Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

March 17, 2016
NOC-AE-16003347
10 CFR 50.90
File No. G25

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Request for Additional Information Regarding the License Amendment Request
For Extension of Containment Leakage Rate Testing Program
South Texas Project Units 1 and 2 TAC NOS MF6176 and MF6177

References:
1. Letter from G. T. Powell, STP, to NRC Document Control Desk, "Units 1 and 2 License Amendment Request for Extending the 10 year ILRT to 15 years", dated April 29, 2015 (NOC-AE-15003227) (ML15128A352)
2. Letter from G. T. Powell, STP, to NRC Document Control Desk, "Units 1 and 2 License Amendment Request for Extending the 10 year ILRT to 15 years PRA Supplement", dated June 29, 2015 (NOC-AE-15003266) (ML15198A147)
3. Email from Lisa Regner, NRC, to Lance Sterling, STPNOC, "STP ILRT RAI (MF6176 and MF6177)", dated September 3, 2015 (AE-NOC-15002702) (ML15251A216)
4. Email from Lisa Regner, NRC, to Lance Sterling, STPNOC, "Draft NRC RAI: Integrated Leak Rate Testing LAR STP ILRT RAI (MF6176 and MF6177)", dated September 10, 2015 (AE-NOC-15002701) (ML16048A426)
5. Letter from Lisa Regner, NRC, to Dennis Koehl, STPNOC, "South Texas Project, Units 1 and 2 – Request for Additional Information Related to a License Amendment Request to Extend the Containment Integrated Leak Rate Test Frequency (CAC Nos. MF6176 and MF6177)", dated March 1, 2016 (ML16053A187)

By Reference 1, STP Nuclear Operating Company (STPNOC) submitted a License Amendment Request (LAR) for extending the 10 year Integrated Leak Rate Test (ILRT) to 15 years. Reference 2 is a supplement to the original submittal that added additional information regarding Probabilistic Risk Assessment topics. By Reference 3 and Reference 4, the NRC staff previously requested additional information (RAI) for their review of the STPNOC LAR. In Reference 5 the NRC has requested that STPNOC provide information regarding Nuclear Safety Advisory Letter (NSAL)-06-6, NSAL-11-5 and NSAL-14-2, and InfoGram (IG)-14-1. STPNOC's response to Reference 5 is provided in the Enclosure to this letter.

A001
NRR

There are no commitments in this letter.

STI: 34285574

If there are any questions regarding the RAI responses, please contact Rafael Gonzales at (361) 972-4779.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 17, 2016
Date

Peter Nemeth
Secretary and General Counsel

rjg

Enclosure: STPNOC Responses to the Request for Additional Information Regarding Units 1 and 2 License Amendment Request for Extending the 10 year ILRT to 15 years, Nuclear Safety Advisory Letters (NSALs)-06-6, -11-5, and -14-2, and InfoGram (IG)-14-1.

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Enclosure

STPNOC Responses to the Request for Additional Information Regarding Units 1 and 2 License Amendment Request for Extending the 10 year ILRT to 15 years, Nuclear Safety Advisory Letters (NSALs)-06-6, -11-5, and -14-2, and InfoGram (IG)-14-1.

By letter dated April 29, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15128A352), as supplemented by letters dated June 29, October 8, and November 11, 2015 (ADAMS Accession Nos. ML15198A147, ML15293A509, and ML15329A304, respectively), STP Nuclear Operating Company (the licensee) requested changes to the Technical Specifications for South Texas Project (STP), Units 1 and 2. The proposed change would permit the existing Containment Integrated Leak Rate Testing frequency to be extended from 10 years to 15 years on a permanent basis.

The U.S. Nuclear Regulatory Commission staff has reviewed the information provided in your application and determined that the following additional information is required to complete the review.

SCVB RAI:

The STP Updated Final Safety Analysis Report (UFSAR) Section 6.2.1.3, "Mass and Energy Release Analyses for Postulated Loss of Coolant Accidents," states the use of the Westinghouse WCAP-10325-P-A methodology for loss-of-coolant accident (LOCA) mass and energy release analysis. Westinghouse Electric Company LLC (Westinghouse) has issued Nuclear Safety Advisory Letters (NSALs)-06-6, -11-5, and-14-2, and InfoGram (IG)-14-1 to report errors in this methodology. Also, a new methodology (GOTHIC) is used for the LOCA containment analysis for which the mass and energy input needs to be corrected based on the above NSALs and the InfoGram.

The licensee indicated that the three Westinghouse NSALs were corrected and incorporated into the new LOCA containment analysis and the analysis results have been incorporated into the UFSAR.

1. Please describe any changes in inputs and assumptions in the reanalysis that could potentially reduce the conservatism in the previous analysis. Please describe which UFSAR sections and figures contain the revised results of the LOCA mass and energy releases, containment pressure response, and Equipment Qualification pressure/temperature response analyses. Provide a brief description of the changes from the previous analysis results.

2. The information provided in the IG-14-1 is generic. Please describe STP plant specific analysis/evaluations performed to determine the applicability of the errors reported in the InfoGram to STP and its impact on the current analysis of record.

STP Response to Question 1:

The response to RAI question 1 is provided in the following three sections.

1.1 Please describe any changes in inputs and assumptions in the reanalysis that could potentially reduce the conservatism in the previous analysis.

> RESPONSE: The containment pressure-temperature response for LOCA was performed in two parts. The first part developed the mass and energy release for use in the containment pressure-temperature response. The second part calculated the containment pressure-temperature response.

The new containment mass and energy release analysis was performed using the same methodology as the previous analysis. The analysis was performed in accordance with the NRC-approved methodology in WCAP-10325-P-A. The revised analysis incorporated the issues addressed in NSAL-06-6, NSAL-11-5 and NSAL-14-2. The incorporation of these issues resulted in an increase in mass and energy releases and did not reduce the conservatism from the previous analysis.

