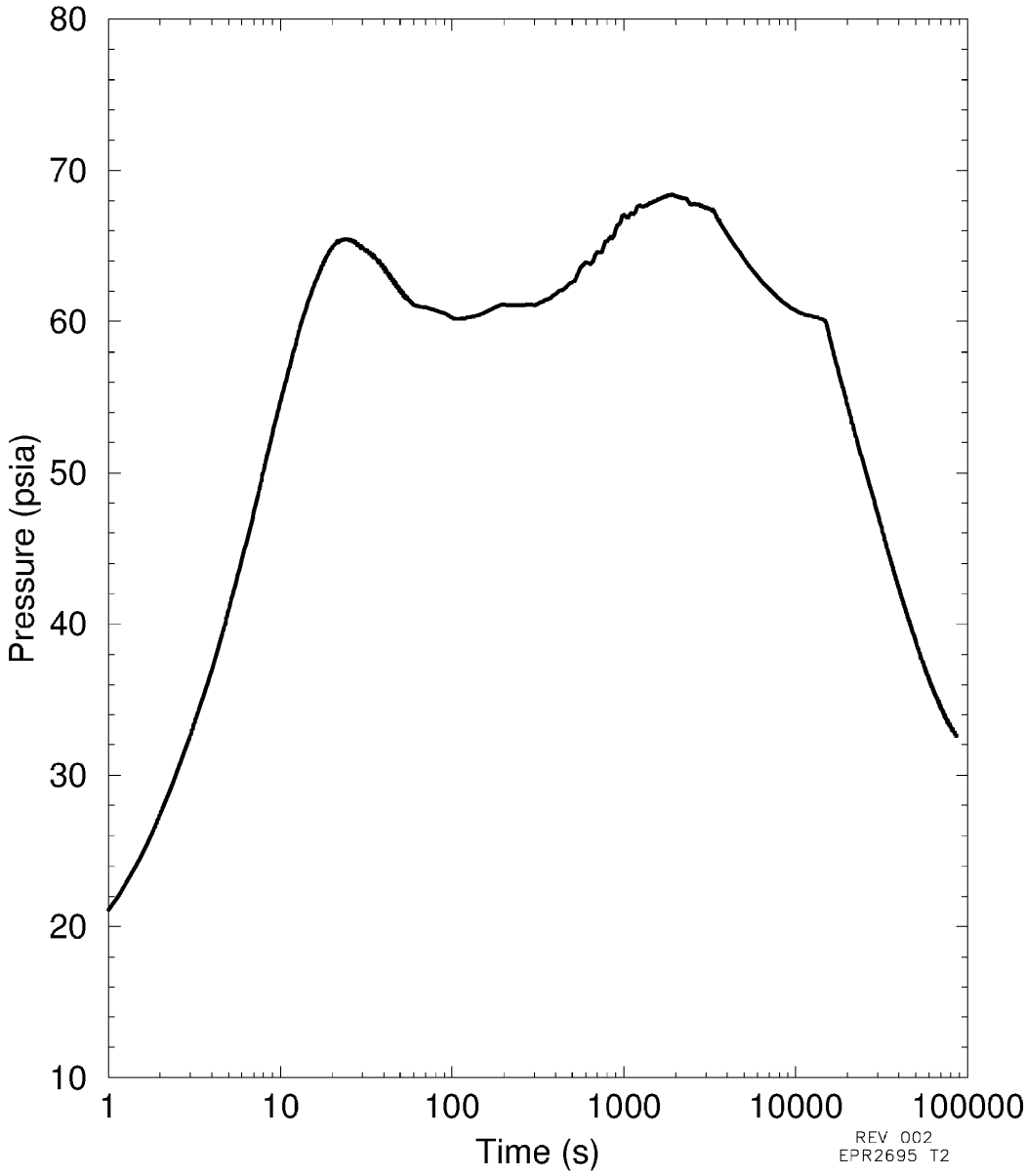

Figure 6.2.1-21—LOCA Containment Temperature vs. Time (CLPD Break Long-Term)

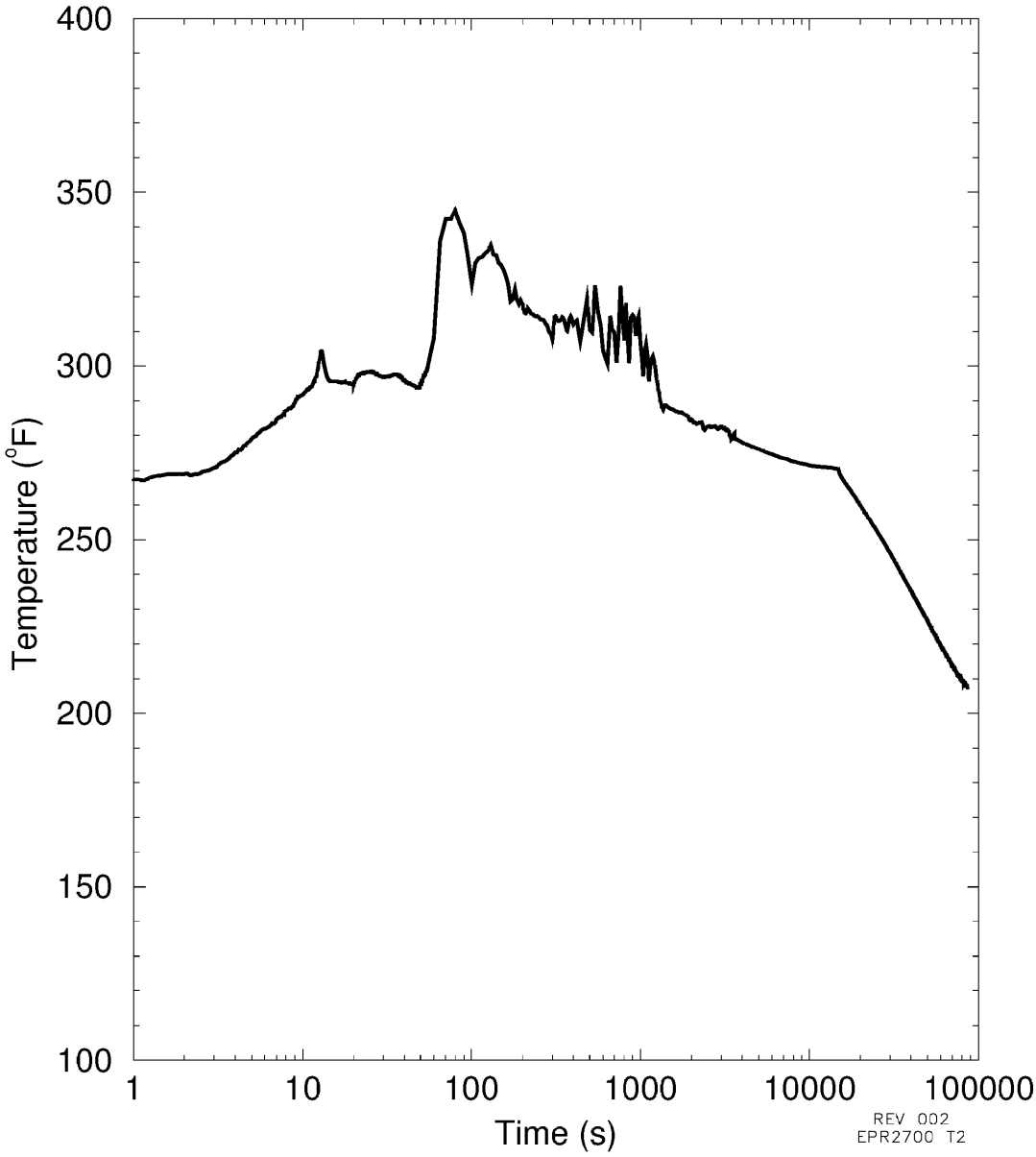

Figure 6.2.1-22—LOCA Integrated Break Mass Flow vs. Time (HL Break)

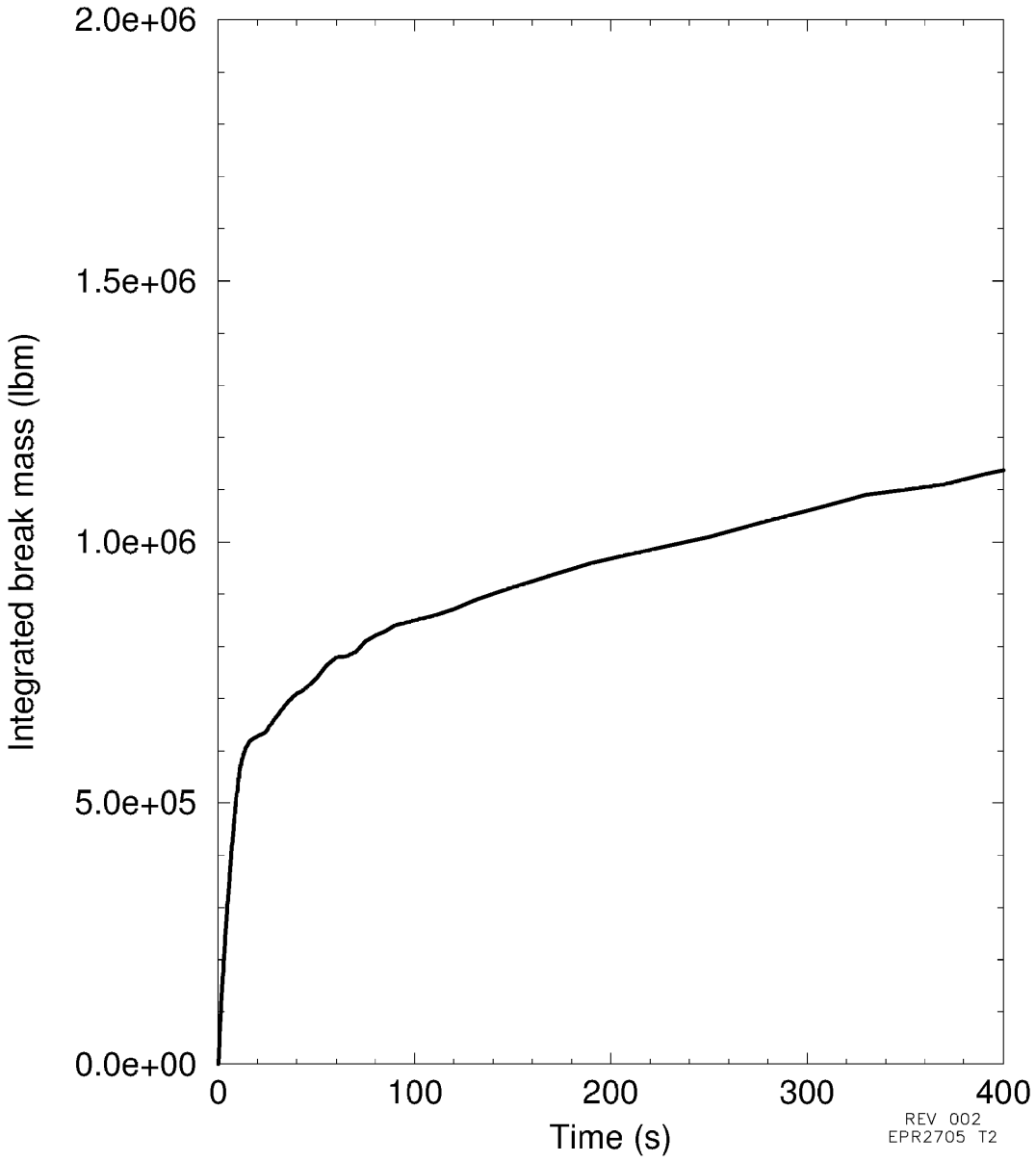

Figure 6.2.1-23—LOCA Integrated Break Energy Flow vs. Time (HL Break)

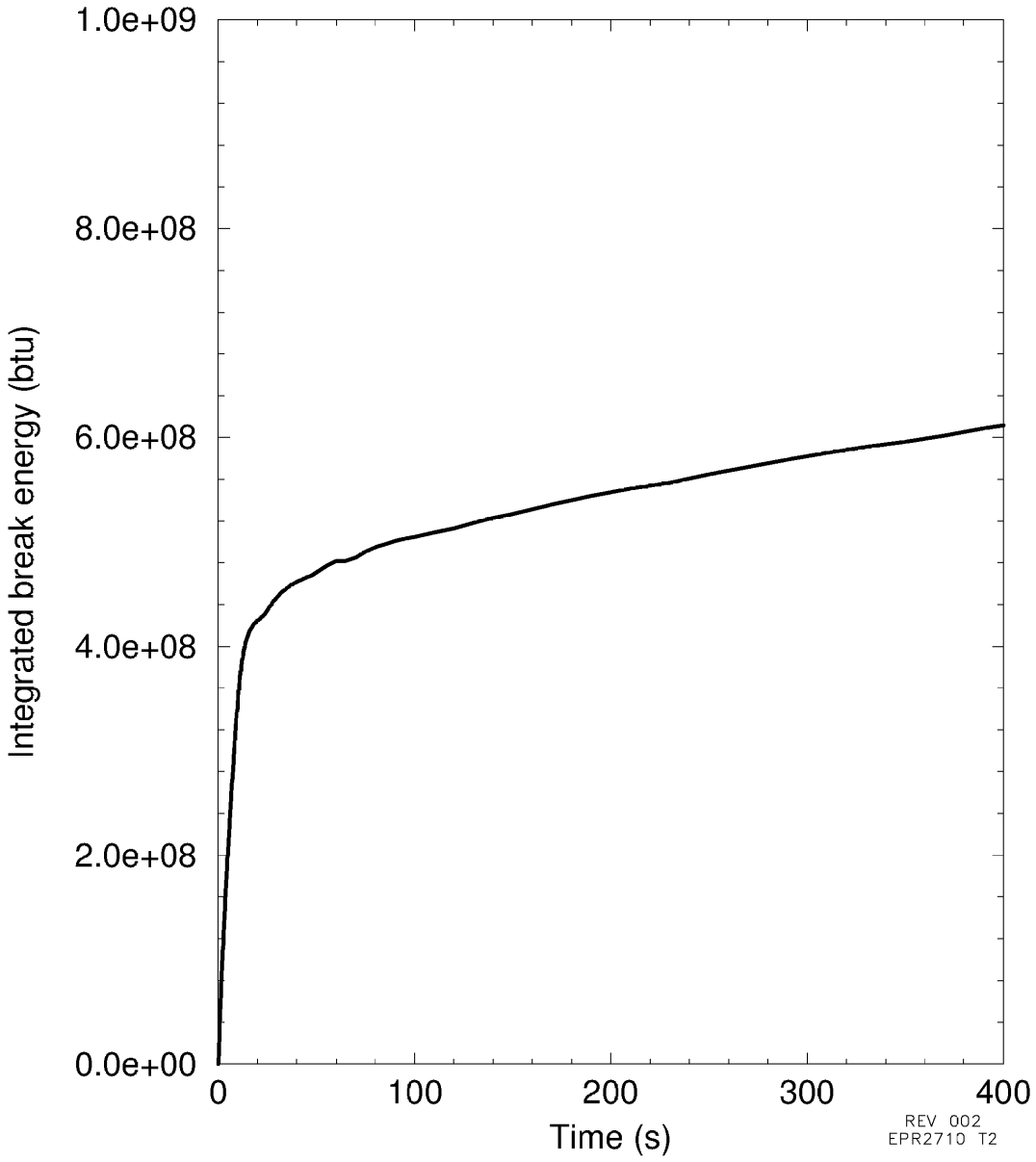

Figure 6.2.1-24—LOCA Integrated Break Mass Flow vs. Time (CLPS Break)

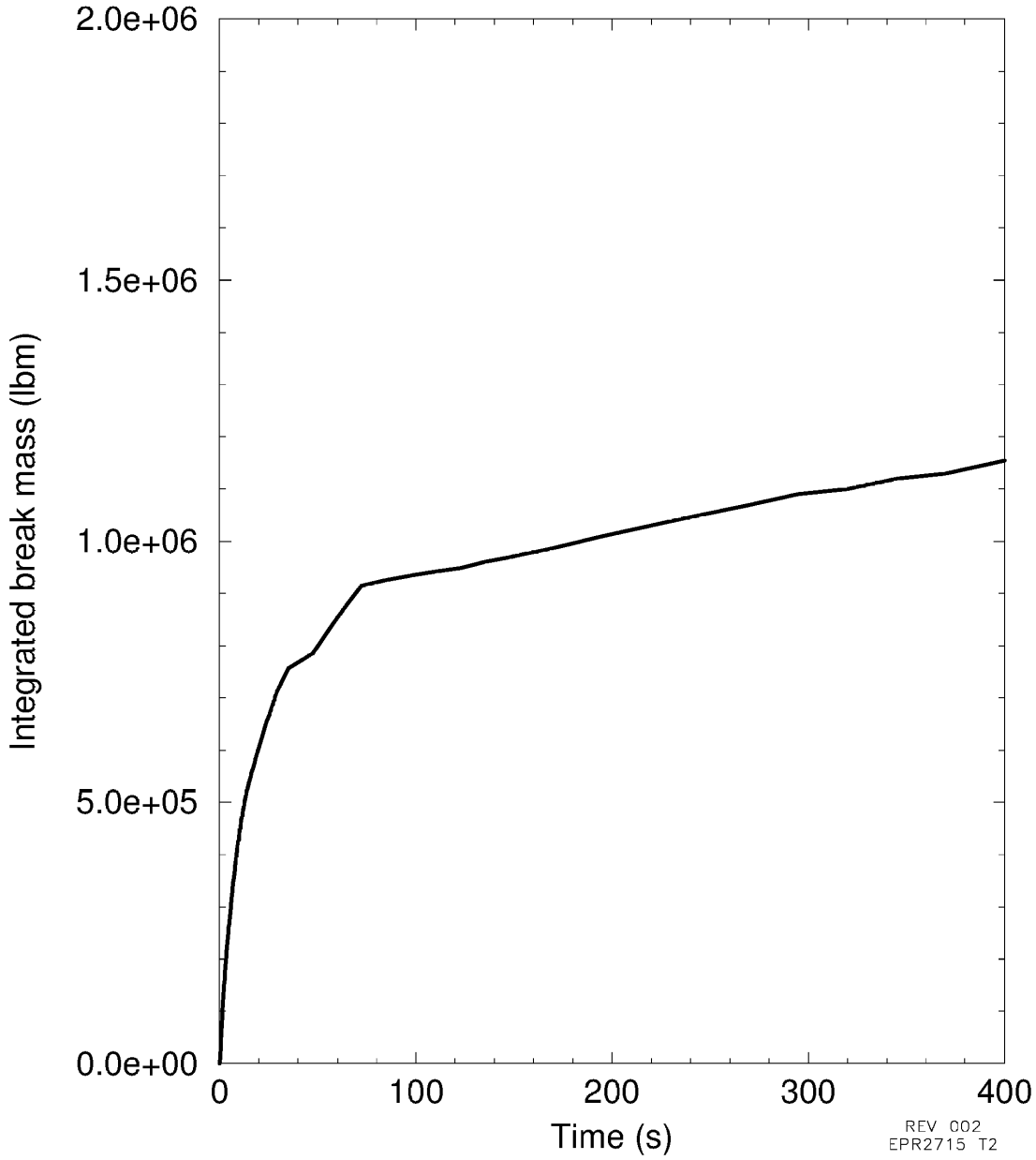

Figure 6.2.1-25—LOCA Integrated Break Energy Flow vs. Time (CLPS Break)

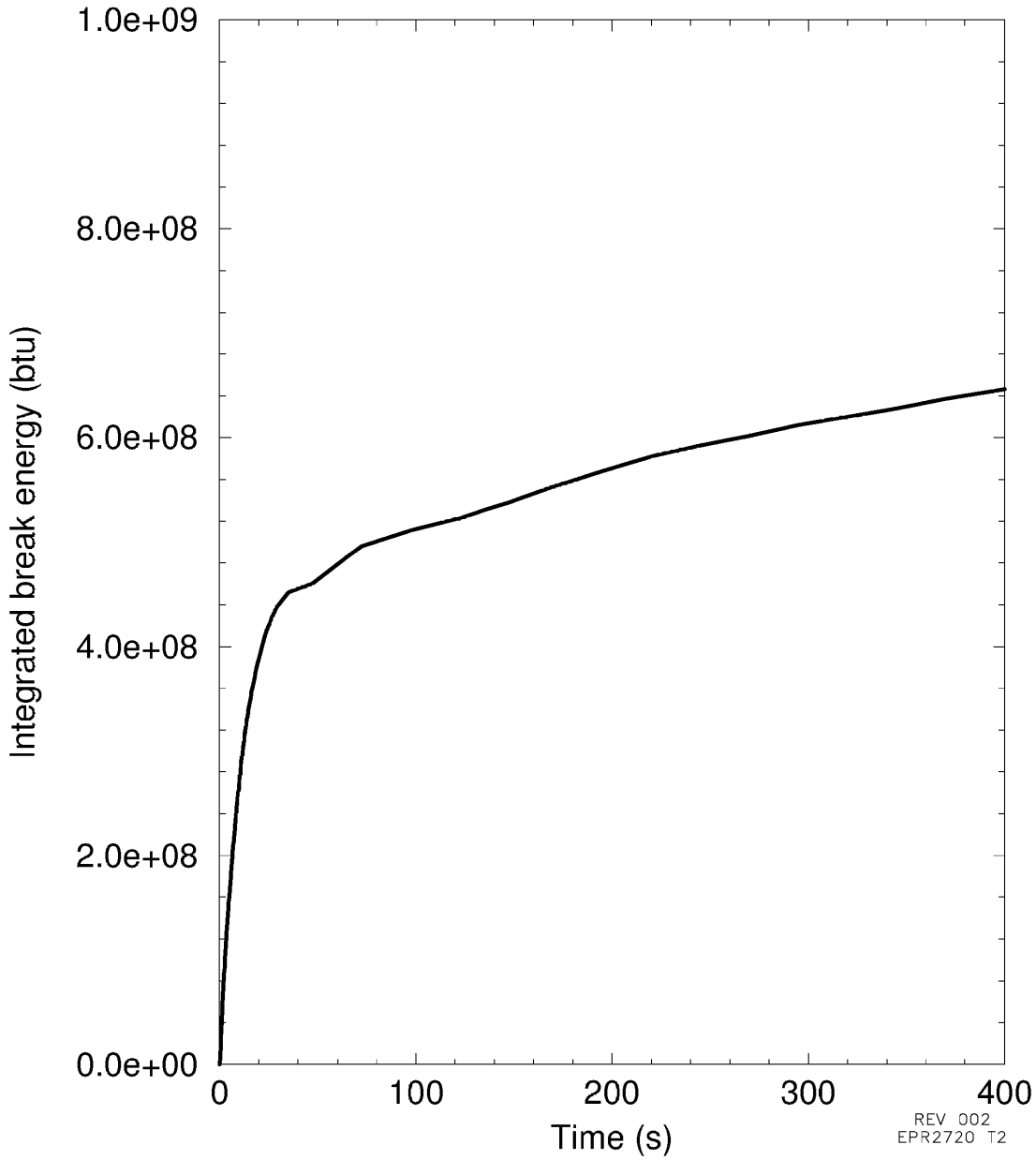

Figure 6.2.1-26—LOCA Integrated Break Mass Flow vs. Time (CLPD Break)

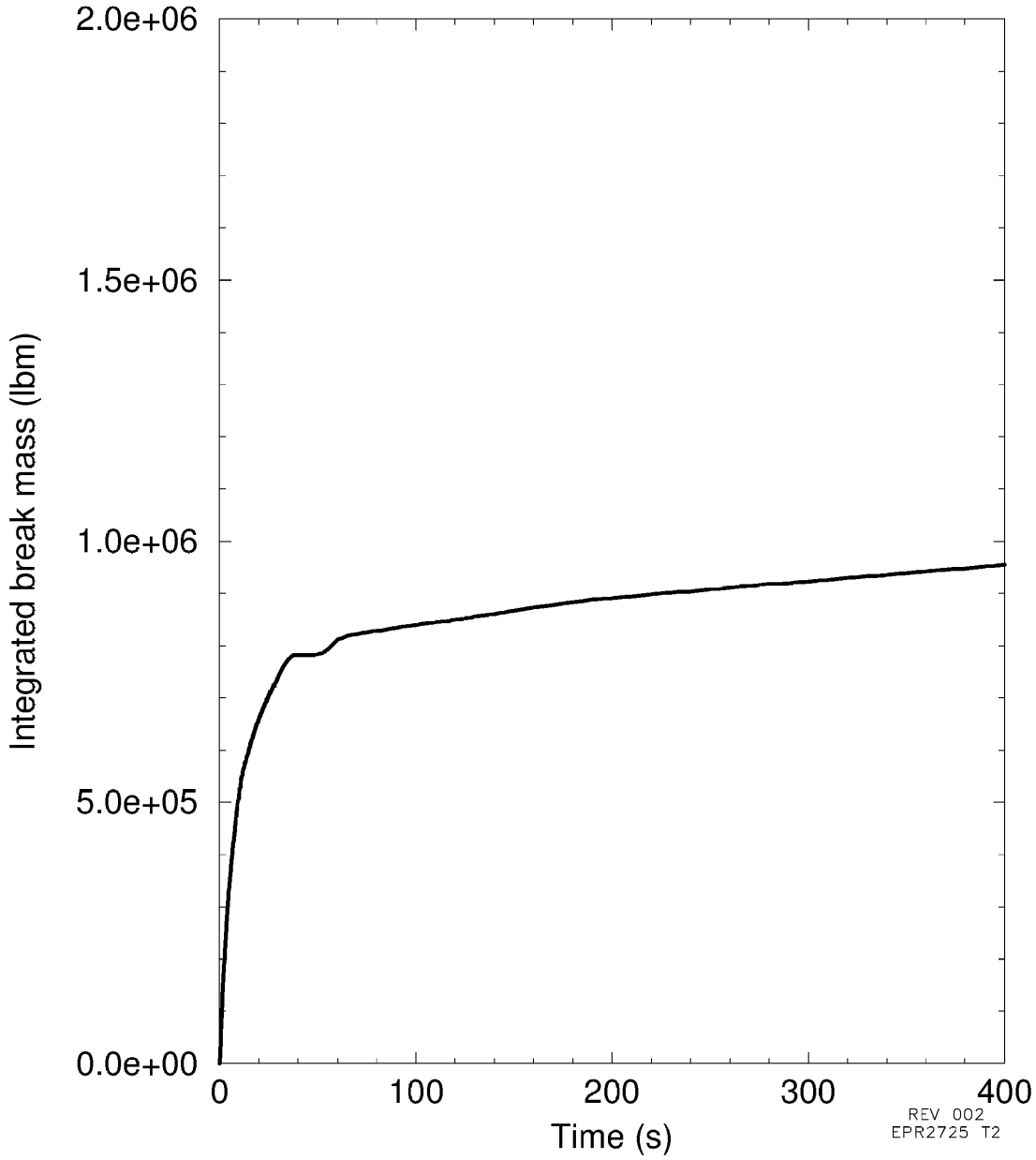

Figure 6.2.1-27—LOCA Integrated Break Energy Flow vs. Time (CLPD Break)

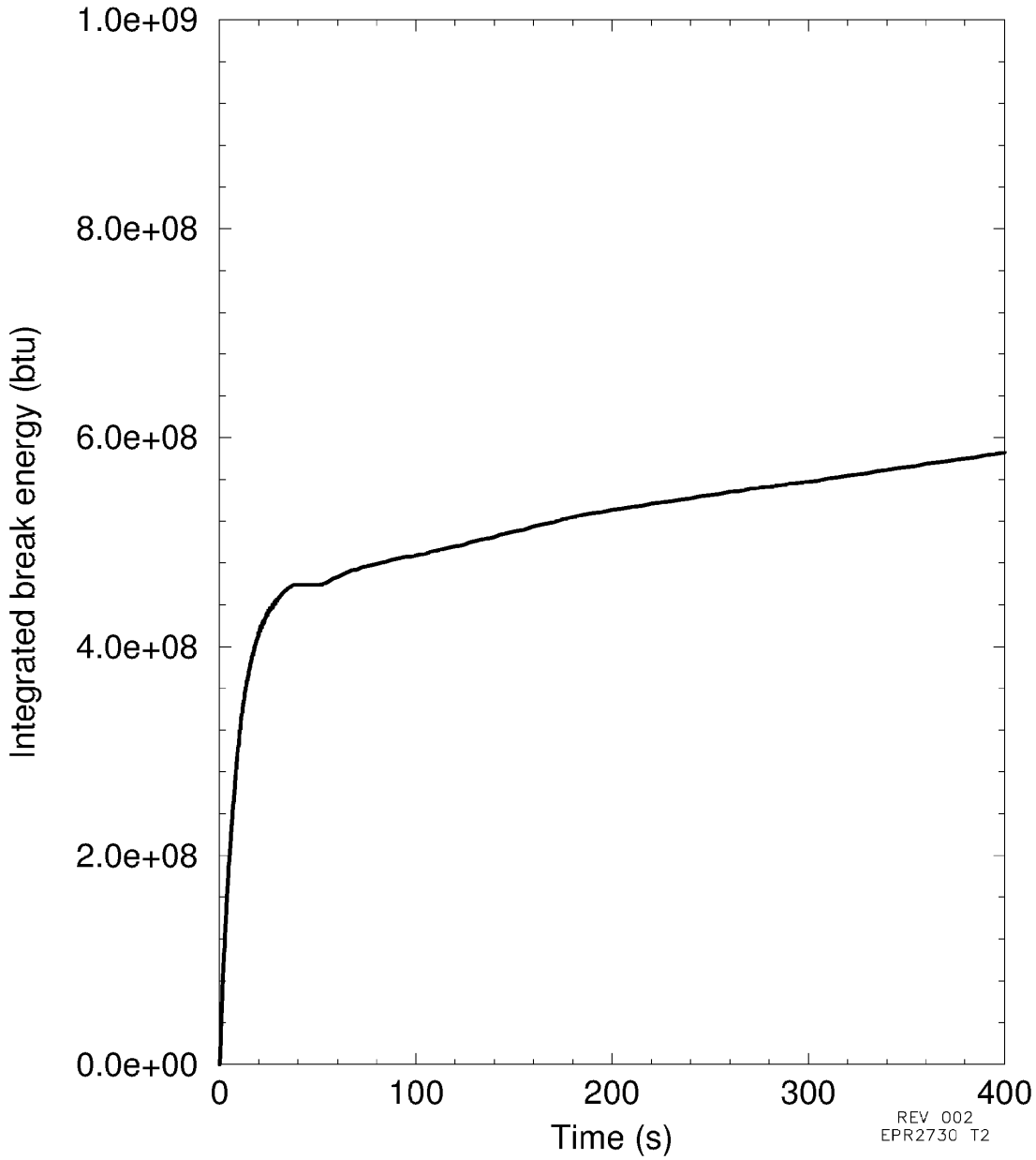

Figure 6.2.1-28—LOCA Integrated Break Mass Flow vs. Time (HL Break, Long-Term)

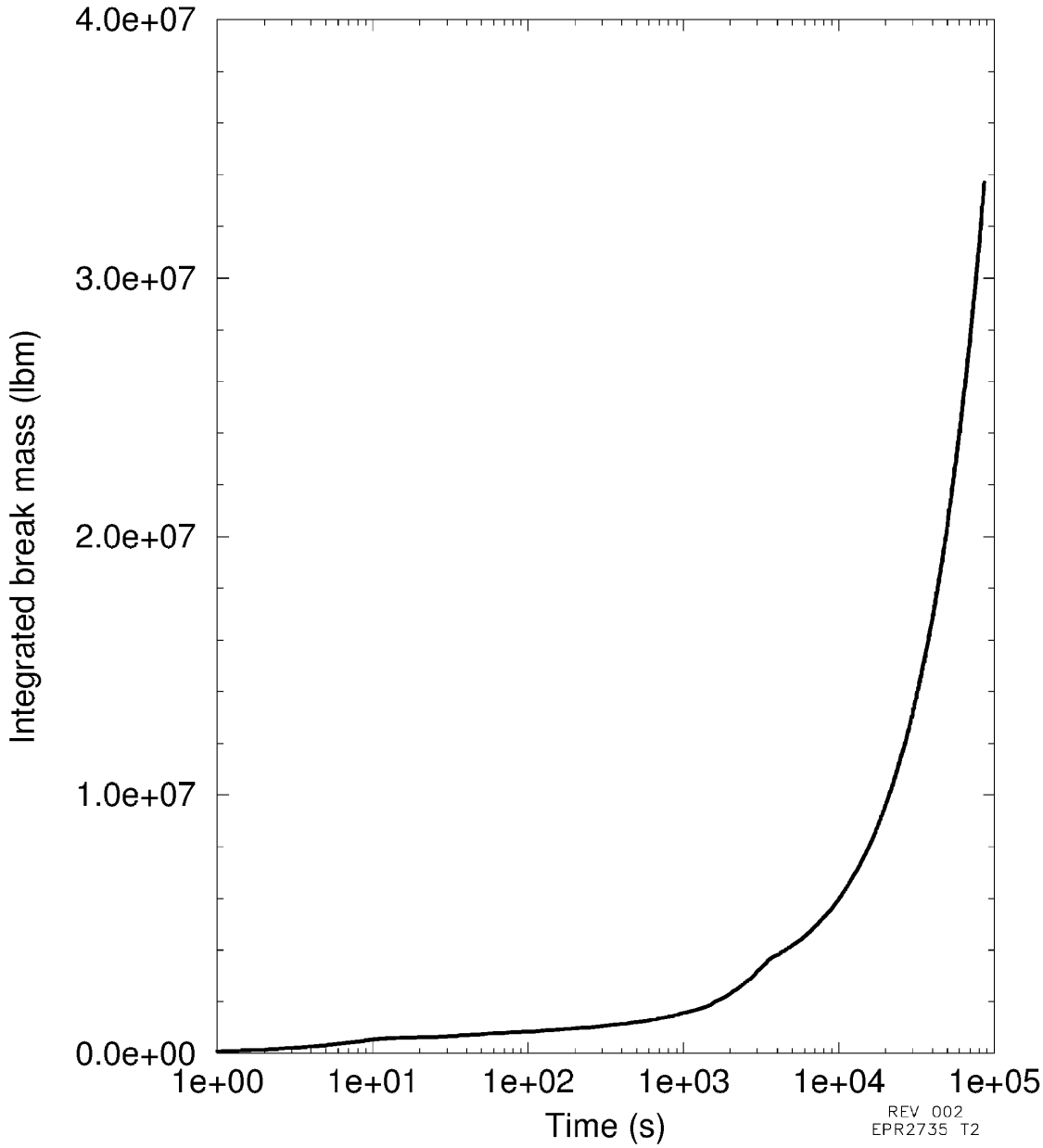

Figure 6.2.1-29—LOCA Integrated Break Energy Flow vs. Time (HL Break, Long-Term)

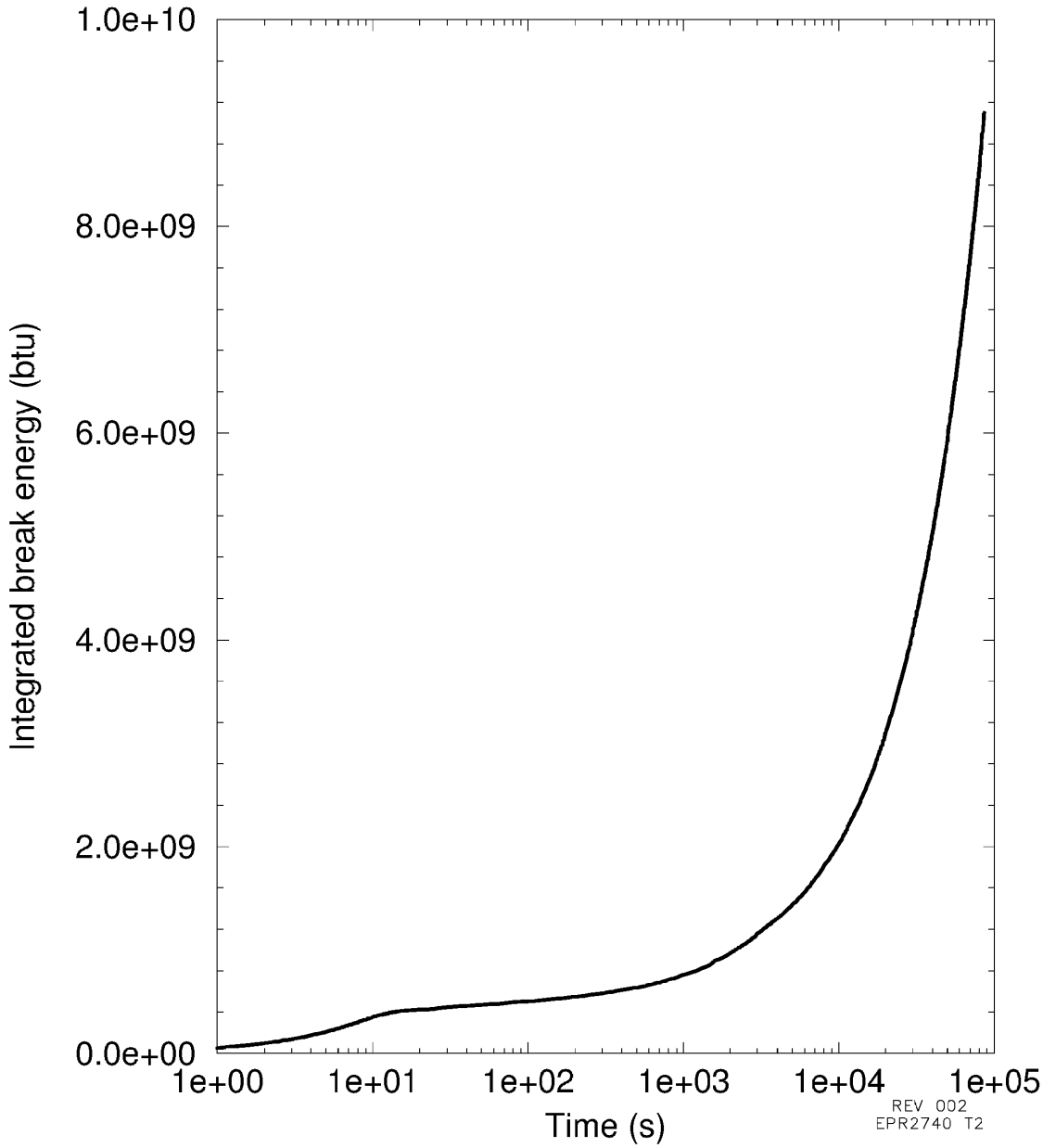

Figure 6.2.1-30—LOCA Integrated Break Mass Flow vs. Time (CLPS Break, Long-Term)

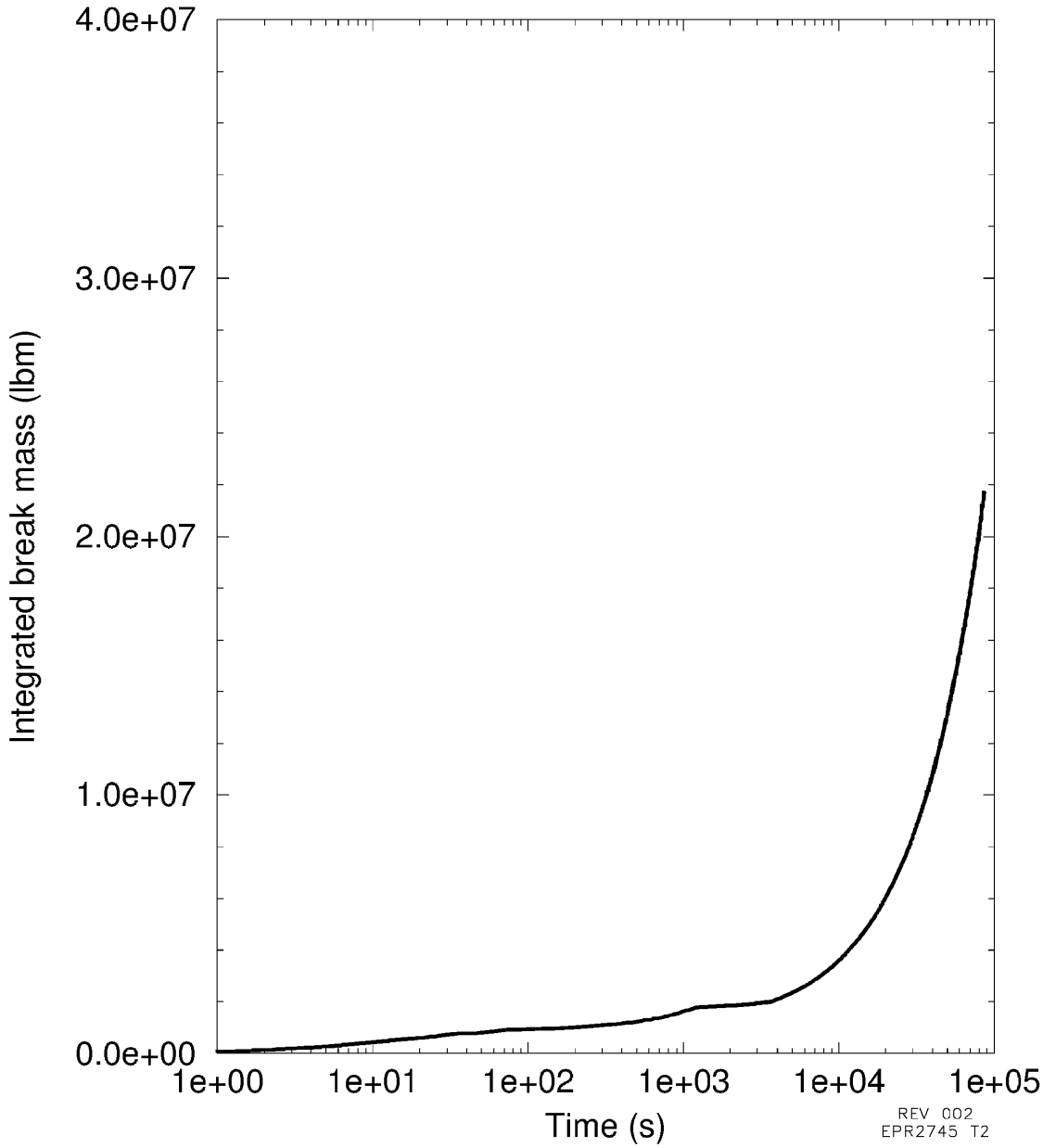

Figure 6.2.1-31—LOCA Integrated Break Energy Flow vs. Time (CLPS Break, Long-Term)

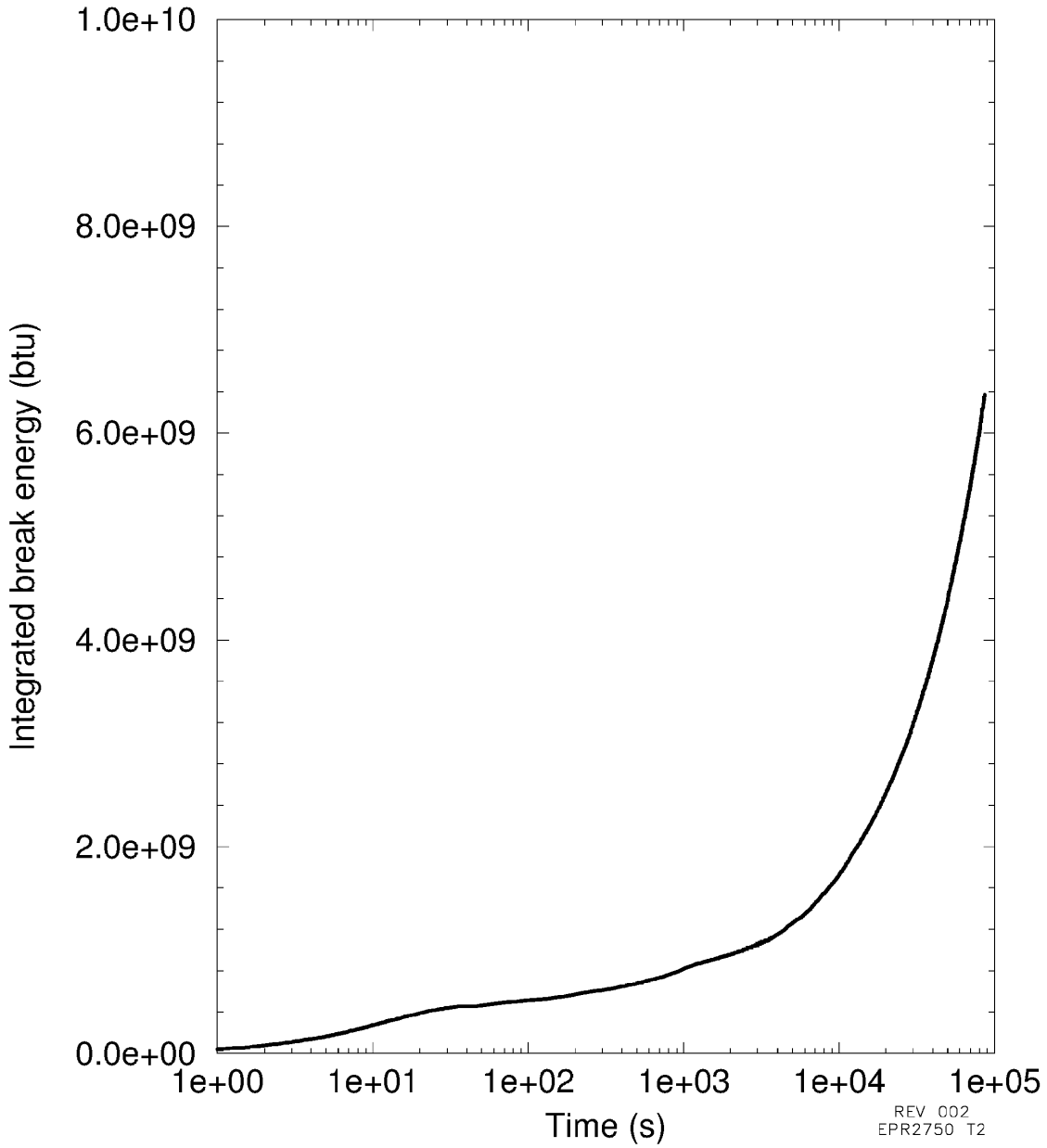

Figure 6.2.1-32—LOCA Integrated Break Mass Flow vs. Time (CLPD Break, Long-Term)

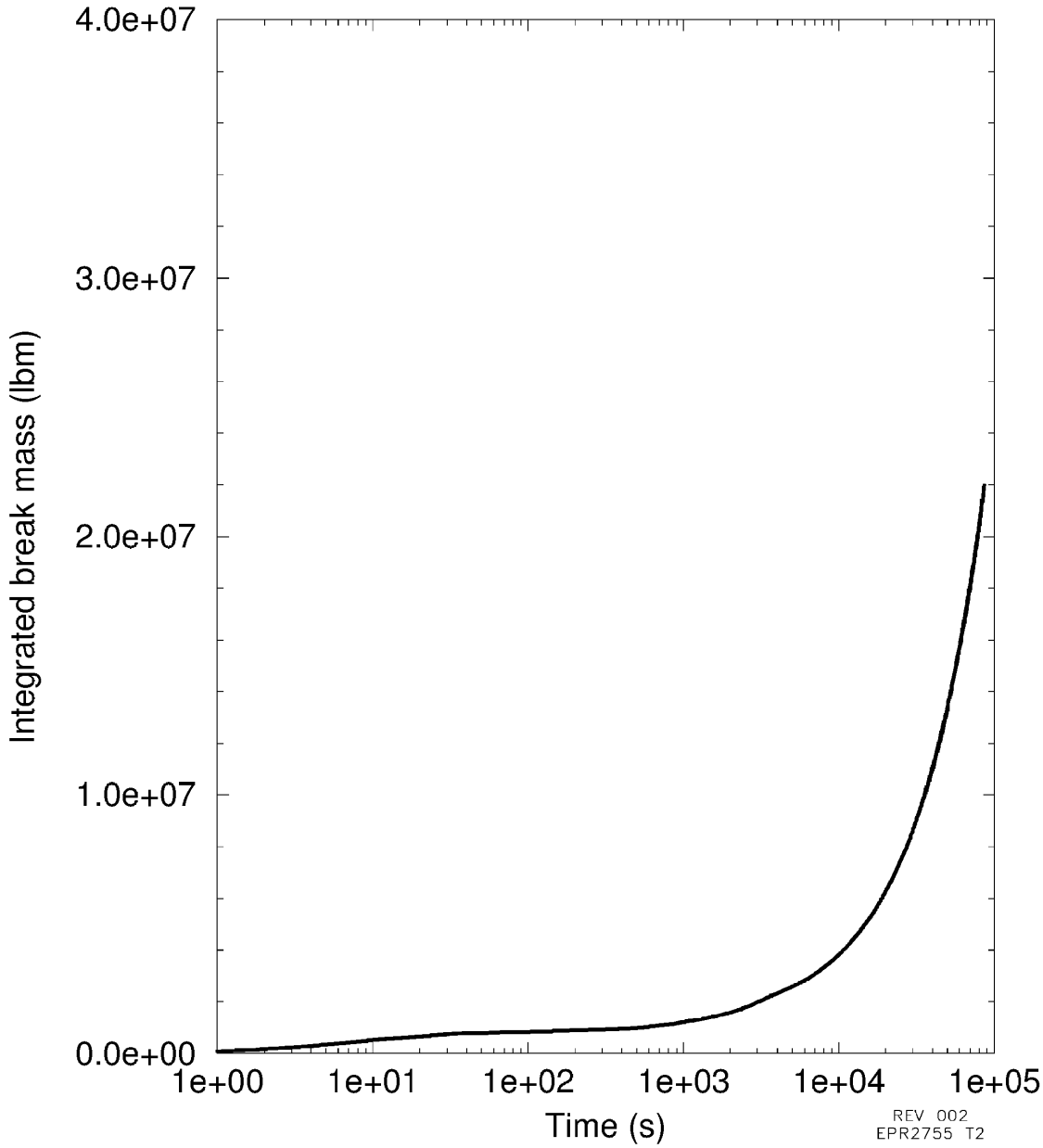

Figure 6.2.1-33—LOCA Integrated Break Energy Flow vs. Time (CLPD Break, Long-Term)