The previous containment pressure-temperature response analysis used the CONTEMPT computer code. The new containment response analysis was performed with the GOTHIC computer code using the NRC-approved methodology documented in Dominion topical report DOM-NAF-3 (Reference 1). UFSAR Section 6.2.1.1.3.1 provides a description of the key models in the GOTHIC analysis (see UFSAR Change Notice 3136, Attachment to this Enclosure). The following items used in the GOTHIC analysis are essentially the same as the items used in the CONTEMPT analysis:

- Containment model
- Containment initial conditions
- Heat sinks
- Reactor Containment Fan Cooler (RCFC) model
- Containment spray model,
- Refueling Water Storage Tank (RWST) model
- Sump recirculation model
- Heat exchanger model

Two significant modeling changes were made when converting from the CONTEMPT to GOTHIC computer models. The first change replaced the Uchida/Tagami condensing heat transfer model with the Diffusion Layer Model (DLM) as discussed in Section 3.3.2 of Reference 1. A sensitivity study was performed using the limiting peak pressure case which is the Double-Ended Hot Leg (DEHL) break with minimum safety injection and minimum containment heat removal systems. Results of the study presented on Figure 1 below shows that the use of the GOTHIC DLM model resulted in a 2.7 psi increase in the peak pressure for the limiting case.

The second change added the liquid/vapor interface model between the atmosphere and the sump. The CONTEMPT model used a constant heat transfer coefficient of $0.4\,\frac{btu}{hr-ft2-{}^{\circ}F}$ while the GOTHIC model used a split heat transfer option that switches the heat transfer from the vapor phase to the liquid phase as discussed in Updated Final Safety Analysis Report (UFSAR) Table 6.2.1.1-9. A separate sensitivity study was performed using the same limiting case discussed earlier. The results presented on Figure 2 below show that the change in the liquid/vapor model had a negligible change on the peak pressure.

1.2 Please describe which UFSAR sections and figures contain the revised results of the LOCA mass and energy releases, containment pressure response, and Equipment Qualification pressure/temperature response analyses.

RESPONSE: UFSAR Sections 6.2.1.1 and 6.2.1.3 discuss the LOCA containment response and mass and energy release analysis. The mass and energy release data are presented in UFSAR Tables 6.2.1.3-4 to-18. The containment pressure/temperature responses are shown in UFSAR Figures 6.2.1.1-30 to-38. UFSAR Change Notice 3136 has been issued to reflect the revised analysis. A copy of the incorporated change notice pages to the UFSAR have been included in the Attachment of this Enclosure.

Figures 3 and 4 below present the equipment qualification pressure/temperature response. These figures are a composite of the peak pressures and temperatures from the LOCA and steam line break analyses.

1.3. Provide a brief description of the changes from the previous analysis results.

RESPONSE: The combination of the increased mass and energy release and changes to the containment model for the limiting case (DEHL break with minimum safety injection and minimum containment heat removal) resulted in a change of the peak containment pressure from 39.5 psig to 40.1 psig. The peak containment temperature changed from 264°F to 262°F, and the peak containment sump temperature changed from 267°F to 274°F.

STP Response to Question 2:

IG-14-1 identified that the stainless steel volumetric heat capacity value that is used in the Westinghouse LOCA M&E release analysis methodology was identified as being lower than the current ASME Boiler and Pressure Vessel Code data. IG-14-1 concluded that the current Westinghouse LOCA M&E release methodology provides a conservative calculation of the energy release rate for input to containment calculations, the methodology has been proven to be overall conservative for containment integrity and downstream analyses, including EQ, and no further action on the part of the utility is required. Additional discussions with Westinghouse identified that the stainless steel specific heat values used in the current analysis were approximately 20% lower than the current ASME Boiler and Pressure Vessel Code data.

To assess the potential impact of the additional energy that could be released due to the higher specific heat values, a sensitivity study was performed. The sensitivity study determined the amount of additional energy required to increase the calculated peak containment pressure to exceed the Technical Specification 6.8.3.j value of 41.2 psig (Pa). The results of the sensitivity study show that the energy released from the primary and secondary metal mass would have to increase by 46% before the Pa value of 41.2 psig was exceeded. Since the 46% additional energy required to exceed the Pa limit is greater than the additional 20% energy that could be released due to the difference in the specific heat values, margin still exists to ensure that the Pa value will not be exceeded during a LOCA event.

Sensitivity Study Description

A summary of the LOCA containment pressure-temperature analysis is presented in UFSAR Section 6.2.1 as amended by Change Notice 3136 (see Attachment). UFSAR Table 6.2.1.1-2 summarizes the results of the peak containment pressure analysis. The DEHL break with minimum safety injection and minimum containment heat removal was chosen since it is the limiting case that determines Pa. UFSAR Figure 6.2.1.1-30 provides the containment pressure response versus time for the DEHL break with the minimum containment heat removal case. UFSAR Table 6.2.1.3-18 provides the energy balance for this case up to the end of blowdown. UFSAR Table 6.2.1.1-10 provides the accident chronology for this event.

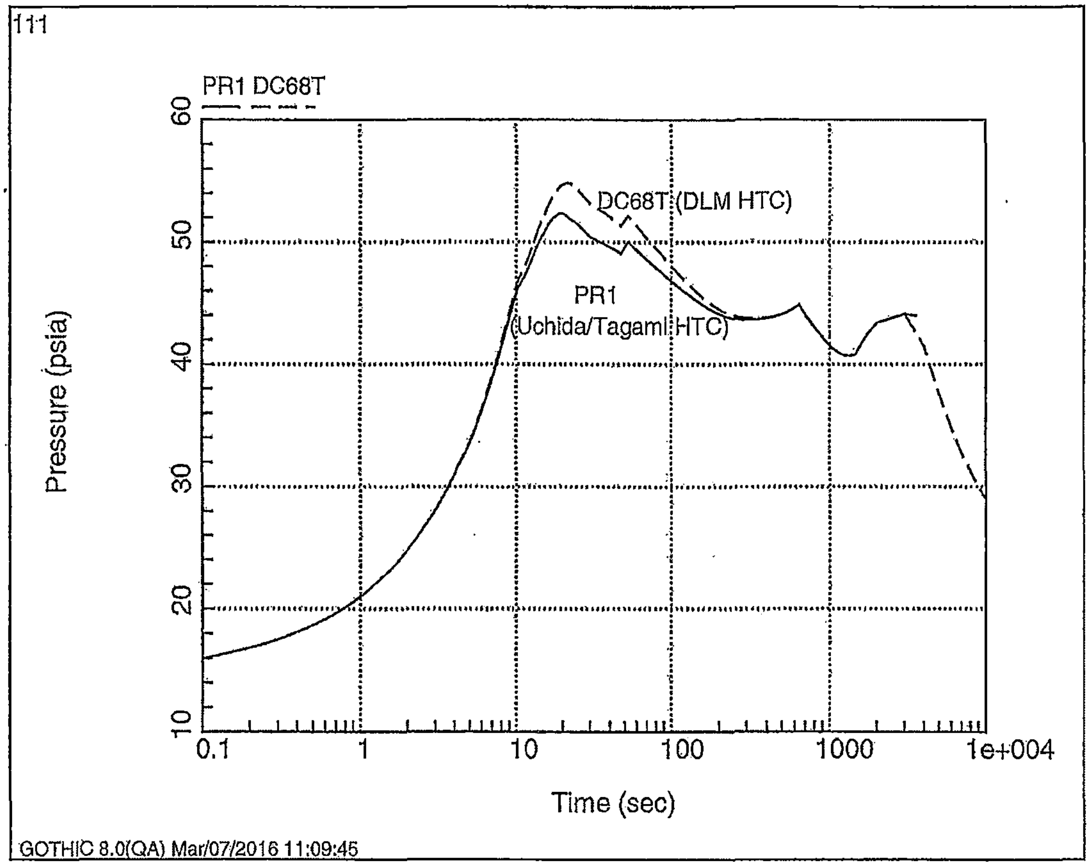
The sensitivity study calculated the additional energy from the metal mass that would be required to increase the peak containment pressure from 40.1 psig to 41.2 psig (Pa). The premise of the sensitivity study is that an increase in the specific heat of the stainless steel would proportionately increase the energy release from the primary and secondary metal. Therefore, if the specific heat were to double, the energy release from the primary and secondary metal mass metal would also double. The LOCA containment pressure-temperature analysis uses the mass and energy releases for the first 3600 seconds, with the sensible energy from the RCS and steam generators being transferred to the sump; after 3600 seconds, energy addition is by decay heat only.

The GOTHIC model used for the design basis analysis was modified to add a multiplier to the energy release for the duration of the mass and energy releases to determine the energy required to increase the calculated peak pressure from 40.1 to 41.2 psig. The resulting pressure versus time is provided on Figure 5 which shows that the first peak is limiting. The results of the analysis show that a factor of 1.02 is required to raise the calculated peak pressure to 41.2 psig. UFSAR Table 6.2.1.3-18 shows that the total energy release to containment (Total Effluent) is 410.27 MBTU. So the additional energy added to containment during the blowdown phase is 8.2 MBTU (0.02 X 410.27 MBTU). The energy balance on UFSAR Table 6.2.1.3-18 shows that the energy contributed to the energy release by the primary metal (204.93 -192.02 MBTU) and secondary metal (161.72 – 156.81 MBTU) during the blowdown phase is 17.82 MBTU for the current analysis. The additional energy from the primary and secondary metal would have to increase by a factor 46% ($\frac{8.2\ MBTU}{17.82\ MBTU} x\ 100$), which is greater than the additional 20% energy that could be provided by the differences in the specific heat values.

Figures 1-5

Figure 1

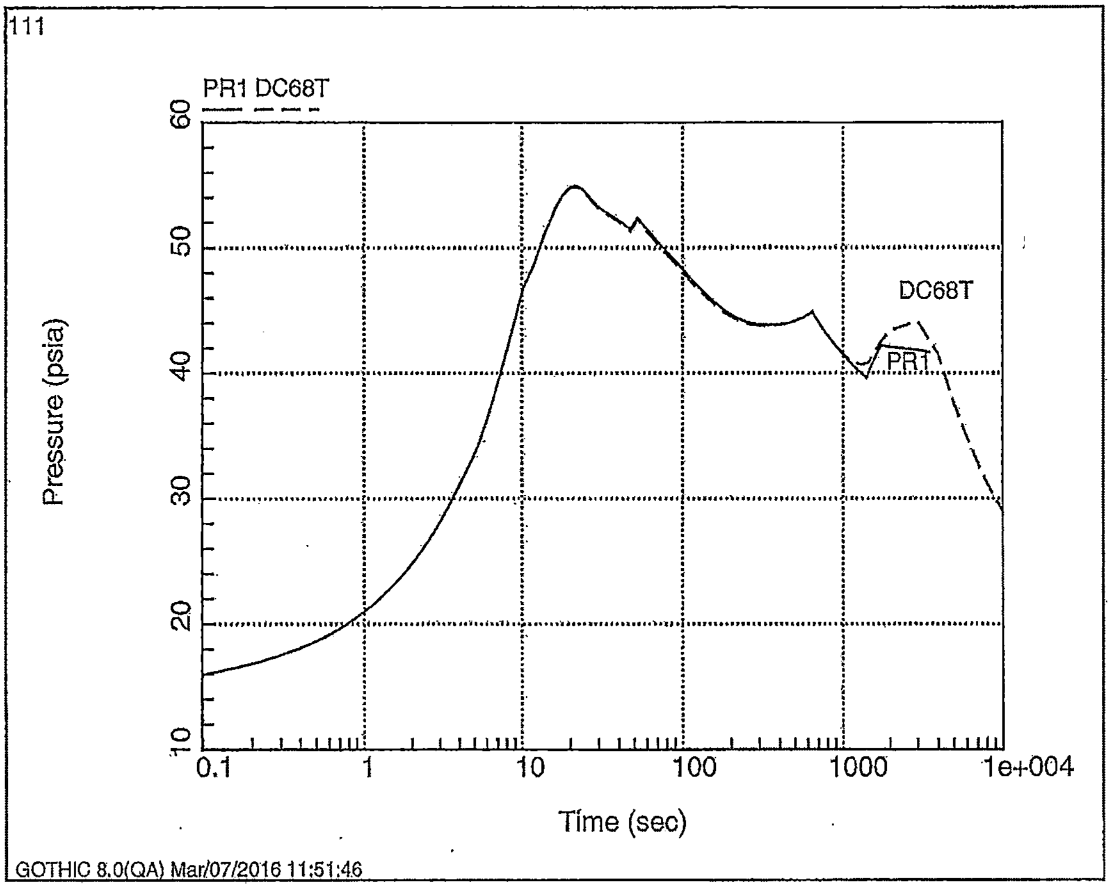
Containment Pressure (psia) with Uchida/Tagami Heat Transfer Coefficient (HTC)