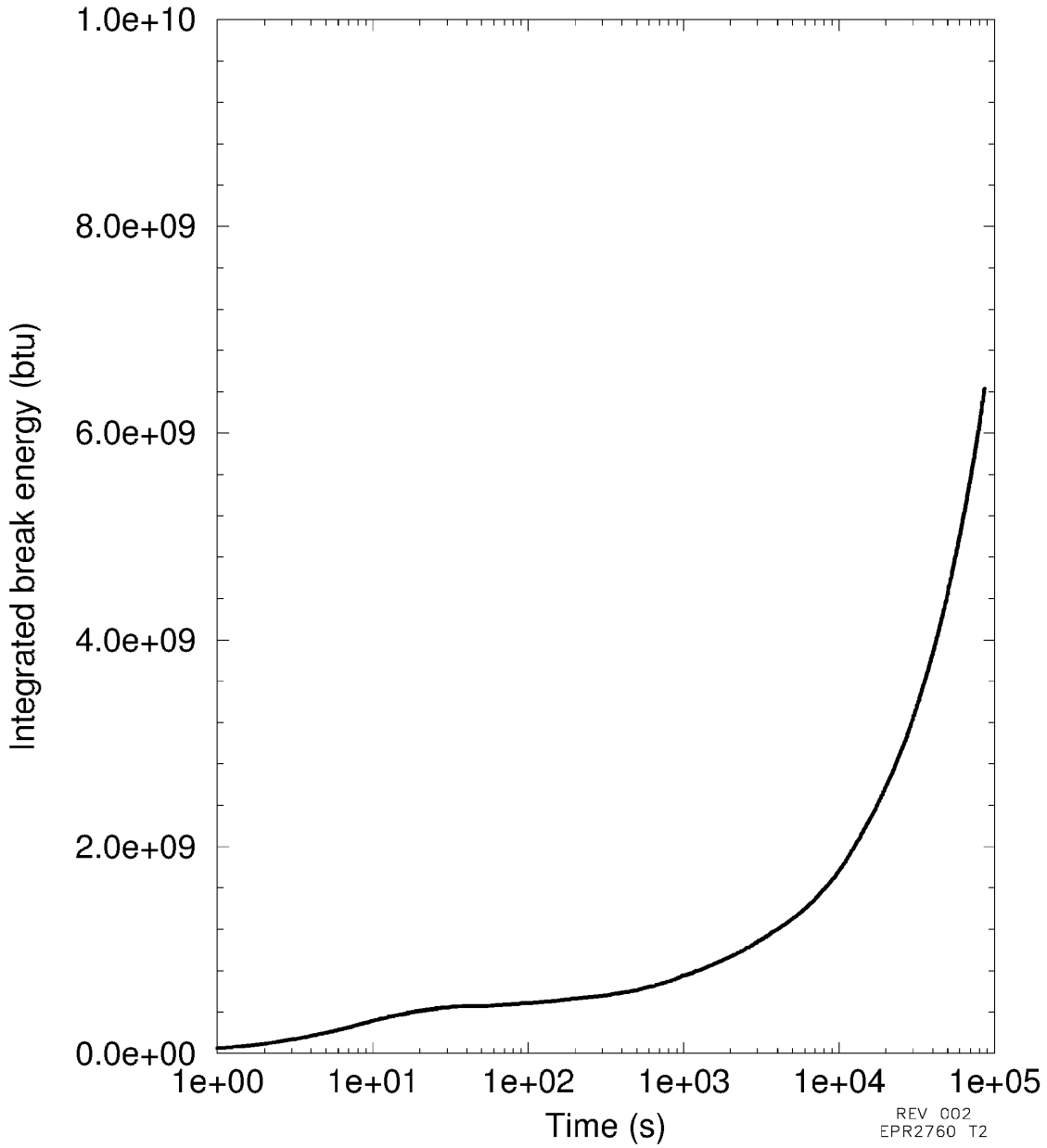

Figure 6.2.1-34—MSLB 20% Power Pressure Response

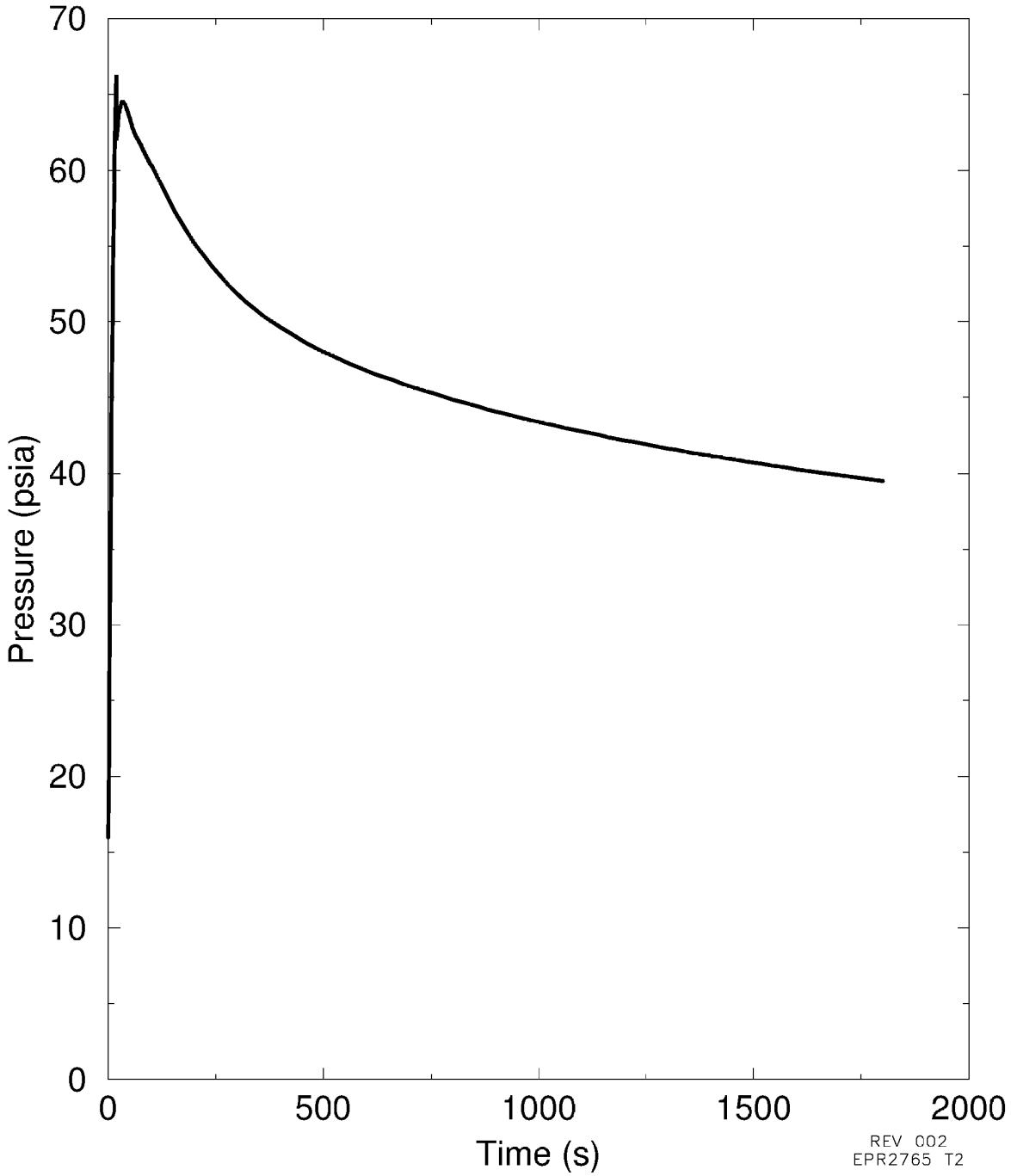

Figure 6.2.1-35—MSLB 20% Power Temperature Response

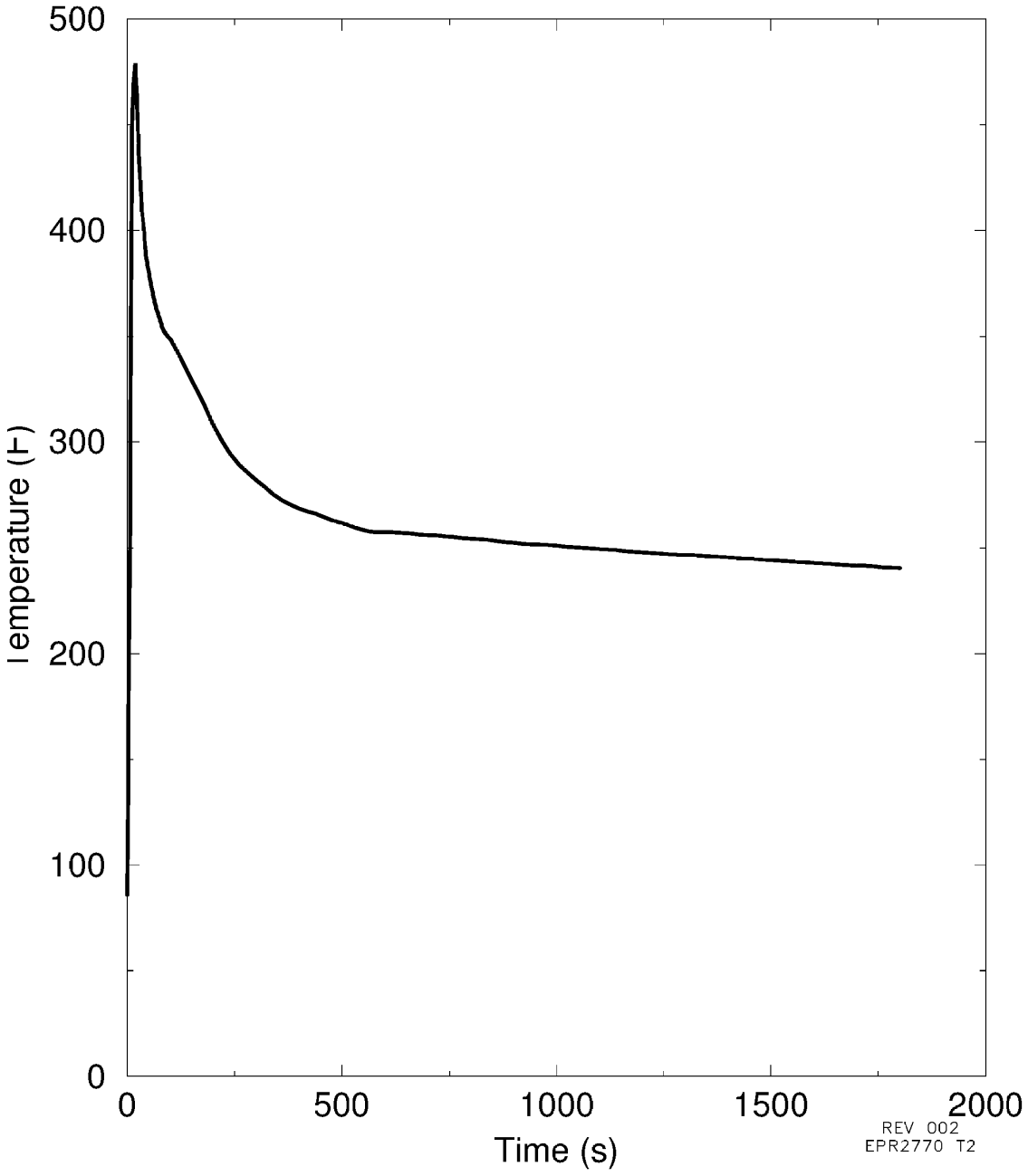

Figure 6.2.1-36—LOCA Containment Dome Temperature at Different Elevations (HL Break Long-Term)

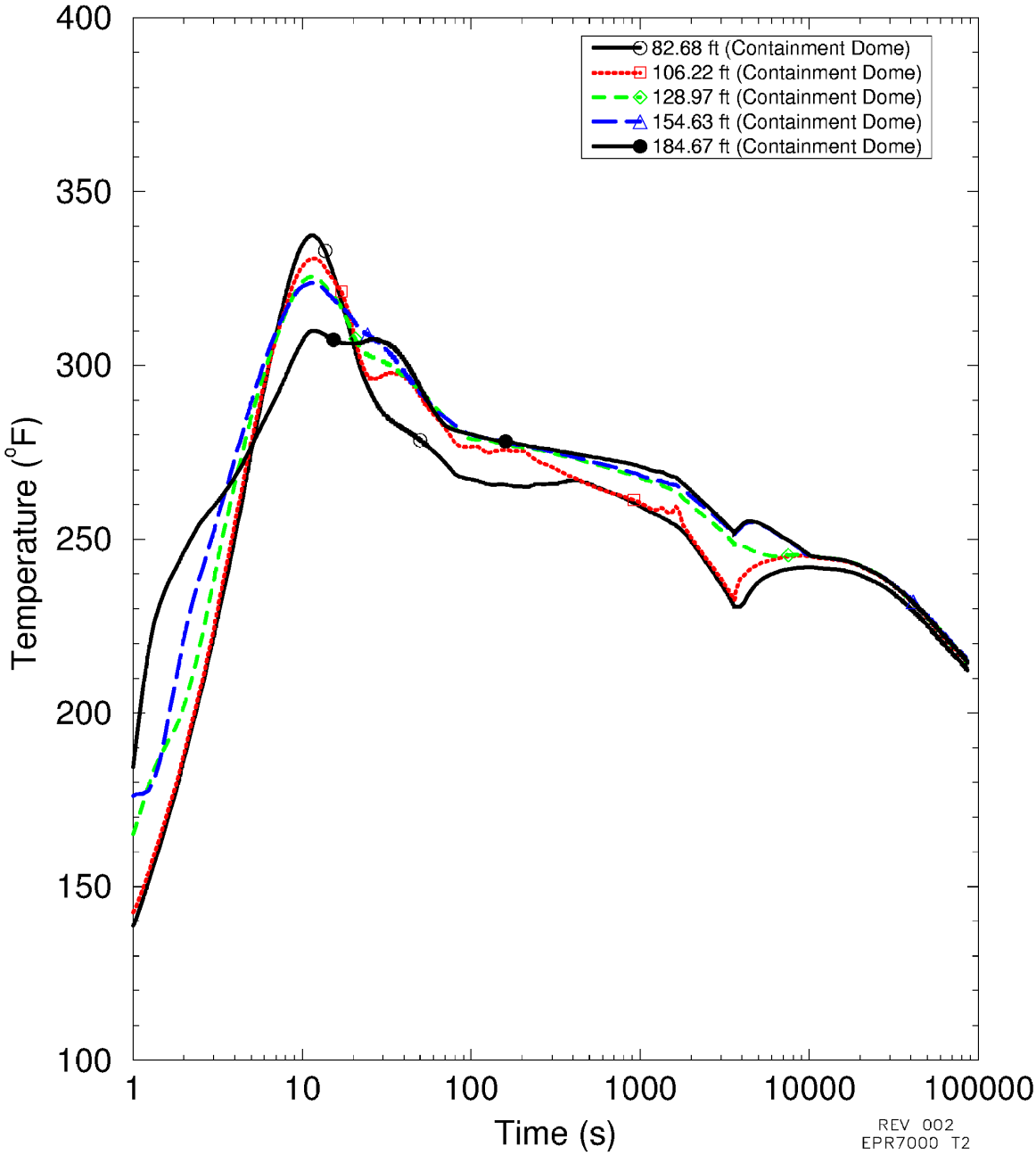

Figure 6.2.1-37—LOCA Containment Temperature below the Dome (HL Break Long-Term)

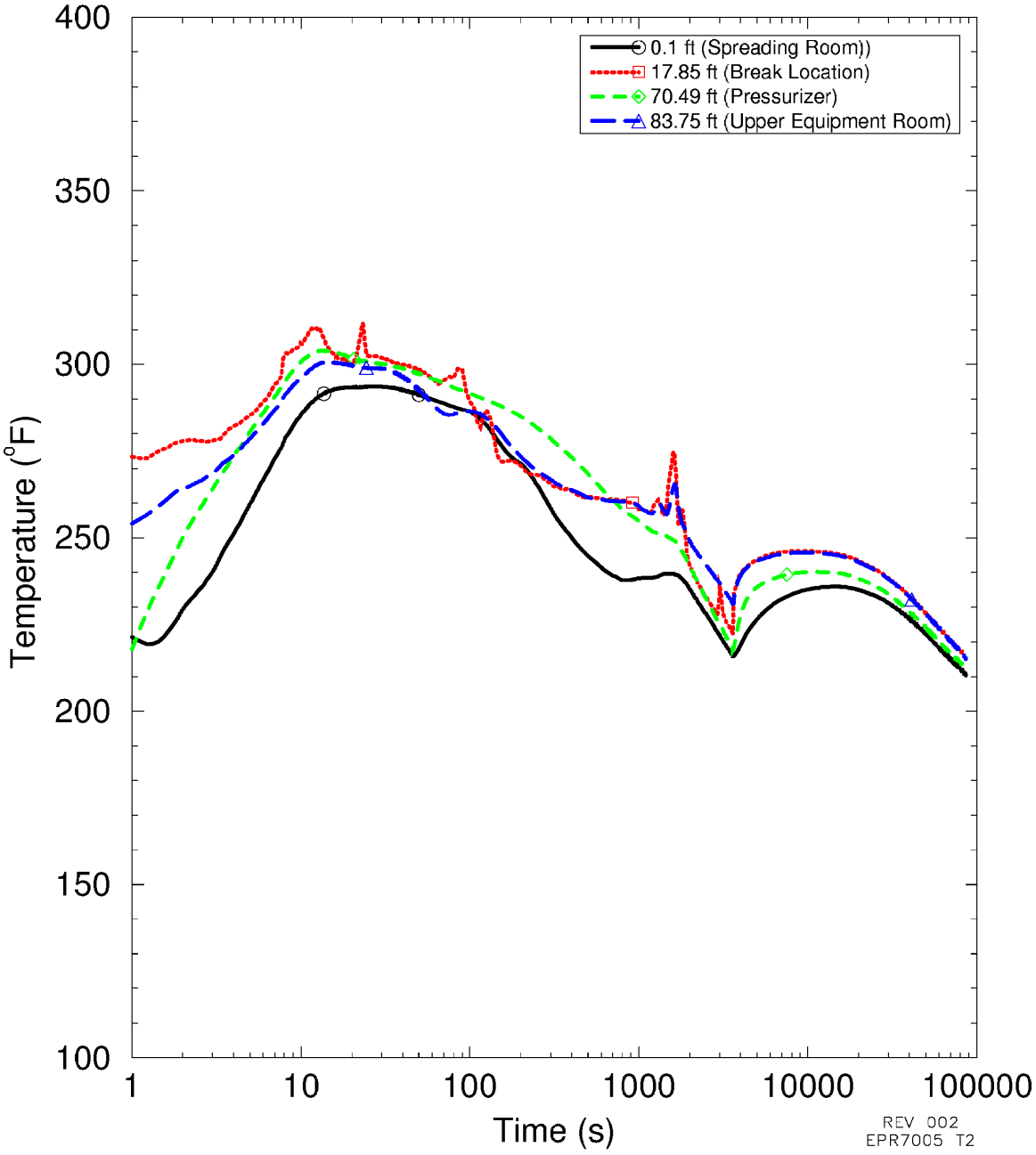

Figure 6.2.1-38—LOCA Containment Dome Temperature at Different Elevations (CLPS Break Long-Term)

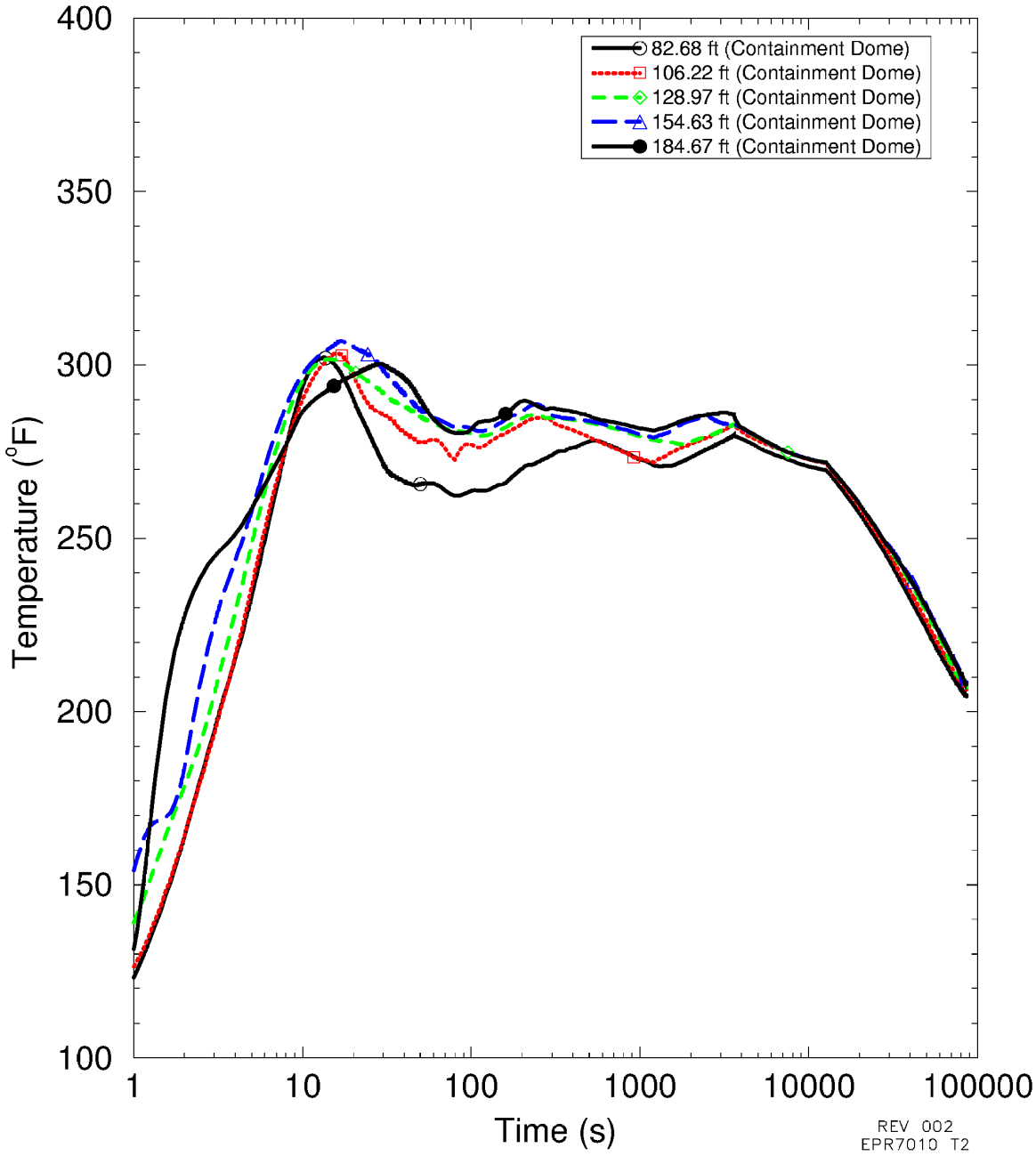

Figure 6.2.1-39—LOCA Containment Temperature below the Dome (CLPS Break Long-Term)

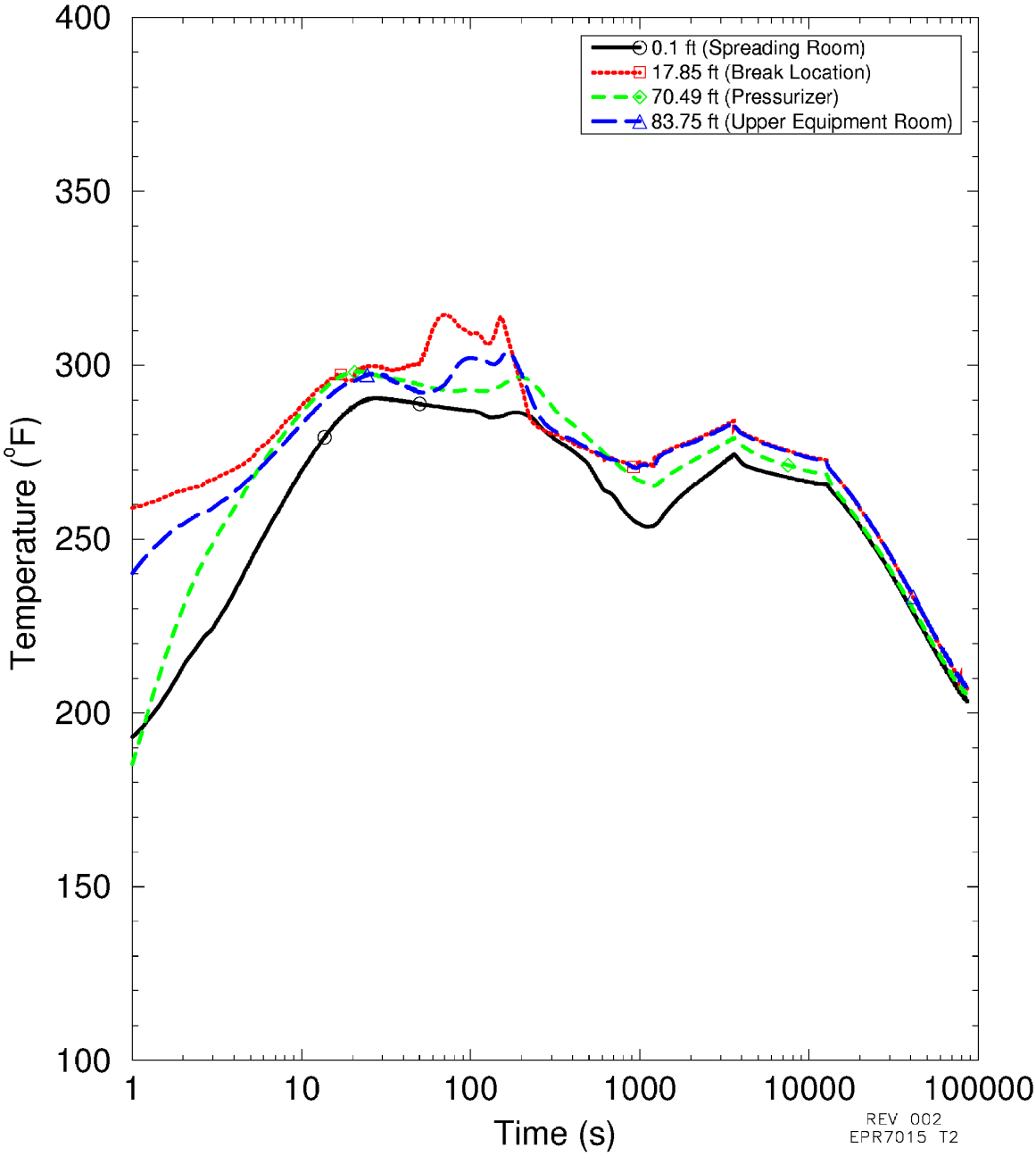

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Figure 6.2.1-40—LOCA Containment Dome Temperature at Different Elevations (CLPD Break Long-Term)

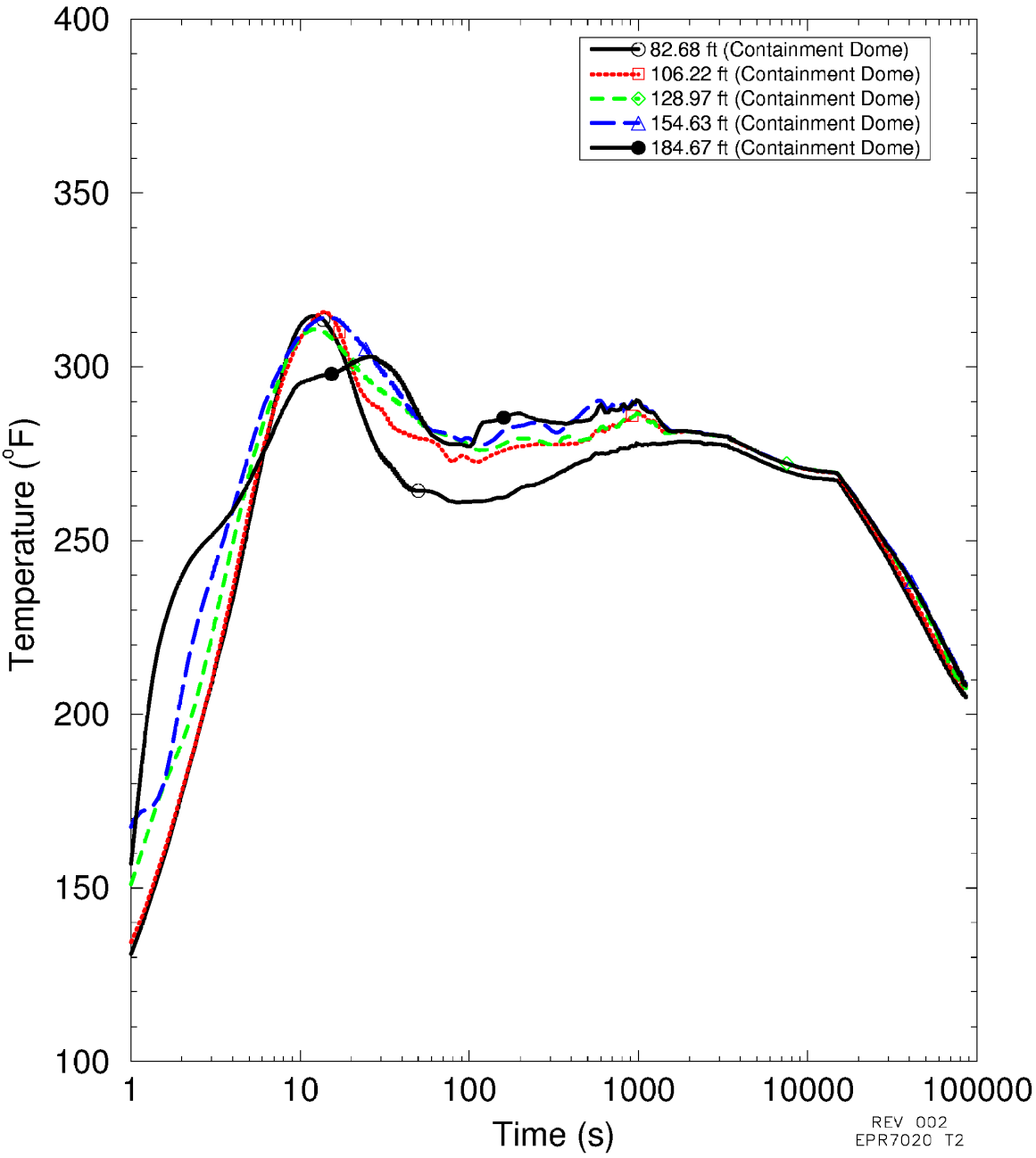


Figure 6.2.1-41—LOCA Containment Temperature below the Dome (CLPD Break Long-Term)

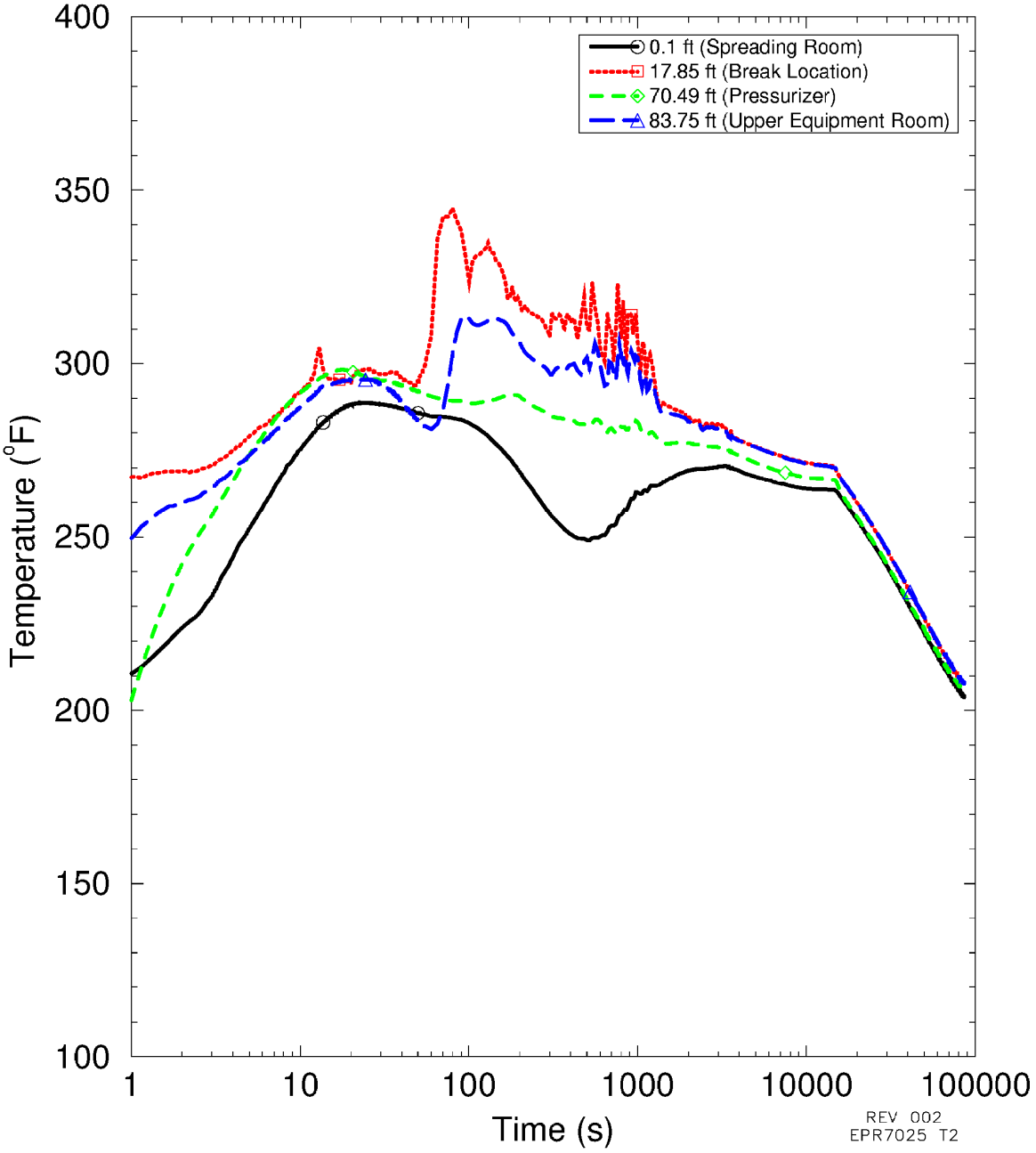


Figure 6.2.1-42—MSLB 20% Power Steam Generator Dome Pressure

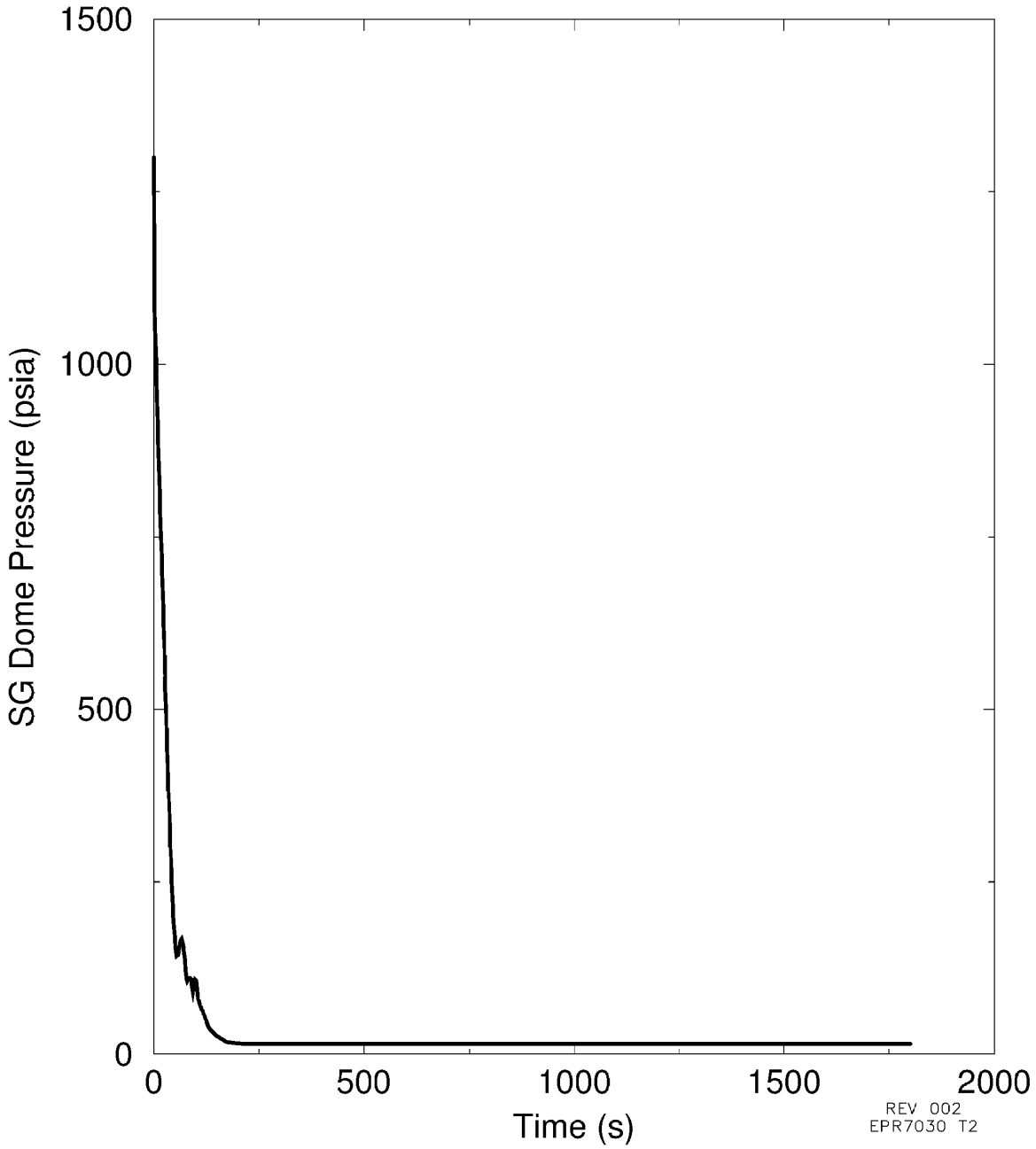


Figure 6.2.1-43—MSLB 20% Power Integrated Break Mass vs. Time

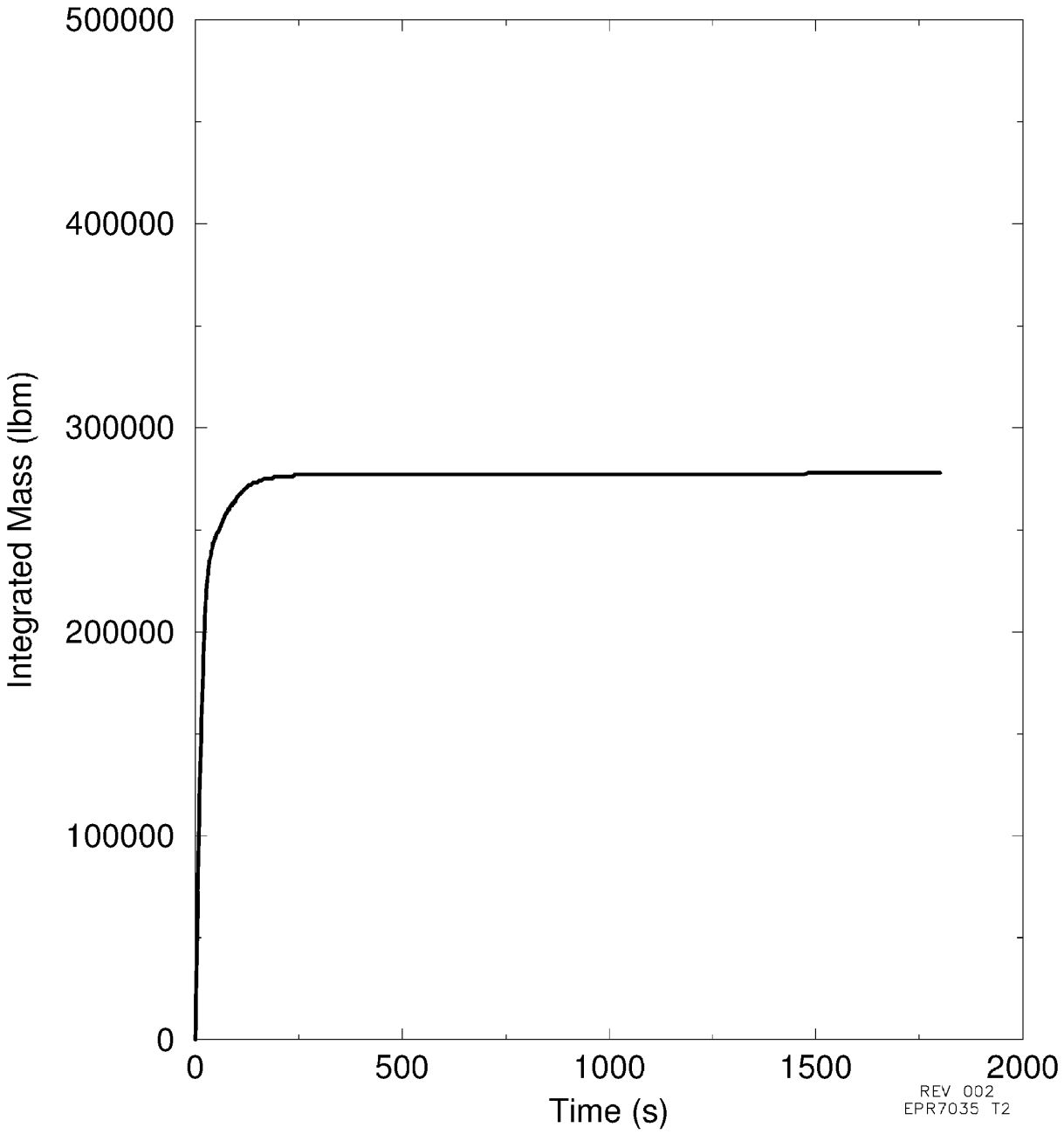
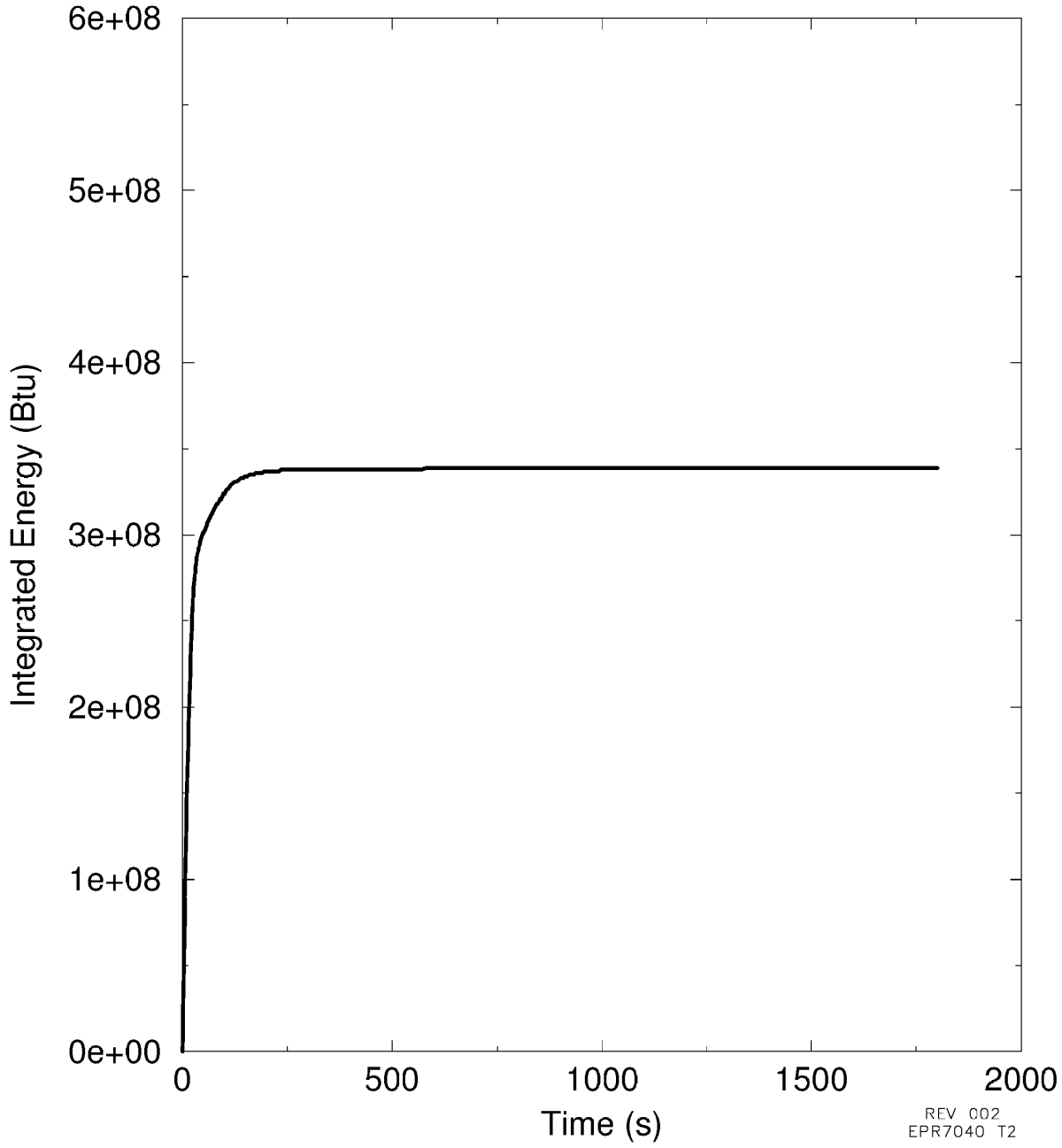


Figure 6.2.1-44—MSLB 20% Power Integrated Break Energy vs. Time



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6.2 Containment Systems

The U.S. EPR containment systems include the containment, the containment isolation system, and the containment combustible gas control system. These systems contain any radionuclides released from the fuel during postulated accidents, preventing further release to the balance of the plant and the environment, and limit the accumulation of combustible gases generated during the accident.

The design basis accidents (DBA) for the containment systems are defined as the most severe event within a spectrum of postulated loss of coolant accidents (LOCA) and main steam line break (MSLB) accidents. DBA mitigation depends upon the high reliability of these containment systems. This section provides the design criteria, design features, and evaluations that demonstrate these systems will function within their specified limits.

6.2.1 Containment Functional Design

The U.S. EPR Reactor Building consists of a cylindrical reinforced concrete outer Shield Building, a cylindrical post-tensioned concrete inner Containment Building with a steel liner, and an annular space between the two buildings. The Shield Building protects the Containment Building from external hazards.

The containment is designed to withstand the environmental and dynamic effects associated with both normal plant operation and postulated accidents (GDC 4).

The containment instrumentation is capable of monitoring variables and systems over their anticipated ranges for all normal operation, for anticipated operational occurrences, and for accident conditions as appropriate for safety, including those variables and systems that can affect the containment and its associated systems. Appropriate controls maintain these variables and systems within prescribed operating ranges (GDC 13).

The containment and its associated systems establish a barrier against the uncontrolled release of radioactivity to the environment, and incorporate sufficient margin in their design so that conditions important to safety are not exceeded for as long as postulated accident conditions require (GDC 16).