PR1	Containment Pressure (psia) with Uchida/Tagami Heat Transfer Coefficient (HTC)
DC68T	Double-Ended Hot Leg Break Minimum Safety Injection, Minimum Containment Heat Removal System (Can be compared with UFSAR Figure 6.2.1.1-30)

Figure 2

Containment Pressure (psia) with No SPLIT or Liquid/Vapor Interface heat transfer



PR1	Containment Pressure (psia) with No SPLIT or Liquid/Vapor Interface heat transfer
DC68T	Double-Ended Hot Leg Break Minimum Safety Injection, Minimum Containment Heat Removal System (Can be compared with UFSAR Figure 6.2.1.1-30)

Figure 3
Peak Pressure Composite for Equipment Qualification

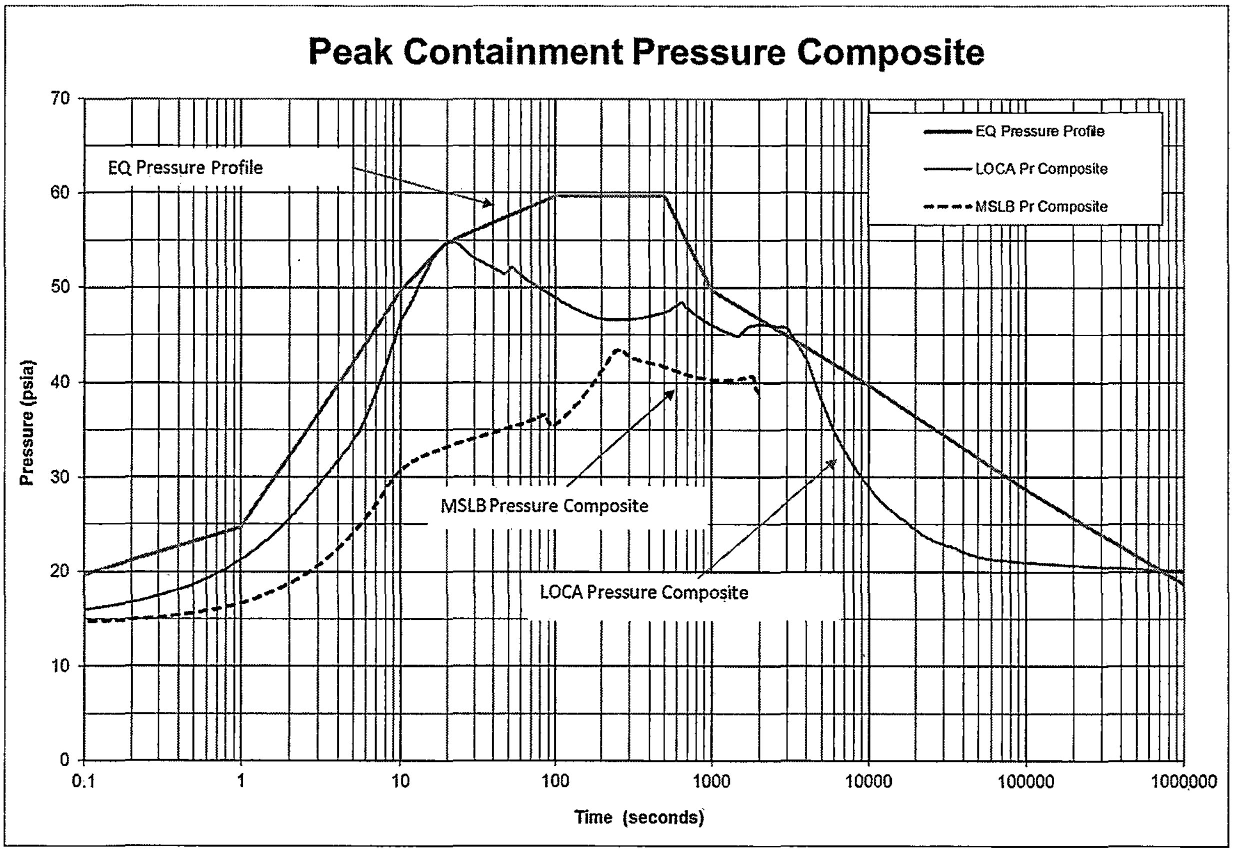


Figure 4
Peak Temperature Composite for Equipment Qualification

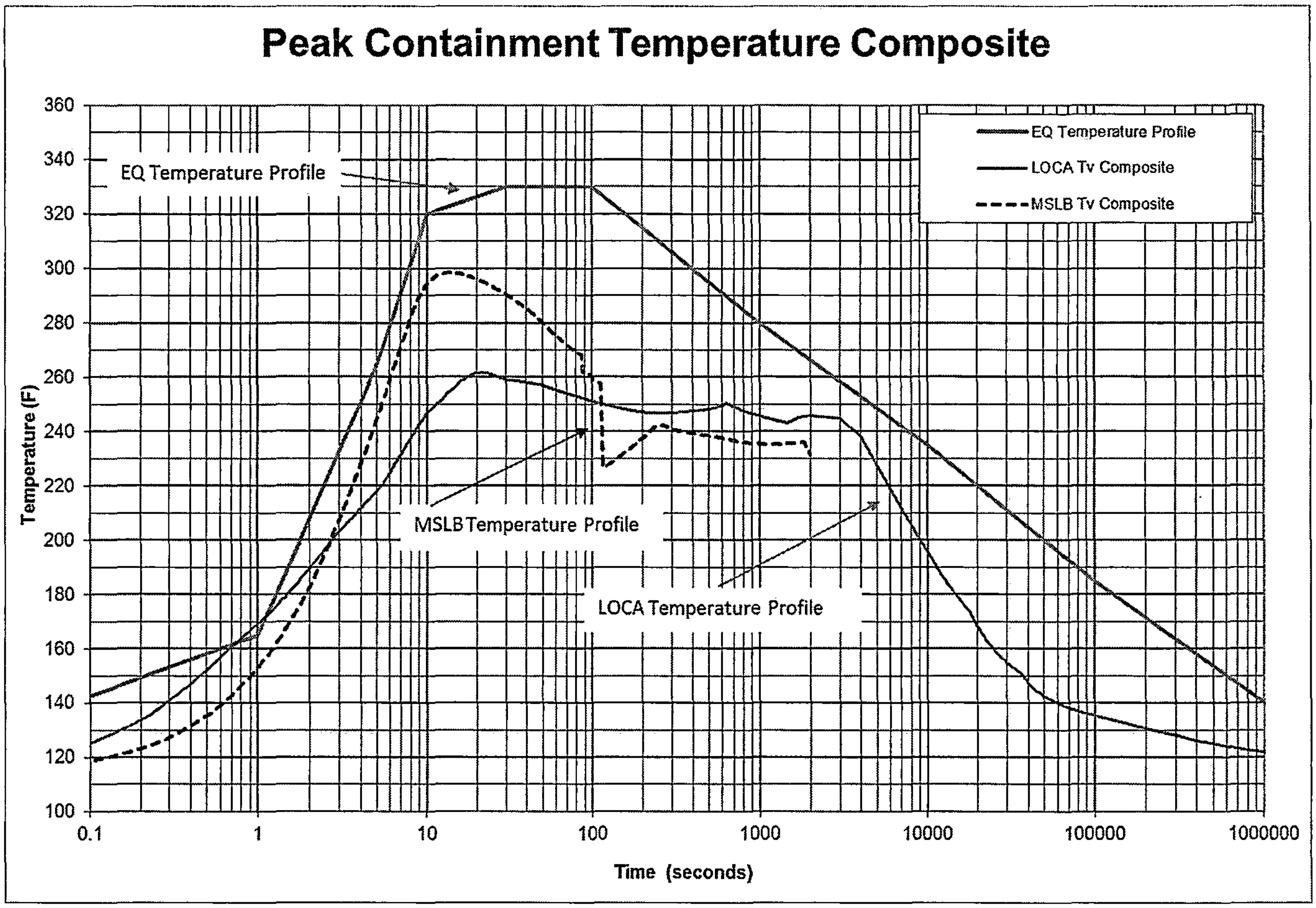
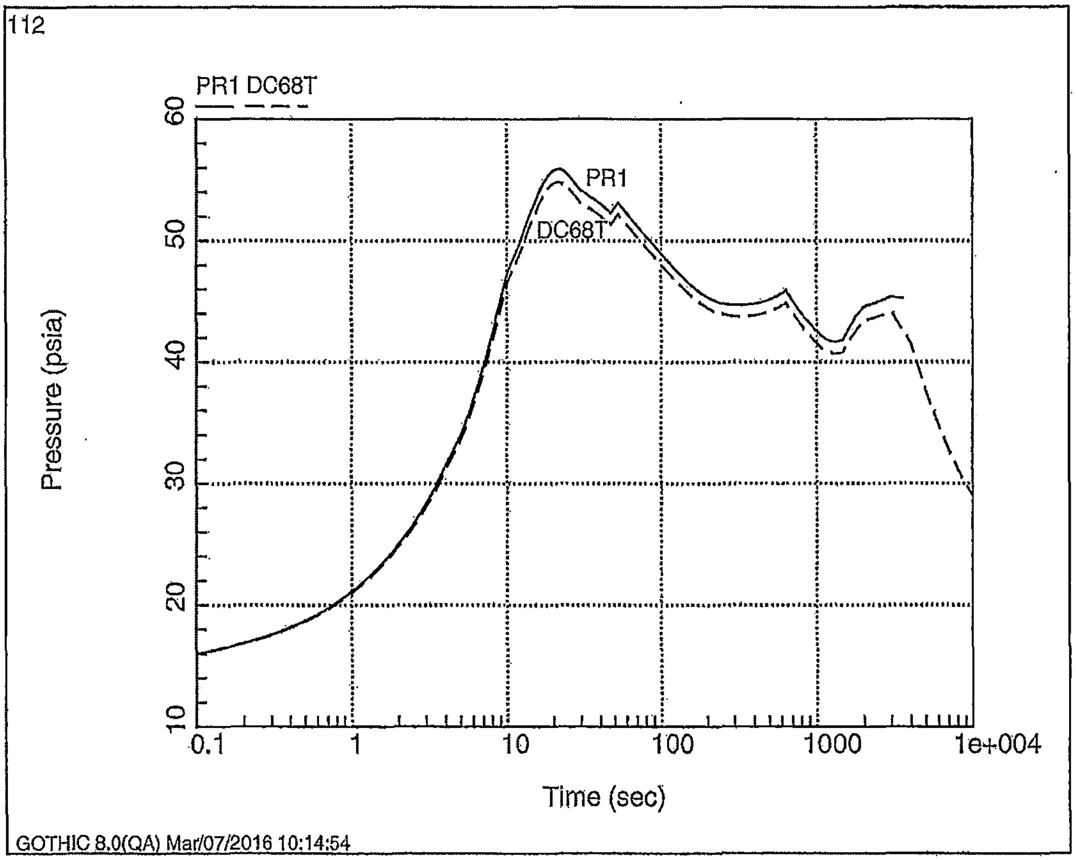


Figure 5

Containment Pressure (psia) with Energy Multiplier of 1.02 (2%)



PR1	Containment Pressure (psia) with Energy Multiplier of 1.02 (2%)
DC68T	Double-Ended Hot Leg Break Minimum Safety Injection, Minimum Containment Heat Removal System (Can be compared with UFSAR Figure 6.2.1.1-30)

References

1. ML063190467, Dominion, Approved Topical Report DOM-NAF-3 NP-A, GOTHIC Methodology for Analyzing the Response to Postulated Pipe Ruptures Inside Containment, November 16, 2006.