The containment is designed so that, in conjunction with features built into the in-containment refueling water storage tank (IRWST) system, which rapidly reduce the containment pressure and temperature following any LOCA it can maintain them at acceptably low levels (GDC 38). As a result the containment can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any LOCA (GDC 50).

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The containment is provided with the means for monitoring the reactor containment atmosphere, spaces containing components for recirculation of LOCA fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents (GDC 64).

The containment conforms to the functional requirements of 10 CFR 50, Appendix K, which defines acceptable evaluation models and calculation of minimum containment pressure for evaluating emergency core cooling system capability, specifically for source of heat during the LOCA and containment pressure control requirements. Refer to Section 15.6.5 for compliance with 10 CFR 50, Appendix K requirements.

Section 6.2.1.1 addresses those aspects of containment design and evaluation that relate to its accident mitigation functions. Containment concerns during refueling operations and reduced primary inventory conditions are discussed in Section 6.2.1.1.4 and the disposition of GL 88-17 for the U.S. EPR is provided in Section 14.7.2.1 and in Table 15.0-60. Section 3.8 provides a physical description of the containment and presents the design criteria relating to construction techniques, static loads, and seismic loads.

6.2.1.1 Containment Structure

6.2.1.1.1 Design Bases

The containment's structures, systems, and components (SSC) that are important to safety are designed to withstand the environmental and dynamic effects associated with both normal plant operation, including maintenance and testing, and postulated accidents. The environmental effects include the temperatures, pressures, and fluids encountered during normal and accident conditions. The dynamic effects include those arising from in-plant equipment failures or accidents including missiles, pipe whipping, and discharging fluids, as well as those resulting from events and conditions outside the containment (e.g., tornadoes, earthquake, or aircraft impact).

The containment and its associated systems are designed to be a leaktight barrier against the release of radioactivity to the environment and are designed to remain functional during a DBA. By meeting these performance requirements, including requirements for access openings and penetrations of the structure and its internal compartments, the containment is designed to accommodate the calculated pressures and temperatures resulting from a LOCA without exceeding its designed leakage limits. It can do so with margin for extra energy sources, degraded engineered safety features (ESF), and using conservative calculational methods.

The radiological consequences of the DBA are presented in Section 15.0.3. The containment, containment systems, and ESF act to limit the release of radioactive material subsequent to a DBA, so that the release does not exceed the limits specified

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in 10 CFR 52.47(a)(2)(iv).Containment design calculations assume the following for a RCS pipe rupture:

- The postulated rupture occurs concurrently with the worst single active failure.
- The systems used to mitigate the consequences of a postulated pipe rupture are protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit subject to design loadings from a safe shutdown earthquake.

  The offsite electrical power system is evaluated to provide the most limiting condition for each postulated break, for example, a loss of offsite power (LOOP) or no LOOP.

  Discharge coefficients (Cd) and the backpressure values are assumed, so as to result in the most limiting condition for each postulated break.
- Multiple pipe breaks do not occur simultaneously or consecutively.

The postulated RCS pipe ruptures are listed in Table 6.2.1-1—Loss of Coolant Accidents, and are described in Section 6.2.1.3. Section 6.2.1.3.1 provides the mass and energy release data for the LOCA.

Containment design calculations assume the following events occur for a secondary system pipe rupture:

- The postulated pipe rupture occurs with the worst single active failure of the main steam isolation valve (MSIV) for the MSLB.
- The offsite electrical power system is assumed to be available for the continued operation of the reactor coolant pumps (RCP) to maximize the primary to secondary heat transfer.
- Multiple pipe breaks do not occur simultaneously or consecutively.

The postulated secondary pipe ruptures are listed in Table 6.2.1-2—Main Steam Line Breaks and are discussed in Section 6.2.1.4. Section 6.2.1.4.3.2 discusses the mass and energy release data for the MSLB.

Containment overpressurization events during refueling operations and reduced primary inventory conditions are mitigated by residual heat removal (RHR) system design features as discussed in Section 5.4.7. These features prevent a loss of decay heat removal and do not result in a challenge to containment closure under these plant conditions. Technical Specifications, Chapter 16, address containment integrity during fuel movement.

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The loads on the internal structures are calculated using the differentials between the maximum calculated subcompartment pressures and 14.7 psia, the pressure of the containment atmosphere at the time of peak subcompartment pressure. These subcompartment pressures are specified conservatively for the analyses discussed in Section 6.2.1.2.

The U.S. EPR does not have an automatic containment spray system or containment air coolers for DBA mitigation. Thus, the U.S. EPR is not susceptible to inadvertent actuation of those systems, or the potential for damage because of the rapid reduction of the containment internal pressure that would result from such an inadvertent actuation. The severe accident heat removal system (SAHRS), described in Section 19.[illegible], includes a manually actuated containment spray system dedicated to severe accident mitigation. This system is not used for DBAs. Because the SAHRS must be manually armed and manually actuated, it is not subject to a single failure that could cause inadvertent actuation of containment spray; eliminating the need to analyze for this event. The following possible events were reviewed:

- Sudden Containment temperature reduction.
- Removal of IRWST inventory.
- Heating, ventilation and air conditioning (HVAC) pulldown of containment pressure.
- Postaccident cooldown.
- Post severe accident cooldown.

The limiting external pressure event was determined to be a sudden reduction in the containment ambient temperature. This reduction in temperature removes heat from the containment building, thereby removing water from the containment atmosphere via condensation on walls, stairs, and other containment structures. A sudden reduction in the containment temperature from normal ambient conditions to 59°F results in a pressure reduction of 2.92 psi inside the containment building, which is within the external design pressure of the building.

Containment heat removal is performed by recirculation of the reactor coolant from the IRWST, through the low head safety injection (LHSI) heat exchangers, to the RCS, and through the break back to the IRWST. The LHSI is part of the safety injection system (SIS) discussed in Section 6.3. The effects of the containment heat removal function of the LHSI heat exchangers are included in the determination of the containment pressure and temperature response discussed in Sections 6.2.1.3 and 6.2.1.4. The containment design evaluation considers the most limiting single failures for the SIS in the development of the long-term model for containment pressure and temperature response.

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The principal parameters affecting postaccident pressure reduction are the heat absorbed by the heat sinks inside the containment and the heat transferred to the containment sumps, which are contained in the IRWST. A conservative amount of heat sink material has been calculated, and its heat absorption capability has been considered in the containment design evaluation discussed in Section 6.2.1.1.3.

The amount of heat transferred through the containment wall and dome to the outside atmosphere is determined to be insignificant.

Heat transferred from the containment to the outside environment during an accident via the LHSI heat exchangers, which are cooled by the component cooling water system (CCWS). The CCWS is in turn cooled by the essential service water system (ESWS). The ESWS is described in Section 9.2.1, and the CCWS is described in Section 9.2.2. Assuming single failures of the LHSI heat exchangers cooling chain are considered in the development of the long-term model for containment temperature and pressure response. The capabilities of the LHSI heat exchangers are provided in Table 6.2.1-3—LHSI Heat Exchanger Data.

To meet the containment safety design basis of limiting the release of radioactive material from a DBA LOCA to acceptable limits, the containment pressure is required to be reduced to less than 50 percent of the peak containment pressure within 24 hours after the DBA LOCA. Chapter 15 discusses the analysis of the offsite radiological consequences of the accident and provides the basis for the containment depressurization rate.

The determination and evaluation of the minimum containment pressure transient are addressed in Section 6.2.1.5.

6.2.1.1.2 Design Features

Containment and subcompartment design parameters are provided in Table 6.2.1-4—Containment Initial and Boundary Conditions, and Table 6.2.1-5—Containment Heat Sink Inventory. The general arrangement drawings for the reactor containment are provided in Section 3.8.1, and simplified drawings illustrating the model used for the containment subcompartment analyses are provided in this section. The structural design of the containment and the subcompartments, and the applicable codes, standards and guides that apply to the design of the containment structure, are addressed in Section 3.8. The structural design considers the effects of postulated piping ruptures, as discussed in Section 3.6.

The design pressure and temperature of the containment are 62 psig and 338°F, respectively. Calculated containment pressures, based on the conservative analyses, are described in Sections 6.2.1.3 and 6.2.1.4.

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The functional capability and frequency of operation of the systems provided to maintain the containment and subcompartment atmospheres within prescribed pressures, temperatures, and humidity limits during normal operation are discussed in Section 9.4.7.

6.2.1.1.3 Design Evaluation

The severity of the temperature rise and pressure peak resulting from a LOCA or MSLB depends upon the nature, size, and location of the postulated rupture. The U.S. EPR containment is designed to contain the energy released from the RCS in the event of a LOCA or from the steam generator (SG) during a MSLB.

In the case of a LOCA, the mass and energy released into the containment is reactor coolant at the primary system temperature. A portion of the coolant is converted to steam, and will remain as steam if its enthalpy is sufficient. Coolant released from the primary system causes an increase in containment steam mass, which in turn increases pressure and temperature. This rise is limited by steam cooling and condensation on contact with the colder containment walls, and by mass and energy exchanges between steam and liquid in the containment. The containment pressure rises until pressure between the primary system and the containment equalizes, and flow through the break decreases to an equilibrium value. The containment pressure then begins to decrease because of the effects of the passive heat sink of the containment.

Following blowdown, the water vapor condenses on the containment heat sinks located throughout the Containment Building, and the saturated water drains along the intermediate floors, grates, stairwells, and walls to the heavy floor of the Containment Building. The effects of condensation induce circulation zones that promote a mixed atmosphere inside the building during and after blowdown. The saturated water drains from the heat sinks pools and forms a large condensation surface on the heavy floor. In the case of a LOCA, saturated and later subcooled water spills out of the break, splashes on the heavy floor, and induces waves in the pooled water, which provides constant circulation that further promotes condensation on the pool surface. Curbed grates in the heavy floor drain directly to the IRWST which in turn creates a fully developed recirculation path from the IRWST to the reactor pressure vessel through the LHSI heat exchangers. Steam condensation on the heat sinks and the water pooled on the heavy floor results in long-term containment cooling and depressurization.

In addition to the generation of the blowdown pressure peak, long-term LOCA cases were analyzed at each break location to determine the limiting pressure and temperature. The spectrum of postulated accidents analyzed is provided in Tables 6.2.1-1 and 6.2.1-2.

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The analytical model and computer code designed to predict containment pressure and temperature responses following the accidents are described in this section. A summary of the predictions is listed in Tables 6.2.1-6, 6.2.1-7, and 6.2.1-8 for short-term containment response for LOCAs, and Table 6.2.1-9 for the MSLB.

Table 6.2.1-6, Table 6.2.1-7, and Table 6.2.1-8 present thirty-eight separate cases for LOCA analysis for three postulated break locations. For the LOCA, the limiting containment pressure results from the double-ended guillotine break in the RCS hot leg piping, with the worst single failure being the loss of one ESF train.

Table 6.2.1-9 lists twenty cases for the MSLB, with four break sizes ranging from the double-ended guillotine break to the 0.5 square foot break area, and power levels from 100 percent down to zero percent of rated thermal power (RTP). The peak containment pressure results from the assumed double-ended guillotine MSLB with a failure of one MSIV at 50 percent RTP.

The passive heat sinks inside the primary containment consist of all painted and unpainted concrete, steel structures and liner for the containment shell and IRWST surfaces. The IRWST heat sinks are exposed to the water in the pool. The remaining heat sinks are exposed to the containment atmosphere. These areas are approximately the same temperature as the containment ambient temperature during normal plant operation. ~~The specific passive heat sinks considered in the containment pressure-temperature analysis~~The complete list of passive heat sinks in the U.S. EPR Containment and their parameters are listed in Table 6.2.1-5—Containment Heat Sink Inventory. ~~A minimum heat sink surface area was considered~~Selected heat sinks were not included in the containment pressure-temperature analysis for conservatism. The minimum heat sink surface area for U.S. EPR FSAR Tier 2, Section 2.1.1.1 is 64,998 m^2 or 699,633 ft^2.

The requirements of 10 CFR 50, Appendix K, Part I A list the required features of the evaluation models for sources of heat during the LOCA. For the heat sources of 10 CFR 50, Appendix K, it must be assumed that the reactor has been operating continuously at a power level at least 1.02 times rated thermal power to allow for instrumentation error. The assumed power level may be decreased provided the proposed alternative value has been demonstrated to account for uncertainties of power level with a lower instrumentation error. The core power is measured using a secondary side heat balance with feedwater flow rate. A heat balance measurement uncertainty of approximately one-half percent of rated thermal power, or 1.005, is applicable to the core power for the U.S. EPR. This value is achieved with the use of an ultrasonic flow meter for the feedwater flow rate. This value is consistent with the assumption used in the safety analysis in Section 15.0.0.3.1.

The heat removal due to safety injection system/residual heat removal (SIS/RHR) system operation is simulated in the GOTHIC Version 7.2 computer code by specifying

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heat exchanger input values from Table 6.2.1-3. The GOTHIC heat exchanger model was benchmarked against heat exchanger performance data to provide a conservative representation.

Table 6.2.1-4 lists the initial containment conditions, based on the range of the normal expected conditions within the containment, with consideration given to maximizing the calculated peak containment pressure. Selection of these conditions is described in Analysis of Containment Response to Postulated Pipe Ruptures Using GOTHIC. (Reference 1)

The highest calculated containment pressure is produced by a MSLB break with the single active failure of one MSIV. A summary of the results of the containment pressure temperature analyses for the spectrum of postulated accidents is tabulated in Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB.

The IRWST is located near the basement floor of the Containment Building. The tank contains a minimum of 500,000 gallons of borated water and is maintained at a temperature between 60°F and 120°F. For the most limiting DBA, the IRWST temperature remains within the limit that supports continuous operation of the safety injection pumps to mitigate the consequences of the accident. The operation of the safety injection pumps provides the necessary cooling to limit containment temperature and pressure within design requirements. IRWST temperature versus time is presented in Figure 6.3-7.

The SIS has four accumulators to provide water to the RCS in the event of a LOCA. The accumulators' non-condensable cover gas (nitrogen) and the mass and energy release rates of the accumulators are included in the short-term model, and are supplied as input boundary conditions to the forcing functions in the long-term GOTHIC model. The nitrogen is assumed to enter the containment starting at time zero and is completely released at time 20 seconds, although the actual release of the nitrogen does not occur until the accumulators' liquid empties into the RCS loops. The calculations require that the nitrogen gas be assigned a temperature value. Since the nitrogen is stored within the accumulators above the water volume, the gas expands as the water drains from the accumulator into the RCS. The expansion results in polytrophic (pV^n) cooling. The cooled gas flows from the accumulators through the RCS piping, and to the containment atmosphere, where it mixes with the RCS coolant causing the nitrogen temperature to rise to the RCS coolant temperature. Since the RCS is depressurizing through the break, the RCS temperature would be lower than the normal operating temperatures. A bounding value of 565.5°F is assigned to the nitrogen. This value corresponds to the RCS cold leg temperature. This assumption is applied with all break locations and is conservative.

The long-term system behavior during various LOCAs has been evaluated to verify the ability of the SIS/RHR system to keep the reactor vessel flooded and maintain the

containment within design conditions following a LOCA. This evaluation is based on the conservative predictions of the performance of the ESF consistent with the single failures assumed for each accident analyzed.

After a DBA, the conditions in containment are measured by post-accident monitoring instrumentation described in Section 7.5.

6.2.1.2 Containment Subcompartments

6.2.1.2.1 Design Basis

The containment internal compartments protect against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that result from equipment failures and from events and conditions outside the containment. The containment internal compartments accommodate the effects of environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs (GDC 4).

The reactor containment structure design, including access openings and penetrations, allows the containment internal compartments to accommodate the calculated pressure and temperature conditions resulting from any LOCA. The design must withstand these conditions without exceeding the design leakage rate requirement (GDC 50).

Subcompartments within containment can withstand the transient differential pressures of a postulated pipe breaks. The subcompartment walls are challenged by the differential pressures resulting from a postulated break in a high energy line breaks (HELB) within individual compartments. These rooms are arranged to allow venting of HELBs to prevent differential pressures from reaching structural limits of compartment walls.

Fluid systems are considered high-energy when, during normal plant conditions, the systems are operated or maintained pressurized under conditions where either or both of the following criteria are met:

- Operating temperature exceeds 200°F.
- Operating pressure exceeds 275 psig.

Fluid systems are considered moderate-energy systems when operated at the above conditions for 2 percent or less of the time the systems are in operation, or for less than 1 percent of the plant operation time.

For the U.S. EPR, the leak before break (LBB) concept is applied (Section 3.6.3) to preclude the need to design components, piping, and supports for the structural dynamic effects of postulated large or double-ended primary system pipe ruptures

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equal to the pressurizer surge line area or larger. The LBB concept also precludes the need to consider double-ended steam line ruptures in the structural design of the steam system components and supports.

6.2.1.2.2 Design Features

The general arrangement drawings for the reactor containment are provided in Section 3.8.1. These drawings form the basis of the subcompartment analysis models. Simplified drawings illustrating the model used for the containment subcompartment analysis are provided in this section.

The subcompartments identified to undergo the highest concentrated loading conditions, such as nuclear steam supply system (NSSS) supports, are selected for determination of the differential pressures across the supporting walls. The combination of the NSSS concentrated loads and the subcompartment differential pressures create critical loading scenarios on the supporting structural elements. These elements are then labeled as critical sections for the Reactor Building interior structures. Appendix 3E presents the Reactor Building critical sections and the structural evaluations associated with them.

Subcompartments adjacent to critical sections are evaluated based on the mass and energy flux from each high energy line in the compartment (Table 6.2.1-10). Subcompartments without high energy lines are omitted from further analyses.

The U.S. EPR principal containment subcompartment design parameters are provided in Table 6.2.1-11, Table 6.2.1-12, Table 6.2.1-13 and Table 6.2.1-14, which includes the free volume and vent area for each critical subcompartment along with the neighboring subcompartment volumes. The vent paths considered in the subcompartment analysis include open doors, grates and through wall openings. The effects of vent areas that become available after the occurrence of a postulated pipe break (e.g., blowout panels, hinged doors, collapsing insulation) are specifically noted and conservatively treated.

6.2.1.2.3 Design Evaluation

High-energy lines identified for the critical subcompartments are compared based on the full-power operating conditions. The mass flux from the postulated double-ended pipe rupture is then calculated using the Homogeneous Equilibrium Model (HEM). With the cross-sectional area for each of the high-energy lines known, the energy flux is calculated. The highest energy flux for each critical subcompartment will be selected for subsequent subcompartment analyses. These are listed in Table 6.2.1-15, Table 6.2.1-16, and Table 6.2.1-17.

The HEM model was used for the HELBs presented in Table 6.2.1-15 with the exception of the pipe breaks inside the RCP and SG cavities (identified as rooms

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30UJA15-006, 30UJA23-004 and 30UJA29-004). The mass and energy release data for these breaks were calculated using the system analysis code CRAFT2 and are presented in Table 6.2.1-16 and Table 6.2.1-17. The GOTHIC computer code is used to determine the differential pressure across subcompartment walls. The calculation of the pressure load uses aspects of the NRC approved GOTHIC containment methodology pertinent to subcompartment pressure response in the Containment Response Topical Report (Reference 1). The suitability of the GOTHIC computer code to calculate differential pressures has been demonstrated in various experimental verifications.

A multi-node GOTHIC model is used as the analysis tool for conducting the subcompartment analysis because it utilizes the modeling of individual regions or subcompartments and connects them hydraulically by junctions or flow paths. The subcompartments rooms have been logically grouped together based on whether the rooms or regions experience gas flows significant enough to be considered well mixed.

Adjacent subcompartments with sufficient openings create a free exchange of gas flows between subcompartments and are grouped together into a lumped node. Subcompartments that include critical walls are separated from the lumped node and modeled as a single subcompartment critical room node (Figure 6.2.1-1 through Figure 6.2.1-4). This re-nodalization is performed so that the magnitude of the initial peak or blowdown peak inside the critical room of interest is captured.

Each of the critical rooms, represented by a single node, was re-nodalized in the circumferential direction, into four nodes so that the initial peaks or blowdown peaks inside the various critical rooms are fully captured. These nodalization sensitivity studies showed that the pressure response generally varied by less than 1 psi as a result of more rigorous nodalization.

The HEM model in GOTHIC for air-steam-water mixtures is actuated for the junctions connected to the blowdown volume. The critical flow regime is expected to exist, if at all, in the junctions connected to the blowdown volume. The incompressibility option is actuated for the flow paths connected to the blowdown volume. The compressibility option has the effect of slightly increasing loss coefficient because of increased density of upstream fluid when pressure drop across the junction becomes large. By selecting the HEM model for the flow paths connected to the blowdown volume, 100 percent droplet entrainment effects for these flow paths are captured.

The analysis approach is to inject the mass and energy release from the HELB into the relevant containment node that comprises the critical room or section that is exposed to the HELB. Initial conditions (e.g., containment pressure, temperature, relative humidity) at the receiving node and surrounding nodes are imposed to maximize the resultant differential pressure across the affected node. The axial effect is accounted

for by injecting the mass and energy release at the elevation where the high energy line is located within the node.

The design pressure transients generated from postulated pipe breaks presented in Table 6.2.1-15 and Figure 6.2.1-5 through Figure 6.2.1-9 for the identified critical sections are designed for as shown in Appendix 3E. The results of these evaluations show that the critical sections can withstand the applied loads including the subcompartment pressures and remain within allowable limits. The structural load calculations apply a factor of 1.4 to the peak pressure predictions from this analysis prior to their use as inputs in the design of the structures of interest.

6.2.1.3 Mass and Energy Release Analyses for Postulated Loss of Coolant Accident

The large break LOCA (LBLOCA) determined to be the most limiting for the purposes of containment analysis is a rupture of a large RCS pipe because it adds the greatest mass and energy to containment in the shortest period of time. This condition leads to a peak for containment temperature and pressure that is referred to as the blowdown peak.

An LBLOCA occurs in five phases:

1. Blowdown.
2. Refill.
3. Reflood.
4. Post-reflood.
5. Decay heat.

During the blowdown phase, there is a rapid depressurization of the RCS and the RCS and containment pressures eventually equalize. The coolant flow rate from the RCS to containment varies depending upon the nature, size, and location of the break. This flow leads to a maximum in the containment temperature and pressure referred to as the "blowdown peak." Core cooling during this phase is by film boiling on the surface of fuel rods. Because film boiling is inadequate to remove the heat contained within the fuel and the decay heat generated by the core, the fuel temperature increases.

As the RCS pressure falls below the pressure within the SIS accumulators, check valves open and water is added to the RCS. As long as there is a pressure gradient between the RCS and containment, water from the accumulators is entrained in the steam exiting through the pipe break. The SIS water cools the steam, and some of it condenses and remains within the primary system. The resulting condensation increases the core coolant flow velocities, and this begins to slow the rise in the fuel

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rod cladding temperature. The blowdown ends when the RCS pressure is approximately equal to the containment pressure.

Following blowdown, a refill period occurs where the SIS provides sufficient liquid to fill the reactor vessel lower head and plenum regions. By this time, the SIS medium head safety injection (MHSI) pumps have started and provide a limited coolant flow to the RCS. Significant flow from the MHSI pumps is not available until later in the event. When the water level reaches the top of the lower plenum of the core, the refill phase is complete.

During the next phase, reflood, the water level rises from the bottom to the top of the reactor core. As the water level rises, the relatively cool water contacts the hot fuel cladding. This heat transfer mechanism can be violent in nature and may produce a "chugging" of the RCS flow. Chugging occurs as the water contacts the hot fuel surface and flashes to steam. As the steam expands, the water is rapidly pushed away from the fuel surface. Incoming water moves the steam away from the fuel area where it encounters cooler water and the steam condenses. This process of steam production and condensing produces the chugging effect of RCS flow through the entire core.

If the pipe rupture is in one of the RCS hot legs, the saturated steam and water mixture exits the break directly into the containment. If the pipe rupture is in one of the RCS cold legs, the two-phase mixture may travel through the SGs, absorb more energy from the secondary side fluid, and become superheated before exiting to the containment. This reflood phase ends once the mixture reaches a level sufficient to quench the core. At this point, the fuel cladding temperature approaches the temperature of the fluid, and both temperatures approach the saturation temperature corresponding to the containment pressure.

The next phase is post-reflood, as the core is recovered by water and long-term cooling occurs. This period is characterized by the core decay heat generation of a significant two-phase mixture in the core region. This steam and water mixture is carried to the break location as in the reflood phase, but in more of a condition that is described as "pot boiling." In addition to decay heat and heat generated from the metal water reaction, the reactor coolant system heat, the secondary side fluid heat, and the primary and secondary metal sensible heat are all released to the containment during this phase. The final phase of the LBLOCA is the decay heat period, during which the energy produced by the decay of fission products is removed.

For the U.S. EPR, the spectrum of LOCA breaks analyzed includes a range of cold leg pump discharge, cold leg pump suction, and hot leg breaks, ranging up to the largest postulated double-ended guillotine break. These breaks range in area from 3.123 to 5.205 square feet.

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A break in the hot leg piping was shown to produce the highest containment pressure during the blowdown phase of the accident. A double-ended guillotine break of this pipe will allow the initial RCS mass and energy to enter the containment early in the transient, before the passive heat sink of the containment can effectively absorb the energy addition. Once the reflood phase begins, the mass and energy release decreases and the building heat sinks begin to reduce the pressure. As noted previously, some of the water injected by the MHSI pumps and accumulators turns to steam in the core and exits the break. The steam will initially be superheated, but it will quickly become saturated as the core temperature is reduced. Containment pressure will continue to decrease from the peak established during the blowdown phase. As break size decreases, the mass and energy release slows, but the residence time increases. This allows additional energy to be transferred from the core and SGs.

The limiting break configuration for the hot leg break scenarios included a doube-ended guillotine break with minimum available safety injection and a postulated LOOP. Figure 6.2.1-10, Figure 6.2.1-11, Figure 6.2.1-12, and Figure 6.2.1-13 provide the pressure and temperature results for the limiting hot leg scenarios. During the blowdown phase of the event, the majority of the liquid that resides in the RCS is expelled to containment. The majority of the energy is the stored energy of this fluid. For a hot leg break the introduction of this energy to containment is rapid and the containment heat sink will not have an opportunity to absorb any appreciable amount of the energy; the containment pressure rises rapidly. The rate of pressure increase is proportional to the rate at which the energy is added. The mass and energy release model is set up to maximize the heat removed from the RCS, in particular the core region and SG. Steps have been taken to delay departure from nucleate boiling (DNB), for example, to maximize the heat transfer from the fuel to the RCS fluid. The liquid in the RCS may have an opportunity to gain additional heat depending on the transit time and path it takes to reach the break. The additional energy also affects the containment pressure. The initial stored energy in the RCS fluid, the rate at which the fluid is expelled, and any heat that the fluid gains as it traverses the system to the break will define the containment pressure response for a LOCA in the hot leg.

After the blowdown phase, the RCS is essentially in pressure equilibrium with the containment. As the system begins to refill, the mass and energy effluent to containment will decrease. It is at this point that the containment heat sinks are able to absorb the energy that has been added to containment and the pressure will begin to decrease. The accumulator injection will quickly quench the core, expelling the stored energy to containment. Thereafter, the energy addition to containment is just that generated by core boiling. Because the SIS injects into the cold legs, little flow will travel through the SGs to the break.

Figure 6.2.1-10 through Figure 6.2.1-13 clearly show the trends of containment pressure increase during the blowdown phase. At the end of the blowdown phase, the containment pressure peaks and begins to decrease for the duration of the event. The

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variation in the peak pressure among the cases is very small. The post-peak behavior of these cases is also very similar. With consistent safety injection among the cases, the energy addition to containment during this time period is similar. At the end of the run, the variation in pressure among the cases is approximately 1 psi. Any of these cases could be considered the limiting case. Ample conservatism is included in the model, and the variation in the results is well within the accuracy of the model.

A break in the cold leg pump suction piping will not produce a limiting blowdown peak pressure of the containment. The resistance of the pumps will delay the blowdown as compared to the hot leg break scenarios, and the RCS depressurizes slightly at a lower rate compared to the hot leg break. As a result, the accumulator injection is slightly delayed compared to the hot leg break. During the reflood phase of the event, initial steam generated in the core will be superheated and begin to approach a saturated condition as the core water level increases. Steam generated in the core passes through the SGs before exiting the break. The secondary side of the SGs is isolated and remains at a higher temperature and pressure than the RCS. Thus, the secondary side of the SGs acts as a heat source and transfers energy from the secondary to the primary system. Consequently, as the steam on the primary side passes through the SGs, it becomes superheated before it is discharged to the SG outlet plenum.

The limiting break configuration for the cold leg pump suction break scenarios included a split break with minimum available safety injection and no postulated LOOP. Figure 6.2.1-14 through Figure 6.2.1-17 provide the pressure and temperature results for the most limiting cold leg pump suction scenarios. The initial enthalpy of the break is lower for a cold leg pump suction break because of the location of the break; the energy addition rate starts off more slowly. However, the blowdown is longer due to the location of the break. Further, more fluid will traverse the SGs to get to the break than for the hot leg break due to the break location. At the end of blowdown, the transit time and path will allow slightly more mass and energy into containment. However, the containment heat sinks will have additional time to absorb this energy. As a result, the peak containment pressure predicted during blowdown is less than that predicted for a hot leg break.

After blowdown, the accumulators and pumped safety injection begin to quench the core, removing its stored energy. As the quench front builds, the break effluent stabilizes, allowing the containment heat sinks time to absorb the energy in containment and reduce the pressure. The core steaming rate will eventually increase, increasing the steam mass flow rate through the break. As the steam from the core traverses the SG, additional energy will be added. As a result, the energy content of the break effluent increases beyond the capacity of the containment heat structures and the containment pressure begins to rise again. The break energy will decrease as the core residual heat decays, and the SIS slowly starts to suppress the core boiling rate

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or the SG secondary temperature reaches equilibrium with the RCS fluid temperature. In either case, the steam energy should be near saturation.

A number of cases showed that once the accumulators have emptied, the break flow initially exceeds the minimum pumped safety injection. As a result, the liquid volume in the reactor vessel (RV) decreases in the short term. During this time, the core is cooled by a mixture of steam and liquid. At some point, the volume of liquid in the RV decreases until it can no longer maintain the quench front. Consequently, steam production in the core will cease, and the decay heat will begin to heat up the fuel and cladding instead of producing steam. The end result is that there is no steam to expel to containment and the containment pressure will begin to decrease.

A break in the cold leg pump discharge piping produces the lowest peak containment pressure, although the pipe area of the cold leg pump discharge is the same as the cold leg pump suction piping and the blowdown phase will be similar in duration and produce similar containment pressure response. During the refill and reflood phases of the cold leg pump discharge event, the SIS pump flow injects into the cold leg pump discharge piping and out the break. Steam exiting the break from the RV side condenses because of the lower temperature from the SIS liquid, and the break effluent is in a saturated condition. For this break configuration, the SIS flow from the MHSI pump and the accumulator in the broken loop exit directly to the containment. With the reduced SIS inventory, the core reflooding rate will be reduced and the effluent quantity through the cold leg pump discharge is similar to that predicted for the cold leg pump suction break. The reduced SIS flow will reduce the mass flowrate through the break, and as a result, the total break energy delivered to the containment. Therefore, the cold leg pump discharge break will result in the lowest containment pressure.

The limiting break configuration for the cold leg pump discharge break scenarios included a split break with minimum available SIS and no postulated LOOP. Figure 6.2.1-18 through Figure 6.2.1-21 provide the pressure and temperature results for the most limiting cold leg pump discharge scenarios.

Subsequent to blowdown, the containment pressure for all the cases continuously decreases without a large variation among the cases. In all cases, the downcomer has formed a liquid seal so that all of the steam generated in the core must traverse the hot legs and the SGs on the way to the break. The steam that goes through the intact loop must pass pumped injection locations on the way to the RV downcomer and through the break. As a result of the condensation on the safety injection fluid, the effluent through the RV side of the break has a low enthalpy. Because there are no condensation sources on the way, the steam that goes through the broken loop to the break will be superheated.

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The U.S. EPR LOCA analyses examine a spectrum of breaks and include variations in the SIS flow, offsite power availability, and pipe break size and configuration. In addition, sensitivity studies were performed to determine the appropriate containment pressure boundary condition for the mass and energy release analysis.

6.2.1.3.1 Mass and Energy Release Data

Blowdown mass and energy release data are presented in Table 6.2.1-18 through Table 6.2.1-20 for the three break locations analyzed. These data represent the limiting configuration with respect to SIS flow, offsite power availability, and containment pressure.

To maximize the containment peak pressure and temperature, the U.S. EPR LOCA analyses use conservative assumptions that maximize the mass and energy released from the RCS to the containment atmosphere. These assumptions maximize the primary system inventory and the heat into the RCS, and also maximize transfer of mass and energy into the containment. To achieve these conservative assumptions, the computer models:

- Maximize the initial reactor power level.
- Maximize the pressurizer volume (thereby increasing primary system inventory).
- Minimize the rate of power decrease.
- Maximize the reactor decay heat.
- Maximize the heat transfer from the secondary system into the primary system.

Table 6.2.1-21—Input Summary for Mass and Energy Release, provides a summary of the initial conditions for the calculation of the mass and energy release.

The blowdown phase mass and energy release rates are calculated by the thermal-hydraulic analysis code, RELAP5/MOD2-B&W. The NRC has reviewed and approved this code as meeting the requirements of 10 CFR 50, Appendix K for pressurized water reactors with recirculating SGs. These 10 CFR 50, Appendix K methods limit the energy transfer from the fuel elements to the RCS fluid to maximize the cladding temperature. While this approach is appropriate for analyses pursuant to 10 CFR 50.46, it is not sufficient for the calculation of mass and energy release rates for containment analyses. Therefore, the method is modified to maximize core heat removal to maximize the containment temperature and pressure response following a LOCA. This adjustment of the method from the 10 CFR 50, Appendix K requirements is consistent with NUREG-0800 and ANSI/ANS-56.4. This adjusted model is used to calculate the mass and energy released to containment from the beginning of the long-term cooling phase, or time of core quench.

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Post-reflood mass and energy release rates are referred to as long-term LOCA and are determined by the GOTHIC Version 7.2 computer code, as presented in Section 6.2.1.1.3, using the model described in Section 6.2.1.3.4.

6.2.1.3.2 Energy Sources

The sources of stored and generated energy used in the LOCA analyses include:

- Reactor power.
- Decay heat.
- Stored energy in the core.
- Stored energy in the RCS fluid and metal, including the reactor vessel and internals.
- Metal-water reaction energy.
- Stored energy in the secondary system, including the SG tubing and secondary water.

The initial reactor power level for the analyses is the RTP level plus an appropriate calorimetric uncertainty. Reactivity components are chosen to provide a conservative insertion of negative reactivity. An appropriate initial stored energy in the core is obtained by using a conservatively high initial fuel temperature. The RCS metal is modeled accurately with respect to its size, location, and composition. The SG secondary side metal mass that is in contact with RCS fluid is also explicitly modeled, and the code includes appropriate computation of the heat transfer across the SG tubes. The energy addition due to the metal-water reaction is calculated based on the same correlation (Baker-Just) specified in the approved 10 CFR 50 Appendix K method.

6.2.1.3.3 Description of Blowdown Model

A description of the RELAP5/MOD2-B&W model used to determine the mass and energy released from the RCS during the blowdown phase of a postulated LOCA is provided in BWNT Loss-of-Coolant Accident Evaluation Model for Recirculating Steam Generator Plants (Reference 2) and RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis (Reference 3). All significant correlations are discussed in these reports.

6.2.1.3.4 Description of Long-Term Cooling Model

Long-term mass and energy release rates are determined by the GOTHIC Version 7.2 computer code, as described in Section 6.2.1.1.3. The long-term energy release rates for RCS metal and SG metal were modeled by the code as multiple heater components

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and as coupled boundary conditions. The long-term RELAP5/MOD2-B&W transients are analyzed to produce mass and energy releases following a LOCA. These transients are terminated at between 5000 and 10,000 seconds, depending upon the break location. During the event, the core is quenched, and the MHSI flow removes decay heat from the reactor. To continue the mass and energy release calculation for the long term, data obtained from the RELAP5/MOD2-B&W analysis is provided for each long-term case. The following information about the RCS primary and second systems at the end of these transients is included in the calculation of the long-term mass and energy release rates.

The RCS primary side metal stored energy relative to 32°F, including the metal in the pressurizer and SG tubes.

- The stored energy content of the core relative to 32°F.
- The secondary side metal stored energy relative to 32°F.
- The RCS primary side fluid mass and internal energy, including the pressurizer.
- The secondary side fluid mass and internal energy, from feedwater inlet to the exit of the steam from the SG.
- The SIS injection flow and enthalpy.
- The RCS pressure, the average temperature for the vapor and liquid, and the final liquid-to-volume fraction.
- The mass flow of the SIS.

6.2.1.3.5 Single Failure Analysis

The effect of single failures of various SIS/RHR system components on the mass and energy releases is included in these analyses. No single failure is assumed in determining the mass and energy releases for the maximum safeguards case. For the minimum safeguards case, the single failure assumed is the loss of one emergency diesel generator that results the loss of one complete train of ESF equipment including the loss of one safety injection train. The analysis of both maximum and minimum safeguards cases bounds the effects of credible single failures.

6.2.1.3.6 Metal-Water Reaction

The exothermic metal-water reaction is calculated using the Baker-Just correlation, as specified in 10 CFR 50, Appendix K.

6.2.1.3.7 Energy Inventories

Inventories of the energy transferred from the primary and secondary systems to the containment, as well as the energy remaining in the primary and secondary systems,

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are provided in Table 6.2.1-23, Table 6.2.1-24, and Table 6.2.1-25 for the three break locations analyzed.

6.2.1.3.8 Additional Information Required for Confirmatory Analysis

System parameters and hydraulic characteristics needed to perform confirmatory analysis are provided in Table 6.2.1-21 and Figure 6.2.1-22 through Figure 6.2.1-33.

6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary Pipe Ruptures inside Containment

Steam line ruptures inside a reactor containment structure may result in significant releases of high energy fluid to the containment environment, producing high containment temperatures and pressures. The mass and energy release following a MSLB depends upon the configuration of the plant's main steam system, the containment design, the plant operating conditions, and the size of the pipe rupture. This section describes the methods used to determine the containment response to these conditions.

Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB lists the scenarios analyzed to determine the limiting case (i.e., highest containment pressures and temperatures) following a MSLB. The scenarios assume a single active failure of one MSIV. The main feedwater (MFW) system includes redundant isolation valves, which preclude an over feeding failure. In all the scenarios, isolation of the MFW system uses the longest delay time and the slowest isolation valve as allowed by NUREG-0588 (Reference 4) model analysis. These scenarios use an eight percent re-vaporization fraction combined with the Uchida heat transfer correlation.

Containment pressure and temperature response to a MSLB depends upon the amount of break effluent that enters the containment atmosphere as steam, and whether that steam is at saturated or superheated conditions. During the depressurization of the SG, there are two phenomena that could reduce the steam contribution by forcing liquid effluent into the containment. The first is the entrainment of liquid drops that are swept out the break because of the high steam velocities. The second is the rapid voiding of the SG that causes a liquid level swell that extends to the break location, and that allows the discharge of saturated liquid. This swelling of liquid level to the steam outlet nozzle and subsequent discharge at the break, is caused by void formation or flashing in the liquid regions of the SG.

The containment response analyses are based on mass and energy released from the MSLB and includes the effects of superheated steam. Smaller breaks require an iterative process for determining the reactor protection system response time to execute a reactor trip signal. The analytical trip setpoint for the ESF actuation system for containment pressure is 4.0 psig plus an additional 0.5 psig uncertainty. An

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additional 1.0 second delay for the high containment pressure signal applies to all breaks, so that the time required for the reactor trip is conservative.

6.2.1.4.1 Significant Parameters Affecting Steam Line Break Mass and Energy Releases

A number of important system design, plant operation, and rupture event parameters affect the containment response to secondary side events. For each of these, there are four major factors that influence the mass and energy release following a MSLB:

- SG fluid inventory.
- Primary-to-secondary heat transfer.
- Protective system operation.
- Steady state secondary system fluid blowdown.

These factors are addressed in the following descriptions of how the important plant parameters impact containment response to secondary side rupture events.

6.2.1.4.1.1 Plant Power Level

MSLBs are postulated to occur in the plant in operating conditions ranging from hot zero power (HZP) to 100 percent RTP. The mass of water in the SG decreases with increasing power level. Therefore, an MSLB occurring at a low power level would be expected to produce a greater total mass release to the containment than one occurring at 100 percent RTP. However, because of greater primary system stored energy, increased heat transfer in the SGs, and the additional energy generation in the nuclear fuel, the energy released to the containment from postulated breaks that occur during power operation may be greater than the energy released with the plant at HZP. Additionally, steam pressure and the dynamic conditions in the SGs change with increasing power, and these have significant influence on both the blowdown rate and the amount of moisture entrained in the fluid that exits during the MSLB sequence. Because of these opposing effects of power level on mass and energy release, no single power level will be the limiting condition for MSLB events. Therefore, HZP and power levels spanning the operating range have been analyzed.

6.2.1.4.1.2 Main Feedwater System Design

The rapid depressurization following a MSLB can cause a large volume of water to be added to the SGs by the MFW system. Therefore, the MFW lines have isolation valves that can rapidly close to limit feedwater addition during the event. The MFW piping layout downstream of these isolation valves impacts the event because it affects the volume in the feedwater piping that would enter SGs. As the SG pressure decreases, the fluid in this MFW piping flashes into steam and provides additional secondary

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fluid to exit the rupture. The feedwater volume and duration of flow can influence the SG blowdown in three ways:

- The rapid addition increases the amount of entrained water in large break cases by lowering the bulk quality of the SG inventory.
- The water entering the SG is subcooled, and it decreases the steam pressure reducing the flowrate out of the break.
- The increased flow causes an increase in the heat transfer rate from the primary-to-secondary system, resulting in greater energy release out the break.

These are competing effects on the total mass and energy release during a MSLB, so bounding conditions are provided in all MSLB scenarios. During periods of predicted entrainment (i.e., the entrainment of water and steam exiting the rupture), the break energy is set to the energy of saturated steam. The MFW system includes isolation valves and control valves, which close upon receipt of an isolation signal, terminating MFW flow. The MSLB analysis examines the single failure of a MFW isolation valve, a MFW control valve, failure of the MFW pumps to trip, and the failure of an MSIV, in order to determine the most limiting scenario.

6.2.1.4.1.3 Emergency Feedwater System Design

Actuation of the emergency feedwater system (EFWS) during an MSLB increases the SG mass available for release to containment. The temperature of the emergency feedwater is low compared to the temperature of the SG inventory. The EFWS water addition cools the SG inventory and decreases the enthalpy of the break flow, but at the same time the EFWS water absorbs heat from the SG tubes and other metal structures. This latter process provides an additional transport mechanism for that energy to the containment, and the net effect of the emergency feedwater actuation is to increase the containment peak temperature and pressure. Because of these competing phenomena, the overall effect of the EFWS on the MSLB containment response is minimal.

Emergency feedwater can be initiated by either low SG level or a safety injection signal coincident with a LOOP signal. However, the LOOP is incredible during this event, so in the MSLB analysis, the emergency feedwater actuation can only occur on low SG level. The MSLB analysis model does not consider SG level, so emergency feedwater activation is conservatively assumed to occur coincident with reactor trip. Upon activation, the time required for the EFW pump to reach full flow is conservatively modeled as 1 second, at which time full EFW flow is delivered to the SG.

Emergency feedwater flow depends on the discharge pressure. However, MSLB analysis does not consider this, so the analysis assumes the highest possible flow to the affected SG.

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The emergency feedwater system isolates on high level in the SG. Since SG level is not modeled, isolation of the emergency feedwater is assumed to occur by operator action 30 minutes after the start of the event. The MSLB transient simulation proceeds until peak containment pressure and temperature occurs, and this occurs within 30 minutes. Therefore, MSLB analysis assumes emergency feedwater flow for the duration of the event.

6.2.1.4.1.4 Postulated Break Size, Type, and Location

The postulated break area is important when evaluating MSLBs because it controls the rate of the releases to the containment, it exerts significant influence on the steam pressure decay, and it impacts the entrainment of water in the blowdown flow.

Releases are analyzed for four MSL breaks: the double-ended guillotine break and break sizes of 1.0, 0.7 and 0.5 square feet in area. The resulting containment pressure decreases with the break size. Each of the breaks sizes are analyzed at five power levels.

Each SG is equipped with a flow limiting orifice that limits the effective area for the MSLB. Following the isolation of the SG with the broken line, the effective break area can be no greater than the flow restrictor throat area of 1.4 square feet.

The largest double-ended guillotine break, for which the steam pipe is completely severed, is limited by the throat area of the SG flow restrictor. This type of break influences the mass and energy releases to containment by altering both the nature of the steam blowdown from the piping of the SG and the effective break area fed by each SG prior to steam line isolation.

Break location affects steam line blowdown by virtue of the pressure losses that occur in the length of piping between the SG and the break location. The effect of the pressure loss is to reduce the effective break area seen by the SG. This would reduce the rate of blowdown, but it would not significantly change the total release of energy to the containment. Therefore, piping loss effects have been ignored in all blowdown analyses.

6.2.1.4.1.5 Availability of Offsite Power

The U.S. EPR does not have a containment spray system or containment fan coolers as part of the engineered safety features that would be delayed if there was a LOOP. Therefore, offsite power is assumed to be available, and the mass and energy released from the break are maximized due to continued operation of the reactor coolant pumps. The energy transferred from the reactor coolant system to the SGs, with continued operation of the MFW and EFW pumps, maximizes the SG inventories available for release to containment.

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6.2.1.4.1.6 Safety System Failures

The most severe single active failure is the failure of a MSIV. An MSIV failure would provide additional fluid that could be released to the containment via the break. This fluid comes from the blowdown of all the steam piping between the break location and the isolation valves in the intact loops.

6.2.1.4.1.7 Steam Generator Reverse Heat Transfer and Reactor Coolant System Metal Heat Capacity

Following isolation of the intact SGs, energy is transferred to the containment building via the primary coolant. As the steam from the SG enters containment, the reduction in secondary side pressure creates a cooling effect on the primary system. Heat transfer occurs as the temperature of the primary coolant flowing in the SG tubes falls below the bulk temperature of the intact SGs. With an MSLB, this energy is then available to be transferred to the SG.

Similarly, the sensible heat of primary system heated structures must be considered, including the:

- Reactor coolant piping.
- Reactor pressure vessel.
- Reactor coolant pumps.

Heat from these components will be transferred to the primary coolant as cooldown progresses; during an MSLB, this energy is available to be transferred to the SGs. The effects of both the reactor coolant system metal and the reverse SG heat transfer are included in the results presented in containment response analysis.

6.2.1.4.2 Description of Blowdown Model

A description of the RELAP5/MOD2-B&W model used to determine the mass and energy released during the blowdown phase of a postulated MSLB is provided in B&W Safety Analysis Methodology for Recirculating Steam Generator Plants (Reference 5) and the RELAP5 Topical Report (Reference 3). All significant conditions are discussed in these reports.

6.2.1.4.3 Containment Response Analysis

The containment response to postulated MSLBs was analyzed with GOTHIC Version 7.2 (see Section 6.2.1.1.3). The containment model was developed in accordance with the Containment Response Topical Report (Reference 1).

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6.2.1.4.3.1 Initial Conditions

The initial conditions used in the GOTHIC model are addressed in Section 6.2.1.1.3.

6.2.1.4.3.2 Mass and Energy Release Data

Table 6.2.1-22—MSLB Mass and Energy Release Data, present the mass and energy release data used to determine the containment pressure and temperature responses for the limiting MSLB, a double-ended guillotine break of the main steam line at 50 percent RTP concurrent with the single active failure of a single MSIV.

Feedwater isolation for the full and partial double-ended guillotine breaks depends on signals generated by the ESF instrumentation. The feedwater flow rates used in the analyses credited the longest isolation valve stroke time of 40 seconds. Valve leakage is not considered in the analyses as it is bounded by the emergency feedwater injection.

6.2.1.4.3.3 Containment Pressure and Temperature Results

Figure 6.2.1-34 and Figure 6.2.1-35 provide the pressure and temperature results for the most limiting MSLB scenario. Table 6.2.1-9 summarizes the results of all the cases analyzed.

The worst single active failure in the MSLB is the loss of one MSIV. Because the U.S. EPR includes redundant safety-grade feedwater isolation valves, the failure of the main feedwater isolation valve was not specifically analyzed. However, as an additional conservatism, the MFIV valve with the longest stroke time is credited for isolation. ~~The additional feedwater that would be released following isolation of the feedwater system was not explicitly modeled.~~ Full feedwater flow is credited from the beginning of the transient until the isolation valve is fully closed. ~~The volume of water in the feedwater pipe is considered small and does not significantly affect the pressure and temperature response of the containment.~~

The RELAP5 model used for this purpose includes a partial representation of the main feedwater system. The piping downstream of the control and isolation valves is included in the RELAP5 model. Some, but not all, of the piping upstream of the control and isolation valves is explicitly modeled. Consistent with the description in Section 6.2.1.4.1.2, this model allows injection of additional feedwater into the steam generator due to flashing or swelling of the water contained in the unisolated section of the main feedwater piping.

The loss of one MSIV has been assumed for the spectrum of break sizes and power levels analyzed. As illustrated in Table 6.2.1-9, a full double-ended guillotine break of the main steam line at 50 percent RTP results in a peak pressure of 54.14 psig. This case represents the peak calculated containment pressure for the spectrum of breaks analyzed.

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For the spectrum of breaks analyzed, the calculated containment vapor temperature for some cases exceeds the specified containment design temperature of 338°F for a short period of time. While the analyses show the vapor space is superheated the containment walls and structures certainly are not. The primary mode of heat transfer during this time period is condensation on the building surfaces. Therefore, the building surface temperature will be no greater than the saturation temperature at building design pressure of 62 psig, or 309.1°F. Figure 6.2.1-35 shows that the analysis predicts that the containment vapor temperature remains above the design temperature for less than two minutes.

6.2.1.5 Minimum Containment Pressure Analysis for Performance Capability Studies of Emergency Core Cooling System

6.2.1.5.1 Mass and Energy Release Data

Containment pressure calculations are performed by the ICECON module within S-RELAP5 code. ICECON is a variant to the CONTEMPT containment code series. The RLBLOCA methodology treats containment pressure as a statistically varied parameter with a random sampling of the containment volume. The tabular mass and energy release data are not explicitly generated because they are part of the internal code calculations at each time step. The mathematical models that calculate the mass and energy releases to the containment are described in Section 15.6 and conform to the realistic ECCS evaluation models of ~~10 CFR 50, Appendix K~~10 CFR 50.46(a)(1)(i).

6.2.1.5.2 Initial Containment Internal Conditions

The initial values for the containment conditions are representative of 100 percent rated thermal power, and are a pressure of 14.7 psia and temperature of 59°F. The outside atmospheric temperature of 20°F and relative humidity of 100 percent are assumed and modeled within the ICECON module, which also assumes an outside atmospheric temperature of 20°F and a relative humidity of 100 percent. Inside the containment, the IRWST water temperature is expected to be at the containment temperature of ~~approximately 60~~59°F, but could range as high as 122°F, which is the Technical Specification maximum value for IRWST temperature. The RLBLOCA methodology uses the value of 122°F.

6.2.1.5.3 Other Parameters

The containment pressure varies and the RLBLOCA methodology determines it by sampling the containment volume. The nominal or best-estimate value of the containment volume is 2.888×10^6 ft^3. The upper estimate value for the containment volume is 3.645×10^6 ft^3 and represents the empty volume of the containment dome and cylinder and also neglects the volume displaced by the internal walls and structures. This latter value is conservative because a lower containment backpressure results in the highest calculated peak cladding temperature.

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Heat transfer between the IRWST water and containment vapor is treated in a conservative manner. First, the IRWST is assumed to be well mixed so the liquid temperature at the interface between the IRWST water and the containment vapor space is the bulk liquid temperature. This neglects heating of the surface water and maximizes the temperature differential for heat transfer. Second, structures that reduce the exposed surface of the IRWST are neglected. Other simplifications are included that effectively double the IRWST surface area available for heat transfer. Water spillage rates from the accumulator in the broken loop are determined as part of the core reflooding calculation, and are included in the containment code calculational model. The passive heat sinks and thermo-physical properties were derived in accordance with Branch Technical Position 6-2, "Minimum Containment Pressure Model for PWR ECCS Performance Evaluation."

6.2.1.6 Tests and Inspections

Refer to Section 3.8.1.7 and Section 3.8.2.7 for testing and inspection requirements for the containment structure. Refer to Section 6.2.6 for the containment leakage rate testing program, and Section 6.6 for inservice inspection of ASME Class 2 and 3 components. Containment testing and inspections are also included in the Technical Specifications (Chapter 16).

6.2.1.7 Instrumentation Requirements

Refer to Section 7.3 for engineered safety features instrumentation. Refer to Section 12.3.4 for radiation monitoring instrumentation.

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Table 6.2.1-1—Loss of Coolant Accidents
Sheet 1 of 2

Case	Break Location	Break Type	Cd	Single Failure	ECCS	Offsite Power Configuration	Back Pressure
1	Hot Leg	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia
2	Hot Leg	DEG	[illegible]	1 Train ECCS	Min	LOOP	60 psia
3	Hot Leg	[illegible]	1.0	1 Train ECCS	Min	No LOOP	60 psia
4	Hot Leg	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
5	Hot Leg	DEG	0.8	1 Train ECCS	Min	LOOP	60 psia
6	Hot Leg	DEG	0.6	1 Train ECCS	Min	LOOP	60 psia
7	Hot Leg	Split	0.8	1 Train ECCS	Min	LOOP	60 psia
7A	Hot Leg	DEG	1.0	1 Train ECCS	Min	LOOP	14.7 psia
7C	Hot Leg	Split	1.0	1 Train ECCS	Min	LOOP	14.7 psia
8	Pump Suction	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia
9	Pump Suction	DEG	1.0	1 Train ECCS	Min	LOOP	60 psia
10	Pump Suction	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
10B	Pump Suction	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
11	Pump Suction	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
12	Pump Suction	DEG	0.8	1 Train ECCS	Min	No LOOP	60 psia
13	Pump Suction	DEG	0.6	1 Train ECCS	Min	No LOOP	60 psia
14	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
14B	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	14.7 psia
14C	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	76.7 psia
14D [1]	Pump Suction	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
14E	Pump Suction	Split	1.0	1 Train ECCS	Min	No LOOP	14.7 psia
15	Pump Discharge	DEG	1.0	SIS/RHR Heat Exchangers	Max	LOOP	60 psia

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Table 6.2.1-1—Loss of Coolant Accidents
Sheet 2 of 2

Case	Break Location	Break Type[7]	Cd	Single Failure	ECCS	Offsite Power Configuration	Back Pressure
16	Pump Discharge	DEG	1.0	1 Train ECCS	Min	LOOP	60 psia
17	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
18	Pump Discharge	DEG	1.0	SIS/RHR Heat Exchangers	Max	No LOOP	60 psia
19 [2]	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
20 [3]	Pump Discharge	DEG	1.0	1 Train ECCS	Min	No LOOP	60 psia
21	Pump Discharge	DEG	0.8	1 Train ECCS	Min	No LOOP	60 psia
22	Pump Discharge	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
23	Pump Discharge	Split	0.8	1 Train ECCS	Min	No LOOP	60 psia
24	Pump Discharge	DEG	0.6	1 Train ECCS	Min	No LOOP	60 psia
25	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
26	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	14.7 psia
27	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	76.7 psia
28 [1]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
29 [4]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
30 [5]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia
31 [6]	Pump Discharge	Split	1.0	1 Train ECCS	Min	No LOOP	60 psia

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Notes:

1. Increased IRWST Temperature to 248°F.
2. Based on Case 17 with the percentage of LHSI to the intact loop to be 0%.
3. Based on Case 17 with the percentage of LHSI to the intact loop to be 25%.

4. Based on Case 25 with instantaneous feedwater isolation.

5. Long-Term LOCA Run Based on Case 25.

6. Increased IRWST temperature to 170°F.

7. DEG = double-ended guillotine.

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Table 6.2.1-2—Main Steam Line Breaks

Case	Power Level (RTP)	Break Type[1]	Size	Single Failure	Offsite Power Configuration
1	100%	DEG	1.4 ft^2	MSIV	Available
2	100%	Split	1.0 ft^2	MSIV	Available
3	100%	Split	0.7 ft^2	MSIV	Available
4	100%	Split	0.5 ft^2	MSIV	Available
5	80%	DEG	1.4 ft^2	MSIV	Available
6	80%	Split	1.0 ft^2	MSIV	Available
7	80%	Split	0.7 ft^2	MSIV	Available
8	80%	Split	0.5 ft^2	MSIV	Available
9	50%	DEG	1.4 ft^2	MSIV	Available
10	50%	Split	1.0 ft^2	MSIV	Available
11	50%	Split	0.7 ft^2	MSIV	Available
12	50%	Split	0.5 ft^2	MSIV	Available
13	20%	DEG	1.4 ft^2	MSIV	Available
14	20%	Split	1.0 ft^2	MSIV	Available
15	20%	Split	0.7 ft^2	MSIV	Available
16	20%	Split	0.5 ft^2	MSIV	Available
17	HZP	DEG	1.4 ft^2	MSIV	Available
18	HZP	Split	1.0 ft^2	MSIV	Available
19	HZP	Split	0.7 ft^2	MSIV	Available
20	HZP	Split	0.5 ft^2	MSIV	Available

Notes:

1. DEG = double-ended guillotine.

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Table 6.2.1-3—LHSI Heat Exchanger Data

Parameter	Nominal	
No. of shell side passes	1	
Number of tube side passes	1 (U-Tube Design)	
No. of tubes	1088	
Tube material	Austenitic steel (stainless steel)	
Tube thickness	0.04 in	1.016 mm
Total tube side flow area	1.311 ft²	0.1218 m²
Tube internal diameter	0.47 in	11.9 mm
Tube outer diameter	0.55 in	139.97 mm
Shell outer diameter	3.9 ft	1.1887 m
Shell wall thickness	0.71 in	18.034 mm
Tube side fouling resistance	1.70 x 10^{-4} (ft²-hr-°F/BTU) 30 x 10^{-6} (m2-°K/W)	
Shell side fouling resistance	2.[illegible] x 10^{-4} (ft²-hr-°F/BTU) 50 x 10^{-6} (m²-°K/W)	
	Trains 1 & 4	**Trains 2 & 3**
CCW flow rate at inlet of RHRS heat exchanger	82[illegible]9 lb_m/s 76 Kg/s	608.5 lb_m/s 276 Kg/s
CCW temperature at inlet of RHRS heat exchanger	104°F 40°C	91.4°F 33°C
Total tube side surface area (total inside surface area of tubes)	4751.5 ft² 441.4 m²	5203.8 ft² 483.4 m²
Total shell side surface area (total outside surface area of tubes)	5560.3 ft² 516.6 m²	6089.6 ft² 565.7 m²
Overall heat transfer coefficient	444.9 (BTU/ft²-hr-°F) 2526.1 (W/m²-°K)	406.2 (BTU/ft²-hr-°F) 2306. 5 (W/m²-°K)

Table 6.2.1-4—Containment Initial and Boundary Conditions

Item	Parameter	Analytical Value	
1	Containment Free Volume	2,754,237 ft³ 78,000 m³	
2	Initial IRWST Water Volume	50,996 ft³ 1444 m³	
3	Initial IRWST Water Temperature	122°F 50°C	
4	Initial Containment Pressure	15.96 psia 1.1 bar	
5	Initial Containment Temperature	**Service Compartments**	**Equipment Compartments**
		86°F 30°C	131°F 55°C
6	Initial Relative Humidity	30%	
7	Outside or Ambient Temperature	Insulated boundary condition to maximize containment temperature and pressure	

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Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 1 of 22

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
	Containment Wall with Steel Line	0.0002	0	0.006	0.003	1.222	9177
1	Access to RB annulus	0.0002	0	0.006	0.003	1.306	77.56
2	Lower annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	151.24
3	Lower annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	151.24
4	Hot piping to RB annulus	0.0002	0	0.006	0.003	1.306	178.38
5	Middle annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	1140.81
6	Middle annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.3055	1269.38
7	Access to RB annulus	0.0002	0	0.006	0.003	1.306	65.95
8	Middle annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	130.42
9	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	517.31
10	Upper annulus rooms L1 & 2 to RB annulus	0.0002	0	0.006	0.003	1.306	330.64
11	Upper annulus rooms L3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.306	330.64
12	Staircase (south) to RB annulus	0.0002	0	0.006	0.003	1.306	43.7
13	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1.3	2309.5
14	Lower & upper dome L1, 2, 3 & 4 to RB annulus	0.0002	0	0.006	0.003	1	2480
	IRWST Vertical Wall (in contact with IRWST)	0	0	0.004	0	1.404	669
1	Spreading rooms to IRWST	0	0	0.004	0	1.2	42.06
2	IRWST to SG blowdown (LCQ) HX etc.	0	0	0.004	0	0.3	19.66
3	IRWST to components	0	0	0.004	0	0.8	37.96
4	IRWST to elevator	0	0	0.004	0	0.74	2.08
5	IRWST to lower annulus rooms L1 & 2	0	0	0.004	0	1.5	560

Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 2 of 22

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
6	IRWST to hot piping	0	0	0.004	0	1.5	6.88
	IRWST Vertical Wall (to Containment Atmosphere)	0.0004	0	0	0	1.404	669
1	Spreading rooms to IRWST	0.0004	0	0	0	1.2	42.06
2	IRWST to SG blowdown (LCQ) HX etc.	0.0004	0	0	0	0.3	19.66
3	IRWST to components	0.0004	0	0	0	0.8	37.96
4	IRWST to elevator	0.0004	0	0	0	0.74	2.08
5	IRWST to lower annulus rooms L1 & L2	0.0004	0	0	0	1.5	560
6	IRWST to hot piping	0.004	0	0	0	1.5	6.88
	IRWST horizontal wall (~~floor/ceiling~~Heavy Floor)	~~0~~0.00	0	~~0.004~~0	0	1.434	547
1	IRWST to SG blowdown (LCQ) HX etc.	~~0~~0.001	0	~~0.004~~0	0	1	64.64
2	IRWST to components	~~0~~0.001	0	~~0.004~~0	0	0.8	46.56
3	IRWST to lower equipment rooms L1	~~0~~0.001	0	~~0.004~~0	0	1.5	78.8
4	IRWST to lower equipment rooms L2	~~0~~0.001	0	~~0.004~~	0	1.5	139.2
5	IRWST to lower equipment rooms L3	~~0~~0.001	0	~~0.004~~0	0	1.5	139.2
6	IRWST to lower equipment rooms L4	~~0~~0.001	0	~~0.004~~0	0	1.5	78.8
	IRWST Horizontal Wall (IRWST Ceiling)	0	0	0.004	0	1.5	436
1	IRWST to lower equipment rooms L1	0	0	0.004	0	1.5	78.8
2	IRWST to lower equipment rooms L2	0	0	0.004	0	1.5	139.2
3	IRWST to lower equipment rooms L3	0	0	0.004	0	1.5	139.2
4	IRWST to lower equipment rooms L4	0	0	0.004	0	1.5	78.8
	IRWST Basemat	0	0	0.004	0	4	590

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
1	IRWST to ground	0	0	0.004	0	4	590
	Building Basemat (Including IRWST)	0.001	0	0	0	4.0	720
1	Spreading rooms to ground	0.001	0	0	0	4.0	175
2	Access area to ground	0.001	0	0	0	4.0	80
3	SIS pipe penetrations to ground (To SB 1&2)	0.001	0	0	0	4.0	144
4	SIS pipe penetrations to ground (To SB 3&4)	0.001	0	0	0	4.0	142
5	Fuel Building penetrations to ground	0.001	0	0	0	4.0	172
6	Elevator shaft penetrations to ground	0.001	0	0	0	4.0	6.72
	Vertical wall to accessible space	0.0004	0	0	0	0.39	8342
1	access to elevator	0.0004	0	0	0	0.1	52.34
2	lower annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	12.54
3	lower annulus rooms L1 & 2 to access	0.0004	0	0	0	0.1	14.08
4	lower annulus rooms L3 & 4 to access	0.0004	0	0	0	0.1	27.56
5	lower annulus rooms L1 & 2 to hot piping	0.0004	0	0	0	0.15	20.8
6	lower annulus rooms L3 & 4 to hot piping	0.0004	0	0	0	0.15	20.8
7	middle annulus rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.15	362.82
8	middle annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	178.94
9	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.1322	186.96
10	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.25	190.24
11	middle annulus rooms L1 & 2 to access	0.0004	0	0	0	0.1	17.8
12	middle annulus rooms L3 & 4 to access	0.0004	0	0	0	0.1	16.38
13	Internal wall in middle annulus rooms L3 & 4	0.0004	0	0	0	0.25	203.96

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
14	middle annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.15	229.12
15	middle annulus rooms L3 & 4 to staircase (north)	0.0004	0	0	0	0.15	223.08
16	middle annulus rooms L1 & 2 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.7132	365.38
17	Internal wall in middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	28.28
18	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.755	47.6
19	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4443	105.12
20	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.7	156.32
21	middle annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.5	25.2
22	middle annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.5	102.74
23	Internal wall in middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	35.3
24	middle annulus rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	350.76
25	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.15	80.34
26	upper annulus rooms L3 & 4 to staircase (north)	0.0004	0	0	0	0.15	110.26
27	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.5	16.32
28	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.1	123.1
29	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.5	13.68
30	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.65	14.4
31	lower & upper dome L1, 2, 3 & 4 to staircase (south)	0.0004	0	0	0	0.15	58.22

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Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 5 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
32	Internal wall in upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	14.04
33	upper annulus rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.15	29.62
34	upper annulus rooms L3 & 4 lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.5	31.48
35	Internal wall in upper annulus rooms L3 & 4	0.0004	0	0	0	0.15	200.28
36	Internal wall in lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.44115	541.32
37	upper annulus rooms L1 & 2 to staircase (north)	0.0004	0	0	0	0.25	29.92
38	upper annulus rooms L1 & 2 to elevator	0.0004	0	0	0	0.25	25.08
39	Internal wall in upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	37.68
40	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	26.04
41	SG blowdown (LCQ) HX etc. to elevator	0.0004	0	0	0	0.4	8.32
42	SG blowdown (LCQ) HX etc. to access	0.0004	0	0	0	0.1	37.19
43	SG blowdown (LCQ) HX etc. to lower annulus rooms L1 & 2	0.0004	0	0	0	0.4	5.02
44	SG blowdown (LCQ) HX etc. to lower annulus rooms L3 & 4	0.0004	0	0	0	0.15	5.12
45	Components to hot piping	0.0004	0	0	0	0.5	77.08
46	Components to hot piping	0.0004	0	0	0	0.15	9.28
47	lower equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	60.19
48	lower equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	178.12
49	lower equipment rooms L1 to components	0.0004	0	0	0	0.2742	30.19

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Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 6 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
50	lower equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	174.71
51	lower equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	177.35
52	lower equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	201.09
53	surge line, below to elevator	0.0004	0	0	0	0.4779	44.6
54	Components to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	35.02
55	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	12.46
56	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.43975	9.11
57	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.3	6.76
58	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.4	33.44
59	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.15	17.01
60	surge line, below to access	0.0004	0	0	0	0.4	48.55
61	reactor cavity to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	42.23
62	surge line, below to staircase (north)	0.0004	0	0	0	0.6	28.68
63	surge line, below to elevator	0.0004	0	0	0	0.6	12.12
64	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	14.14
65	reactor cavity to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	16.8
66	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	23.04
67	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	56.65
68	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	114.61

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Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
69	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	128.02
70	middle equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	157.44
71	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	138.92
72	surge line, below to staircase (north)	0.0004	0	0	0	0.5	34.46
73	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	29.64
74	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.275	42.08
75	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	26.3
76	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.15	8.4
77	PZR to staircase (north)	0.0004		0	0	0.5	39.12
78	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0		0	0.10695	79.38
79	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.10965	86.6
80	PZR to middle annulus rooms L3 & 4	0.0004	0	0		0.5	42.7
81	PZR to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	32.31
82	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0		0	0.15	156.04
83	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4423	316.84

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
84	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	277.91
85	upper equipment rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.5	16.4
86	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	43.19
87	upper equipment rooms L3 & 4 to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	227.72
88	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	29.77
89	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4431	321.22
90	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
91	PZR to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	47.59
92	PZR to upper annulus rooms L1 & 2	0.0004	0	0	0	0.4	66.57
93	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	15.09
94	PZR to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	17.48
	Vertical wall to non-accessible space	0.0004	0	0	0	0.501	11032
1	spreading rooms to components	0.0004	0	0	0	0.6	91.12
2	spreading rooms to components	0.0004	0	0	0	0.25	91.4
3	spreading rooms to lower equipment rooms L4	0.0004	0	0	0	0.27265	41.92
4	spreading rooms to components	0.0004	0	0	0	0.4	25.18
5	Internal wall in SG blowdown (LCQ) HX etc.	0.0004	0	0	0	0.25	12.64

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Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
6	RPV pit to SG blowdown (LCQ) HX e[illegible].	0.0004	0	0	0	1.36	5.2
7	Internal wall in components	0.0004	0	0	0	0.25365	299.32
8	RPV pit to components	0.0004	0	0	0	1.36	105.6
9	Internal wall in components	0.0004	0	0	0	0.2	46.9
10	lower equipment rooms L1 to RPV pit	0.0004	0	0	0	1.01135	65.1
11	lower equipment rooms L2 to RPV pit	0.0004	0	0	0	1.0228	61.42
12	RPV pit to lower equipment rooms L3	0.0004	0	0	0	1.0228	61.42
13	RPV pit to lower equipment rooms L4	0.0004	0	0	0	1.0212	63.48
14	RPV pit to surge line, below	0.0004	0	0	0	0.82845	26.88
15	lower equipment rooms L1 to lower equipment rooms L4	0.0004	0	0	0	0.25	30.96
16	lower equipment rooms L2 to surge line, below	0.0004	0	0	0	0.4564	154.18
17	lower equipment rooms L3 to surge line, below	0.0004	0	0	0	0.44975	174.86
18	lower equipment rooms L4 to components	0.0004	0	0	0	0.25	7.46
19	lower equipment rooms L4 to components	0.0004	0	0	0	0.6	34.4
20	Internal wall in surge line, below	0.0004	0	0	0	0.25	154.68
21	Internal wall in components	0.0004	0	0	0	0.4	26.66
22	lower equipment rooms L1 to reactor cavity	0.0004	0	0	0	0.6	68.24
23	lower equipment rooms L2 to reactor cavity	0.0004	0	0	0	0.6	30.48
24	reactor cavity to lower equipment rooms L3	0.0004	0	0	0	0.6	30.48
25	reactor cavity to lower equipment rooms L4	0.0004	0	0	0	0.6	65.2
26	Internal wall in reactor cavity	0.0004	0	0	0	0.6	21.74

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
27	reactor cavity to surge line, below	0.0004	0	0	0	0.6	164.8
28	middle equipment rooms L1 to reactor cavity	0.0004	0	0	0	0.6	569.6
29	middle equipment rooms L1 to reactor cavity	0.0004	0	0	0	0.6	255.12
30	reactor cavity to middle equipment rooms L3	0.0004	0	0	0	0.6	250.64
31	reactor cavity to middle equipment rooms L4	0.0004	0	0	0	0.6	572.64
32	reactor cavity to PZR	0.0004	0	0	0	0.6	132.54
33	Internal wall in equipment rooms L1	0.0004	0	0	0	0.5	84.46
34	lower equipment rooms L1 to lower equipment rooms L2	0.0004	0	0	0	0.5	168.92
35	Internal wall in lower equipment rooms L2	0.0004	0	0	0	0.5	175.48
36	lower equipment rooms L2 to reactor cavity	0.0004	0	0	0	0.4	25.2
37	Internal wall in lower equipment rooms L3	0.0004	0	0	0	0.5	175.48
38	lower equipment rooms L3 to lower equipment rooms L4	0.0004	0	0	0	0.5	168.92
39	Internal wall in lower equipment rooms L4	0.0004	0	0	0	0.5	168.92
40	lower equipment rooms L4 to middle equipment rooms L4	0.0004	0	0	0	0.6	83.78
41	Internal wall in surge line, below	0.0004	0	0	0	0.4	163.86
42	reactor cavity to surge line, below	0.0004	0	0	0	0.25	29.62
43	reactor cavity to surge line, below	0.0004	0	0	0	0.4	17
44	Internal wall in middle equipment rooms L1	0.0004	0	0	0	0.5	127.08
45	middle equipment rooms L1 to middle equipment rooms L2	0.0004	0	0	0	0.75105	62.14

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
46	Internal wall in middle equipment rooms L2	0.0004	0	0	0	0.5	126.28
47	middle equipment rooms L2 to surge line, below	0.0004	0	0	0	0.4	110.16
48	Internal wall in middle equipment rooms L3	0.0004	0	0	0	0.5	126.48
49	middle equipment rooms L3 to surge line, below	0.0004	0	0	0	0.4	114
50	middle equipment rooms L3 to middle equipment rooms L4	0.0004	0	0	0	0.75155	61.94
51	Internal wall in middle equipment rooms L4	0.0004	0	0	0	0.5	127.52
52	surge line, below to PZR	0.0004	0	0	0	0.275	176.42
53	Internal wall in middle equipment rooms L1	0.0004	0	0	0	0.6	76.72
54	middle equipment rooms L1 to middle equipment rooms L2	0.0004	0	0	0	0.5	61.8
55	middle equipment rooms L2 to PZR	0.0004	0	0	0	0.4	17.84
56	middle equipment rooms L3 to PZR	0.0004	0	0	0	0.4	85
57	middle equipment rooms L3 to middle equipment rooms L4	0.0004	0	0	0	0.5	61.8
58	Internal wall in middle equipment rooms L4	0.0004	0	0	0	0.6	71.04
59	Internal wall in PZR	0.0004	0	0		0.4	50.76
60	Internal wall in upper equipment rooms L1 & 2	0.0004	0	0	0	0.4535	226.34
61	Internal wall in upper equipment rooms L3 & 4	0.0004	0		0	0.4535	226.34
62	upper equipment rooms L3 & 4 to PZR	0.0004	0	0		0.25	102
63	SG blowdown (LCQ) HX etc. to elevator	0.0004	0	0	0	0.4	8.32
64	SG blowdown (LCQ) HX etc. to access	0.0004	0	0	0	0.1	37.19

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Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
65	SG blowdown (LCQ) HX etc. to lower annulus rooms L1 & 2	0.0004	0	0	0	0.4	5.02
66	SG blowdown (LCQ) HX etc. to lower annulus rooms L3 & 4	0.0004	0	0	0	0.15	5.12
67	Components to hot piping	0.0004	0	0	0	0.5	77.08
68	Components to hot piping	0.0004	0	0	0	0.15	9.28
69	lower equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	60.19
70	lower equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	178.12
71	lower equipment rooms L1 to components	0.0004	0	0	0	0.2742	30.19
72	lower equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	174.71
73	lower equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	[illegible]	0	0	0.6	177.35
74	lower equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	201.09
75	surge line, below to elevator	0.0004	0	0	0	0.4779	44.6
76	Components to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	35.02
77	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	12.46
78	surge line, below to middle annulus rooms L3 & 4	0.0004	0	[illegible]	0	0.43975	9.11
79	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.3	6.76
80	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.4	33.44
81	Components to middle annulus rooms L3 & 4	0.0004	0	0	0	0.15	17.01
82	surge line, below to access	0.0004	0	0	0	0.4	48.55

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
83	reactor cavity to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	42.23
84	surge line, below to staircase (north)	0.0004	0	0	0	0.6	28.68
85	surge line, below to elevator	0.0004	0	0	0	0.6	12.12
86	surge line, below to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	14.14
87	reactor cavity to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	16.8
88	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	23.04
89	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.6	56.65
90	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	114.61
91	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.6	128.02
92	middle equipment rooms L3 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	157.44
93	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.6	138.92
94	surge line, below to staircase (north)	0.0004	0	0	0	0.5	34.46
95	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.5	29.64
96	surge line, below to middle annulus rooms L1 & 2	0.0004	0	0	0	0.275	42.08
97	middle equipment rooms L2 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	26.3
98	middle equipment rooms L1 to staircase (south)	0.0004	0	0	0	0.15	8.4
99	PZR to staircase (north)	0.0004	0	0	0	0.5	39.12
100	middle equipment rooms L1 to middle annulus rooms L1 & 2	0.0004	0	0	0	0.10695	79.38

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
101	middle equipment rooms L4 to middle annulus rooms L3 & 4	0.0004	0	0	0	0.10965	86.6
102	PZR to middle annulus rooms L3 & 4	0.0004	0	0	0	0.5	42.7
103	PZR to middle annulus rooms L1 & 2	0.0004	0	0	0	0.4	32.31
104	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
105	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4423	316.84
106	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.5	277.91
107	upper equipment rooms L1 & 2 to staircase (south)	0.0004	0	0	0	0.5	16.4
108	upper equipment rooms L1 & 2 to upper annulus rooms L1 & 2	0.0004	0	0	0	0.25	43.19
109	upper equipment rooms L3 & 4 to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	227.72
110	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	29.77
111	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4431	321.22
112	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.15	156.04
113	PZR to upper annulus rooms L3 & 4	0.0004	0	0	0	0.5	47.59
114	PZR to upper annulus rooms L1 & 2	0.0004	0	0	0	0.4	66.57
115	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.25	15.09

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
116	PZR to lower & upper dome L1, 2, 3 & 4	0.0004	0	0	0	0.4	17.48
	Horizontal wall (floor/ceiling) to accessible space	0.001	0	0	0	0.318	8056
1	Internal wall in access	0.001	0	0	0	0.3	23.94
2	lower annulus rooms L1 & 2 to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	595.74
3	lower annulus rooms L3 & 4 to middle annulus rooms L3 & 4	0.001	0	0	0	0.3	756.3
4	staircase (south) to hot piping	0.001	0	0	0	0.3	32.22
5	middle annulus rooms L1 & 2 to hot piping	0.001	0	0	0	0.3	286.54
6	middle annulus rooms L3 & 4 to hot piping	0.001	0	0	0	0.3	250
7	Internal wall in middle annulus rooms L1 & 2	0.001	0	0	0	0.25	560.4
8	Internal wall in middle annulus rooms L3 & 4	0.001	0	0	0	0.25	498.8
9	Internal wall in middle annulus rooms L3 & 4	0.001	0	0	0	0.14925	782.62
10	middle annulus rooms L1 & 2 to middle annulus rooms L3 & 4	0.001	0	0	0	0.95	36.6
11	access to staircase (north)	0.001	0	0	0	0.25	48.4
12	middle annulus rooms L1 & 2 to access	0.001	0	0	0	0.25	47
13	middle annulus rooms L3 & 4 to access	0.001	0	0	0	0.25	52.2
14	Internal wall in middle annulus rooms L1 & 2	0.001	0	0	0	0.15	719.68
15	Internal wall in lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.15	17.38
16	middle annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	167

Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
17	middle annulus rooms L1 & 2 to staircase (south)	0.001	0	0	0	0.5	40.82
18	middle annulus rooms L3 & 4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	366.08
19	middle annulus rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	335.16
20	middle annulus rooms L1 & 2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	84.26
21	Internal wall in upper annulus rooms L1 & 2	0.001	0	0	0	0.25	359
22	Internal wall in upper annulus rooms L3 & 4	0.001	0	0	0	0.25	430
23	Internal wall in upper annulus rooms L1 & 2	0.001	0	0	0	0.5	132
24	upper annulus rooms L1 & 2 to staircase (south)	0.001	0	0	0	0.25	98.1
25	lower & upper dome L1, 2, 3 & 4 to staircase (north)	0.001	0	0	0	0.25	29
26	lower & upper dome L1, 2, 3 & 4 to elevator	0.001	0	0	0	0.15	13.44
27	upper annulus rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	224
28	upper annulus rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	132
29	Components to hot piping	0.001	0	0	0	0.3	11.3
30	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	9.55
31	Components to staircase (south)	0.001	0	0	0	0.3	7.75
32	Components to middle annulus rooms L3 & 4	0.001	0	0	0	0.26235	27.1
33	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.95	23.7
34	Components to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.95	26.4

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Table 6.2.1-5—Containment Heat Sink Inventory
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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
35	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.6	490.84
36	middle equipment rooms L1 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	69.8
37	middle equipment rooms L2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	6.78
38	middle equipment rooms L3 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	17.08
39	middle equipment rooms L4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	35.88
40	middle equipment rooms L1 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	47.8
41	middle equipment rooms L4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	24.51
42	PZR to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	12.88
43	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	32
44	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	34
45	PZR to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	60
	Horizontal wall (floor/ceiling) to non-accessible space	0.001	0	0	0	0.439	3068
1	spreading rooms to components	0.001	0	0	0	0.7	463.72
2	spreading rooms to components	0.001	0	0	0	0.15	33.4
3	Internal wall in components	0.001	0	0	0	0.7	26.8

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
4	surge line, below to SG blowdown (LOQ) HX etc.	0.001	0	0	0	0.3	273.84
5	lower equipment rooms L4 to components	0.001	0	0	0	0.3	138.48
6	lower equipment rooms L1 to components	0.001	0	0	0	0.3	81.14
7	Internal wall in components	0.001	0	0	0	0.3	165.68
8	RPV pit to reactor cavity	0.001	0	0	0	0.3	76
9	lower equipment rooms L1 to reactor cavity	0.001	0	0	0	0.6	44.4
10	lower equipment rooms L2 to reactor cavity	0.001	0	0	0	0.68	5.4
11	lower equipment rooms L3 to surge line, below	0.001	0	0	0	0.88	5.4
12	reactor cavity to lower equipment rooms L4	0.001	0	0	0	0.6	56
13	Internal wall in surge line, below	0.001	0	0	0	0.3	226.4
14	reactor cavity to surge line, below	0.001	0	0	0	0.68	17.2
15	reactor cavity to components	0.001	0	0	0	0.6	34.2
16	lower equipment rooms L4 to middle equipment rooms L4	0.001	0	0	0	0.15	61.78
17	Internal wall in surge line, below	0.001	0	0	0	0.15	218
18	reactor cavity to surge line, below	0.001	0	0	0	0.15	17.38
19	middle equipment rooms L3 to PZR	0.001	0	0	0	0.5	9.48
20	Internal wall in PZR	0.001	0	0	0	0.5	80.48
21	Internal wall in upper equipment rooms L3 & 4	0.001	0	0	0	0.15	4.4
22	Internal wall in PZR	0.001	0	0	0	0.25	90.8
23	Components to hot piping	0.001	0	0	0	0.3	11.3
24	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.3	9.55

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	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
25	Components to staircase (south)	0.001	0	0	0	0.3	7.75
26	Components to middle annulus rooms L3 & 4	0.001	0	0	0	0.26235	27.1
27	Components to middle annulus rooms L1 & 2	0.001	0	0	0	0.95	23.7
28	Components to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.95	26.4
29	reactor cavity to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.6	490.84
30	middle equipment rooms L1 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	69.8
31	middle equipment rooms L2 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	6.78
32	middle equipment rooms L3 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	17.08
33	middle equipment rooms L4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.5	35.88
34	middle equipment rooms L1 to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	47.8
35	middle equipment rooms L4 to upper annulus rooms L3 & 4	0.001	0	0	0	0.5	24.51
36	PZR to upper annulus rooms L1 & 2	0.001	0	0	0	0.5	12.88
37	upper equipment rooms L1 & 2 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	32
38	upper equipment rooms L3 & 4 to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	34
39	PZR to lower & upper dome L1, 2, 3 & 4	0.001	0	0	0	0.25	60
	Thick steel	0.0002	0.04	0	0	0	2470

Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 20 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
1	Components to hot pipi[illegible]	0.0002	0.3	0	0	0	8
2	lower & upper dome L[illegible]2, 3 & 4 to [illegible] ann[illegible]s	0.0002	0.05	0	0	0	57
3	Internal steel in lower & u[illegible]e L1[illegible], 3 &	0.0002	0.0388	0	0	0	1942.8
4	Internal steel in lower & upper dom[illegible]1, [illegible]3 & 4	0.0002	0.0371	0	0	0	462
	Medium steel	0.0002	0.0086	0	0	0	13230
1	Internal steel in components	0.0002	0.0086	0	0	0	23.72
2	Internal steel in IRWST	0.000[illegible]	0.0086	0	0	0	59.8
3	Internal steel in SG blowdown (LCQ) HX etc.	0.[illegible]02	0.0086	0	0	0	2.54
4	Internal steel in access	[illegible].002	[illegible]0086	0	0	0	44.99
5	Internal steel in lower annulus rooms L3 & 4	0.000[illegible]	0.0[illegible]6	0	0	0	37.64
6	Internal steel in hot piping	[illegible].0002	0.008[illegible]	0	0	0	35.31
7	Internal steel in lower annulus rooms L1 & 2	0.0[illegible]02	0.[illegible]6	0	0	0	36.47
8	Internal steel in lower equipment rooms L3	0.0002	[illegible].0086	[illegible]	0	0	398.32
9	Internal steel in lower equipment rooms L4	0.0002	0.0086	0	0	0	432.57
10	Internal steel in lower equipment rooms L1	0.0002	0.00[illegible]	0	0	0	432.57
11	Internal steel in lower equipment rooms L2	0.0002	0.008[illegible]	0	[illegible]	0	398.32
12	Internal steel in middle annulus rooms L3 & 4	0.0002	0.0086	0	0	0	1928.98
13	Internal steel in middle annulus rooms L1 & 2	0.0002	0.0086	[illegible]	0	0	1790.91
14	Internal steel in surge line, below	0.0002	0.0086	0	[illegible]	0	48.78
15	Internal steel in middle equipment rooms L3	0.0002	0.0086	0	0	0	926.23
16	Internal steel in middle equipment rooms L4	0.0002	0.0086	0	0	0	881.02
17	Internal steel in middle equipment rooms L1	0.0002	0.0086	0	0	0	881.02

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Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 21 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
18	Internal steel in middle equipment rooms L2	0.0002	0.0086	0	0	0	926.23
19	Internal steel in PZR	0.0002	0.0086	0	0	0	11.84
20	Internal steel in upper equipment rooms L3 & 4	0.0002	0.0086	0	0	0	818.35
21	Internal steel in upper equipment rooms L1 & 2	0.0002	0.0086	0	0	0	818.35
22	Internal steel in upper annulus rooms L3 & 4	0.0002	0.0086	0	0	0	40.2
23	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0086	0	0	0	2194.65
24	Internal steel in upper annulus rooms L1 & 2	0.0002	0.0086	0	0	0	57.34
25	Internal steel in staircase (south)	0.0002	0.0086	0	0	0	4.29
	Thin steel	0.0002	0.0015	0	0	0	8640
1	Internal steel in components	0.0002	0.0015	0	0	0	26.76
2	Internal steel in IRWST	0.0002	0.0015	0	0	0	67.5
3	Internal steel in SG blowdown (LCQ) HX etc.	0.0002	0.0015	0	0	0	4.3
4	Internal steel in access	0.0002	0.0015	0	0	0	60.84
5	Internal steel in lower annulus rooms L3 & 4	0.0002	0.0015	0	0	0	50.93
6	Internal steel in hot piping	0.0002	0.0015	0	0	0	47.78
7	Internal steel in lower annulus rooms L1 & 2	0.0002	0.0015	0	0	0	49.36
8	Internal steel in lower equipment rooms L3	0.0002	0.0015	0	0	0	192.5
9	Internal steel in lower equipment rooms L4	0.0002	0.0015	0	0	0	209.05
10	Internal steel in lower equipment rooms L1	0.0002	0.0015	0	0	0	209.05
11	Internal steel in lower equipment rooms L2	0.0002	0.0015	0	0	0	192.5
12	Internal steel in middle annulus rooms L3 & 4	0.0002	0.0015	0	0	0	1671.17
13	Internal steel in middle annulus rooms L1 & 2	0.0002	0.0015	0	0	0	1606.45

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Table 6.2.1-5—Containment Heat Sink Inventory
Sheet 22 of 22

	Description	Thickness, m					Total Surface, m²
		Paint	C-Steel	S-Steel	Air	Concrete	
14	Internal steel in surge line, below	0.0002	0.0015	0	0	0	109.56
15	Internal steel in middle equipment rooms L2	0.0002	0.0015	0	0	0	454.34
16	Internal steel in middle equipment rooms L4	0.0002	0.0015	0	0	0	427.97
17	Internal steel in middle equipment rooms L1	0.0002	0.0015	0	0	0	428.09
18	Internal steel in middle equipment rooms L2	0.0002	0.0015	0	0	0	454.31
19	Internal steel in PZR	0.0002	0.0015	0	0	0	16.03
20	Internal steel in upper equipment rooms L3 &	0.0002	0.0015	0	0	0	415.34
21	Internal steel in upper equipment rooms L1 &	0.0002	0.0015	0	0	0	415.34
22	Internal steel in upper annulus rooms L3 & 4	0.0002	0.0015	0	0	0	54.4
23	Internal steel in lower & upper dome L1, 2, 3 & 4	0.0002	0.0015	0	0	0	1392.85
24	Internal steel in upper annulus rooms L1 & 2	0.0002	0.0015	0	0	0	77.6
25	Internal steel in staircase (south)	0.0002	0.0015	0	0	0	5.8
				Cumulative Available Surface Area			67,646 (728,136 ft²)
				Minimum Surface Area			64,998 (699,633 ft²)

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Table 6.2.1-6—Short-Term Containment Response Hot Leg Breaks

Variable	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 7A	Case 7C
Short Term Containment Analysis Results									
Peak Pressure (psia)	66.45	66.45	65.80	65.80	65.60	65.51	66.53	66.69	66.26
Time of Peak Pressure (s)	32.0	32.0	24.0	24.0	25.0	28.0	25.0	31.0	22.0035
Peak Vapor Temperature (°F)	273.708	273.708	272.842	272.841	272.575	272.457	273.821	273.031	273.46
Time of Peak Vapor Temperature (s)	32.0	32.0	24.0	24.0	25.0	27.0	25.0	31.0	22.0035
Case Description									
Break Configuration[1]	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=1.0	DEG, Cd=0.8	DEG, Cd=0.6	DES, Cd=0.8	DEG, Cd=1.0	DES, Cd=1.0
ECCS	MAX	MIN	MIN	MAX	MIN	MIN	MIN	MIN	MIN
Containment Pressure (psia)	60.0	60.0	60.0	60.0	60.0	60.0	60.0	14.7	14.7
IRWST Temperature (°F)	122	122	122	122	122	122	122	122	122

Notes:

1. DEG = double-ended guillotine; DES = double-ended split.

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Table 6.2.1-7—Short Term Containment Response Cold Leg Pump Suction Breaks

Variable	Case 8	Case 9	Case 10	Case 10B	Case 11	Case 12	Case 13	Case 14	Case 14B	Case 14C	Case 14D	Case 14E
Short Term Containment Analysis Results												
Peak Pressure, (psia)	64.6	64.[illegible]	65.8	65.8	65.8	66.0	65.9	66.3	66.3	66.2	66.4	66.5
Time of Peak Pressure, (s)	36.0	36.[illegible]	3[illegible]	38.[illegible]	38.0	39.0	40.0	40.0	40.0	40.0	41.0	40.0
Peak Vapor Temp. (°F)	271.2	271.2	272[illegible]	272.9	272.8	273.0	273.0	273.5	273.6	273.4	273.6	273.7
Time of Peak Vapor Temp (s)	35.0	35.0	38.0	38.0	38.0	39.0	40.0	40.0	40.0	40.0	40.0	40.0
Case Description												
Break Configuration[1]	DEG, Cd=1	DEG, Cd=1	DEG, Cd=1	DEG, Cd=1	DE[illegible] Cd=1	DEG, Cd=0.8	DEG, Cd=0.6	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=0.8	DES, Cd=1
ECCS	MAX	MIN	MIN	MIN	MA[illegible]	MIN	MI[illegible]	MIN	MIN	MIN	MIN	MIN
Containment Pressure (psia)	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	14.7	76.7	60	14.7
IRWST Temp. (°F)	122	122	122	122	122	122	122	122	122	122	248	122

Notes:

1. DEG = double-ended guillotine; DES = double-ended split .

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Table 6.2.1-8—Short Term Response Cold Leg Pump Discharge Breaks

Variable	Case 15	Case 16	Case 17	Case 18	Case 19	Case 20	Case 21	Case 22	Case 23	Case 24	Case 25	Case 26	Case 27	Case 28	Case 29	Case 30	Case 31
Short Term Analysis Results																	
Peak Pressure(psia)	63.77	63.77	63.69	63.69	63.69	63.69	63.82	64.30	63.41	63.92	64.85	65.17	64.91	64.95	64.98	65.37	65.38
Time of Peak Pressure (s)	24	24	25	[illegible]	25	25	26	25	27	28	24	25	24	25	25	24	25
Peak Vapor Temp. (°F)	270.04	270.04	269.93	[illegible].93	[illegible]69.93	269.93	270.11	270.77	269.53	270.24	271.52	271.96	271.61	271.66	271.71	272.24	272.25
Time of Peak Vapor Temp. (s)	24	24	25	25	[illegible]5	25	26	25	27	28	24	25	24	25	24	24	25
Case Description																	
Break Configuration[1]	DEG C=1	DEG C=1	DEG [illegible]	DEG C=1	[illegible]G Cd=[illegible]	DEG C=1	DEG C=.8	DES C=.8	DES C=.6	DEG C=.6	DES C=1	DES C=1	DES C=1	DES C=1	DES C=1	DES C=1	DES C=1
ECCS	MAX	MIN	MIN	MAX	MIN	[illegible]IN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Pressure (psia)	60	60	60	60	[illegible]	[illegible]	60	60	60	60	60	14.7	76.7	60	60	60	60
IRWST Temp. (°F)	122	122	122	122	122	122	122	122	122	122	122	122	122	248	122	122	170

Notes:

1. DEG = double-ended guillotine; DES = double-ended split

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Table 6.2.1-9—Peak Containment Pressure and Temperature for MSLB

Description	Time of Peak Pressure (s)	Peak Pressure (psia)	Time of Peak Temperature (s)	Peak Temperature (°F)
100 % Power Cases				
DEG[1]	47.02	65.22	30.02	420.07
1.0 ft² split	260.02	60.05	43.02	358.72
0.7 ft² split	390.02	59.15	98.02	327.53
0.5 ft² split	610.02	58.20	550.02	305.79
80 % Power Cases				
DEG[1]	55.02	65.70	28.02	421.03
1.0 ft² split	245.[illegible]	60.01	74.02	360.44
0.7 ft² split	[illegible].02	59.01	57.02	333.66
0.5 ft² split	63[illegible].02	57.54	490.02	303.66
50 % Power Cases				
DEG[1]	48.02	68.84	27.02	427.93
1.0 ft² split	15[illegible].02	60.40	49.02	369.11
0.7 ft² split	370.0[illegible]	58.[illegible]	52.02	335.58
0.5 ft² split	550.02	[illegible].04	490.02	303.90
20 % Power Cases				
DEG[1]	60.01	59.49	60.01	264.99
1.0 ft² split	155.01	[illegible]1.20	[illegible].01	368.85
0.7 ft² split	357.50	58.47	52.[illegible]1	340.23
0.5 ft² split	617.50	55.84	425.[illegible]	298.61
0 % Power Cases				
DEG[1]	54.02	60.09	54.[illegible]	365.88
1.0 ft² split	230.02	56.41	230.02	260.30
0.7 ft² split	350.02	55.96	[illegible]0.02	[illegible].78
0.5 ft² split	590.02	55.35	560.02	28[illegible]79

Notes:

1. DEG = double-ended guillotine.

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Table 6.2.1-10—Critical Subcompartments in Containment

Room Name (30UJA)	Room Description	System Name (Pipe Name)	Operating Pressure (psia)	Operating Temperature (°F)	NPS (in)	Accident Pressure (psia)
11 - 004	SG Loop 2	SIS/RHR (J~~NG23 R002~~INA20 BR001)	~~710.7~~2250.0	~~77.0~~625.7	~~12~~10	~~*~~20.80
11 - 006	RCP Loop 3	CVCS (KBA35 BR002)	2324.0	512.3	4	*
11 - 027	SI valves Loop 3	SIS/RHR (JNG33 BR001)	~~710.7~~814.7	~~77.0~~140	12	~~*~~16.90
15 - 004	SG Loop 2	CVCS (KBA34 BR019)	2324.0	512.3	3	*
15 - 006	RCP Loop 3	SIS/RHR(JNG33 BR007)	2250.0	563.4	10	29.02
18 - 004	SG Loop 2	SG Blowdown (LCQ10 BR012)	1144.3	561.0	2	*
23 - 004	SG Loop 2	FW(LAB370 BR005)	1131.2	446.3	20	28.36
29 - 004	SG Loop 2	FW(LAB370 BR005)	1131.2	446.3	20	31.07
29 - 019	Pressurizer Cavity	RCS (JEF10 BR004)	2250.0	653.0	6	17.82
34 - 004	SG Loop 2	SG (JEA20 BR300)	1123.0	559.0	1	*
34 - 019	Pressurizer Relief Valve Cavity	RCS (JEF10 BR004)	2250.0	653.0	6	18.59

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Table 6.2.1-15—High Energy Lines in Critical Subcompartments