Attachment:

1. Incorporated UFSAR Change Notice 3136

Incorporated
UFSAR Change Notice 3136

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conservative set of assumptions that maximize the heat removal effectiveness of ESF systems, structural heat sinks, and other potential heat removal processes. The assumptions are discussed in Section 6.2.1.5.

6.2.1.1.2 Design Features: Design features of the Containment and its internal structures are described in Sections 3.8.1 and 3.8.3, respectively.

6.2.1.1.2.1 Protection from the Dynamic Effects of Postulated Accidents – The Containment structure, subcompartments, and ESF systems safety functions are protected from loss due to the dynamic effects of postulated accidents. Containment design provides separation, barriers, or restraints as required to protect essential structures, systems, and components from accident-generated missiles, pipe whip, and jet impingement forces. Detailed criteria, locations, and descriptions of devices used for protection are given in Sections 3.5 and 3.6.

6.2.1.1.2.2 Codes and Standards – Codes and standards applied to the design, fabrication, and erection of the Containment and internal structures are given in Sections 3.8.1 and 3.8.3. In each case, the codes and standards used are consistent with equipment safety function.

6.2.1.1.2.3 Protection Against External Pressure Loads – No special provisions are required for protection against loss of Containment integrity under external loading conditions. Inadvertent operation of CHRS and other possible modes of plant operation (e.g., Containment purging) that could potentially result in significant external structural loading, have resulted in pressure differentials lower than the design Containment pressure differential for external loading. Details of this evaluation are provided in Section 6.2.1.1.3.6.

6.2.1.1.2.4 Potential Water Traps Inside the Containment – Drains from potential water traps discharge into the Containment sump. All significant water traps are thereby eliminated.

6.2.1.1.2.5 Containment Cooling and Ventilation Systems – During normal reactor operation, Containment atmosphere is maintained at or below the Technical Specification limit by continuous operation of the RCFC system. This system is described in detail in Section 6.2.2.2.

6.2.1.1.3 Design Evaluation:

6.2.1.1.3.1 Containment Pressure and Temperature Analysis – In the event of a postulated LOCA, MSLB, or main feedwater line break (FWLB), mass and energy will be released from the rupture and high-temperature, high-pressure fluid will flash to steam. This release of mass and energy raises Containment atmosphere pressure and temperature. The magnitude of the resulting pressure and temperature peaks is a function of the nature, location, and size of the postulated rupture.

To establish the controlling rupture for Containment design, a range of primary and secondary breaks, as described in Table 6.2.1.1-1, was analyzed to determine the effect of each break on Containment. The LOCA analysis is discussed in Section 6.2.1.3. The MSLB analysis is discussed in Section 6.2.1.4. As discussed in Section 6.2.1.4, the FWLB does not produce peak Containment pressure or temperature as severe as LOCA or MSLB cases. Therefore, the FWLB cases are not analyzed. CN-3136

The Containment analysis is performed in two stages. In the first stage, the mass and energy release is calculated for a spectrum of breaks (double-ended pump suction, DEPS; double-ended hot leg, DEHL; and double-ended and split break MSLBs). The mass and energy release models and break sizes are described in Section 6.2.1.3 (LOCA) and 6.2. 1.4 (MSLB). CN-3136

In the second stage, the mass and energy releases are used in the Containment rulalysis model for calculating the peak pressure and temperature. The Containment analysis model is described below.

(a) Containment Model CN-3136

The containment pressure and temperature transients are analyzed by using the GOTHIC code (References 6.2.1.1-11 and 6.2.1.1-13). GOTHIC is an integrated, general purpose thermal hydraulics software for design, licensing, safety and operating analysis of nuclear power plant containments, confinement buildings and system components. Applications of GOTHIC include evaluation of containment and sub-compartment response to the full spectrum of high energy line breaks within the design basis envelope and systems evaluations involving multiphase flow and heat transfer, gas mixing and other thermal hydraulic behavior.

The LOCA and MSLB analyses use a single volume (node) for the containment building with separate treatment given to the sump and containment atmosphere regions. Inherent in this lumped parameter approach is the assumption that within each region the fluid is well mixed.

During a LOCA or MSLB, the mixing induced by the break jet is significant. Later in the transient, containment sprays and/or reactor containment fan coolers (RCFCs) continue to promote mixing in the containment.

(b) Containment Initial Conditions

To determine the maximum containment pressure and temperature, the most restricting Containment normal operating pressure and temperature are assumed to be at the Technical Specification operating limit and. the outside atmosphere temperature is assumed to be at design maximum value. The initial conditions for the limiting Containment peak pressure case are given in Table 6.2.1.1-3.

For Containment LOCA peak pressure analysis, the Safety Injection System (SIS) and the CHRS (i.e., CSS and RCFC) are assumed to operate in the mode that maximizes Containment peak Pressure. The initial conditions are listed in Table 6.2.1.1-5.

For calculating the Containment peak pressure, the minimum CHRS capacity is the conservative condition. Thus, the CHRS equipment were assumed to be affected by the most restrictive single active failure, which is the loss of one SDG train coupled with one RCFC unit being out of service for maintenance. The analyses show that a sustained loss of one safety-related electrical distribution train (i.e., one SDG) will minimize ESF response and maximize Containment pressures. The LOCA analysis gives the highest pressure, and the analysis is discussed in Section 6.2.1.3. CN-3136

For Containment peak temperature analysis (due to MSLB}, a spectrum of single active failures and break sizes were considered. The MSLB analysis is discussed in Section 6.2.1.4.

(c) Mass and Energy Releases

For LOCA, the mass and energy release analysis is discussed in Section 6.2.1.3.

For MSLB, the mass and energy release analysis is discussed in Section 6.2. 1.4.

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(d) Heat Sinks (Thermal Conductors)

Containment structures are one of the major passive heat sinks for energy removal and are modeled as thermal conductors. The thermal conductors are made of up a number of layers of different materials. The thermal conductors are divided into regions, one for each material layer, with an appropriate thickness and material thermos-physical properties for each region. One-dimensional heat conduction solutions are used.