Room Name (30 UJA)	Pipe Name	Pressure ([illegible])	Temp. (°F)	Pipe ID (in)	Enthalpy (BTU/lb_m)	Mass Flux (lb_m/ft^2- s)	CSA (ft^2)	Energy Flux (MMBTU/hr)
11 - 004	~~JNG23-BR002~~JNA20 BR001	~~[illegible]0.7~~225[illegible]	~~77.0~~625.7	~~10.126~~8.5	~~47.0184~~651.8	~~12243.9100~~15831.9	~~0.5592~~0.394	~~2.3180564~~14.638101 x10^3
11 - 006	KBA35 BR002	2324[illegible]	12[illegible]	3.438	501.7042	16233.5300	0.0645	3.7803532x10^3
11 - 027	JNG33 BR001	~~710.7~~814.7[illegible]	~~77.0~~140.[illegible]0	~~11.750~~11.376	~~47.0184~~110.0	~~12243.9100~~22292.1	~~0.7530~~0.706	~~3.1212164~~12.4618588x10^3
15 - 004	KBA34 BR019	2324.[illegible]	512.3	[illegible].624	501.7042	16233.5300	0.0376	2.2021571x10^3
15 - 006	JNG33 BR007	2250.0	563.4	8.500	See Table 6.2.1-16			
18 - 004	LCQ10 BR012	1144.3	561[illegible]	1.687	563.5935	3657.1790	0.0155	2.303574x10^2
23 - 004	LAB70 BR005	1131.2	446.[illegible]	17.000	See Table 6.2.1-17			
29 - 004	LAB70 BR005	1131.2	446.3	17.[illegible]	See Table 6.2.1-17			
29 - 019	JEF10 BR004	2250.0	653.0	[illegible].187	1116.8[illegible]17	2968.1370	0.1467	3.5024176x10^3
34 - 004	JEA20 BR302	1123.0	559.0	0.[illegible]5	1187.710[illegible]	1384.4530	0.0036	4.28908x10^1
34 - 019	JEF10 BR004	2250.0	653.0	5.187	1116.8[illegible]7	2968.1370	0.1467	3.5024176x10^3

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 1 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0	2298.5	0	1212.4	0	410	2298.2	0	1197	0	600
0.0001	2339.8	0	1212.4	1000	510	2231.8	0	1197	1000	600
0.1001	1611.5	2307	1171.5	42752	626.6	1212	4870	1193.7	32209	571.8
0.2001	1443.2	3334	1178.1	42748	610	990.3	5041	1196.1	31580	560.3
0.3001	1426.5	3420	1179.3	42303	606.4	852	4478	1199.3	27477	555.9
0.4001	1387.8	3740	1181.6	41043	601	767.7	4730	1204.7	23684	530
0.5	1358.4	3977	1183.6	40025	596.9	730.[illegible]	4478.5	1206.5	23083.1	519.2
0.6	1333.9	4187	1185	39138	593.5	70[illegible]	4210	1207.5	22918	512.6
0.7	1310.4	4409	1186.4	38258	590.5	684.5	4008	1207.9	22884	505.9
0.8	1286.7	4685	1187.7	37254	587.4	670.6	38[illegible]	1208.8	23488	500
0.9	1259.5	5171	1189.5	35760	584.3	650.9	3773	1209	22980	496.5
1	1219.7	5891	1190.4	33477	580.7	63[illegible]	[illegible]60	1209.5	22343	492.6
1.1	1202	5799	1189.5	31884	587.6	601	4026	12[illegible]9	21742	480.2
1.2	1181.2	5690	1189.2	30521	595.1	585.7	40[illegible]	1215	21053	473.2
1.3	1156.7	5742	1189.3	29158	598.9	573.3	4[illegible]7	12[illegible]	20668	470.3
1.4	1132.2	5992	1190.3	27780	597.9	562.9	4009	1216.1	20360	467.9
1.5	1106.5	6240	1191.8	26575	594.9	554.4	3976	1216.7	20122	465.9
1.6	1082.9	6427	1193.5	25569	591.2	547.5	3938	1216.4	19972	464.2

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 2 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1.7	1063.3	6562	1[illegible].7	24794	587.4	542.2	3889	1216.7	19910	462.8
1.8	1019.7	6321	[illegible]6.9	25056	573.1	538.6	3833	1216.7	19932	461.8
1.9	1006.9	5978	1197[illegible]	26[illegible]	564.5	536.3	3773	1216.4	20028	461.1
2	990.7	5970	1198.1	[illegible]078	561.6	534.9	3714	1216.2	20158	460.7
2.1	974.5	5998	1199.4	[illegible]630	[illegible].5	533.7	3662	1216.1	20278	460.3
2.2	958.4	6094	1200.1	24[illegible]7	[illegible]8	532.2	3623	1215.7	20354	460
2.3	944.3	6214	1201.2	24267	553.5	52[illegible]8	3596	1216.1	20360	459.5
2.4	931.6	6306	1201.9	23659	551.4	526.[illegible]	3585	1215.8	20278	458.9
2.5	903.8	6726	1206.9	23009	540.4	[illegible].7	3585	1216.1	20109	458
2.6	894.9	6980	1210.8	22339	530.4	515.9	[illegible]95	1216	19866	456.9
2.7	884.9	6969	1211.4	22048	528.7	510.4	3603	1216.5	19600	455.5
2.8	876.2	6941	1211.7	21841	527.2	50[illegible]	3620	1216.7	19284	454.2
2.9	868.2	6895	1212.1	21717	525.8	496.[illegible]	3641	[illegible]7.3	18911	452.6
3	860.8	6835	1212.2	21658	524.5	489	366[illegible]	121[illegible]	18543	451
3.1	853.8	6762	1212.5	21650	523.3	481.9	[illegible]76	1217[illegible]	18181	449.4
3.2	846.9	6686	1212.5	21664	522.1	475.5	368[illegible]	[illegible]18	17847	447.8
3.3	840.2	6606	1212.7	21692	521	469.3	3695	1218.4	17535	446.3
3.4	833.7	6528	1212.9	21726	519.9	463.3	3698	1218.7	17254	444.9
3.5	827.5	6452	1212.9	21763	518.8	457.7	3699	1219	16990	443.5

Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 3 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
3.6	821.4	6380	[illegible]	21792	517.7	452.5	3701	1219.1	16728	442.2
3.7	816.1	6315	[illegible]13.1	21806	516.7	446.9	3701	1219.5	16474	440.9
3.8	810.7	6261	1213[illegible]	21[illegible]	515.7	442.5	3699	1219.7	16244	439.7
3.9	808.9	6220	1213.4	[illegible]796	515.1	437.4	3696	1219.8	16033	438.5
4	802.2	6202	1213.3	[illegible]1708	5[illegible].3	433.1	3696	1219.9	15795	437.3
4.1	796.9	6150	1213.6	21[illegible]8	5[illegible]3	428.9	3689	1220.3	15623	436.4
4.2	793.3	6101	1213.6	21658	512.4	42[illegible]2	3694	1220.2	15378	435.2
4.3	788.8	6074	1213.8	21611.9	511.8	419[illegible]	3697	1220.7	15128.9	434
4.4	784.2	6044	1213.7	21545	511	[illegible].6	3703	1221	14860	432.8
4.5	780.5	5998	1214	21541	510.2	410.2	[illegible]07	1221.2	14609	431.7
4.6	777.6	5949	1214.1	21568	509.6	405.6	3708	1221.3	14376	430.5
4.7	775.9	5902	1214	21637	509.2	401[illegible]	[illegible]708	1221.5	14137	429.4
4.8	773.6	5854	1213.8	21712.9	508.8	398[illegible]	3701	1[illegible]21.7	13964.9	428.4
4.9	770.7	5792	1213.7	21803	508.3	395	368[illegible]	122[illegible]9	13852	427.5
5	768.6	5717	1213.8	21934	507.8	391.5	[illegible]78	122[illegible]	13718	426.7
5.1	767	5645	1213.5	22081	507.4	388.2	367[illegible]	1[illegible]2.2	13563	425.8
5.2	765.9	5580	1213.4	22217	507.2	385.4	3662	1221.9	13438	424.9
5.3	764.6	5526	1213.2	22327.9	506.9	382.6	3649	1222.4	13337.9	424.2
5.4	762.4	5478	1213.2	22405	506.6	379.8	3643	1222.2	13213	423.4

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 4 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
5.5	759.9	5436	1213.2	22452	506.2	377	3637	1222.8	13076	422.7
5.6	757.5	5403	1213.1	22488	505.7	374.3	3631	1222.5	12955	421.9
5.7	754.8	5375	1213.1	22469	505.2	371.7	3625	1222.7	12831	421.2
5.8	752.1	5352	1213.2	22488.9	504.8	369	3621	1222.7	12698	420.5
5.9	748.9	5333	1213.3	22459	504.2	366.5	3614	1223.2	12578	419.7
6	747.3	5323	1213.4	22440	503.9	364	3609	1223	12460	419.1
6.1	743.6	5324	1213.6	22321	503.3	361.5	3605	1223	12335	418.4
6.2	740.4	5320	1213.6	22229	502.7	359.1	3598	1223.4	12216	417.7
6.3	736.9	5321	1213.9	22117.9	502.1	356.7	3592	1223.4	12104	417
6.4	733.3	5328	1214	21982	501.4	354.3	3588	1223.5	11980	416.3
6.5	729.5	5336	1214.4	21833	500.8	352	3585	1223.3	11856	415.7
6.6	725.6	5347	1214.4	21673	500.1	349	3578	1223.7	11742	415
6.7	721.8	5356	1214.6	21514	499.4	347.2	3571	1224.1	11624	414.4
6.8	718	5362	1214.9	21366.9	498.7	344.7	3566	1223.8	11498	413.6
6.9	714.7	5362	1215.1	21249	498.1	342.3	3559	1223.9	11379	412.9
7	711.4	5353	1215.2	21170	497.5	340.1	3544	1224	11287	412.3
7.1	708	5336	1215.4	21112	496.9	338.3	3534	1224.1	11227	411.7
7.2	704.3	5322	1215.1	21041	496.2	336.6	3521	1224.2	11176	411.2
7.3	700.4	5316	1215.7	20923.9	495.5	335.4	3514	1223.9	11120	410.7

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 5 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
7.4	696.3	5325	1[illegible].8	207[illegible]	494.8	334	3508	1224	11069	410.3
7.5	691.8	5342	1[illegible]5.9	20552	494	332.7	3498	1224.4	11024	409.9
7.6	687.2	5361	1216[illegible]	20[illegible]	493.2	330.5	3489	1223.9	10971	409.4
7.7	682.8	5371	1216.4	[illegible]0134	492.[illegible]	327.6	3475	1224.1	10861	408.6
7.8	678.6	5369	1216.9	[illegible]985.9	[illegible].5	324.6	3471	1224.4	10680	407.7
7.9	674.7	5361	1216.8	19[illegible]2	[illegible].8	321.6	3475	1224.8	10453	406.9
8	670.9	5347	1216.9	19781	490	31[illegible]5	3482	1225	10203	406
8.1	667	5330	1217	19699.9	489.3	315[illegible]	3487	1225.4	9943	405.1
8.2	663.1	5312	1217.3	19619.1	488.5	[illegible].3	3490	1225.5	9686.1	404.2
8.3	659.1	5297	1217.4	19528.9	487.8	309	[illegible]91	1225.6	9424	403.2
8.4	654.3	5297	1217.5	19364.1	486.9	305.4	3492	1226.2	9152.1	402.2
8.5	649.5	5306	1217.7	19151.9	486	301[illegible]	[illegible]495	1226.7	8864	401.1
8.6	644.8	5312	1218.3	18947.9	485.1	298.[illegible]	3499	[illegible]6.7	8561	400
8.7	640.5	5313	1218.3	18777.1	484.3	294.4	350[illegible]	122[illegible]	8257	398.8
8.8	636.5	5305	1218.4	18649.9	483.4	290.9	[illegible]99	122[illegible]	7956	397.8
8.9	632.4	5289	1218.6	18549.1	482.7	287.3	349[illegible]	[illegible]7.9	7668	396.7
9	628.5	5270	1218.7	18459.9	481.9	284	3488	1228.1	7392	395.5
9.1	624.4	5251	1218.7	18371.9	481	280.9	3480	1228.5	7125	394.5
9.2	620.3	5234	1219	18267.1	480.2	277.9	3470	1228.8	6871	393.5

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 6 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.3	616	5223	1219.9	18140.9	479.4	275	3459	1228.7	6624	392.6
9.4	611.7	5214	1219.3	17999.1	478.5	272.3	3445	1229.2	6387	391.6
9.5	607.5	5208	1219.[illegible]	178[illegible].9	477.7	269.7	3432	1228.9	6159	390.7
9.6	603	5203	1219.7	[illegible]691.9	476.8	267.3	3415	1229.4	5946	389.9
9.7	598.4	5198	1219.7	17525.1	4[illegible].9	265	3399	1229	5757	389
9.8	593.9	5191	1220.1	173[illegible].9	[illegible]5	262.7	3379	1229.4	5594	388.2
9.9	589.3	5187	1220.2	17171.1	474.1	26[illegible]6	3360	1229.1	5460	387.4
10	584.3	5183	1220.6	16973.9	473.1	258.[illegible]	3339	1229.2	5353	386.7
10.1	578.8	5179	1220.7	16755.9	472	[illegible]5.5	3319	1229.2	5266	385.9
10.2	573.1	5171	1221	16530.1	470.9	254.7	[illegible]01	1228.8	5189	385.2
10.3	567.2	5156	1221.4	16318.9	469.6	253.1	3283	1229.1	5108	384.6
10.4	561.2	5137	1221.4	16121.1	468.4	251	3267	1229.3	5013	384
10.5	555.1	5115	1221.6	15923.9	467.1	249.[illegible]	3256	1[illegible]8.7	4900	383.4
10.6	548.8	5093	1221.9	15717.9	465.8	248.4	3245	122[illegible]	4765	382.9
10.7	542.4	5072	1222	15501.1	464.4	247	[illegible]37	122[illegible]	4612	382.3
10.8	536.8	5049	1222.4	15295.9	463.1	246	32[illegible]	1[illegible]9.2	4441	381.9
10.9	530.4	5008	1222.4	15198.1	461.8	245.1	3223	1229	4260	381.6
11	526	4877	1222.2	15448.9	460.4	244.1	3214	1229.2	4077	381.1
11.1	524	4683	1221.2	16066.9	459.5	242.3	3208	1229	3896	380.6

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 7 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.2	519.5	4557	1[illegible].6	1637[illegible].1	458.7	240.6	3199	1229.4	3719	380.1
11.3	512.7	4538	[illegible]21	[illegible]6169.9	457.4	239.1	3189	1229.3	3547	379.4
11.4	505.5	4569	1221[illegible]	157[illegible].1	455.8	237.8	3177	1229.4	3375	378.9
11.5	498.4	4615	1222	[illegible]227.9	454.[illegible]	236.8	3164	1229.3	3205	378.4
11.6	491.6	4666	1222.7	[illegible]691.9	4[illegible].9	235.9	3149	1229	3038	378
11.7	485.2	4708	1223.1	141[illegible].1	4[illegible].4	234.3	3131	1229	2880	377.6
11.8	478.9	4732	1223.8	13748.9	450	23[illegible]7	3110	1228.8	2743	376.8
11.9	472.7	4744	1224.4	13351.1	448.6	230.[illegible]	3085	1228.5	2634	376.2
12	466.5	4748	1224.5	12984	447.2	[illegible].6	3056	1228.5	2562	375.3
12.5	437.5	4716.6	1225.6	12045.8	443	218.7	[illegible].6	1228.1	2483	372.5
13	410.5	4600.8	1226.6	10793.6	436.1	214.2	2880.[illegible]	1227.4	2183.6	369.9
13.5	382.7	4446.8	1227.4	9660	429.1	211[illegible]	[illegible]806.8	1226.8	1810.6	367.7
14	356.1	4276.4	1228.2	8555.2	421.5	216.[illegible]	2767.2	1[illegible]25.5	1327.8	368.2
14.5	332	4113.2	1228.8	7457.2	414.4	220.6	2703[illegible]	122[illegible]	764.4	369.5
15	307.9	3962.2	1229.6	6353	407.1	216.4	2[illegible]4.6	12[illegible]	386.4	369.5
16	265.9	3689.2	1230.2	4972.4	396.7	195	233[illegible]	1[illegible]8.3	177.9	364
17	229.4	3278.6	1229.6	3534.3	382.6	162.4	1980.4	1217.7	70.3	351.3
18	200.5	2848.5	1227.4	2286.9	369.1	133.7	1634.2	1223.3	42.5	336.9
19	143	2372.6	1223.5	1193.2	354.6	69.7	1211.8	1228.6	22.9	311.3

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 8 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
20	120.6	1669.8	[illegible]	707.[illegible]	323.4	52	557.2	1219.8	41.2	254
22	92.8	1253.5	[illegible]	454.6	300.7	59.8	681.1	1205.6	86.4	263.6
24	82.3	1252.9	[illegible]	[illegible]	299.4	73	795.5	1204	140.4	274.6
26	80.5	1111.9	1209.8	[illegible]	291	72.1	916.4	1207.1	265.2	279.4
28	72.7	815.3	1198.3	[illegible]	[illegible]	64.8	731.2	1215.1	56.4	270.4
30	65.3	681.2	1194.1	[illegible]	[illegible]	56.7	699.8	1221.9	40.6	272.1
34	49.3	515	1188.3	3377.8	261.4	[illegible]	518.8	1225.6	21.7	252.4
38	44.5	280	1178.7	4514	248.8	[illegible]	342.8	1198.5	54.9	215.8
42	37.5	159.6	1172.6	5691.7	[illegible]	[illegible]	330.2	1183.7	133.3	211.3
46	31.1	100.7	1168.3	5865.5	224.6	19.9	[illegible]	1181.3	135.2	208.8
50	25.2	47.8	1163.2	6909.2	202.8	19.1	[illegible]	1173.8	132.4	201.3
54	23.3	33	1163.2	6614.1	192.7	[illegible]	[illegible]	1168.6	146	196.4
58	18.7	111.3	1183.5	1797.9	196.9	[illegible]	135.6	[illegible]	125.2	189.4
62	18	78.8	1186.1	1857.1	190	14.8	[illegible]	[illegible]	63.6	181.4
66	16	86.8	1189.5	808.5	187.5	14.7	[illegible]	[illegible]	22.5	180.4
69.9	16.9	78.8	1182.9	678.1	184.9	14.7	[illegible]	[illegible]	5.6	179.1
90.1	21.3	167.5	1164.8	1000.8	200	14.7	0.9	1186.7	0	180
120.1	21.9	164.9	1165.1	1163.9	201.9	14.7	76.3	1162.3	68.1	187
150.1	22.1	186.8	1166.7	999	202.4	15.2	82.8	1155.5	208.9	183.9

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 9 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
180.1	20.1	205.5	11[illegible].2	568.[illegible]	199.5	14.9	50.3	1153.2	186.7	181.6
210.1	19.7	192.9	1[illegible]67.7	517.9	197.5	14.8	31.1	1154.6	48.9	181
240.1	19.3	167.9	1164[illegible]	65[illegible]	196.4	14.7	12.9	1182.3	1.8	177.2
270.1	19.2	154.9	1163.3	[illegible]22.1	194.6	14.7	0.3	1180	0	240
300.1	19.8	136.1	1161.6	[illegible]34.6	1[illegible].8	14.7	0.3	1073.3	0	240
330.1	19.3	133.4	1161.1	73[illegible]	1[illegible]5	14.7	0.1	1030	0	240
360.1	19.3	124.7	1160	888.7	194.3	1[illegible]7	0.5	1124	0	240
400	18.5	109.6	1158.8	914.5	192.6	14.7	0	1430	0	240
Begin ong-Term Release (Total Break Flow)[1]										
430	14.7	126	1160	870	193	—	—	—	—	—
500	14.7	116	1159	870	192	—	—	—	—	—
700	14.7	93	1157	870	190	—	—	—	—	—
910	14.7	79	1156	870	188	—	—	—	—	—
1120	14.7	74	1156	870	187	—	—	—	—	—
1508	14.7	61	1154	870	184	—	—	—	—	—
2016	14.7	53	1152	870	183	—	—	—	—	—
3997	14.7	35	1152	870	182	—	—	—	—	—
4903	14.7	20	1150	870	181	—	—	—	—	—
5038	14.7	29	1151	870	181	—	—	—	—	—

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Table 6.2.1-18—Mass and Energy Results for Case 7A Blowdown HL
Sheet 10 of 10

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
5098	14.7	24	1151	870	181	—	—	—	—	—
5158	14.7	13	1151	870	181	—	—	—	—	—
5188	14.7	9	1143	870	181	—	—	—	—	—
5308	14.7	7.5	1143	870	181	—	—	—	—	—
5529[2]	Note 3	4.5	1318	870	210	—	—	—	—	—
6244	Note 3	4.1	1391	870	210	—	—	—	—	—
7009	Note 3	4.0	1407	870	210	—	—	—	—	—
8005	Note 3	4.0	1410	870	212	—	—	—	—	—
13,409	Note 3	4.0	1412	870	213	—	—	—	—	—
13,509	Note 3	0	—	870	213	—	—	—	—	—
86,400	Note 3	0	—	870	149	—	—	—	—	—

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy releases at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results in a discontinuity in the mass and energy releases due to distinct modeling approaches.
3. RCS upstream pressure equal to containment pressure over this interval.

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 1 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0	2246.8	0	1[illegible]2.4	0	410	2247.9	0	1197	0	460
0.0001	2237.2	0	1212[illegible]	1000[illegible]	440	2237.1	0	1197	1000	460
0.1001	938.8	1945	1203.7	3[illegible]3	522	599	2695	1206	28447	516.7
0.2001	948.7	1690	1196.5	[illegible]287	53[illegible]	595.5	2696	1205.7	24065	503.7
0.3001	923.7	1332	1196.2	41[illegible]	[illegible]0	634.3	2412	1205.1	24370	511.5
0.4001	1007.2	1010	1196.5	39172	539.[illegible]	6[illegible]1	2365	1205	22869	511.7
0.5	1002.1	944.9	1196.9	39293.3	543.2	638.[illegible]	2307.3	1204.4	23655.7	516.1
0.6	1006.5	979	1195.9	39238	54[illegible]8	6[illegible]	2311	1204.5	23405	518.2
0.7	1012.6	1019	1196.1	39275	544.4	[illegible]39.9	[illegible]49	1204.6	23203	519.8
0.8	1018.1	1070	1195.6	39316	545	639.7	239[illegible]	1204.4	22946	521.5
0.9	1025.6	1133	1194.9	39362	545.5	639.[illegible]	[illegible]2453	1205	22644	523.1
1	1027.7	1212	1196	39352	545.9	634.[illegible]	2[illegible]33	[illegible]04.5	22214	524.4
1.1	1025.5	1300	1195.6	39142	546.1	628.7	2626	12[illegible]	21638	525.3
1.2	1022.9	1376	1196.1	38869	546.5	625.6	2[illegible]2	1205	21120	526.7
1.3	1018.3	1473	1195.8	38529	546.8	624.2	27[illegible]	12[illegible].5	20673	528.3
1.4	1008.2	1649	1196.5	38016	545.6	617.2	2881	1205.6	20168	529.1
1.5	993.7	1834	1196.9	37404	543.8	609.3	3002	1205.8	19490	528.8
1.6	977.4	2035	1198.3	36649	541.5	603.1	3094	1206.8	18888	529.4

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 2 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1.7	911.7	2168	120[illegible]	3518[illegible]	533.4	567.3	4807	1217	18570	486.7
1.8	906.5	2343	1[illegible]0.7	[illegible]4810	527.4	531.2	4984	1221.9	15516	463.1
1.9	899.4	2755	1202.[illegible]	3417[illegible]	520.4	515.1	4993	1223	14661	459.4
2	892.6	2920	1202.7	3[illegible]44	518.2	505.8	5003	1223.7	13990	456.7
2.1	881.9	3010	1202.9	[illegible]370	51[illegible]	495.7	5024	1224.5	13367	454.7
2.2	845.6	3053	1204.5	322[illegible]	[illegible]4	456.9	4974	1225.5	11947	449.1
2.3	829.4	3061	1210.7	30953	517.7	42[illegible]4	4819	1226.9	10276	440.3
2.4	824.7	3008	1230.2	30804	516.8	421.[illegible]	4704	1227	9921	436.6
2.5	816.2	2967	1240.6	30315	51[illegible].9	[illegible].2	4717	1227.7	9246	434.5
2.6	808	2936	1247.1	29911	519.1	409.5	[illegible]36	1228.3	8820	433.4
2.7	795.4	2916	1254.1	29428	519.2	403.3	473[illegible]	1228.7	8426	432
2.8	781.5	2913	1264	28820	518.6	395[illegible]	[illegible]722	1229.4	7991	430.3
2.9	768	2938	1271.1	28185	517.4	388[illegible]	4694	[illegible]29.6	7565	428.2
3	755.6	2979	1274.2	27571	516.3	380.7	4660[illegible]	123[illegible]	7156	426.2
3.1	744.5	3018	1274.1	27003	515.4	374.5	[illegible]26	1230[illegible]	6780	424.4
3.2	734.8	3042	1272.4	26520	514.7	369.6	45[illegible]	1[illegible].7	6480	422.9
3.3	726.1	3046	1271.2	26136	514.1	365.7	4561	1230.7	6284	421.6
3.4	718.4	3041	1268.2	25844	513.4	362.4	4529	1230.8	6182	420.6
3.5	711.5	3026	1266.6	25619	512.6	359.6	4497	1230.8	6149	419.8

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 3 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
3.6	705.5	3011	126[illegible]	2544[illegible]	511.7	357.1	4465	1230.8	6161	419
3.7	700.2	2994	1[illegible]2.3	[illegible]5305	510.9	355.1	4436	1230.4	6202	418.3
3.8	695.6	2979	1260.[illegible]	2519[illegible]	510.1	353.3	4406	1230.6	6261	417.8
3.9	691.5	2965	1258.8	[illegible]02	509.3	351.8	4378	1230.6	6332	417.2
4	687.8	2954	1257.3	[illegible]021	50[illegible]	350.5	4352	1230.2	6406	416.8
4.1	684.4	2946	1255.8	249[illegible]	[illegible]8	349.2	4325	1230.4	6483	416.3
4.2	681.2	2940	1254.6	24873	507.1	3[illegible]	4301	1230.3	6558	416
4.3	678.2	2936	1253.6	24801.9	506.4	346.[illegible]	4279	1229.9	6631	415.6
4.4	675.4	2936	1252	24731	50[illegible].8	3[illegible].9	4257	1229.9	6700	415.3
4.5	672.7	2937	1250.9	24663	505.1	345	[illegible]36	1229.9	6762	415
4.6	670.2	2941	1249.7	24597	504.5	344.1	4217	1229.7	6821	414.6
4.7	667.7	2946	1248.9	24527	504	343[illegible]	[illegible]198	1229.7	6870	414.5
4.8	665.4	2953	1247.9	24455.9	503.4	342.[illegible]	4181	1[illegible]29.5	6917	414.1
4.9	663.2	2961	1246.9	24384	502.9	341.7	4165	1229[illegible]	6959	413.9
5	660.9	2971	1245.7	24305	502.4	341	4[illegible]9	1229[illegible]	6996	413.7
5.1	658.8	2982	1244.6	24224	501.9	340.4	41[illegible]	1[illegible].3	7029	413.4
5.2	656.7	2993	1243.8	24140	501.5	339.7	4121	1229.3	7059	413.2
5.3	654.6	3005	1242.9	24052.9	501.1	339.1	4109	1229	7087	413
5.4	655.1	3021	1241.9	23967	500.7	338.7	4096	1229.1	7114	412.8

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 4 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
5.5	641.6	3540	1229	23786	489	334.8	4097	1229	7198	413.2
5.6	640.1	3816	1213.2	23527	483.1	333	4043	1229.2	7055	411.3
5.7	634.9	3837	1213.5	23275	482	329.1	4012	1228.9	7003	410.4
5.8	629.6	3864	1213.5	22925.9	480.9	324.8	3972	1228.9	6916	409.1
5.9	624.5	3891	1213.5	22776	479.9	320.8	3933	1228.9	6828	407.9
6	619.7	3915	1214	22529	479.9	317.2	3897	1229.1	6753	406.6
6.1	615.1	3938	1214.4	22313	478	313.7	3865	1229.3	6688	405.6
6.2	610.8	3962	1214.4	22093	477.2	310.5	3837	1228.9	6632	404.5
6.3	606.9	3985	1214.7	21880.9	476.4	307.6	3809	1229.1	6577	403.6
6.4	602.6	4009	1214.9	21666	475.6	304.7	3783	1229.3	6524	402.6
6.5	598.2	4035	1215.1	21430	474.7	301.6	3756	1229.3	6458	401.7
6.6	594	4061	1215.4	21191	473.8	298	3728	1229.1	6391	400.6
6.7	590.1	4086	1215.8	20956	473	295.6	3700	1229.3	6330	399.6
6.8	586.3	4113	1215.8	20722.9	472.2	292.8	3674	1229.3	6272	398.6
6.9	582.5	4139	1216.5	20488	471.5	290.1	3648	1229	6211	397.8
7	578.8	4169	1216.4	20247	470.7	287.5	3622	1229.2	6147	396.9
7.1	575.2	4200	1216.6	19998	470	284.9	3599	1229.2	6078	396
7.2	571.9	4231	1217.3	19748	469.3	282.5	3575	1229.4	6007	395.1
7.3	568.7	4271	1217.1	19479.9	468.7	280.3	3554	1229.2	5939	394.4

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 5 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
7.4	563.6	4324	1217.[illegible]	19112.[illegible]	467.9	277.7	3531	1229.5	5869	393.5
7.5	557.2	4397	1218.1	18587	466.8	273.7	3500	1229.2	5764	392.4
7.6	552.2	4476	1218.[illegible]	1803[illegible]	465.6	269.6	3460	1229.1	5626	391
7.7	548.2	4551	1219.3	1[illegible]77	464.7	266.7	3425	1229.4	5501	389.7
7.8	545.1	4612	1219.8	1[illegible]33.9	46[illegible]	264.5	3402	1229	5392	388.9
7.9	542.4	4658	1220.2	169[illegible]	[illegible]5	262.5	3381	1229.1	5294	388
8	539.4	4694	1220.4	16709	462.9	26[illegible]5	3363	1229.1	5205	387.4
8.1	536.1	4723	1220.9	16466.9	462.3	258.[illegible]	3345	1229.3	5120	386.7
8.2	532.8	4751	1221	16220.1	46[illegible]6	[illegible].3	3326	1229.3	5034	385.9
8.3	529.5	4776	1221.5	15975.9	460.9	254.3	[illegible]08	1229.1	4948	385.1
8.4	525.9	4798	1221.7	15736.1	460.3	252.2	328[illegible]	1229.3	4862	384.3
8.5	522.4	4813	1222	15513.9	459.5	25[illegible]	[illegible]269	1229.2	4775	383.6
8.6	518.9	4824	1222.2	15305.9	458.8	248	3249	1[illegible]28.9	4697	382.8
8.7	515.9	4828	1222.3	15135.1	458	246.1	3228	1229[illegible]	4630	382.1
8.8	512.5	4823	1222.7	14999.9	457.4	244.3	3[illegible]9	1229[illegible]	4578	381.4
8.9	510.2	4815	1222.5	14902.1	456.7	242.8	31[illegible]	1[illegible].6	4531	380.7
9	508.7	4805	1222.7	14850.9	456.2	242	3177	1229.1	4507	380.3
9.1	506.2	4790	1222.9	14812.9	455.8	241	3169	1228.9	4497	380
9.2	503.8	4775	1222.8	14743.1	455.2	239.5	3153	1229	4471	379.4

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 6 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.3	501.9	4762	122[illegible]	14694.[illegible]	454.7	238.3	3138	1228.8	4444	379
9.4	500	4749	1[illegible]2.8	[illegible]659.1	454.3	237.1	3125	1228.7	4423	378.5
9.5	498.4	4736	1222.[illegible]	14623[illegible]	453.9	236	3111	1229.1	4401	377.9
9.6	496.9	4726	1223	1[illegible]3.9	453.5	235	3100	1228.8	4376	377.6
9.7	495.3	4719	1223	1[illegible]46.1	45[illegible]	233.9	3089	1228.7	4345	377.3
9.8	493.6	4718	1222.9	1447[illegible]	[illegible]8	232.8	3077	1228.7	4302	376.7
9.9	491.8	4722	1223.2	14363.1	452.4	2[illegible]6	3066	1228.4	4240	376.3
10	489.8	4735	1223.3	14207.9	452	230.[illegible]	3053	1228.7	4159	375.8
10.1	487.2	4755	1223.5	13998.9	45[illegible]5	[illegible].1	3040	1228.6	4058	375.4
10.2	484.4	4780	1223.9	13738.1	450.9	227.7	[illegible]24	1228.5	3943	374.7
10.3	481.4	4806	1224.2	13452.9	450.3	226.3	300[illegible]	1228.6	3822	374.2
10.4	478.3	4828	1224.4	13173.1	449.7	224[illegible]	[illegible]987	1228.1	3708	373.7
10.5	475.1	4842	1224.8	12917	449	223.[illegible]	29[illegible]68	1[illegible]28.3	3612	373
10.6	471.8	4847	1225.2	12685	448.2	221.9	2953	1228[illegible]	3535	372.4
10.7	468.6	4848	1225.1	12485.1	447.5	220.4	2[illegible]8	122[illegible]	3473	371.8
10.8	465.6	4843	1225.5	12309	446.8	219	292[illegible]	1[illegible]8	3424	371.2
10.9	462.8	4837	1225.5	12158.1	446	217.7	2906	1228.1	3384	370.5
11	460.1	4828	1225.6	12035	445.4	216.5	2892	1227.9	3350	370.1
11.1	457.7	4817	1226	11930	444.8	215.5	2878	1228	3323	369.6

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 7 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.2	454.8	4806	122[illegible]	11801.[illegible]	444.1	214	2864	1227.5	3296	369.1
11.3	452.1	4793	1[illegible]5.9	[illegible]1690	443.5	212.5	2844	1227.8	3263	368.5
11.4	449.6	4780	1226[illegible]	11598[illegible]	442.8	211.3	2827	1227.7	3237	367.8
11.5	447.2	4770	1226.1	1[illegible]86	442.2	210.1	2812	1227.7	3213	367.4
11.6	444.8	4762	1226.3	[illegible]358	44[illegible]	209	2798	1227.4	3189	367
11.7	442.4	4755	1226.3	1122[illegible]1	[illegible]1	207.8	2784	1227.1	3167	366.4
11.8	440.1	4748	1226.4	11087	440.5	20[illegible]8	2769	1227.4	3146	365.9
11.9	437.6	4741	1226.6	10938.1	439.9	205.[illegible]	2756	1227	3126	365.4
12	435	4735	1226.6	10770	43[illegible]3	[illegible].6	2741	1227.5	3104	364.9
12.5	422.7	4711.4	1227	10252.4	437.5	199.8	[illegible].8	1226.9	3045.2	363.7
13	409.4	4630.4	1227.3	9692.8	434.2	193.7	2638.[illegible]	1226.6	2962.2	361.3
13.5	398.4	4533.2	1227.4	9350	430.9	189[illegible]	[illegible]571.8	1226.3	2894	358.8
14	387.2	4465	1227.7	8866.8	428	184.[illegible]	2517.4	[illegible]26	2864.6	356.7
14.5	375	4407	1228.2	8379.8	424.9	179.5	2463[illegible]	1225[illegible]	2761.2	354.5
15	360.6	4329.6	1228.7	7889.4	421.2	173	22[illegible].4	1225	2628.8	351.6
16	333.3	4187.9	1229.3	7172	415.3	161.6	229[illegible]	1[illegible]5	2440.3	347.3
17	315	3972.5	1229.2	6755.2	408.6	151.9	2165.8	1224.5	2471.9	341.5
18	286.1	3857.8	1230.5	5031.3	401.4	147.9	2066.1	1223.1	1693.2	338
19	256.3	3552	1230.3	3890.1	390.8	133.4	1924.4	1221.2	1259.8	332.7

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 8 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
20	235.5	3239.8	1229.4	3730.7	381.3	123.8	1736	1219.3	1076.3	324.2
22	213.5	2918.2	1226.3	3702.9	374.9	152.3	1712.4	1216.1	497	326.3
24	170	2218.4	1221.[illegible]	690.[illegible]	350.4	126.5	1408.3	1210.1	124.3	316.1
26	107.9	1600	1212.3	[illegible].5	330.1	80	1183.5	1206.7	27.7	310.3
28	105.4	1303.8	1214.2	[illegible]44.8	31[illegible]	65.3	801.7	1199	112.8	273.5
30	99.5	1264.7	1213	1775.[illegible]	[illegible]3	64.1	826.3	1198.6	23.3	278
34	83.5	922.6	1202.7	1676.8	301	5[illegible]	704.3	1197.9	37	265.8
38	73.3	620.1	1193	2209.4	286	49.4	627.5	1194	88.7	256.6
42	57.1	286.8	1197.1	5482.7	26[illegible].6	[illegible]	502.8	1190	53.9	241.8
46	31.7	67.9	1200.1	9950.5	236.5	30.8	[illegible]3	1187.5	78	234.4
50	29	56.3	1197	8307.7	207.7	30.2	433.[illegible]	1186.8	60.2	233.4
54	40.9	50	1194.2	7899.6	209	37.[illegible]	[illegible]69.8	1194.8	8.8	232.3
58	45.3	29.4	1205.6	7474.4	202.2	25	291.3	[illegible]02.5	5.8	221.6
62	32.5	32	1198	6726.4	184.4	23	277.7	1189.[illegible]	27.3	208
66	32	19.9	1176.9	6382.5	186.2	20.3	2[illegible].1	1176	30.5	201.4
70	20.9	31.2	1178.6	5177.5	188.6	16.2	229	[illegible]9	34.2	197.1
74	21.2	45.9	1168.9	3207.7	187.7	15.1	167.7	1164.8	76.3	191.2
78	21.1	90.7	1168.7	1291.3	201.2	15.3	177.7	1172.2	36.5	192.2
82	21.1	118.7	1169.5	630.1	200.9	16.1	171.7	1177.5	21.5	191.6

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 9 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
86	20.3	114.4	116[illegible]	629.4	200	15.6	163.9	1167.4	33.3	191.3
90	20.8	108.9	[illegible]65	[illegible]32.4	199.2	15.8	157.2	1164.8	39.8	190.1
120	20	96.2	1161.[illegible]	663.[illegible]	197.1	15.5	137.5	1160.3	67.4	188.1
150	19.7	93.8	1160.9	[illegible].6	196.5	15.6	134.8	1160.1	69.9	188.1
180	19.7	92.4	1160.5	[illegible]3.5	19[illegible]	15.3	134.7	1160	75.2	188
210	20.1	91.8	1159.9	68[illegible]	[illegible]1	15.8	132.3	1159.3	72.2	187.8
240	19.8	90.5	1161	685.5	195.9	[illegible]	125.9	1158.4	87	187
270	18.9	82.6	1159.9	719	194.5	15.2	126	1158.5	62.5	186.9
300	18.5	75.8	1158.7	683.8	19[illegible].5	[illegible]	113.5	1157.5	63.6	185.8
330	17.2	69.3	1160	670.6	190	14.5	[illegible].6	1155.9	51.1	184.7
360	16.9	63.4	1160	638.2	188	14.5	94.6	1156.5	35.5	183.7
400	16.7	56.6	1160.8	620.5	186.1	14.[illegible]	[illegible]86.8	1158.1	31	183

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 10 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
Begin Long-Term Release (Total Break Flow)[1]										
480	14.7	130	1160	636	183	—	—	—	—	—
580	14.7	117	1155	711	183	—	—	—	—	—
600	14.7	126	1158	5	184	—	—	—	—	—
700	14.7	120	1156	27	[illegible]	—	—	—	—	—
1400	14.7	91	1153	762	[illegible]	—	—	—	—	—
1800	14.7	84	1154	761	179	—	—	—	—	—
2200	14.7	70	1152	752	178	—	—	—	—	—
2800	14.7	62	1153	800	173	—	—	—	—	—
4200	14.7	38	1150	829	170	—	—	—	—	—
5400	14.7	35	1153	850	158	—	—	—	—	—
6600	14.7	26	1148	871	152	—	—	—	—	—
8800	14.7	24	1151	900	148	—	—	—	—	—
10,000	14.7	18.6	1147	893	146	—	—	—	—	—
10,811[2]	Note 3	11.1	1271	871	177	—	—	—	—	—
11,811	Note 3	12.2	1242	868	177	—	—	—	—	—
12,811	Note 3	12.2	1237	867	177	—	—	—	—	—
15,611	Note 3	11.6	1234	867	177	—	—	—	—	—
17,211	Note 3	10.8	1234	867	177	—	—	—	—	—

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Table 6.2.1-19—Mass and Energy Results for Case 14E Cold Leg Pump Suction
Sheet 11 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Press (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
18,811	Note 3	9.8	1227	868	177	—	—	—	—	—
20,211	Note 3	9.1	1232	869	177	—	—	—	—	—
25,011	Note 3	7.6	1230	870	176	—	—	—	—	—
30,011	Note 3	5.8	1227	872	174	—	—	—	—	—
35,011	Note 3	4.7	1225	873	173	—	—	—	—	—
40,012	Note 3	1.2	1221	876	171	—	—	—	—	—
45,012	Note 3	0.68	1217	877	170	—	—	—	—	—
49,412	Note 3	0	—	878	168	—	—	—	—	—
86,400	Note 3	0	—	879	158	—	—	—	—	—

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy release at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results in a discontinuity in the mass and energy releases due to distinct modeling approaches.
3. RCS upstream pressure equal to containment pressure over this interval.

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 1 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
0	2356.7	0.0	1[illegible]2.4	0.0	410.0	2357.1	0.0	1197.0	0.0	480.0
1E-04	2286.4	0.0	121[illegible].4	1000.0	350.0	2428.9	0.0	1197.0	1000.0	480.0
0.1001	998.9	889.0	1194.0	38[illegible].0	551.9	1289.4	1160.0	1194.0	45578.0	548.4
0.2001	1089.4	1181.0	1197.3	[illegible]244.0	546[illegible]	1476.9	3265.0	1176.8	55632.0	558.1
0.3001	1080.9	362.0	1191.3	41[illegible]7.0	[illegible]7.5	1076.8	4061.0	1175.9	49473.0	564.6
0.4001	1030.5	1605.0	1197.2	37513.0	54[illegible].0	1464.7	2386.0	1177.9	58683.0	557.2
0.5	994.2	1669.7	1198.7	37128.1	540.4	14[illegible]7	2525.5	1181.2	56345.3	555.1
0.6	980.0	1788.0	1198.7	36662.0	[illegible]38.3	14[illegible]8	2633.0	1181.3	55836.0	554.0
0.7	985.7	1882.0	1199.8	36283.0	536.6	[illegible]276.7	[illegible]675.0	1181.7	55029.0	553.1
0.8	981.9	1959.0	1199.3	35906.0	535.2	1004.7	26[illegible]7.0	1184.6	52955.0	551.8
0.9	950.8	2119.0	1200.7	35143.0	532.5	1026[illegible]	2276.0	1184.5	53552.0	551.5
1	880.6	2257.0	1201.0	34426.0	530.1	14[illegible]7	[illegible]22.0	1185.4	52719.0	550.8
1.1	858.6	2380.0	1201.3	33917.0	527.6	1362.[illegible]	2044.0	1[illegible]5.3	53786.0	550.7
1.2	851.4	2473.0	1202.3	33469.0	525.7	1272.6	21[illegible].0	118[illegible]2	51991.0	549.5
1.3	864.7	2502.0	1202.6	33337.0	524.9	1309.5	[illegible]10.0	11[illegible].1	50762.0	548.8
1.4	886.9	2585.0	1202.7	32935.0	523.2	1367.8	2525.[illegible]	[illegible]186.3	49886.0	547.4
1.5	879.5	2705.0	1204.0	32215.0	520.5	1224.5	1902.0	1188.4	48374.0	548.9
1.6	867.2	2682.0	1203.2	32281.0	520.6	979.3	2104.0	1191.6	45592.0	546.9

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 2 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
1.7	787.1	2937.0	1205.[illegible]	30841.[illegible]	515.5	1314.0	1533.0	1191.5	49046.0	547.2
1.8	820.6	2987.0	1204.8	[illegible]632.0	513.8	950.5	1992.0	1191.5	46321.0	545.1
1.9	827.9	3007.0	1205.[illegible]	3009[illegible]	513.0	999.6	1742.0	1190.6	46547.0	547.7
2	771.4	3035.0	1205.0	3[illegible]69.0	512.6	1161.5	1182.0	1192.4	45365.0	549.7
2.1	811.6	3065.0	1205.0	[illegible]750.0	5[illegible].2	1112.6	1535.0	1190.8	48642.0	547.5
2.2	782.1	3022.0	1205.1	297[illegible]0	[illegible]1.8	1019.4	1648.0	1194.7	42938.9	545.5
2.3	761.2	3083.0	1205.4	29225.0	510.[illegible]	1[illegible]6.7	1273.0	1193.1	46668.0	548.9
2.4	818.5	3016.0	1205.0	29713.0	511.6	958[illegible]	1636.0	1193.2	43486.9	546.6
2.5	774.8	3030.0	1205.4	29223.0	5[illegible]0.8	1[illegible]7.0	1427.0	1195.2	41955.0	546.6
2.6	736.2	3029.0	1204.8	28669.0	510.2	1051.7	[illegible]26.0	1194.4	41959.0	548.6
2.7	711.3	2959.0	1205.0	28026.0	510.4	1150.5	126[illegible]	1194.4	41491.9	547.7
2.8	709.0	2828.0	1205.0	27333.0	511.8	117[illegible]	1315.0	1195.0	41511.0	547.0
2.9	751.3	2708.0	1204.3	26793.0	513.7	111[illegible]	1590.0	[illegible]93.8	41173.9	546.7
3	747.8	2656.0	1204.9	26225.0	514.2	973.9	1567[illegible]	119[illegible]9	39921.0	545.1
3.1	713.2	2539.0	1204.2	25506.0	515.6	960.2	1[illegible]3.0	119[illegible]5	39856.0	544.6
3.2	695.8	2462.0	1204.7	24876.0	516.4	957.4	162[illegible]0	1[illegible]5.4	39880.9	544.1
3.3	694.2	2404.0	1204.2	24391.0	517.2	946.9	1700.0	1196.0	39893.0	543.6
3.4	674.5	2364.0	1204.6	23779.0	517.3	945.7	1794.0	1195.4	39651.9	542.6
3.5	676.9	2268.0	1204.1	23232.0	518.9	955.5	1794.0	1195.9	39657.0	542.7

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 3 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
3.6	666.4	2263.0	120[illegible]	2279[illegible]	518.7	950.9	1871.0	1195.8	39342.0	541.4
3.7	639.9	2270.0	1[illegible]4.5	[illegible]400.0	518.4	1220.0	1944.0	1196.9	38782.9	540.3
3.8	601.8	2286.0	1204.[illegible]	2212[illegible]	518.1	1067.1	2092.0	1198.4	37226.0	539.1
3.9	602.0	2303.0	1204.5	2[illegible]20.0	518.[illegible]	1002.5	2230.0	1197.2	38189.9	534.3
4	595.6	2297.0	1204.8	[illegible]490.0	5[illegible].1	995.4	2483.0	1198.1	37682.0	530.1
4.1	588.2	2295.0	1205.3	211[illegible]0	[illegible]8.2	983.5	2589.0	1198.9	37148.0	529.2
4.2	580.6	2289.0	1204.8	20806.0	518.[illegible]	[illegible]3.5	2705.0	1199.2	36563.0	528.2
4.3	573.6	2279.0	1205.6	20445.9	518.7	962[illegible]	2817.0	1199.9	35992.9	527.5
4.4	569.7	2270.0	1205.1	20154.0	5[illegible]9.2	[illegible]9.5	2920.0	1200.5	35361.0	526.9
4.5	565.0	2258.0	1205.8	19939.0	519.8	935.2	[illegible]26.0	1200.7	34636.0	525.9
4.6	560.2	2250.0	1205.7	19680.0	520.4	922.3	308[illegible]	1201.8	34013.0	525.3
4.7	556.4	2246.0	1205.9	19430.0	520.9	91[illegible]	3125.0	1202.0	33435.0	525.0
4.8	554.2	2271.0	1205.9	19165.9	521.6	898[illegible]	3160.0	[illegible]02.9	32851.9	524.9
4.9	552.5	2316.0	1206.5	18896.0	522.6	889.5	3211[illegible]	120[illegible]0	32266.0	525.2
5	549.4	2334.0	1206.2	18693.0	523.0	881.7	[illegible]8.0	120[illegible]7	31888.0	525.1
5.1	547.0	2350.0	1206.6	18514.0	522.9	873.4	32[illegible]0	1[illegible]3.8	31563.0	524.7
5.2	543.7	2375.0	1206.5	18345.0	522.6	863.3	3281.0	1204.7	31222.0	523.3
5.3	539.0	2436.0	1206.7	18050.9	521.8	853.1	3314.0	1205.9	30869.9	522.0
5.4	534.3	2502.0	1206.8	17714.0	520.9	843.5	3329.0	1206.8	30530.0	521.0

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 4 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
5.5	544.7	3972.0	121[illegible]	1818[illegible]	485.3	766.6	3814.0	1216.6	29331.0	505.8
5.6	504.0	4598.0	1[illegible]0.8	[illegible]142.0	458.8	763.3	4820.0	1237.3	28079.0	476.4
5.7	479.5	4587.0	1222.[illegible]	1475[illegible]	451.8	761.3	5201.0	1246.3	27917.0	467.4
5.8	466.6	4580.0	1223.4	1[illegible]21.9	447.6	759.6	5387.0	1249.4	27511.9	466.0
5.9	455.0	4551.0	1224.0	[illegible]443.0	[illegible].9	750.1	5299.0	1249.1	26973.0	469.3
6	441.7	4575.0	1224.8	1261[illegible]0	[illegible]1.9	751.0	5220.0	1248.5	26174.0	475.0
6.1	384.3	4347.0	1225.5	11553.0	432.[illegible]	[illegible].9	5164.0	1253.3	25977.0	477.3
6.2	363.8	4125.0	1227.0	10279.0	422.2	748[illegible]	5156.0	1259.4	25842.0	477.4
6.3	351.2	4084.0	1227.4	9372.0	4[illegible]7.9	[illegible]1.3	5126.0	1253.1	24772.9	485.3
6.4	341.8	4045.0	1228.3	8686.0	414.8	733.7	[illegible]33.0	1238.6	23533.0	492.8
6.5	335.0	4012.0	1228.5	8163.0	412.5	728.3	522[illegible]	1221.4	22408.0	498.0
6.6	328.8	3977.0	1228.8	7773.0	410.6	72[illegible]	[illegible]5361.0	1215.2	21553.0	499.4
6.7	322.7	3935.0	1228.9	7469.0	408.8	714[illegible]	5476.0	[illegible]215.5	20904.0	498.5
6.8	317.0	3891.0	1229.0	7207.0	406.9	707.7	556[illegible]	121[illegible]0	20382.9	497.4
6.9	311.4	3844.0	1229.0	6962.0	405.1	699.1	5[illegible]4.0	121[illegible]5	19857.0	495.9
7	307.6	3808.0	1229.1	6791.0	403.7	696.3	56[illegible]0	1[illegible]6.9	19549.0	494.9
7.1	304.0	3776.0	1229.1	6668.0	402.4	690.8	5690.0	1217.3	19351.0	494.2
7.2	300.5	3745.0	1229.3	6539.0	401.4	684.9	5705.0	1217.5	19082.0	493.2
7.3	296.8	3716.0	1229.0	6355.0	400.2	678.6	5748.0	1217.9	18709.9	492.1

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 5 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
7.4	292.2	3679.0	1229.2	6125.0	398.8	670.9	5813.0	1218.6	18216.0	490.9
7.5	287.8	3648.0	1229.3	5881.0	397.3	664.2	5888.0	1219.3	17640.0	489.5
7.6	283.3	3623.0	1229.4	5612.0	395.9	658.6	5984.0	1219.9	17040.0	488.5
7.7	278.7	3598.0	1229.5	5310.0	394.3	652.2	6096.0	1220.7	16320.0	487.5
7.8	275.1	3567.0	1230.1	4994.0	392.0	647.0	6211.0	1221.4	15517.9	486.4
7.9	272.2	3546.0	1229.7	4690.0	391.9	643.5	6323.0	1222.2	14749.0	485.7
8	269.4	3534.0	1230.2	4391.0	390.[illegible]	6[illegible]2	6429.0	1222.8	13895.0	485.1
8.1	267.0	3522.0	1230.2	4092.0	390.0	632[illegible]	6546.0	1223.6	13046.0	484.1
8.2	264.7	3502.0	1230.1	3756.0	389.2	[illegible]8.7	6692.0	1224.4	12207.1	483.4
8.3	263.8	3477.0	1229.9	3433.0	388.5	625.1	[illegible]21.0	1225.2	11349.0	482.7
8.4	263.4	3473.0	1229.6	3142.0	388.4	622.6	694[illegible]	1226.0	10546.1	482.3
8.5	263.7	3464.0	1229.6	2878.0	388.1	61[illegible]	7033.0	1226.5	9765.0	481.8
8.6	264.4	3469.0	1229.8	2664.0	388.3	616[illegible]	7085.0	[illegible]26.9	9084.0	481.4
8.7	265.3	3472.0	1229.3	2480.0	388.7	611.5	7088[illegible]	122[illegible]1	8460.0	480.5
8.8	265.2	3467.0	1229.0	2308.0	388.7	607.5	7[illegible]7.0	122[illegible]4	7956.0	479.8
8.9	265.3	3451.0	1229.0	2166.0	388.7	604.6	71[illegible]0	1[illegible]7.7	7564.0	478.9
9	265.7	3443.0	1228.6	2021.0	388.6	601.1	7159.0	1228.0	7177.0	478.4
9.1	266.4	3429.0	1228.5	1895.0	388.9	597.9	7156.0	1228.4	6810.0	477.6
9.2	266.9	3422.0	1228.2	1788.0	389.0	594.8	7157.0	1228.4	6501.0	477.1

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 6 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
9.3	267.8	3416.0	1227.[illegible]	1691.[illegible]	389.1	591.3	7136.0	1228.5	6199.0	476.4
9.4	268.2	3409.0	1227.6	1615.0	389.3	588.8	7119.0	1228.7	5965.0	475.8
9.5	268.9	3401.0	1227.[illegible]	1540.[illegible]	389.4	585.8	7096.0	1228.7	5736.0	475.3
9.6	270.0	3402.0	1227.1	1[illegible]4.0	389.7	582.7	7056.0	1228.6	5468.0	474.4
9.7	270.3	3405.0	1227.0	[illegible]95.0	3[illegible].0	578.9	7022.0	1228.7	5212.0	474.0
9.8	269.3	3390.0	1227.3	133[illegible].0	[illegible]9.7	573.0	6979.0	1228.7	5014.0	472.8
9.9	267.1	3367.0	1226.7	1291.0	389.[illegible]	5[illegible].3	6921.0	1228.9	4831.0	471.4
10	264.5	3333.0	1226.7	1262.0	388.6	558.[illegible]	6845.0	1229.1	4715.0	469.9
10.1	262.7	3300.0	1226.5	1218.0	3[illegible]7.2	[illegible]1.0	6765.0	1229.2	4547.0	468.2
10.2	259.2	3266.0	1226.1	1186.0	386.7	543.9	[illegible]91.0	1229.5	4407.0	466.7
10.3	255.2	3222.0	1226.3	1182.0	384.9	536.4	660[illegible]	1229.4	4359.0	465.1
10.4	250.6	3178.0	1226.1	1185.0	383.5	52[illegible]	6523.0	1229.6	4331.0	463.3
10.5	245.7	3133.0	1226.1	1221.0	381.8	52[illegible]	6453.0	[illegible]29.6	4406.0	462.0
10.6	240.6	3084.0	1225.9	1267.0	379.9	516.1	6369.[illegible]	122[illegible]7	4509.0	460.5
10.7	235.4	3029.0	1226.1	1304.0	378.0	508.7	6[illegible]0.0	122[illegible]9	4598.0	458.8
10.8	231.0	2983.0	1226.0	1335.0	376.0	503.4	62[illegible]0	1[illegible]0.1	4646.0	457.2
10.9	226.7	2939.0	1226.3	1364.0	374.4	496.8	6160.0	1230.3	4691.0	456.0
11	223.4	2899.0	1225.7	1386.0	372.8	491.6	6087.0	1230.3	4695.0	454.5
11.1	221.0	2866.0	1226.1	1382.0	371.5	485.5	6032.0	1230.3	4615.0	453.3

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 7 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
11.2	218.5	2838.0	1225.[illegible]	1368.[illegible]	370.6	478.9	5959.0	1230.4	4470.0	451.7
11.3	215.4	2805.0	1[illegible]5.6	[illegible]359.0	369.6	471.3	5879.0	1230.5	4331.0	450.0
11.4	210.8	2759.0	1225.[illegible]	1375[illegible]	367.8	462.8	5789.0	1230.6	4270.0	448.2
11.5	204.9	2707.0	1225.0	1[illegible]20.0	365.5	454.0	5685.0	1230.7	4300.0	445.7
11.6	198.3	2649.0	1225.7	[illegible]486.0	3[illegible].1	444.9	5587.0	1230.5	4412.0	443.8
11.7	191.7	2586.0	1225.2	155[illegible]0	[illegible]0.3	436.1	5486.0	1231.0	4550.0	441.4
11.8	185.9	2518.0	1225.2	1618.0	357.[illegible]	4[illegible]7.9	5392.0	1231.2	4697.0	439.2
11.9	181.0	2455.0	1225.1	1675.0	354.9	421[illegible]	5311.0	1231.0	4856.0	437.5
12	175.4	2396.0	1224.3	1737.0	3[illegible]2.4	[illegible]4.0	5218.0	1231.0	5021.0	435.5
12.5	157.3	2244.4	1224.5	1884.2	345.2	375.8	[illegible]95.0	1230.6	5415.0	429.8
13	157.2	2199.6	1224.5	2242.6	343.1	372.3	405[illegible]	1226.1	5346.8	426.8
13.5	143.7	2097.2	1224.1	2475.2	338.2	34[illegible]	[illegible]3534.4	1224.3	5403.4	419.7
14	134.5	1947.0	1223.2	2435.6	331.6	317[illegible]	3222.0	[illegible]24.6	5203.2	411.8
14.5	127.6	1853.2	1222.3	2548.0	327.2	301.5	2866[illegible]	122[illegible]4	5031.6	406.4
15	121.1	1773.8	1221.7	2657.4	323.4	281.8	[illegible]9.4	121[illegible]5	4892.4	402.0
16	106.2	1621.5	1220.3	2660.1	315.8	247.6	22[illegible]7	[illegible]3.0	4710.4	390.0
17	98.0	1462.5	1217.6	2935.2	308.5	217.7	1951.1	1246.0	4926.7	366.0
18	89.6	1353.6	1216.1	3217.5	302.5	201.5	1723.6	1254.7	4808.6	345.7
19	109.4	1012.2	1205.6	3584.2	309.8	203.3	1629.6	1263.9	4443.4	323.9

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 8 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
20	100.7	873.8	120[illegible]	3079.[illegible]	303.4	185.6	1446.7	1264.9	3800.6	309.9
22	68.8	734.8	1[illegible]5.6	[illegible]839.8	298.3	121.0	1153.4	1256.7	3625.5	299.5
24	69.7	550.4	1189.[illegible]	2630[illegible]	283.5	113.7	705.3	1242.5	3817.5	284.8
26	59.0	478.6	1188.7	1[illegible]3.6	275.8	70.7	605.9	1218.9	2563.4	276.2
28	60.7	231.6	1189.5	[illegible]15.7	2[illegible].6	60.6	268.8	1228.2	908.7	264.1
30	60.0	245.0	1202.7	239[illegible]	[illegible]3.2	62.6	256.8	1209.0	376.6	264.6
34	60.0	208.5	1180.8	284.6	263.[illegible]	[illegible]9	227.1	1201.4	529.6	264.1
38	60.2	133.9	1212.7	242.0	260.4	67.[illegible]	133.1	1262.5	537.3	261.9
42	62.7	143.4	1192.4	2280.5	2[illegible]6.2	[illegible].4	195.4	1250.8	1689.6	262.0
46	62.4	95.5	1212.6	3491.6	236.4	60.9	[illegible]3.3	1253.1	1090.7	249.6
50	66.0	107.0	1220.0	2005.3	228.2	60.4	139.[illegible]	1260.0	661.1	254.2
54	60.2	113.7	1215.0	1166.5	238.3	61.[illegible]	136.0	1248.2	516.8	247.4
58	60.2	139.6	1232.6	225.0	257.3	61.[illegible]	1[illegible]3.7	[illegible]28.8	472.8	258.9
62	60.2	149.2	1230.0	145.2	261.1	61.5	161.[illegible]	121.[illegible]5	333.0	262.4
66	60.2	155.5	1205.7	220.4	261.4	61.7	[illegible]5.5	119.[illegible]9	456.2	262.7
90	60.1	79.2	1203.3	27.4	257.4	60.2	6[illegible]	1[illegible]3.9	66.2	259.2
120	60.2	149.4	1193.6	57.7	262.0	61.3	143.5	1206.8	133.7	262.9
150	60.3	154.2	1188.2	77.1	262.1	61.0	152.7	1194.0	214.0	263.0
180	60.2	97.7	1208.5	87.3	256.6	60.6	87.2	1220.8	225.4	258.8

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 9 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
210	60.1	146.0	118[illegible]	236.[illegible]	261.7	61.5	173.7	1184.0	572.9	262.6
240	60.3	129.8	1[illegible]5.3	[illegible]73.3	260.2	60.8	122.5	1196.9	183.4	261.6
270	60.2	127.0	1184.[illegible]	70.[illegible]	261.4	60.8	122.3	1184.4	201.4	262.5
300	60.1	127.3	1191.1	[illegible]7.0	258.5	61.2	131.8	1185.4	424.5	259.9
350	60.2	110.6	1192.7	[illegible]27.0	[illegible].8	60.8	103.0	1191.0	308.0	254.2
400	60.0	110.8	1186.6	44.[illegible]	[illegible]0.7	60.6	108.3	1184.5	113.9	262.1
450	60.1	108.1	1188.0	39.7	260.[illegible]	[illegible]5	106.1	1184.7	98.2	262.0
500	60.1	108.7	1180.9	41.9	260.6	60.[illegible]	106.6	1181.0	119.5	262.1
550	60.0	102.9	1181.4	38.7	[illegible]9.6	[illegible].5	101.2	1181.5	107.3	261.7
600	60.1	93.7	1182.0	58.9	257.9	60.3	[illegible]9.9	1181.2	165.3	260.2
650	60.1	87.7	1181.8	68.0	256.1	60.4	82.[illegible]	1182.5	167.3	258.2
700	60.1	90.3	1180.3	62.0	257.2	60.[illegible]	86.3	1181.5	149.7	259.5
750	60.1	86.8	1181.8	52.5	256.8	60.[illegible]	[illegible]3.6	[illegible]81.3	136.0	259.3
800	60.0	87.7	1179.2	51.7	256.6	60.4	85.[illegible]	117[illegible]5	145.2	259.2
850	60.1	87.9	1179.5	57.7	258.1	60.4	[illegible].1	117[illegible]9	161.6	260.0
900	60.0	85.5	1178.8	62.5	257.6	60.4	82.[illegible]	1[illegible]9.9	174.2	259.8
950	60.0	82.7	1179.4	55.3	256.8	60.3	80.5	1179.3	151.1	259.5
1000	60.0	81.1	1179.1	62.3	257.1	60.3	78.2	1179.0	162.8	259.2

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 10 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
Begin Long-Term Release (Total Break Flow)[1]										
1125	60	152	1180	225	258	—	—	—	—	—
1375	60	134	1180	253	254	—	—	—	—	—
1625	60	116	1179	265	250	—	—	—	—	—
1875	60	104	1179	283	[illegible]	—	—	—	—	—
2500	60	88	1179	30[illegible]	[illegible]	—	—	—	—	—
3500	60	69	1179	335	212	—	—	—	—	—
4500	60	54	1177	378	218	—	—	—	—	—
5500	60	48	1178	391	230	—	—	—	—	—
6500	60	46	1179	391	236	—	—	—	—	—
7500	60	37	1180	391	240	—	—	—	—	—
9000	60	32	1179	391	222	—	—	—	—	—
9252[2]	Note 3	18.6	1221	391	252	—	—	—	—	—
10,000	Note 3	16.0	1263	391	250	—	—	—	—	—
15,000	Note 3	15.8	1263	391	243	—	—	—	—	—
18,000	Note 3	14.4	1255	391	241	—	—	—	—	—
35,000	Note 3	6.2	1214	391	231	—	—	—	—	—
40,000	Note 3	5.2	1210	397	228	—	—	—	—	—
50,000	Note 3	2.8	1202	397	222	—	—	—	—	—

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Table 6.2.1-20—Mass and Energy Results for Case 31 CLPD (Long-Term Case B)
Sheet 11 of 11

	Reactor Vessel Side of the Break					SG Side of the Break				
Time (s)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)	Upstream Pressure (psia)	Average Steam Mass Flow (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow (lb_m/s)	Average Liquid Enthalpy (BTU/lb_m)
60,000	Note 3	1.8	1192	397	219	—	—	—	—	—
70,000	Note 3	1.1	1194	397	216	—	—	—	—	—
86,400	Note 3	0.075	1189	397	213	—	—	—	—	—

Notes:

1. Tabulated values are produced by averaging the instantaneous mass and energy releases at discrete times.
2. The code transition from RELAP5/MOD2-B&W to GOTHIC results in a discontinuity in the mass and energy releases due to distinct modeling approaches.
3. RCS upstream pressure equal to containment pressure over the interval.

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Table 6.2.1-21—Input Summary for Mass and Energy Release

Parameter	Value
RCS Conditions	
Core Power	4612 MWt
Decay Heat	1.2*ANS71 (plus actinides)
Core Inlet Temperature	565.5°F
Total RCS Flow Rate	498932 gpm
Pressurizer	
PZR Liquid Level	59.7 span%
IRWST	
Liquid Temperature	122°F
Safety Injection Accumulators	
Liquid Volume	1236 – 1324.3 ft³
Total Volume	1942.5 ft³
Pressure	653 – 682 psia
Liquid Temperature	90.5°F

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 1 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
0.00	0.00	0.00	0.00	0.00
0.00	7956.19	1172.22	0.00	508.89
1.00	[illegible]644.91	1234.80	0.00	446.19
2.00	83[illegible]33	1240.19	0.00	453.46
3.00	10,84[illegible]02	1242.35	0.00	535.39
4.00	12.[illegible].36	1244.07	0.00	542.36
5.00	[illegible],690.[illegible]	1245.02	0.00	542.86
6.00	13.[illegible].64	1244.40	0.00	541.10
7.00	12[illegible]82.59	[illegible]239.73	0.00	538.70
8.00	11,63[illegible]76	1234.10	0.00	536.99
9.00	10,869.53	1228.90	0.00	535.70
10.00	10,247.24	1223.[illegible]	0.00	534.25
11.00	9731.39	12[illegible]	0.00	532.40
12.00	9246.65	[illegible]215.84	0.00	529.83
13.00	8559.26	12[illegible]13	[illegible]00	527.21
14.00	7990.50	1213.1[illegible]	0.00	523.98
15.00	7600.12	1213.29	0.00	520.26
16.00	7328.61	1215.54	0[illegible]	516.24
17.00	7132.66	1216.77	0.00	512.54
18.00	6979.76	1217.61	[illegible].00	[illegible]09.15
19.00	6865.99	1218.28	0.0[illegible]	50[illegible]98
20.00	6789.44	1218.71	0.00	50[illegible]97
21.00	6708.73	1219.05	0.00	[illegible]0.13
22.00	6527.66	1219.72	0.00	497.23
23.00	6131.66	1221.13	0.00	494.25
24.00	5688.01	1222.62	0.00	491.14
25.00	5210.93	1224.34	0.00	486.62
26.00	4415.65	1227.06	0.00	476.62
27.00	3587.21	1229.00	0.00	467.06
28.00	3009.15	1229.81	0.00	459.50
29.00	2625.09	1229.76	0.00	455.46

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 2 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
30.00	2378.98	1229.25	0.00	454.35
31.00	2217.35	1228.97	0.00	453.98
32.00	2103.54	1228.18	0.00	454.77
33.00	1984.45	1227.52	0.00	453.75
34.00	1874.55	1226.94	0.00	452.32
35.00	1787.54	1226.44	0.00	450.94
36.00	1697.85	1225.68	0.00	447.07
37.00	1534	1225.72	0.00	445.62
38.00	1558.30	1225.83	0.00	449.89
39.00	1578.88	1224.81	0.00	451.03
40.00	1529.37	1224.30	0.00	450.14
41.00	1444.08	1223.68	0.00	447.27
42.00	1342.26	1223.5	0.00	443.76
43.00	1294.65	1222.91	0.00	441.87
44.00	1267.37	1222.68	0.00	439.99
45.00	1234.39	1222.4	0.00	436.95
46.00	1203.29	1222.59	0.00	433.91
47.00	1172.83	1222.54	0.00	431.25
48.00	1145.67	1222.57	0.00	428.16
49.00	1121.62	1223.27	0.00	434.56
50.00	1095.91	1224.80	0.00	437.36
52.00	1048.02	1224.24	0.00	437.72
54.00	1015.12	1228.99	0.00	437.73
56.00	957.31	1226.34	0.00	423.81
58.00	919.16	1230.07	0.00	450.00
60.00	860.99	1226.95	0.00	0.00
62.00	797.73	1226.14	0.00	0.00
64.00	734.76	1226.19	0.00	0.00
66.00	678.35	1227.74	0.00	0.00
68.00	628.00	1227.01	0.00	0.00
70.00	584.23	1227.96	0.00	0.00

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 3 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
72.00	559.30	1229.23	0.00	0.00
74.00	569.54	1231.21	0.00	0.00
76.00	588.32	1230.22	0.00	0.00
78.00	[illegible]1.06	1229.75	0.00	0.00
80.00	657[illegible]5	1228.63	0.00	0.00
82.00	669[illegible]5	1227.59	0.00	0.00
84.00	[illegible].00	1226.89	0.00	0.00
86.00	650[illegible]	1226.87	0.00	0.00
88.00	[illegible]4.82	1226.87	0.00	0.00
90.00	61[illegible]97	1226.88	0.00	0.00
92.00	597.49	1226.25	0.00	0.00
94.00	563.89	1225.04	0.00	0.00
96.00	528.37	122[illegible]5	0.00	0.00
98.00	491.66	[illegible]24.19	0.00	0.00
100.00	454.34	1[illegible]24.23	[illegible].00	0.00
105.00	411.68	1223.[illegible]9	0.[illegible]	0.00
110.00	363.48	1223.21	0.00	0.00
115.00	297.66	1220.83	0.0[illegible]	0.00
120.00	240.05	1217.74	[illegible].00	0.00
125.00	217.26	1217.51	0.00	0.00
130.00	197.36	1216.56	0.[illegible]0	[illegible]00
135.00	180.75	1216.66	0.00	0.[illegible]0
140.00	179.20	1218.83	0.00	[illegible]00
145.00	175.36	1222.36	0.00	0.00
150.00	167.01	1223.83	0.00	0.00
155.00	157.40	1228.89	0.00	0.00
160.00	148.66	1230.86	0.00	0.00
165.00	141.36	1230.36	0.00	0.00
170.00	135.08	1229.88	0.00	0.00
175.00	129.70	1229.50	0.00	0.00
180.00	124.99	1229.52	0.00	0.00

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 4 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
185.00	120.61	1230.91	0.00	0.00
190.00	116.79	1230.92	0.00	0.00
195.00	113.52	1230.87	0.00	0.00
200.00	[illegible].66	1230.86	0.00	0.00
205.00	108[illegible]0	1230.89	0.00	0.00
210.00	105[illegible]4	1230.99	0.00	0.00
215.00	[illegible].62	1231.08	0.00	0.00
220.00	101[illegible]	1231.23	0.00	0.00
225.00	[illegible].72	1231.40	0.00	0.00
230.00	9[illegible]6	1231.52	0.00	0.00
235.00	96.50	1231.59	0.00	0.00
240.00	95.14	1231.75	0.00	0.00
245.00	93.83	123[illegible]9	0.00	0.00
250.00	92.57	[illegible]33.37	0.00	0.00
255.00	91.30	[illegible]34.57	[illegible].00	0.00
260.00	90.32	1234.[illegible]2	0.[illegible]	0.00
265.00	89.39	1234.64	0.00	0.00
270.00	88.55	1234.60	0.0[illegible]	0.00
275.00	87.78	1234.68	[illegible].00	0.00
280.00	87.06	1234.64	0.00	0.00
285.00	86.39	1234.65	0.[illegible]0	[illegible]00
290.00	85.76	1234.70	0.00	0.[illegible]0
295.00	85.20	1234.73	0.00	[illegible]00
300.00	84.68	1234.67	0.00	0.00
305.00	84.18	1234.68	0.00	0.00
310.00	83.73	1234.68	0.00	0.00
315.00	83.30	1234.67	0.00	0.00
320.00	82.90	1234.64	0.00	0.00
325.00	82.50	1234.62	0.00	0.00
330.00	82.16	1234.57	0.00	0.00
335.00	81.86	1234.53	0.00	0.00

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 5 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
340.00	81.59	1234.50	0.00	0.00
345.00	81.35	1234.47	0.00	0.00
350.00	81.14	1234.45	0.00	0.00
355.00	[illegible].96	1234.40	0.00	0.00
360.00	80.[illegible]	1234.37	0.00	0.00
365.00	80.[illegible]	1234.33	0.00	0.00
370.00	[illegible].44	1234.30	0.00	0.00
375.00	80.[illegible]	1234.27	0.00	0.00
380.00	[illegible].14	1234.24	0.00	0.00
385.00	80.[illegible]	1234.20	0.00	0.00
390.00	79.88	1234.17	0.00	0.00
395.00	79.78	1234.14	0.00	0.00
400.00	79.68	123[illegible]	0.00	0.00
405.00	79.59	[illegible]34.08	0.00	0.00
410.00	79.51	[illegible]34.04	[illegible].00	0.00
415.00	79.44	1234.[illegible]	0.[illegible]	0.00
420.00	79.37	1233.98	0.00	0.00
425.00	79.31	1233.95	0.0[illegible]	0.00
430.00	79.25	1233.92	[illegible].00	0.00
435.00	79.20	1233.89	0.00	0.00
440.00	79.15	1233.86	0.[illegible]0	[illegible]00
445.00	79.11	1233.81	0.00	0.[illegible]0
450.00	79.07	1233.76	0.00	[illegible]00
455.00	79.04	1233.73	0.00	0.00
460.00	79.00	1233.70	0.00	0.00
465.00	78.98	1233.68	0.00	0.00
470.00	78.95	1233.64	0.00	0.00
475.00	78.92	1233.61	0.00	0.00
480.00	78.90	1233.58	0.00	0.00
485.00	78.88	1233.55	0.00	0.00
490.00	78.86	1233.52	0.00	0.00

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Table 6.2.1-22—MSLB Mass and Energy Release Data
Sheet 6 of 6

Time (s)	Average Steam Mass Flow Rate (lb_m/s)	Average Steam Enthalpy (BTU/lb_m)	Average Liquid Mass Flow Rate (lb_m/s)	Average Liquid Enthalpy[1] (BTU/lb_m)
495.00	78.84	1233.49	0.00	0.00
500.00	78.83	1233.47	0.00	0.00

Note:

1. The Average Liquid Enthalpy is reported for completeness. Since the Average Liquid Mass Flow Rate is zero the liquid enthalpy is not considered in the analysis.

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Table 6.2.1-23—Containment Energy Distribution for Hot Leg Break
Sheet 1 of 2
Energy (BTU)

	Prior to LOCA t = seconds	End of Blowdown t = 20 seconds	Peak Pressure t = 26 seconds	End of Reflood t =3957 seconds	1 day into recirculation
Reactor Coolant Internal Energy	4.00[illegible]-08	3.886E+07	4.135E+07	3.402E+07	5.398E+07
Accumulator Coolant Internal Energy	3.[illegible]77E+[illegible]	2.9167E+07	2.2555E+07	1.3066E+05	1.3066E+05
Energy Stored in RV Internals	N/A (included in Pressurizer, Primary Piping, Valves and Pumps)				
Energy Stored in Core	3.545E+07	1.369E+07	1.104E+07	5.207E+06	(Included in Energy stored in Pressurizer, Primary Piping, Valves, and Pumps)
Energy Generated During Shutdown from Decay Heat	0.000E+00	1.1[illegible]E+07	1.290E+07	4.129E+08	5.213E+08 [1]
Energy Stored in Pressurizer, Primary Piping, Valves, and Pumps	2.140E+08	2.034E+[illegible]8	2.014E+[illegible]	1.308E+08	4.135E+07
Energy Stored in SG Metals	2.075E+08	2.077E+08	2.[illegible]76E+08	1.814E+08	1.234E+08
Secondary Coolant Internal Energy in SG	4.801E+08	5.113E+08	5.152E+08	4.[illegible]9E+08	(Included in SG Metals)
Energy Content in RCB Atmosphere	2.996E+07	4.495E+08	4.536E+[illegible]8	2.183E+[illegible]	7.426E+07
Energy Content in RCB and Internals	3.863E+09	3.882E+09	3.890E+09	4.2[illegible]E+09	4.764E+09
Energy Content of Recirculation Intake Water (IRWST)	2.831E+08	2.908E+08	2.944E+08	[illegible]494E+08	5.753E+08
Energy Content of BWST Water	N/A (See Energy Content of Recirculation [illegible] Water (IRWST))				
Energy Removed by LHSI Heat Exchangers	N/A (For prior to long term transition see ΔQ of ECCS source)				3.382E+09 [2]

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Table 6.2.1-23—Containment Energy Distribution for Hot Leg Break
Sheet 2 of 2
Energy (BTU)

	Prior to LOCA t = 0 seconds	End of Blowdown t = 20 seconds	Peak Pressure t = 26 seconds	End of Reflood t =3957 seconds	1 day into recirculation
Energy Removed by Reactor Containment Building Fan Coolers	N/A to U.S. EPR				
SIS Pump Energy	0.000E+00	0.000E+00	0.000E+00	5.592E+06	1.237E+08
RCP Energy	N/A (LOOP)				
Decay Heat (after transition)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.996E+09 [3]
ΔQ of ECCS Source	0.000E+00	0.000E+00	0.000E+00	1.969E+08	3.036E+08 [4]
Accumulator Nitrogen	0.000E+00	1.914E+06	1.919E+06	1.919E+06	9.186E+05
Main Feedwater	0.000E+00	3.6[illegible]E+07	4.324E+07	4.927E+07	4.927E+07
Energy Balance					
Initial Energy	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09
Sum of Energy Added	0.0000E+00	5.0270E+07	5.8[illegible]3E+07	4.6970E+08	3.6907E+09
Total 1	5.5488E+09	5.5990E+09	5.6068E+09	6.[illegible]85E+09	9.2394E+09
Final Energy	5.5488E+09	5.6260E+09	5.6368E+09	5.873[illegible]E+09	5.6328E+09
Sum of Energy Removed	0.0000E+00	0.0000E+00	0.0000E+00	[illegible].9690E[illegible]	3.6853E+09
Total 2	5.5488E+09	5.6260E+09	5.6368E+09	6.07[illegible]E+09	9.3181E+09
Difference	0.0%	-0.5%	-0.5%	-0.9%	-0.9%

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Notes:

1. This is decay heat prior to long term transition. It should be added to decay heat after transition (see Note 3) for total decay heat in 24 hours.
2. RHR heat removal after long term transition.
3. Decay heat after long term transition.
4. This is heat removed by RHR system prior to long term transition. It should be added to heat removed after transition (see Note 2) for total RHR heat removal in 24 hours.

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Table 6.2.1-24—Containment Energy Distribution for Cold Leg Pump Suction Break
Sheet 1 of 2
Energy (BTU)

	Prior to LOCA t = [illegible] seconds	Peak Pressure t = 40 seconds	End of Blowdown t=50.5 seconds	End of Reflood t =4000 seconds	1 day into recirculation
Reactor Coolant Accumulator Internal Energy	4.00[illegible]+08	4.132E+07	3.510E+07	2.935E+07	3.660E+07
Accumulator Coolant Internal Energy	[illegible]577E+07	1[illegible]47E+07	8.5671E+06	1.3155E+05	1.3155E+05
Energy Stored in RV Internals	N/A (included in Pressurizer, Primary Piping, Valves and Pumps)				
Energy Stored in Core	3.545E+07	8.626E+0[illegible]	8.601E+06	5.782E+06	(Included in Energy stored in Pressurizer, Primary Piping, Valves, and Pumps)
Energy Generated During Shutdown from Decay Heat	0.000E+00	1.774[illegible]07	2.000E[illegible]	4.170E+08	7.997E+08 [1]
Energy Stored in Pressurizer, Primary Piping, Valves, and Pumps	2.140E+08	1.974E+08	[illegible]45E+08	1.328E+08	3.659E+07
Energy Stored in SG Metals	2.075E+08	2.076E+08	2.072E+[illegible]	1.[illegible]4E+08	2.777E+08
Secondary Coolant Internal Energy in SG	4.801E+08	5.698E+08	5.89[illegible]+08	5.717E[illegible]08	(Included in SG Metals)
Energy Content in RCB Atmosphere	2.996E+07	4.609E+08	4.710E+08	[illegible]88E+08	7.611E+07
Energy Content in RCB and Internals	3.863E+09	3.898E+09	3.908E+09	4.262E+09	4.874E+09
Energy Content of Recirculation Intake Water (IRWST)	2.831E+08	2.986E+08	3.036E+08	6.3[illegible]E+08	6.225E+08
Energy Content of BWST Water	N/A (See Energy Content of Recirculation Intake Water (IRWST))				

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Table 6.2.1-24—Containment Energy Distribution for Cold Leg Pump Suction Break
Sheet 2 of 2
Energy (BTU)

	Prior to LOCA t = 0 seconds	Peak Pressure t = 40 seconds	End of Blowdown t=50.5 seconds	End of Reflood t =4000 seconds	1 day into recirculation
Energy Removed by LHSI Heat Exchangers	N/A (or prior to long term transition see ΔQ of ECCS source)				2.988E+09 [2]
Energy Removed by Reactor Containment Building Fan Coolers	N/A to U.S. EPR				
SIS Pump Energy	0.000E+00	1.718E+04	3.222E+04	5.688E+06	1.237E+08
RCP Energy	0.000E+00	7.479E+04	7.479E+04	7.479E+04	7.479E+04
Decay Heat (after transition)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.737E+09 [3]
ΔQ of ECCS Source	0.000E+00	1.7[illegible]E+04	4.674E+04	1.987E+08	6.008E+08 [4]
Accumulator Nitrogen	0.000E+00	1.9[illegible]E+06	1.919E+06	1.919E+06	1.919E+06
Main Feedwater	0.000E+00	9.855E+07	1.244E+08	2.489E+08	2.489E+08
Energy Balance					
Initial Energy	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09
Sum of Energy Added	0.0000E+00	1.1830E+08	1.4644E+[illegible]	6.7[illegible]63E+08	3.9117E+09
Total 1	5.5488E+09	5.6671E+09	5.695[illegible]+09	6.2224E+09	9.4605E+09
Final Energy	5.5488E+09	5.6987E+09	5.7264E+[illegible]	6.0[illegible]9E+0[illegible]	5.9232E+09
Sum of Energy Removed	0.0000E+00	1.7834E+04	4.6739E+04	[illegible].9871E+08	3.6971E+09
Total 2	5.5488E+09	5.6987E+09	5.7265E+09	6.2566E+09	9.5121E+09
Difference	0.0%	-0.6%	-0.5%	[illegible]	-0.5%

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Notes:

1. This is decay heat prior to long term transition. It should be added to decay heat after transition (see Note 3) for total decay heat in 24 hours.

2. RHR heat removal after long term transition.

3. Decay heat after long term transition.

4. This is heat removed by RHR system prior to long term transition. It should be added to heat removed after transition (see Note 2) for total RHR heat removal in 24 hours.

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Table 6.2.1-25—Containment Energy Distribution for Cold Leg Pump Discharge Break
Sheet 1 of 2
Energy (BTU)

	Prior to LOCA t = 0 seconds	Peak Pressure t = 24 seconds	End of Blowdown t=30.5 seconds	Peak P after End of Blowdown t=1300 s	End of Reflood t=4000 s	1 day into recirculation
Reactor Coolant Internal Energy	4.004E+07	2.723E+07	2.442E+07	4.019E+07	4.302E+07	4.702E+07
Accumulator Coolant Internal Energy	3.557E+07	1.9557E+07	1.3053E+07	1.3096E+05	1.3096E+05	1.3096E+05
Energy Stored in RV Internals	N/A (included in Reactor Coolant Internal Energy)					
Energy Stored in Core	3.545E+07	1.148E+07	1.18E+07	7.864E+06	7.650E+06	(Included in Energy stored in Pressurizer, Primary Piping, Valves, and Pumps)
Energy Generated During Shutdown from Decay Heat	0.000E+00	8.136E+06	9.667E+06	1.760E+08	4.110E+08	7.356E+08 [1]
Energy Stored in Pressurizer, Primary Piping, Valves, and Pumps	2.140E+08	2.031E+08	2.017E+08	1.829E+08	1.384E+08	4.168E+07
Energy Stored in SG Metals	2.075E+08	2.077E+08	2.075E+08	1.660E+08	1.654E+08	1.822E+08
Secondary Coolant Internal Energy in SG	4.801E+08	5.348E+08	5.492E+08	6.499E+08	6.645E+08	(Included in SG Metals)
Energy Content in RCB Atmosphere	2.996E+07	4.648E+08	4.606E+08	3.289E+08	2.887E+08	9.634E+07
Energy Content in RCB and Internals	3.863E+09	3.888E+09	3.897E+09	4.114E+09	4.27E+09	5.086E+09
Energy Content of Recirculation Intake Water (IRWST)	2.831E+08	3.010E+08	3.078E+08	5.083E+08	5.853E+08	6.754E+08

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Table 6.2.1-25—Containment Energy Distribution for Cold Leg Pump Discharge Break
Sheet 2 of 2
Energy (BTU)

	Prior to LOCA t = 0 seconds	Peak Pressure t = 24 seconds	End of Blowdown t=30.5 seconds	Peak P after End of Blowdown t=1300 s	End of Reflood t=4000 s	1 day into recirculation
Energy Content of BWST Water	N/A (See Energy Content of Recirculation Intake Water (IRWST))					
Energy Removed by LHSI Heat Exchangers	N/A (For prior to long term transition see ΔQ of ECCS source)					3.008E+09 [2]
Energy Removed by Reactor Containment Building Fan Coolers	N/A to U.S. EPR					
SIS Pump Energy	0.000E+00	0.000E+00	5.512E+03	1.823E+06	5.689E+06	1.237E+08
RCP Energy	0.000E+00	6.908E+04	6.908E+04	6.908E+04	6.908E+04	6.908E+04
Decay Heat (after transition)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.791E+09 [3]
ΔQ of ECCS Source	0.000E+00	0.000E+00	7.314E+03	1.517E+07	1.522E+08	4.366E+08 [4]
Accumulator Nitrogen	0.000E+00	1.923E+06	1.923E+06	1.923E+06	1.923E+06	1.923E+06
Main Feedwater	0.000E+00	5.913E+07	7.514E+07	2.517E+08	2.517E+08	2.517E+08
Energy Balance						
Initial Energy	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09	5.5488E+09
Sum of Energy Added	0.0000E+00	6.9257E+07	8.6808E+07	4.[illegible]149E+08	[illegible]E+08	3.9042E+09
Total 1	5.5488E+09	5.6180E+09	5.6356E+09	5.980[illegible]E+09	6.2191E+09	9.4529E+09
Final Energy	5.5488E+09	5.6591E+09	5.6725E+09	6.0190E+09	6.1113E+09	6.1288E+09
Sum of Energy Removed	0.0000E+00	0.0000E+00	7.3135E+03	3.1467E+07	1.52[illegible]E+08	3.4447E+09
Total 2	5.5488E+09	5.6591E+09	5.6725E+09	6.0505E+09	6.2635E+09	9.5736E+09
Difference	0.0%	-0.7%	-0.7%	-1.2%	-0.7%	-1.3%

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Notes:

1. This is decay heat prior to long term transition. It should be added to decay heat after transition (see Note 3) for total decay heat in 24 hours.

2. RHR heat removal after long term transition.

3. Decay heat after long term transition.

4. This is heat removed by RHR system prior to long term transition. It should be added to heat removed after transition (see Note 2) for total RHR heat removal in 24 hours.

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Figure 6.2.1-10—LOCA Containment Pressure vs. Time (HL Break)

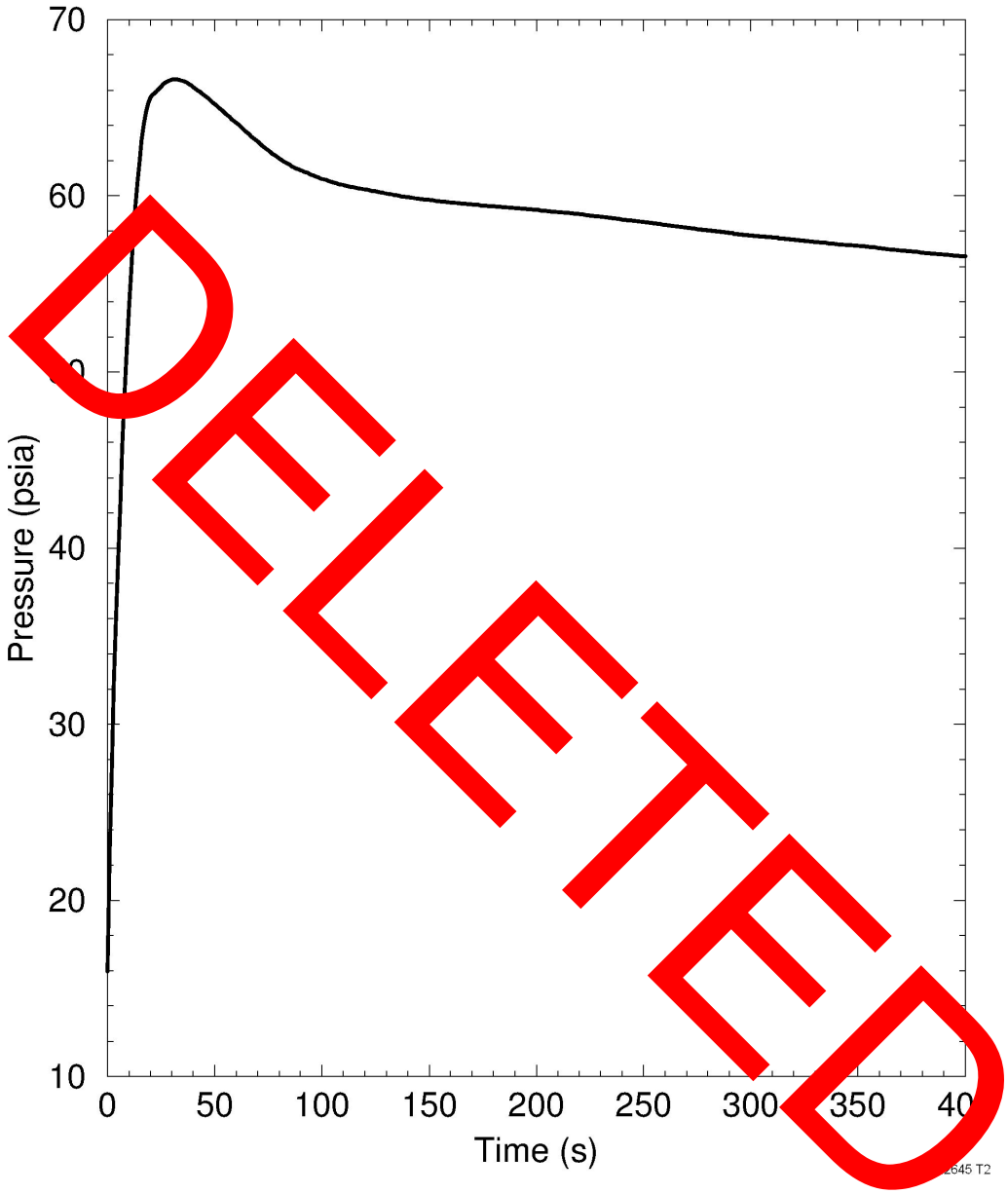

Figure 6.2.1-11—LOCA Containment Temperature vs. Time (HL Break)

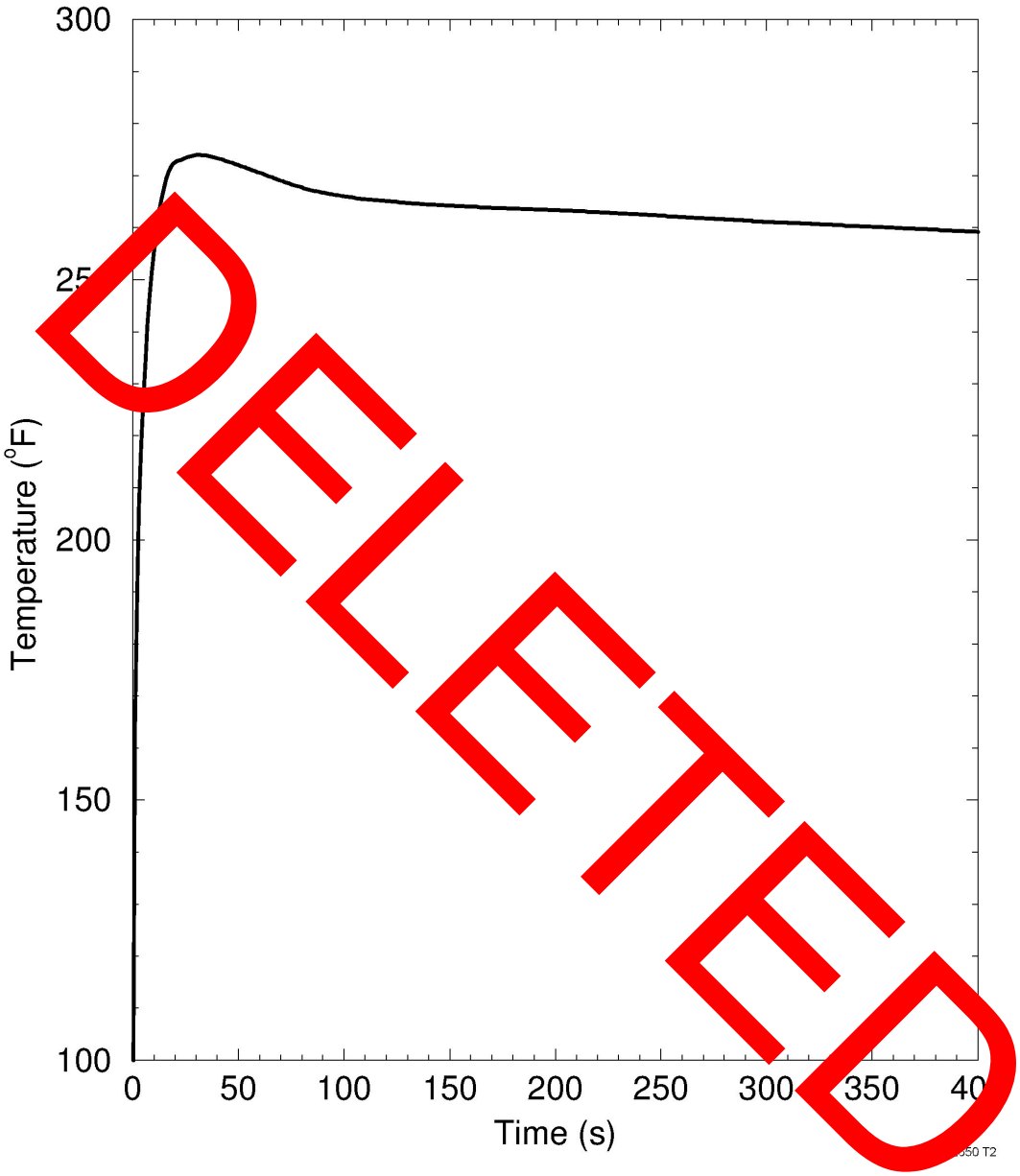

Figure 6.2.1-12—LOCA Containment Pressure vs. Time (HL Break Long-term)