The small air gap or contact resistance between the containment liner and the concrete is modeled as a separate material layer at the nominal gap thickness with applicable material properties. This approach conservatively overestimates the contact resistance because convection and radiation effects will be ignored.

Concrete, Metal, and protective coating properties are typical values for the temperature range observed in the analyses. Table 6.2.1.1-7 gives a summary of containment structural heat sinks used in the analysis. Thermo-physical properties of these heat sinks are listed in Table 6.2.1.1-8.

(e) Passive Heat Sink Heat Transfer Coefficients

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The GOTHIC Direct heat transfer option with the DLM (Diffusion Layer Model) condensation option is used for all containment passive heat sinks except the sump floor. With the Direct option, all condensate goes directly to the liquid pool at the bottom of the volume. The effects of the condensate film on the heat and mass transfer are incorporated in the formulation of the DLM option. Under the DLM option, the condensation rate is calculated using a heat and mass transfer analogy to account for the presence of noncondensing gases.

For a conductor representing the containment floor or sump walls that will eventually be covered with water from the break and condensate, the Split heat transfer is used to switch the heat transfer from the vapor phase to the liquid phase as the liquid level in the containment builds up.

For conductors with both sides exposed to the containment, the Direct heat transfer with DLM option is applied to both sides. If the conductor is symmetric about the center plane, a half thickness conductor is used with the total surface area of two sides and an insulated back side heat transfer option is used. The conductor face that is not exposed to the atmosphere is assumed insulated. For the insulated side, the Specified Heat Flux option is used with the nominal heat flux set to zero.

Containment walls above grade and the containment dome have a specified external temperature boundary condition with a heat transfer coefficient of 2.0 Btu/hr-ft^2-°F to model convective heat transfer to the outside atmosphere.

Surface heat transfer coefficients used in the analysis for LOCA and MSLB cases are shown in Table 6.2.1.1-9. CN-3136

(f) RCFC Model.

The reactor containment fan coolers (RCFCs) arc modeled by specifying input values using heat removal rate versus Containment atmosphere saturation temperature curve. This performance curve is based on the cooling coil design data including fouling and is shown in Figure 6.2.1.5-2. Start times are based on SDG start time, loading sequencing time, and startup time for the various ESF systems. The start times are provided in Table 6.2.1.1-10 and the RCFC parameters are given in Table 6.2.1.1-5.

(g) Containment Spray Model

For the containment spray system (CSS), spray water is taken from the RWST during the injection phase and the liquid region of the containment eluting the sump recirculation phase. The spray flow is added directly to the containment vapor space. The analysis uses the general modeling practices for spray nozzles, spray pumps, spray system delivery times including piping fill time and pump start delays. The model calculates the sensible heat transfer between the spray drops and vapor and evaporation or condensation at the drop surface.

(h) RWST Model

The refueling water storage tank (R WST) liquid volume is used to determine a reasonable prediction of inventory draw down for determining the time of transfer to the sump recirculation phase. The RWST parameters are shown in Table 6.2.1.1-3.

(i) Sump Recirculation Model

The sump recirculation phase starts after depletion of the RWST liquid inventory. At the time of transfer to the sump recirculation phase, the safety injection system (HHSI and LHSI) and containment sprays swap suction from the RWST to the containment sump. During this phase, the LHSI is cooled by the RHR heat exchanger. The HHSI and CSS flows are not cooled. Two LHSI-RHR heat exchanger train combination are used to cool the recirculation flow to the RCS during the post-SG depressurizations phase (after 3600 seconds). CN-3136

(j) Heat Exchanger Model

The RHR exchanger is modeled using the GOTIHC HEAT EXCHANGER option. Fouling factors and tube plugging are applied for conservatism.

6.2.1.1.3.2 Long-Term Containment Performance CN-3136

The results of the most severe cases for primary and secondary side breaks were evaluated to verify the ability of the CHRS to maintain Containment conditions within design limits. These evaluations were based upon conservative assumptions for ESF equipment performance. The minimum CHRS operation was based on loss" of offsite power (LOOP) with one SDG failure. Thus, only two of three CHRS trains minus one additional RCFC unit out for maintenance were assumed in the analysis. During the sump recirculation phase, two LHSI-RHR heat exchanger train combination are used to cool the recirculation flow to the RCS. The containment sprays are not cooled by any heat exchanger. Hot leg recirculation is not considered since it has no significant impact on Containment analysis results.

The spectrum of accidents postulated for determining the Containment peak pressure and temperature, subcompartment peak pressure, and external pressure is summarized in Table 6.2.1.1-1. The calculated peak maximum pressure, design pressure, and margin between the calculated peak and design pressures are given in Table 6.2.1.1-2. Containment parameters used in the analysis are given in Table 6.2.1.1-3.

For LOCA, the scenarios analyzed are the double-ended pump section (DEPS) and the double-ended hot leg (DEHL) breaks coincident with LOOP. These analyses were performed with both minimum safety injection (SI) and maximum SL The minimum SI case includes flow from two SI trains (LHSI + HHSI). The maximum SI case includes flow from all three SI trains.

For the analyzed LOCA cases, the pipe break locations, break areas, peak pressures and temperatures are summarized in Table 6.2.1.1-2. Based on the results, the DEHL break provided the highest peak Containment pressure. For long-term analysis, all analyzed cases have similar pressure and temperature profiles.

A summary of the peak containment LOCA pressures and temperatures is given in Table 6.2.1.1-2. Figures 6.2.1.1-30 to 6.2.1.1-38 show the results of two representative LOCA analyses. The long-term analysis shows that the Containment pressure is reduced below 50 percent of the peak calculated pressure within 24 hours.

For MSLB, several double-ended and split break cases were analyzed at different power levels and different single-active failures. A summary of the peak containment MSLB pressures and temperatures is given in Table 6.2.1.1-14. The highest temperature occurs for a double-ended MSLB where no entrainment is included in the mass and energy releases (discussed in Section 6.2.1.4). This is conservative since the Containment response to a mass and energy release with entrainment effects would result in lower temperatures at or near the saturated conditions.