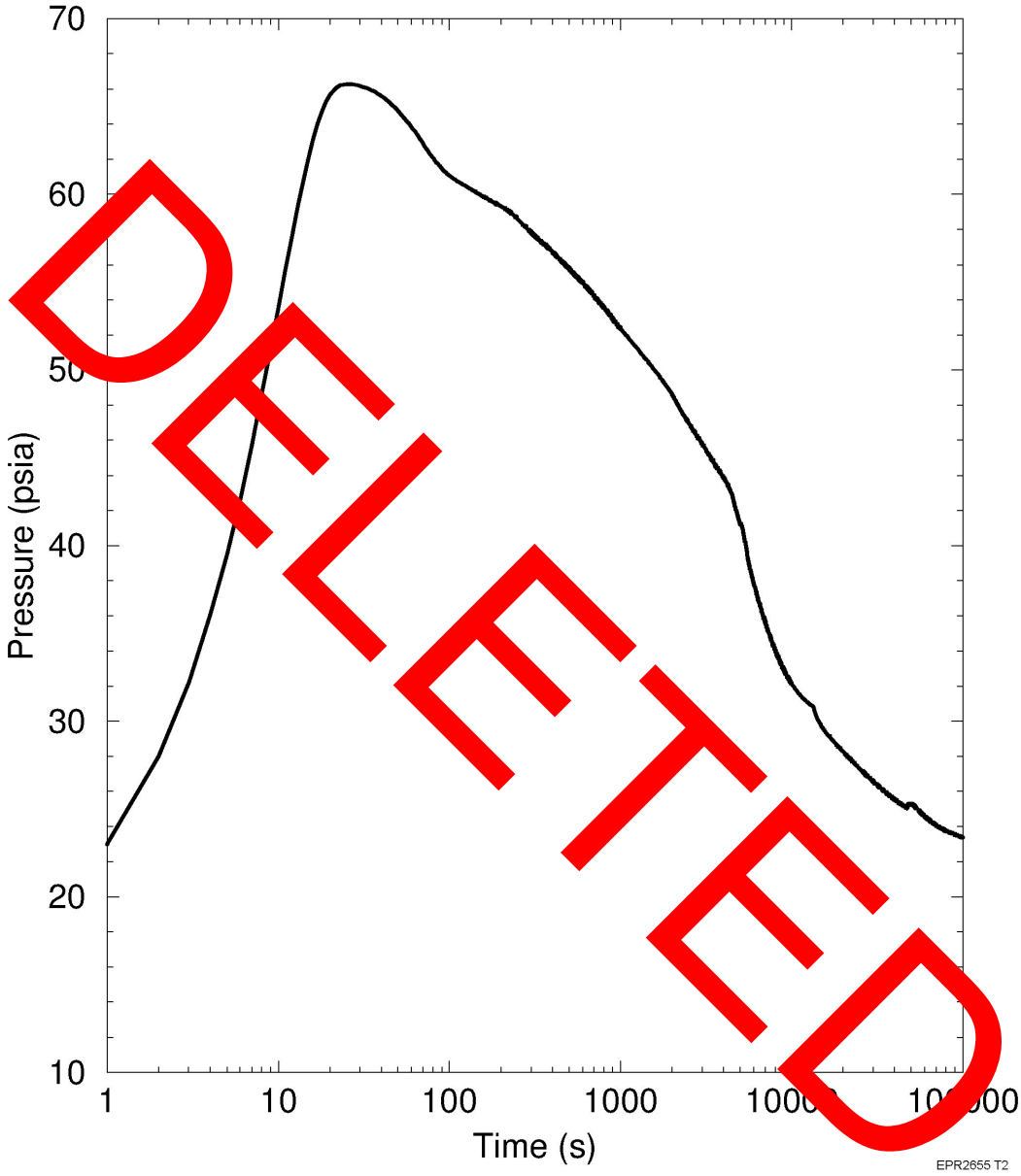

Figure 6.2.1-13—LOCA Containment Temperature vs. Time (HL Break Long-term)

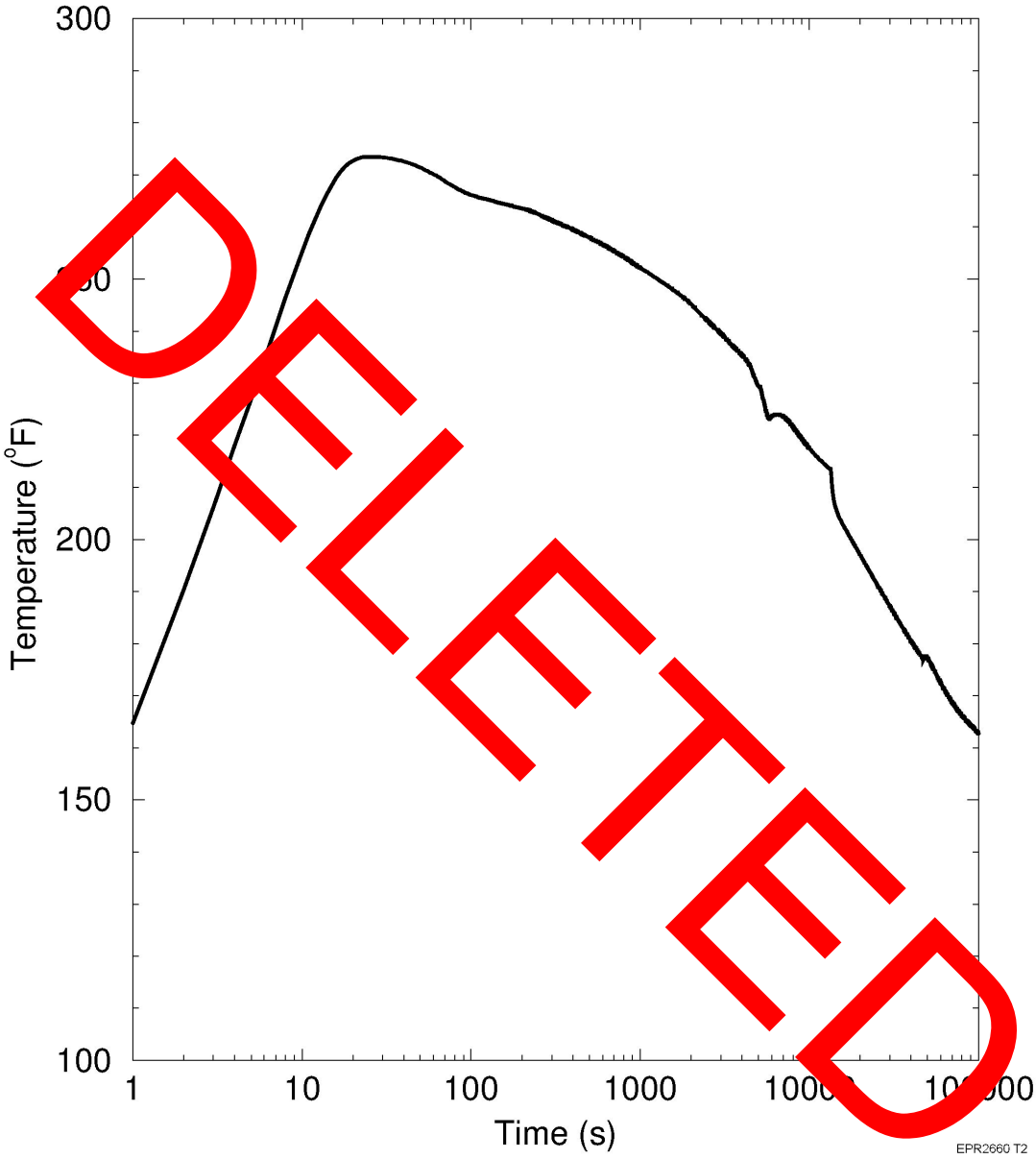

Figure 6.2.1-14—LOCA Containment Pressure vs. Time (CLPS Break)

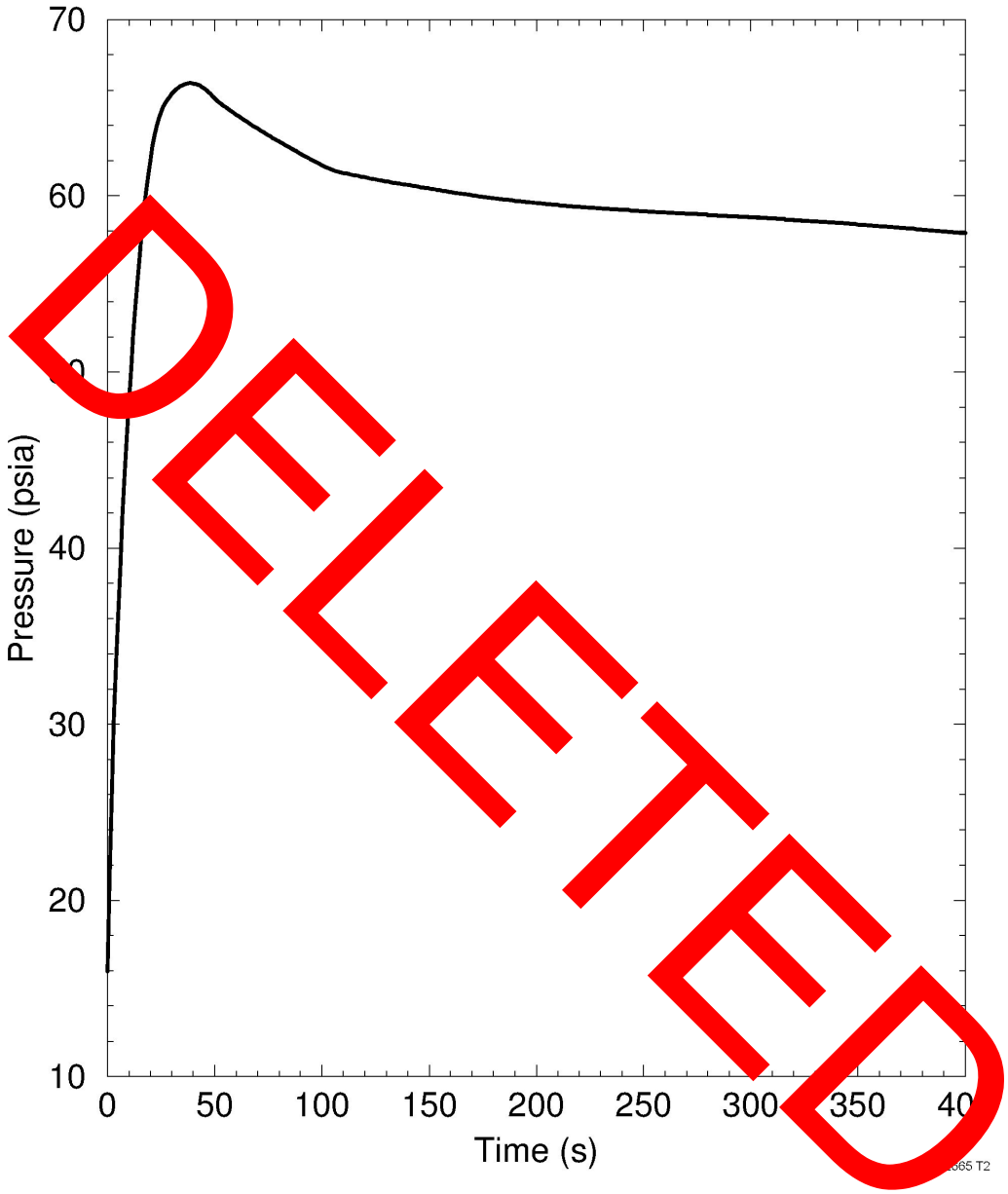

Figure 6.2.1-15—LOCA Containment Temperature vs. Time (CLPS Break)

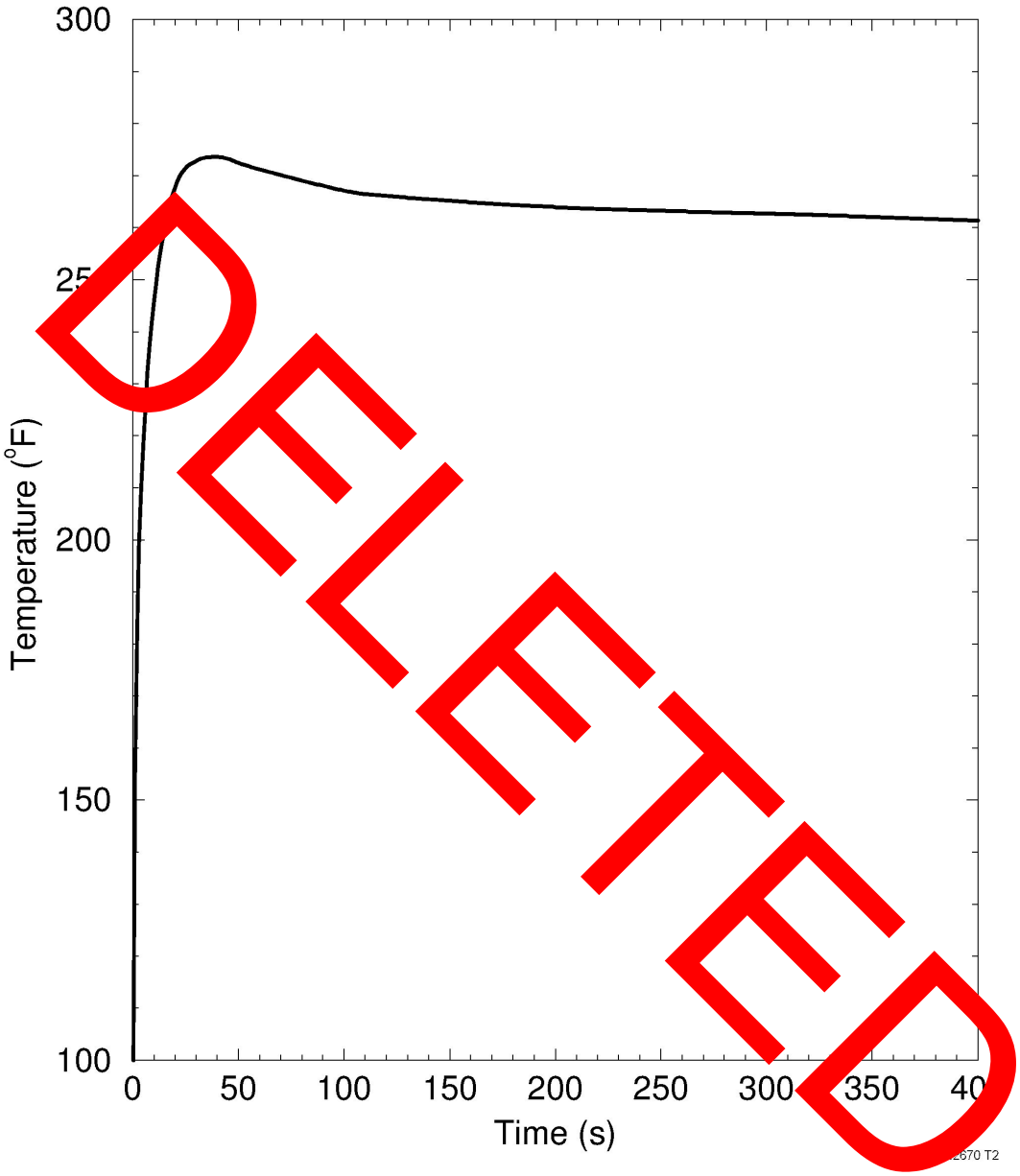

Figure 6.2.1-16—LOCA Containment Pressure vs. Time (CLPS Break Long-term)

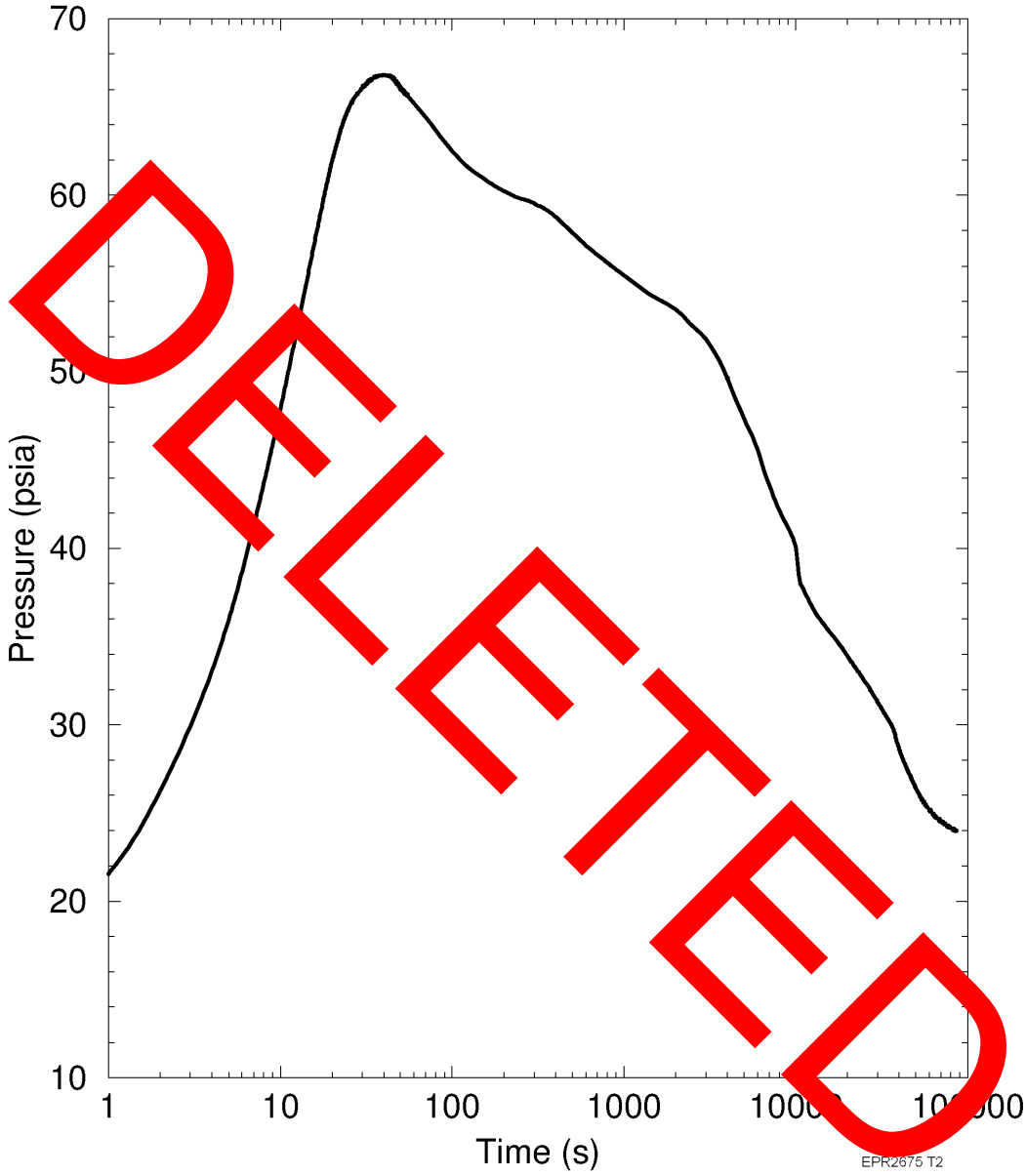

Figure 6.2.1-17—LOCA Containment Temperature vs. Time (CLPS Break Long-term)

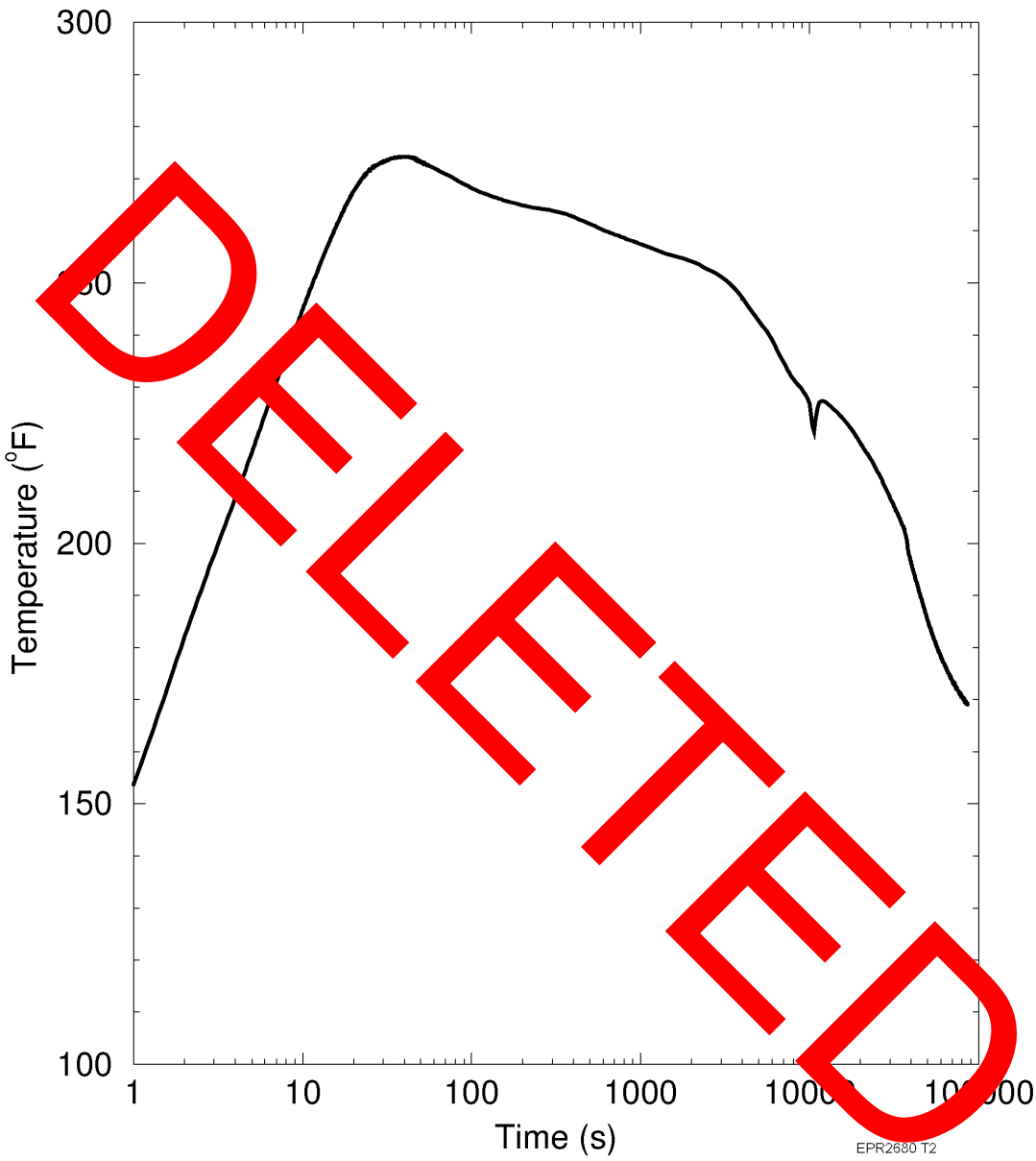

Figure 6.2.1-18—LOCA Containment Pressure vs. Time (CLPD Break)

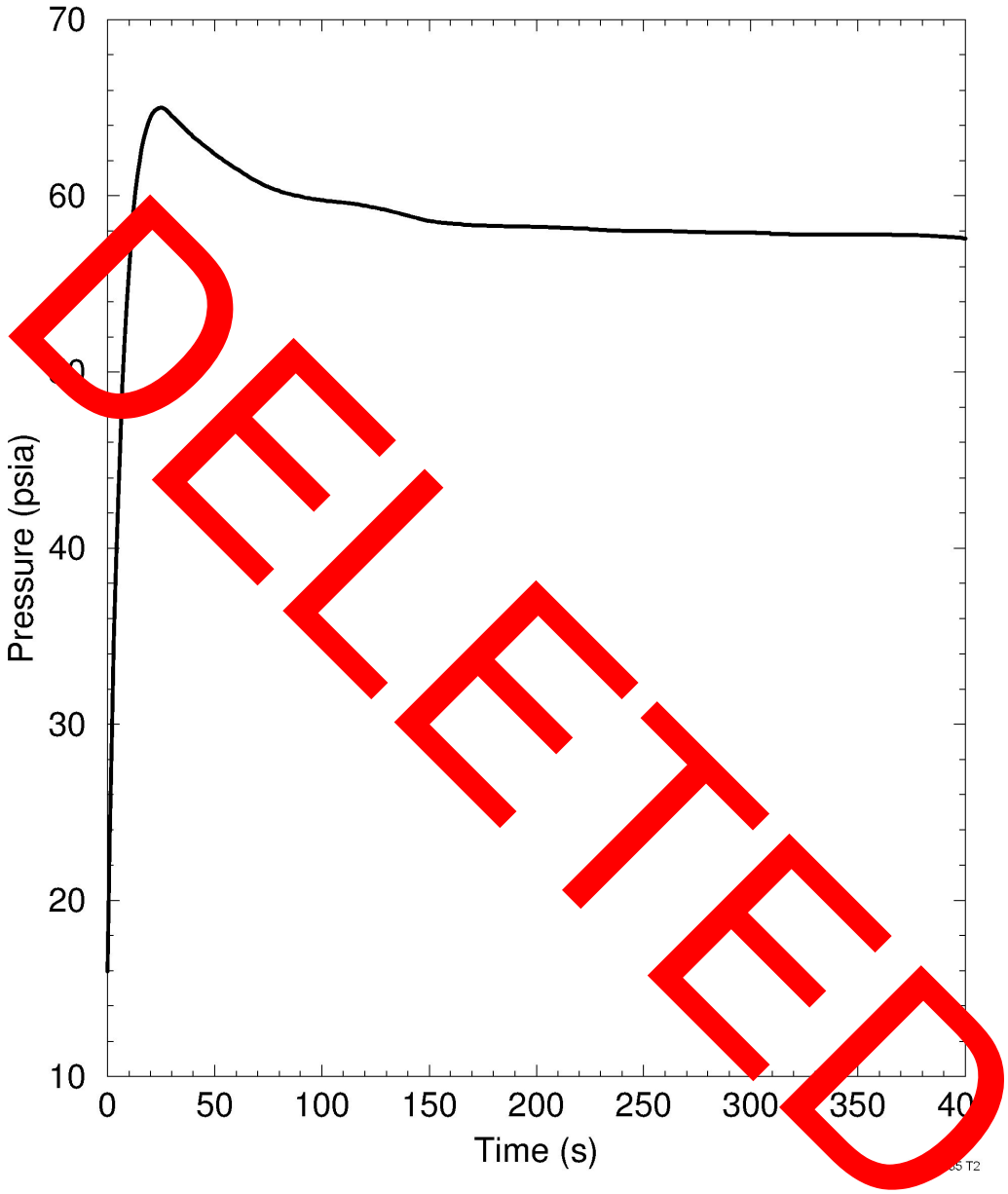

Figure 6.2.1-19—LOCA Containment Temperature vs. Time (CLPD Break)

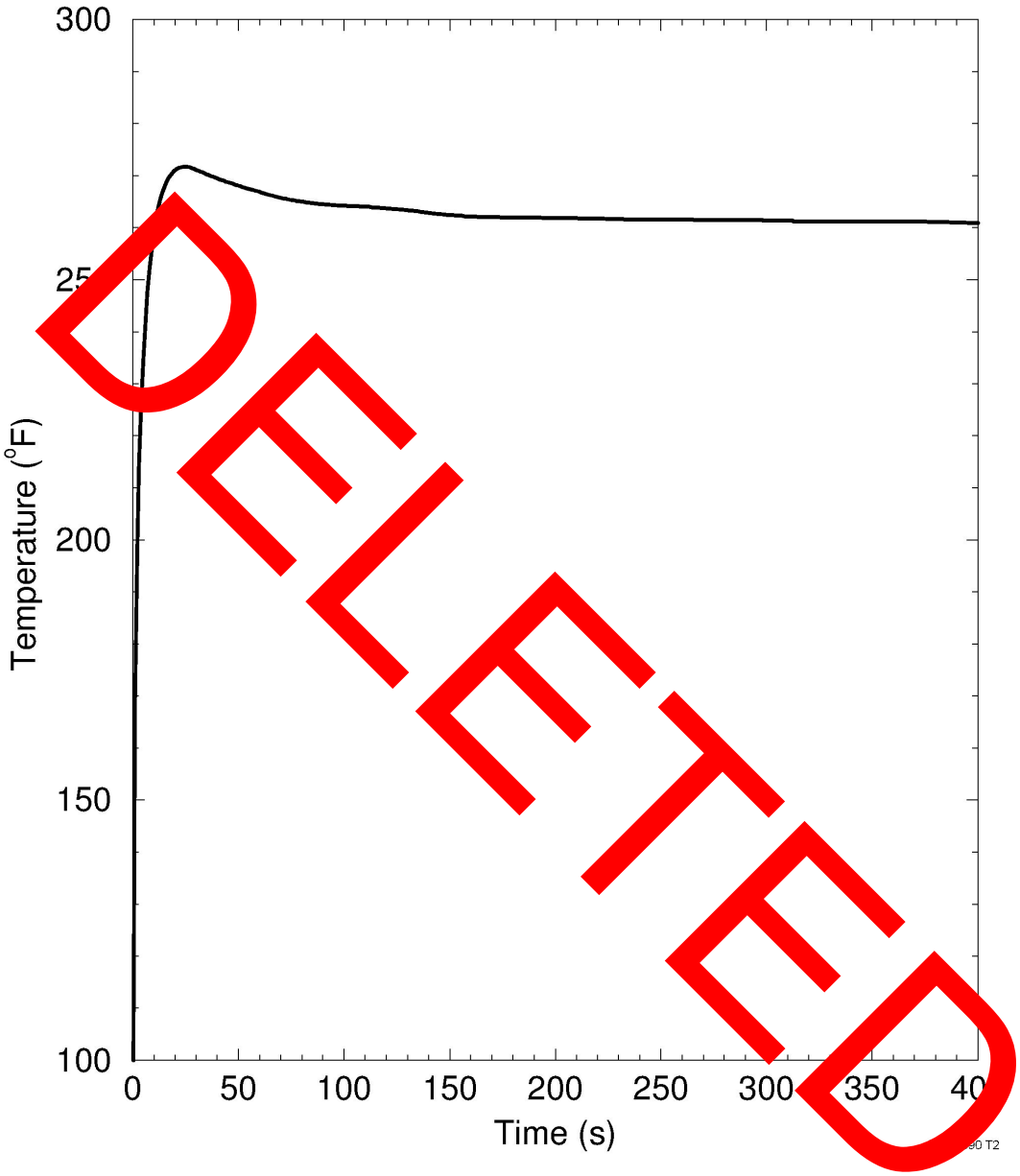

Figure 6.2.1-20—LOCA Containment Pressure vs. Time (CLPD Break Long-Term)

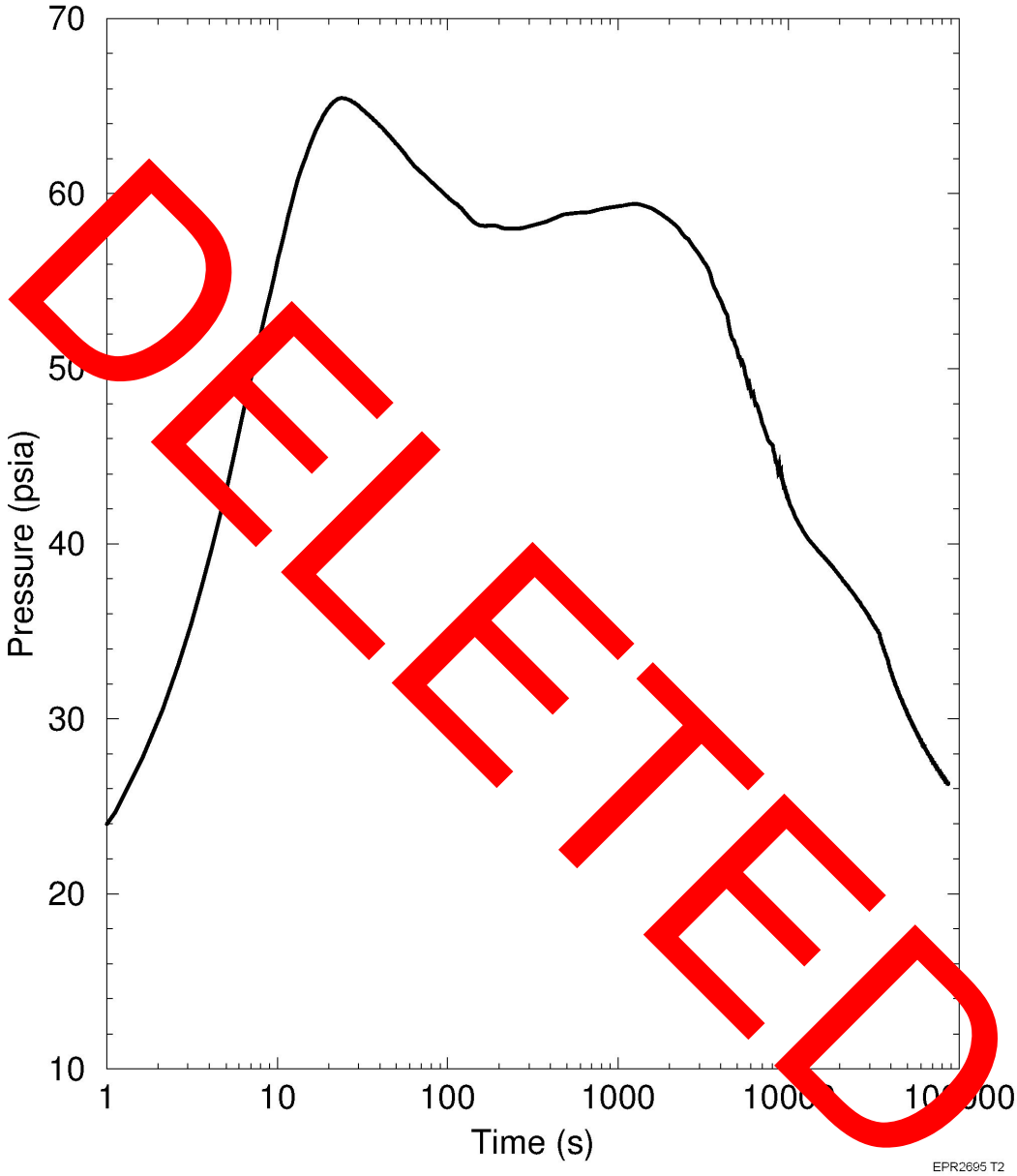

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Figure 6.2.1-21—LOCA Containment Temperature vs. Time (CLPD Break Long-Term)

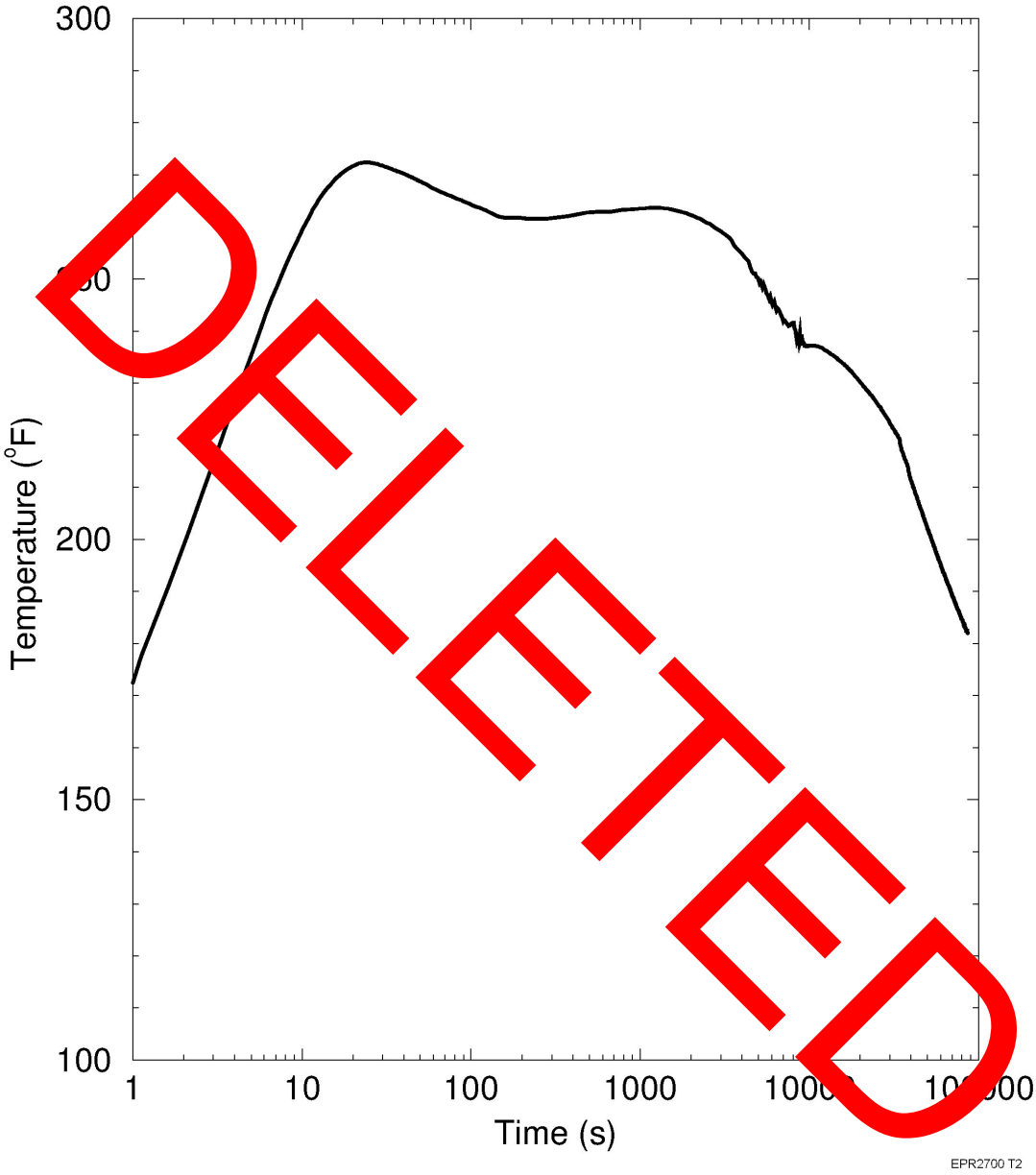


Figure 6.2.1-22—LOCA Integrated Break Mass Flow vs. Time (HL Break)

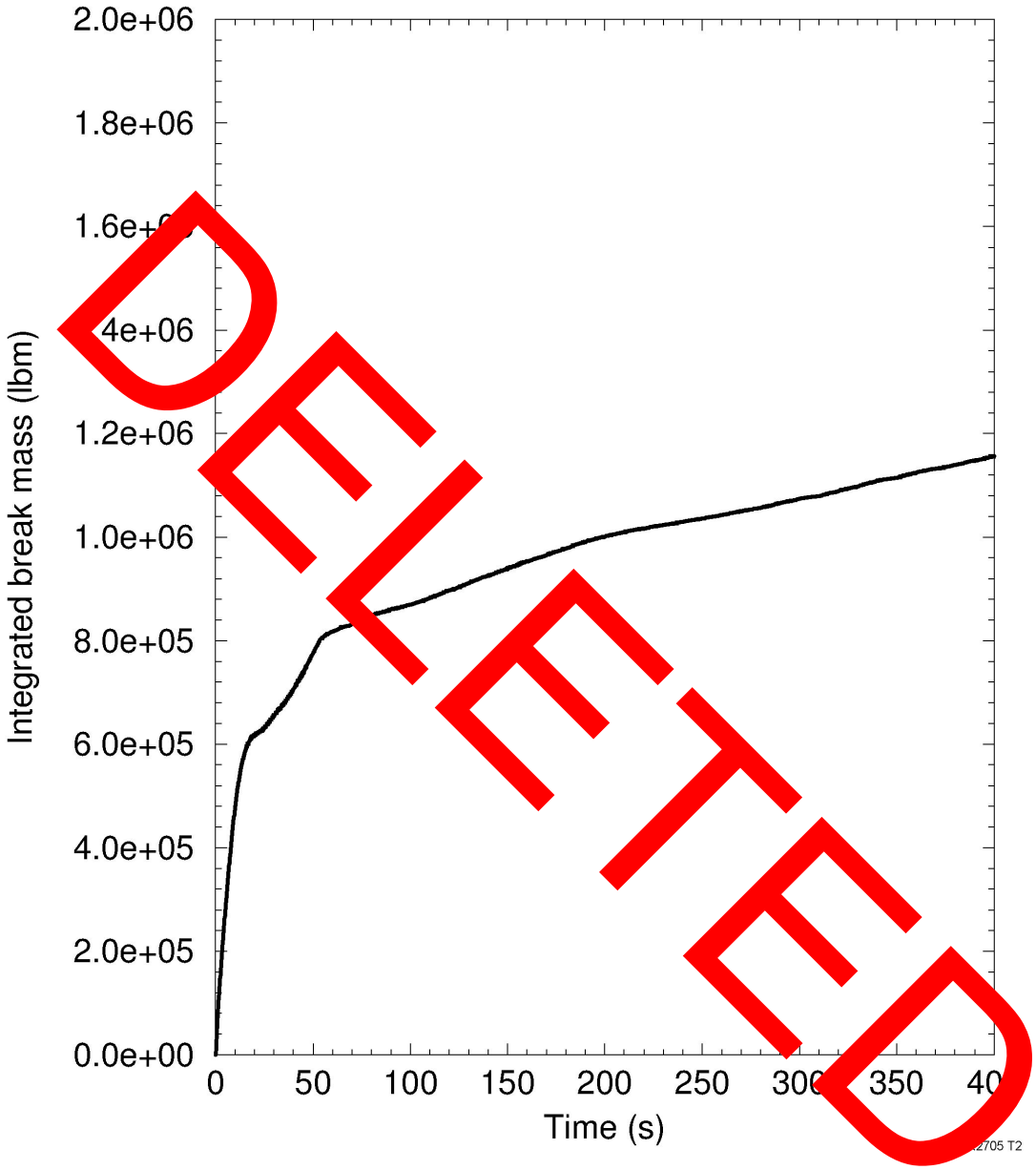


Figure 6.2.1-23—LOCA Integrated Break Energy Flow vs. Time (HL Break)

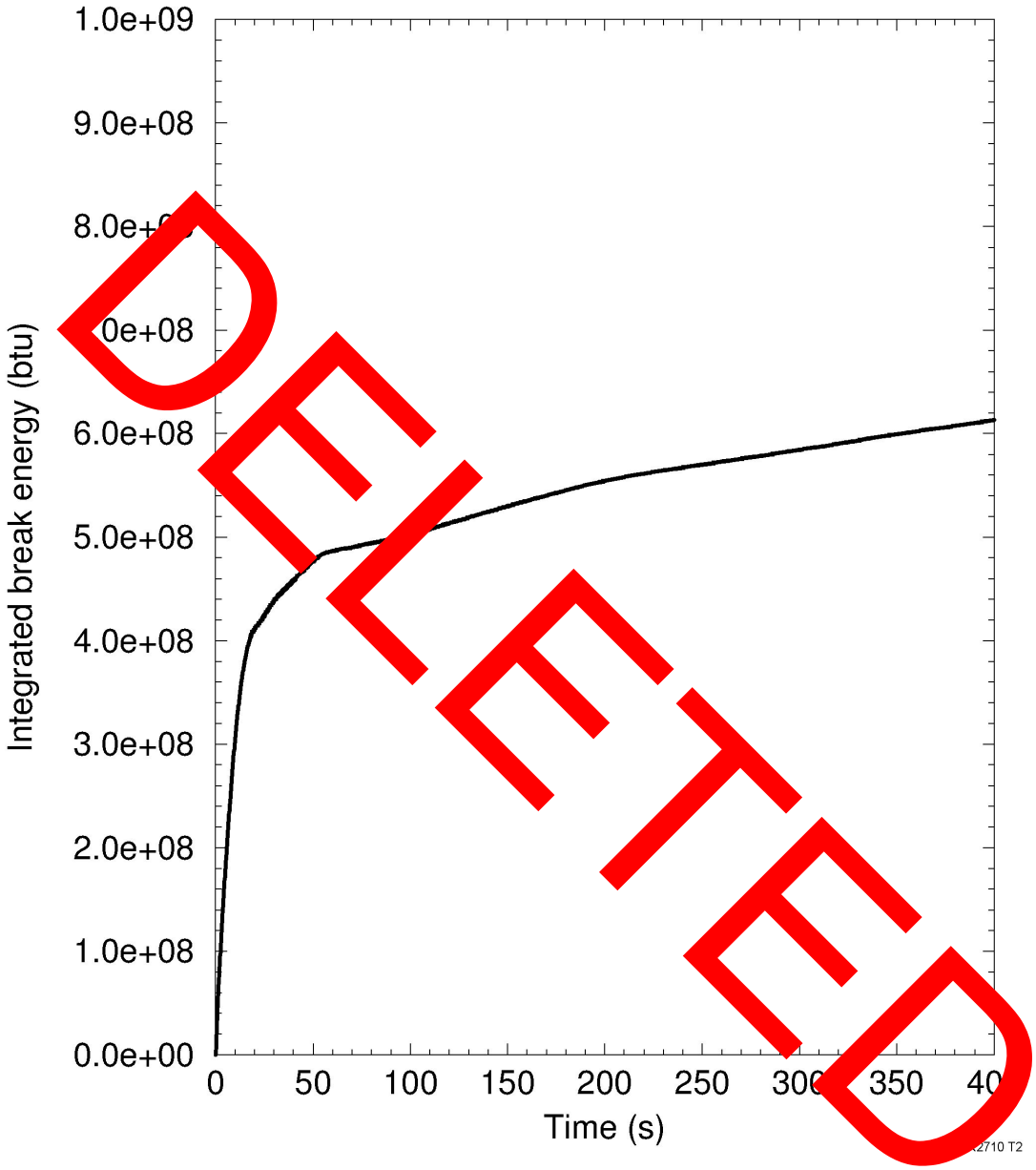


Figure 6.2.1-24—LOCA Integrated Break Mass Flow vs. Time (CLPS Break)

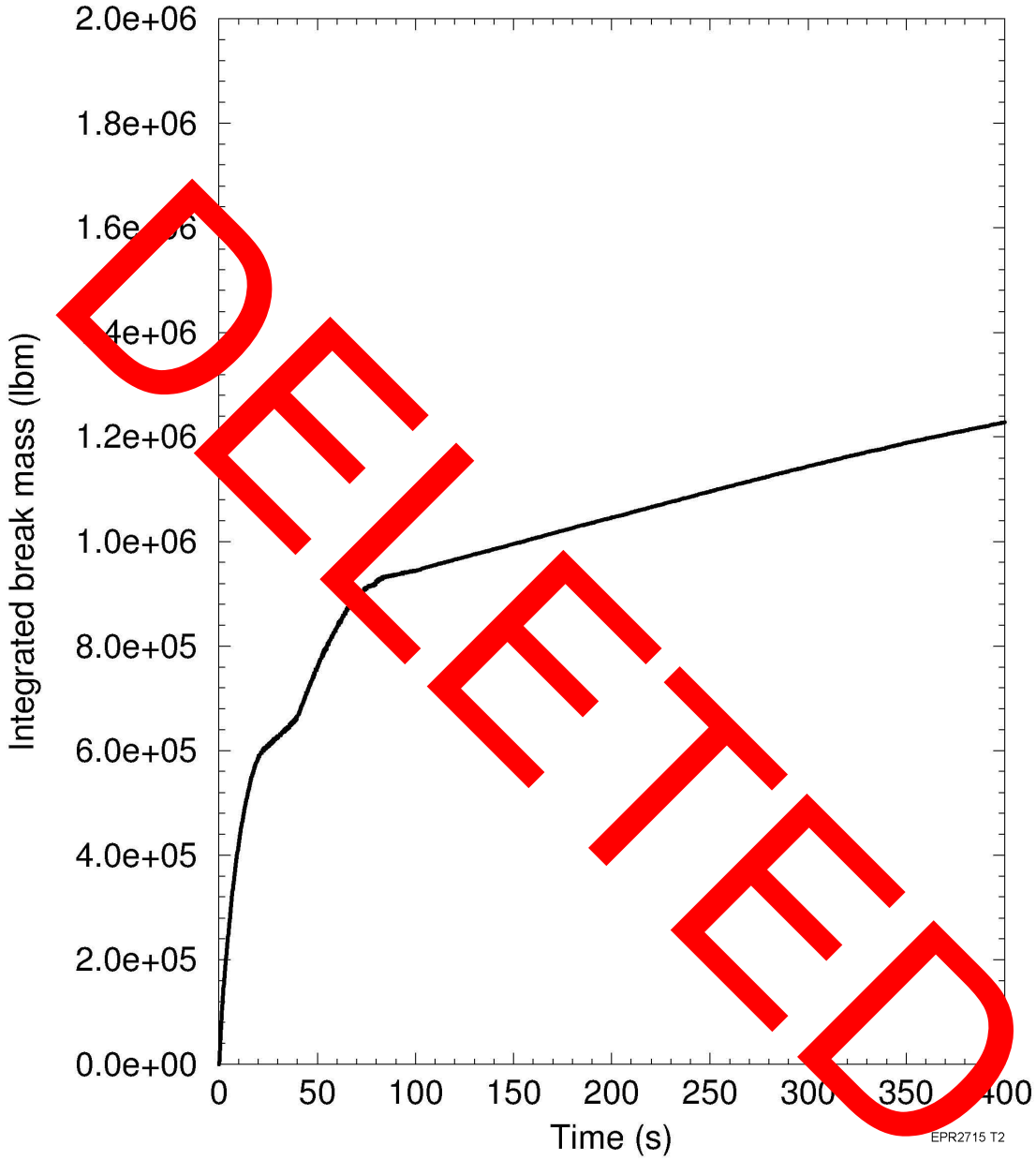


Figure 6.2.1-25—LOCA Integrated Break Energy Flow vs. Time (CLPS Break)

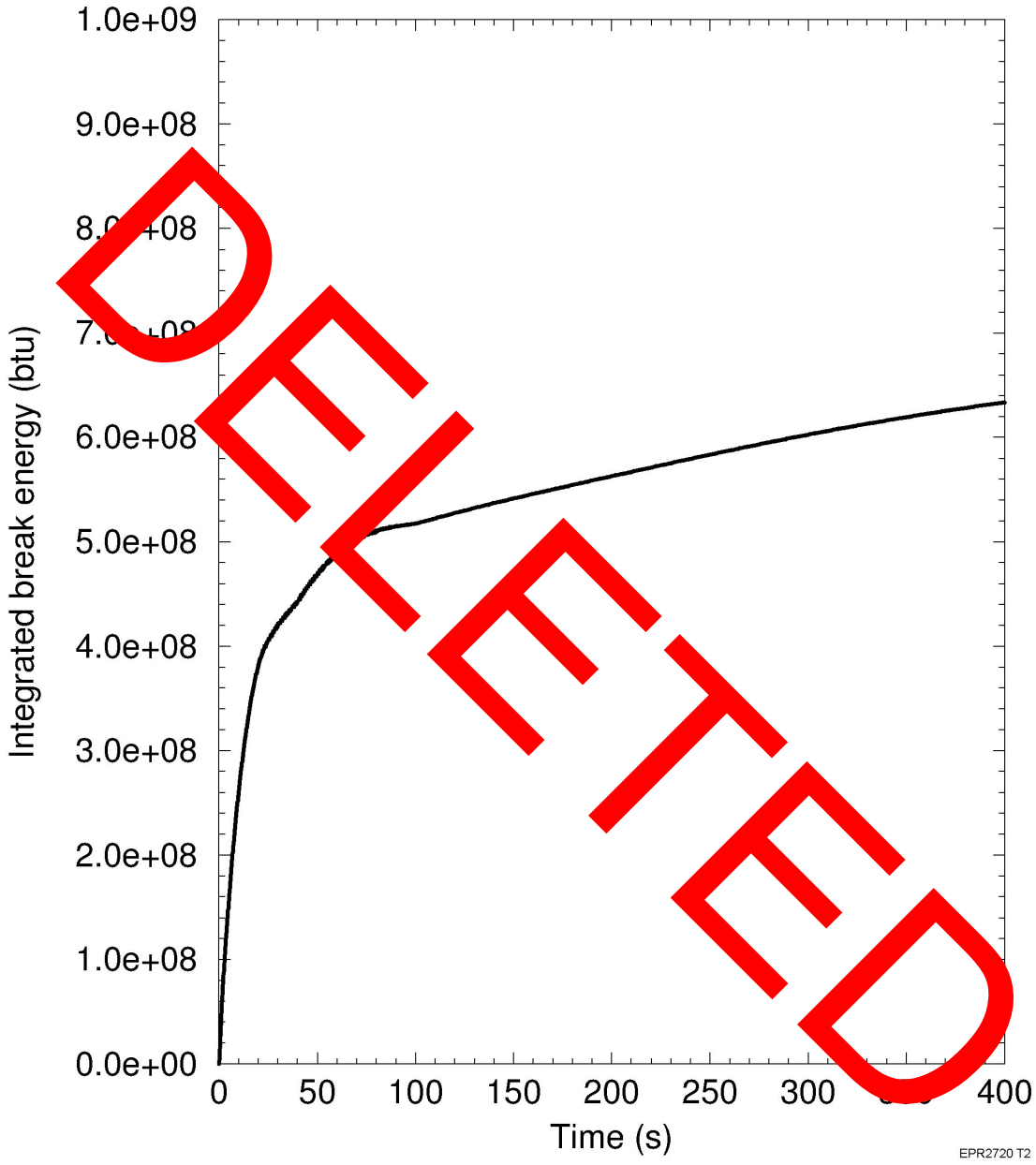


Figure 6.2.1-26—LOCA Integrated Break Mass Flow vs. Time (CLPD Break)

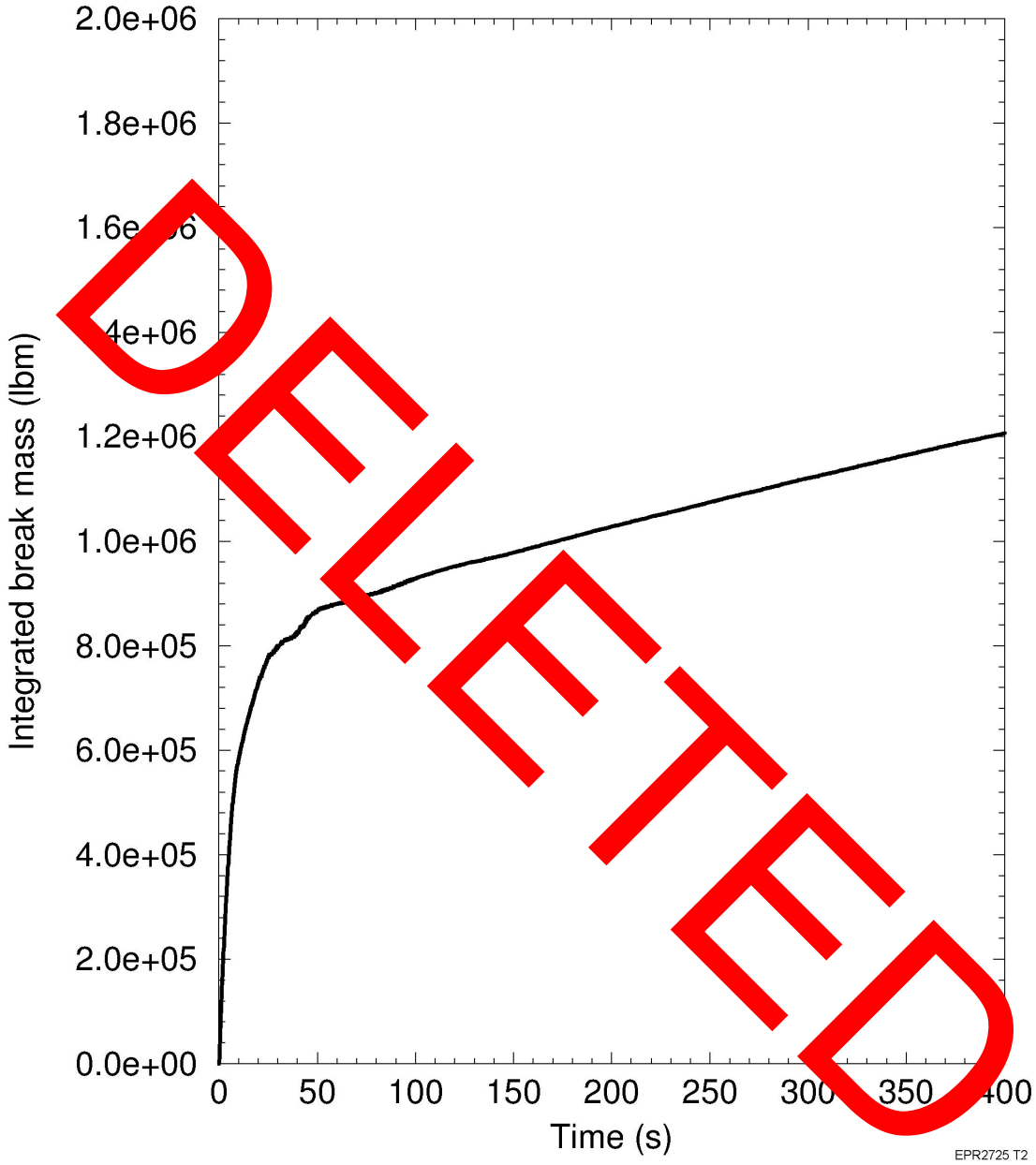


Figure 6.2.1-27—LOCA Integrated Break Energy Flow vs. Time (CLPD Break)

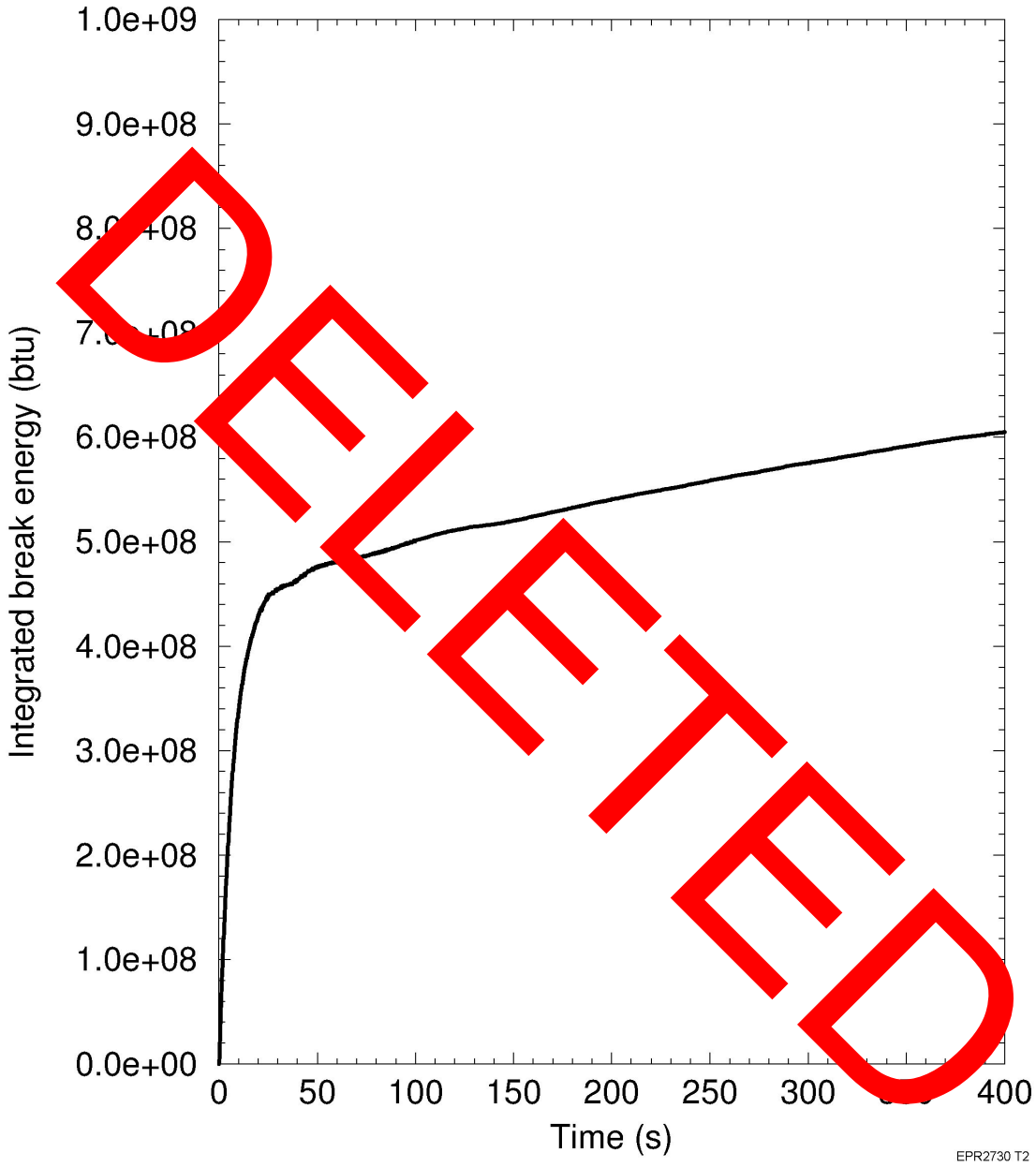


Figure 6.2.1-28—LOCA Integrated Break Mass Flow vs. Time (HL Break, Long-Term)

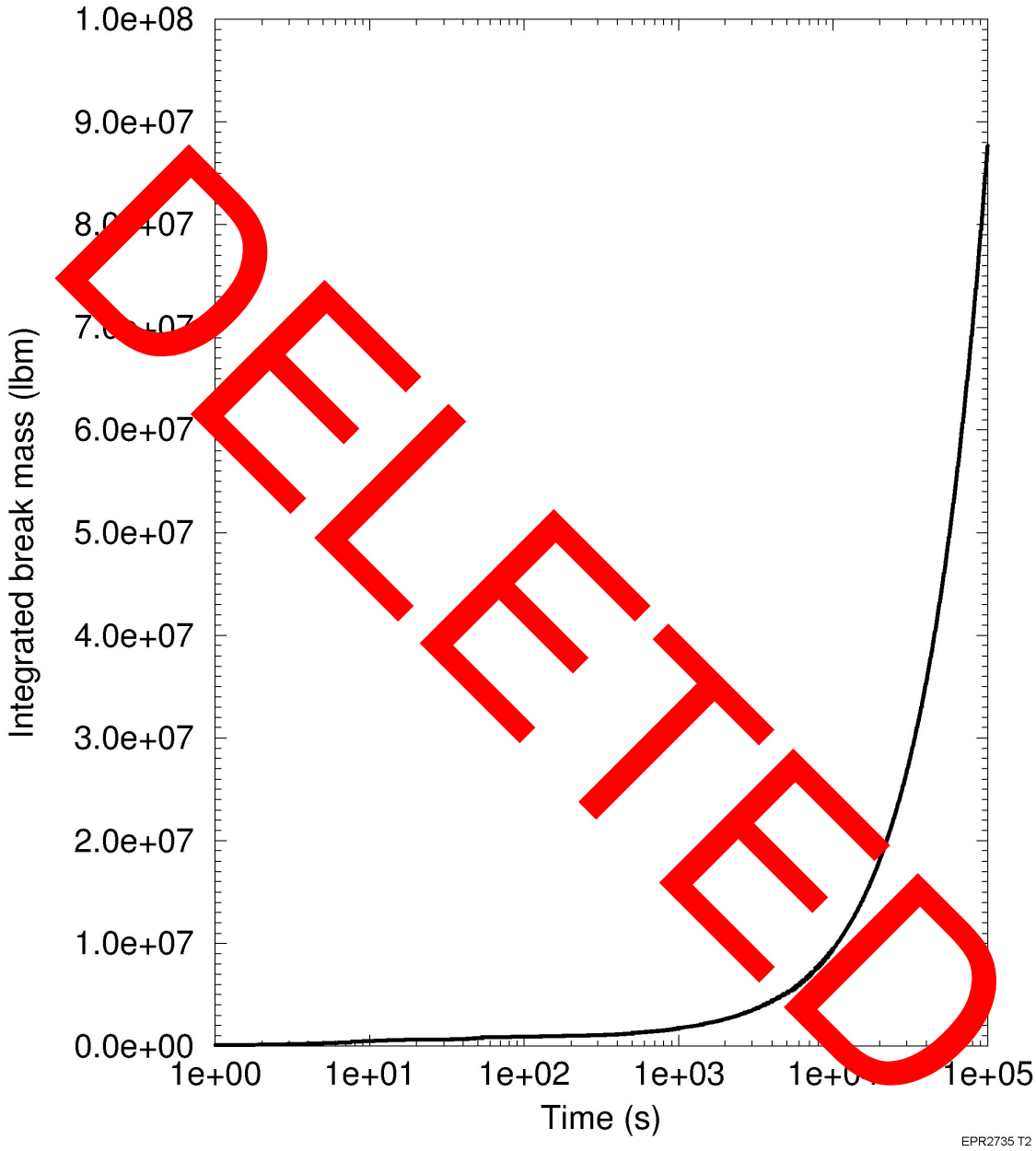


Figure 6.2.1-29—LOCA Integrated Break Energy Flow vs. Time (HL Break, Long-Term)

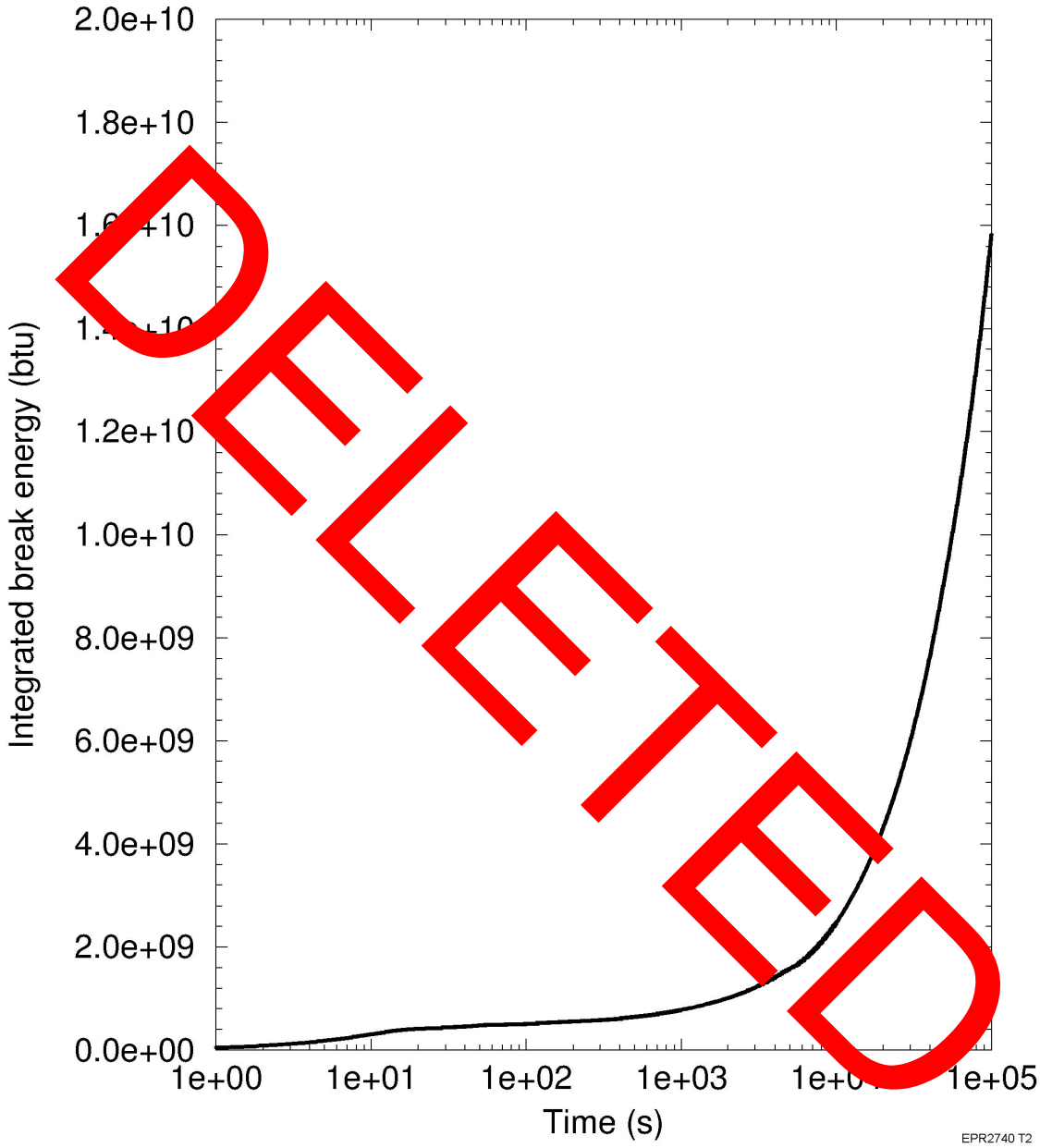


Figure 6.2.1-30—LOCA Integrated Break Mass Flow vs. Time (CLPS Break, Long-Term)

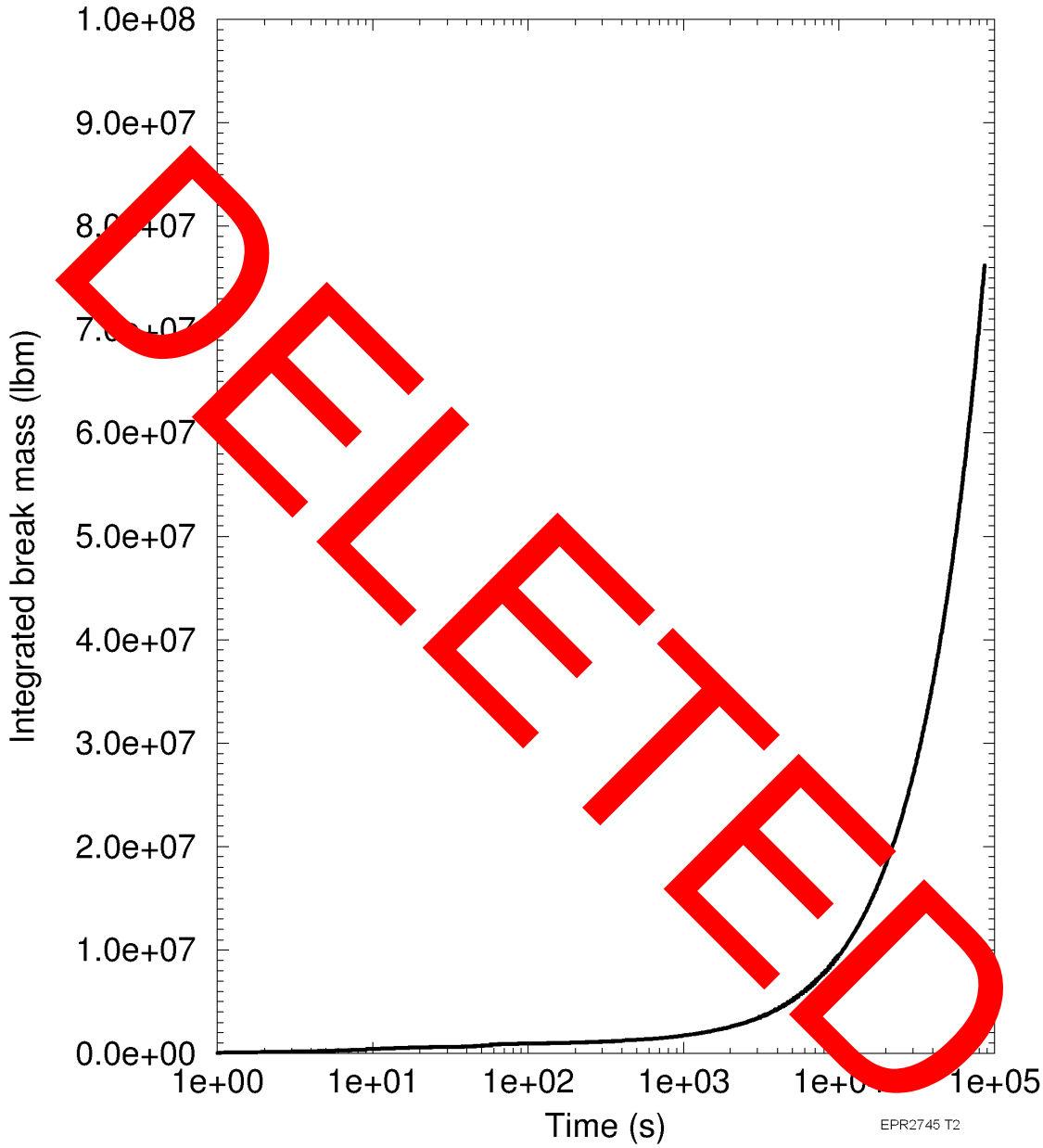


Figure 6.2.1-31—LOCA Integrated Break Energy Flow vs. Time (CLPS Break, Long-Term)

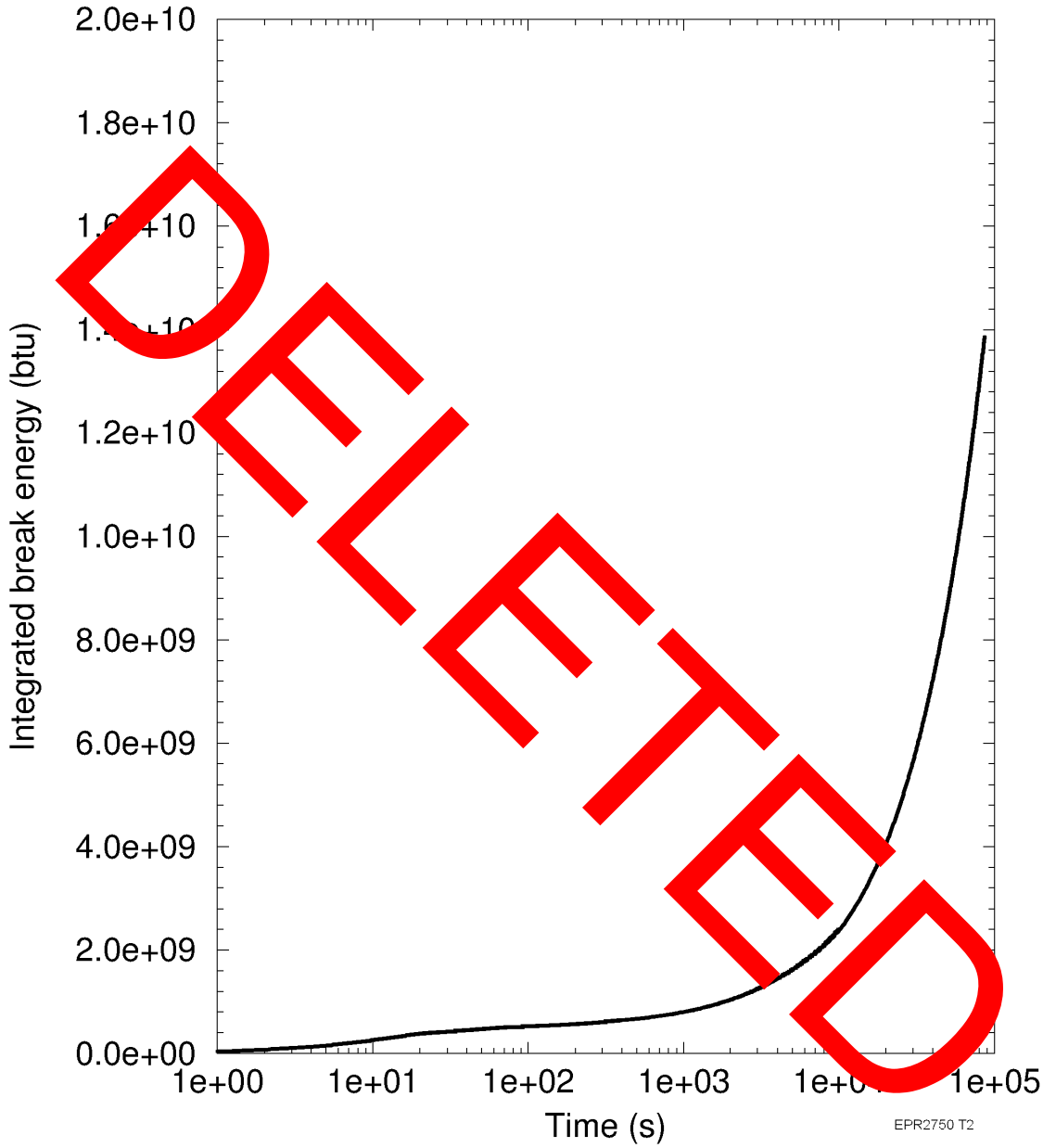


Figure 6.2.1-32—LOCA Integrated Break Mass Flow vs. Time (CLPD Break, Long-Term)

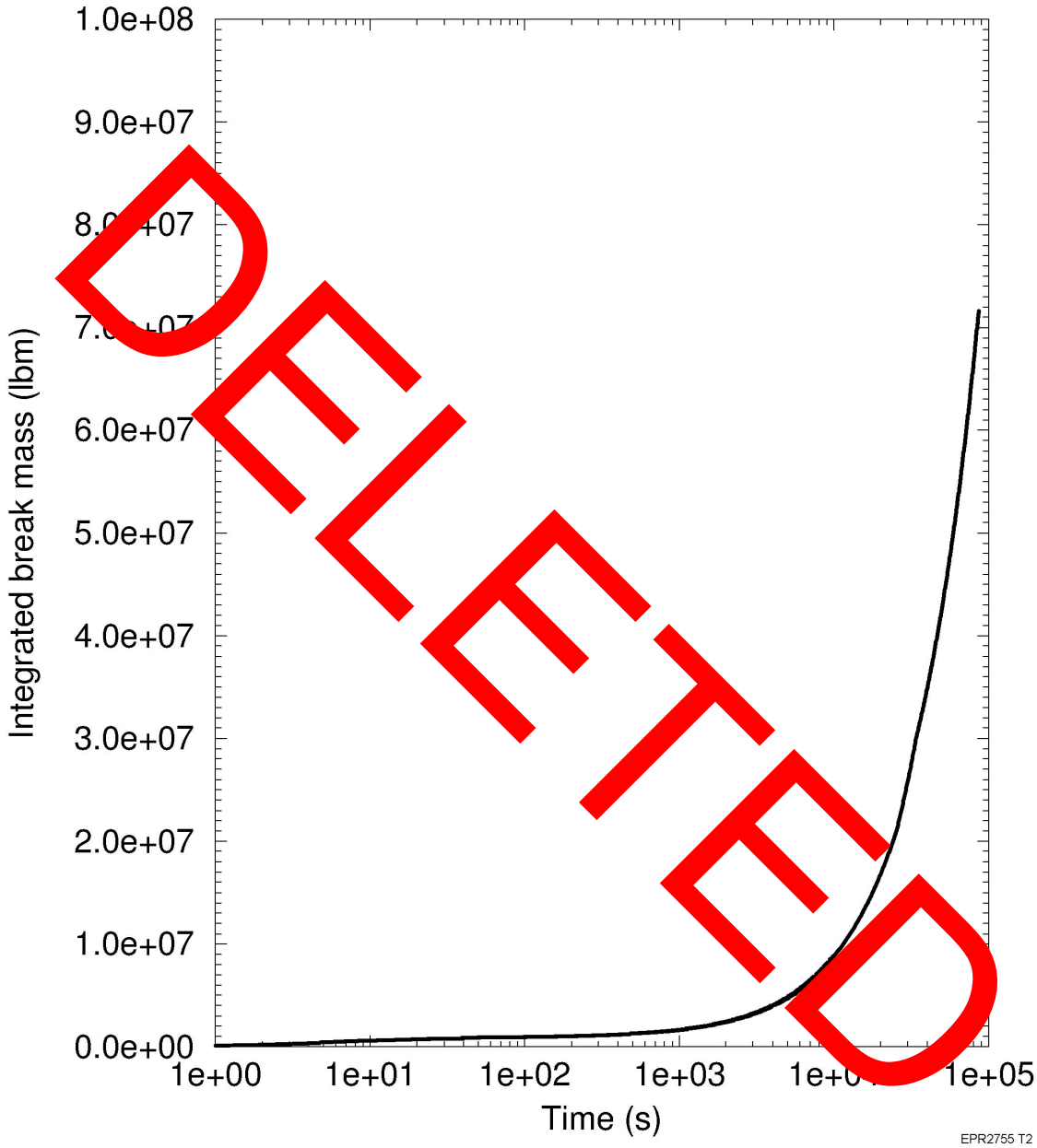


Figure 6.2.1-33—LOCA Integrated Break Energy Flow vs. Time (CLPD Break, Long-Term)

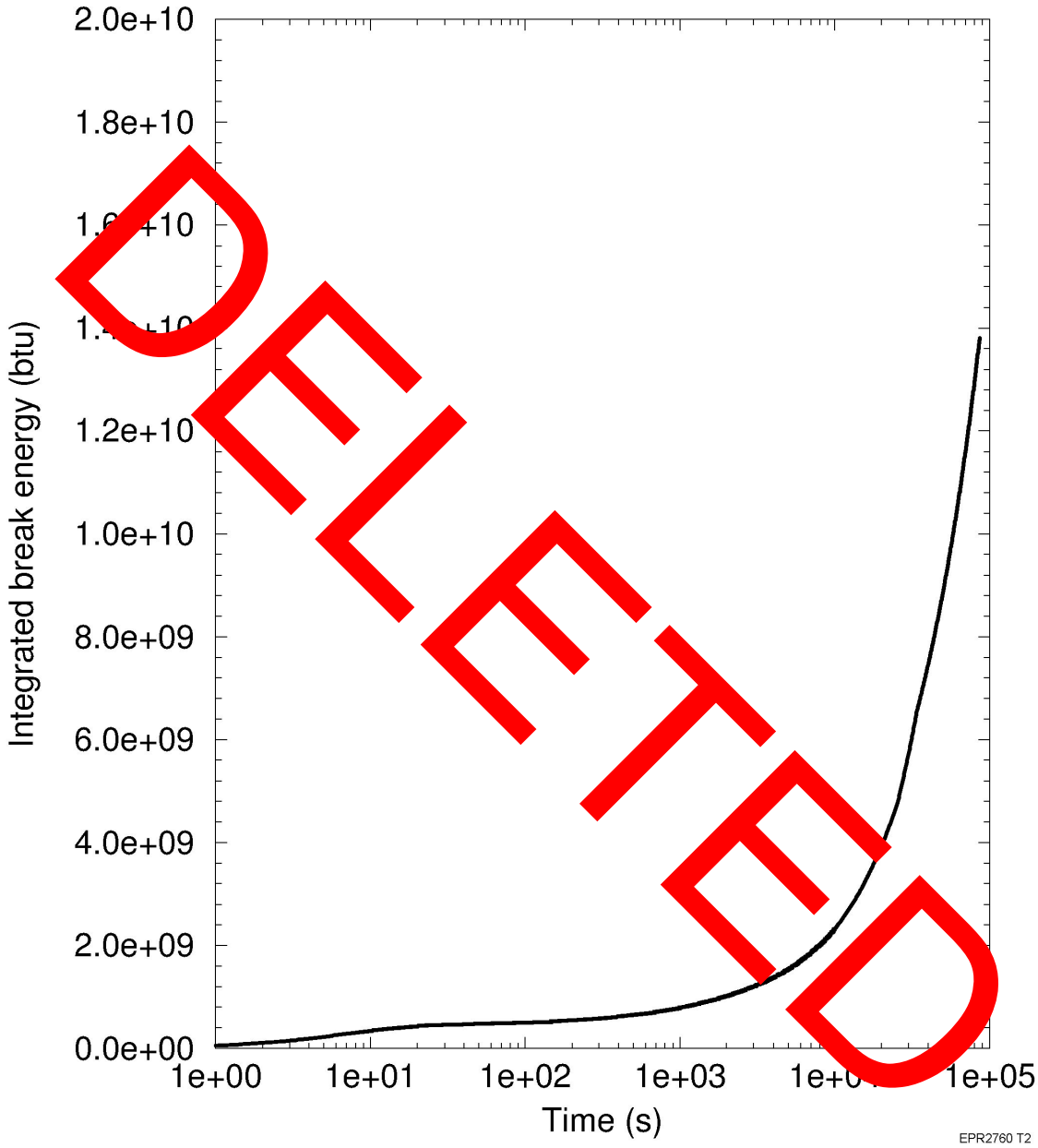


Figure 6.2.1-34—MSLB Containment Pressure vs. Time (50% Rated Power)

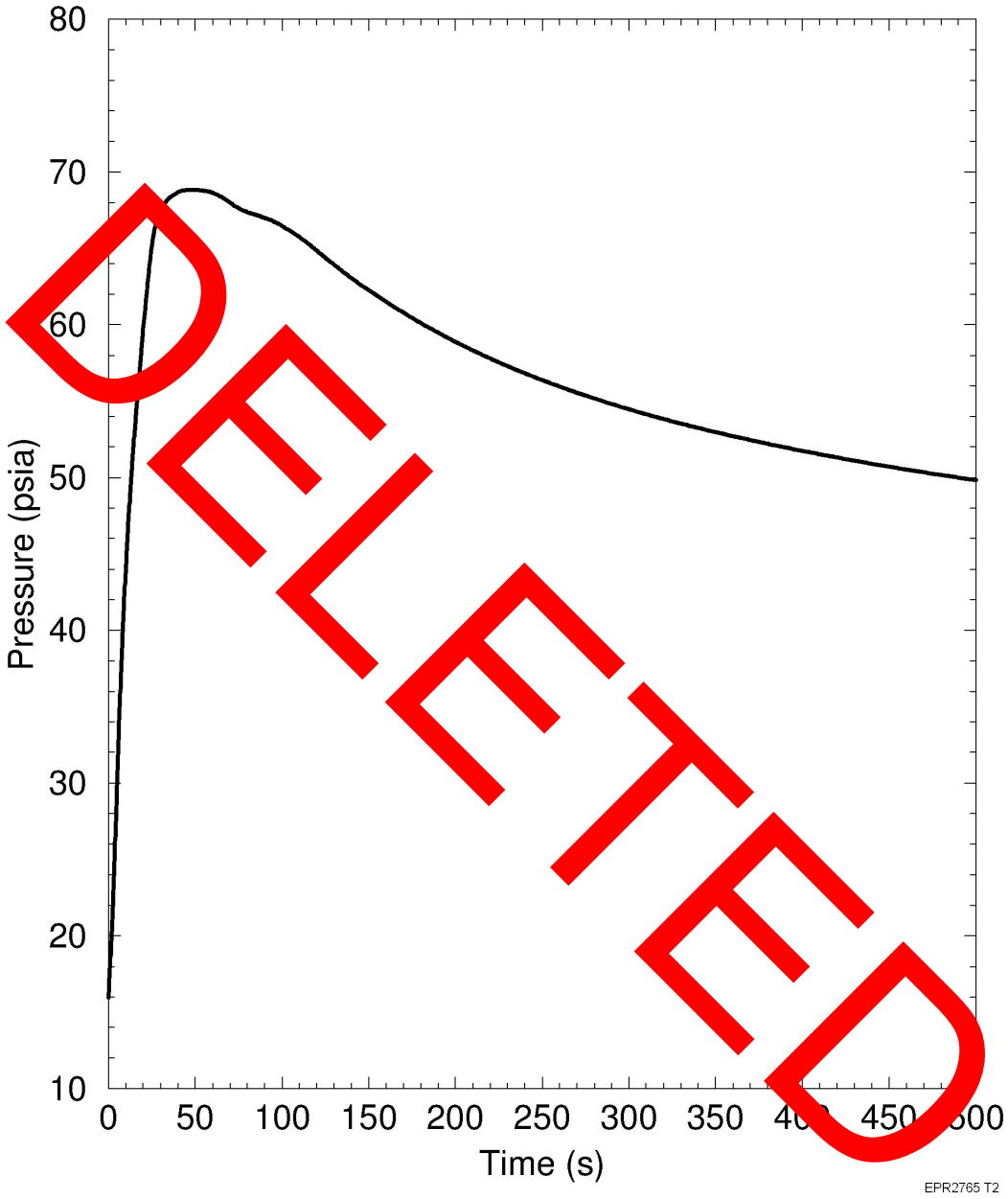
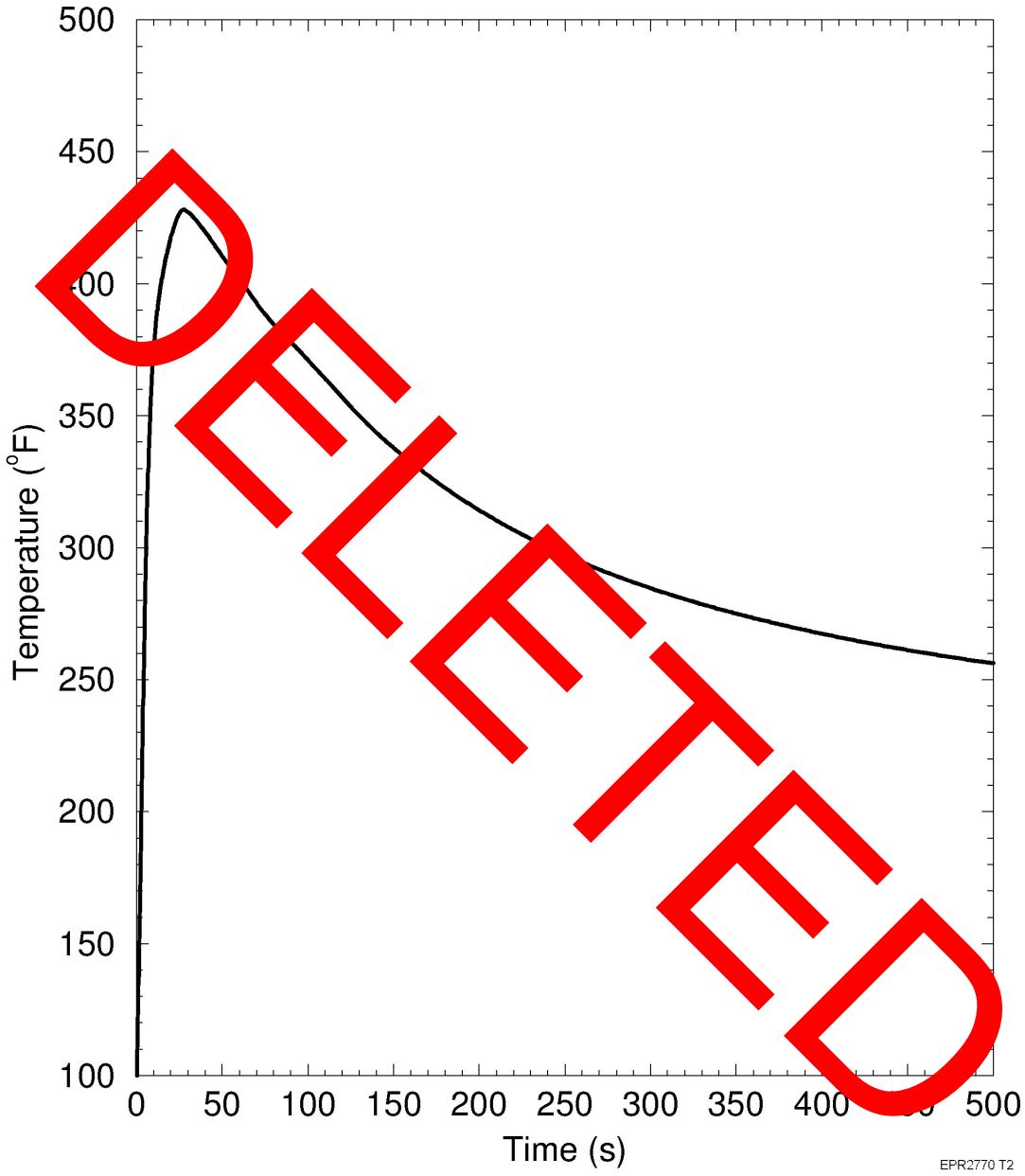


Figure 6.2.1-35—MSLB Containment Temperature vs. Time (50% Rated Power)



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6.2.2 Containment Heat Removal Systems

The containment design includes integrated systems to limit the containment pressure and temperature increase and maintain them at acceptably low levels following the accident. These systems include the CONVECT system, recirculation and heat removal features built into the in-containment refueling water storage tank (IRWST), and re-alignment of the emergency core cooling system (ECCS) system to the hot legs.

In the event of an accident, communication is established between the accessible space and the equipment area by opening mixing dampers and a combination of rupture and convection foils, thereby transforming the divided containment volume into a single convective volume. This transformation to a single convective volume is performed by the CONVECT system. This enables equalization of pressure between the containment compartments and promotes efficient mixing of the atmosphere by establishing a global convective loop within the containment. The resulting atmospheric mixing increases convective cooling to walls and structures.

The CONVECT system of convection foils, rupture foils, and mixing dampers is part of the combustible gas control system (CGCS). The CONVECT system is designed to provide adequate mixing for both large and small breaks inside and outside of equipment rooms. Following a large-break LOCA, the pressure differential between rooms increases rapidly and the rupture foils open in either direction. For a small break, the pressure differential might not be sufficient at all locations, so only the rupture foils near the break open. However, as the equipment area temperature rises, the convection foils open to provide adequate vent area between the accessible space and the equipment rooms.

Following blowdown, the vapor in the atmosphere condenses on the passive containment heat sinks located throughout the containment. The saturated water drains along the intermediate floors, grates, stairwells, and walls to the IRWST. Condensation-induced circulation zones provide additional mixing of the containment atmosphere during and after blowdown. Saturated water drains from the heat sinks in the equipment area, pools on the heavy floor, and mixes with the liquid break effluent. Curbed grates in the heavy floor direct the condensate and spilled reactor coolant back to the IRWST.

For the U.S. EPR design, a manual realignment of at least 75 percent of the LHSI from the cold leg to the hot leg injection location takes place during the final LBLOCA phase (about 60 minutes after the initiating event). Hot leg injection serves both as a mechanism for removing core decay heat, leading to the complete cessation of steaming, and for maintaining core boron concentrations below the threshold concentration for precipitation.

IRWST water is recirculated by the LHSI pumps through the SIS heat exchangers, where it is cooled by the component cooling water system (CCWS). Then it is pumped into the RCS to cool the core before it returns to the IRWST through the break.

The design basis containment analysis for loss of coolant accidents and main steam line breaks, and the containment pressure and temperature responses for these events, is discussed in Section 6.2.1. As shown in Figure 6.2.1-12, Figure 6.2.1-16, and Figure 6.2.1-20, containment pressure decreases to half its peak in less than twenty-four hours after a LOCA.

The SIS provides cooling of the IRWST in the event of a LOCA and provides long-term core cooling. The SIS consists of four independent trains, providing sufficient capacity, diversity, and independence to perform its required safety functions following design basis transients or accidents assuming a single failure in one train while a second train is out-of-service for preventive maintenance. Section 6.3 discusses the SIS, including design bases, instrumentation, and inspection and testing requirements. Section 6.3 includes a discussion of the design features for avoidance of the potential loss of long-term cooling capability due to sump screen blockage in the IRWST and presents the performance evaluation of the design, a summary of component testing, and a comparison to the regulatory positions of RG 1.82.

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6.2.2 Containment Heat Removal Systems

Containment heat removal systems reduce containment pressure and temperature following any LOCA and maintain them at acceptably low levels. For the U.S. EPR, the containment heat removal function is accomplished by cooling the IRWST inventory into which the spilled and condensing reactor coolant flows following RCS blowdown, via the LHSI cooling function of the SIS.

Following blowdown, the reactor coolant vapor produced from the RCS leak condenses on the containment heat sinks. The saturated water drains along the intermediate floors, grates, stairwells, and walls to the heavy floor of the containment building. The effects of condensation induce circulation zones that provide a mixing of the containment atmosphere during and after blowdown. The saturated water draining from the heat sinks pools and forms a large condensation surface on the heavy floor. In the case of a LOCA, saturated reactor coolant spills out of the break, splashes on the heavy floor, and induces waves in the pooled water, which provides constant circulation that further promotes condensation on the pool surface. Curbed grates in the heavy floor drains direct the condensed reactor coolant back to the IRWST. The water in the IRWST is recirculated by the LHSI pumps through the heat exchangers, where it is cooled by the component cooling water system (CCWS), and pumped into the RCS to cool the core. The condensation of the reactor coolant vapor by the heat sinks and the subcooled liquid flowing across the heavy floor, and rejection of the heat to the environs via the LHSI heat exchanger cooling chain, results in long-term cooling and depressurization of the containment.

Long-term hydrogen mixing experiments were conducted in the Battelle Model Containment (BMC) facility to verify hydrogen mixing by natural convection after a LBLOCA in the Biblis containment. The geometry of the BMC facility is similar to that of the U.S. EPR; no fan coolers or sprays were available for active cooling during these tests.

The U.S. EPR does not credit active cooling by fan coolers or sprays inside containment during a postulated LBLOCA. The similar geometry and the minimum active containment cooling systems used in the BMC facility tests make the findings directly applicable to the LBLOCA for the U.S. EPR containment analysis.

As described in the June 1999 NEA/CSNI report on containment thermal-hydraulics and hydrogen distribution (Reference 6), these tests provide direct experimental evidence that sump flashing or evaporation resulting from sump liquid superheat generate effective natural convection currents throughout containment. The condition of sump liquid superheat also occurs in the IRWST in the long term as a result of LBLOCA. These tests show that sump evaporation that occurs in the absence of active containment cooling establishes effective natural convection currents throughout the U.S. EPR containment.

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The design basis containment analysis for loss of coolant accidents and main steam line breaks, and the containment pressure and temperature responses for these events, is discussed in Section 6.2.1. As shown in Figures 6.2.1-12, 6.2.1-16, and 6.2.1-20, the LHSI heat exchangers are sufficient to reduce the containment pressure to half its peak in less than eight hours after a LOCA.

The SIS provides cooling of the IRWST in the event of a LOCA and provides long-term cooling and pressure suppression of the containment volume. The SIS consists of four independent trains, providing sufficient capacity, diversity, and independence to perform its required safety functions following design basis transients or accidents assuming a single failure in one train while a second train is out-of-service for preventive maintenance. Section 6.3 discusses the SIS, including design bases, instrumentation and inspection and testing requirements. Section 6.3 includes a discussion of the design features for avoidance of the potential loss of long-term cooling capability due to sump screen blockage in the IRWST and presents the performance evaluation of the design, a summary of component testing, and a comparison to the regulatory positions of RG 1.82.

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