Figures 6.2.1.1-25, 6.2.1.1-27, 6.2.1.1-28 and 6.2.1.1-29 show plots of various parameters for the most limiting MSLB temperature case. CN-3136

6.2.1.1.3.3 Accident Chronology – The accident chronology for the most severe RCS break (LOCA) is provided in Table 6.2.1.1-10. The chronology for the design basis MSLB is shown in Table 6.2.1.1-15.

Section 3.6.2. As discussed in Reference 3.6-14 and Section 3.6.2.1.1.1, item a, RCL ruptures and the associated dynamic effects are not included in the design bases. The accident that results in the maximum differential pressure across the walls of the respective compartment is designated as the subcompartment design basis. Calculated differential pressures are compared to the design pressure values used in the structural design of subcompartment walls and equipment to ensure that peak calculated values are less than design values. These design and calculated pressure differentials are presented under each subcompartment section below.

6.2.1.2.2 Design Features:

6.2.1.2.2.1 Reactor Cavity – The reactor cavity is a heavily reinforced concrete structure that performs the dual function of providing reactor vessel support and radiation shielding. It is described in Section 3.8.3.1 and is shown in the general arrangement drawings listed in Table 1.2-1. At the elevation of the primary piping nozzles, the reactor vessel is surrounded by an inspection toroid. No pipe ruptures are postulated in the reactor cavity or inspection toroid.

6.2.1.2.2.2 Steam Generator Compartments –The SG and its supports have been described in Section 3.8.3.1, and the general arrangement of the SG and associated structural arrangement are listed as Figures 1.2-13 through 1.2-20 in Table 1.2-1. These general arrangement drawings have been used to define nodal boundaries. The SG subcompartments consist of the entire free volume between the primary shield and the secondary shield walls and from El. 19 ft to 83 ft. Each quadrant vents to the containment at the top of the SG compartment. See Tables 6.2.1.2-5A, 6.2.1.2-5B, and 6.2.1.2-6B for nodal volume and junction properties. In addition to the above vent path, two more vent paths vent the break nodes to the Containment. These are (a) the eight penetration paths that lead the hot and cold leg pipes to the reactor cavity and (b) the six heating, ventilation, and air-conditioning (HVAC) vents between the SG compartments above El. 19 ft and subpedestal region below El. 16 ft. Steam generator compartments A and D, and B and C are directly connected together while A and B, and C and D are connected via a passage. No blowout panels are used, thus the flow area is assumed to be constant with respect to time. Some junctions are considered partially blocked by debris. CN-3136

6.2.1.2.2.3 Pressurizer Compartment – The pressurizer subcompartment, shown in the general arrangement drawings listed in Table 1.2-1, consists of a vertical, rectangular, reinforced concrete structure surrounding the pressurizer which is supported at its base by a steel skirt. No blowout panels are used, thus the flow area is assumed to be constant with respect to time.

6.2.1.2.2.4 Surge Line Subcompartment – The surge line subcompartment consists of the area above the grating at El. 37 ft-3 in., the area below El. 37 ft-3 in., and the vestibule where the surge line penetrates the secondary shield wall. These subcompartments are shown in the general arrangement drawings listed in Table 1.2-1. See Section 6.2.1.2.3.5 for elimination of surge line breaks due to leak-before-break.

6.2.1.2.2.5 Main Steam Line and Feedwater Line Subcompartments – The main steam line and feedwater line subcompartments are located between the secondary shield wall and the Containment wall. The general arrangement drawings listed in Table 1.2-1 show the equipment and structures in these locations. The most confined spaces resulting in maximum local pressures from either break are near the pipe penetrations to the outside of the Containment. Vent paths consist of a combination of series and parallel flow resistances joining major elevations of approximately

RHR Line Break

Double-ended ruptures of the RHR piping were assumed to occur between the hot leg piping and the first isolation valve in the 12" section of the RHR piping. The remainder of the RHR piping is not modeled because of break exclusion due to Arbitrary Intermediate Break (Ref. 6.2.1.2-10). The mass and energy release rates from the isolated piping section was calculated using RETRAN-02 computer code. The mass and energy release rates for the RCS side of the break was calculated using the methodology from Reference 6.2.1.2-5. The total mass and energy releases for the double-ended rupture are shown in Table 6.2.1.2-1P. These releases are based on an initial RCS pressure of 2,296 psia and a hot leg temperature of 629.9°F. CN-3136

Three break cases were investigated. These were a break in Node 15 (at the hot leg junction), a break in Node 4 (at the first valve upstream of the RCS), and a break in Node 12 (at the hot leg junction, but artificially moved to the opposite side of the hot leg). The Node 12 break was modeled to conservatively envelop the results of the 8" Safety Injection line break case.

The COMPARE computer code (Ref. 6.2.1.2-9) was used to perform the SG subcompartment pressurization analysis. The nodalization of the SG subcompartment is shown on Figure 6.2.1.2-3 and 6.2.1.2-11. The node and junction parameters for the SG loop compartment are given on Table 6.2.1.2-6. The flow parameters were evaluated to account for all obstructions such as cable tray supports and various small-sized piping. The principal obstructions within the SG loop compartments are the SG and reactor coolant pumps. CN-3136

The flow from one node to the other was calculated using the homogeneous equilibrium model option for the analysis. The peak differential pressures for each subcompartment are listed in Table 6.2.1.2-5A. The pressure differential given on Table 6.2.1.2-5A is generally evaluated with respect to the containment (Node 41.) The pressure-time histories for all cases are presented in Figure 6.2.1.2-20A to -20C. These nodes are in the SG compartment in which the RHR breaks occur.

Force and moment coefficients on the SG and reactor coolant pump have been evaluated to help facilitate determination of forces and moments due to the pressures generated by the analyzed breaks. Force coefficients represent the projections of the SG and RCP on three mutually perpendicular planes selected for this purpose (Figure 6.2.1.2-30). For the steam generator loop "C" compartment, the positive "Z" direction is north, the positive "X" direction is west, the positive "Y" direction is vertically up. The origin for the steam generator at the bottom center of the SG while the origin for the reactor coolant pump is at the bottom center of the reactor coolant pump. Moment coefficients represent the force coefficients multiplied by the moment arm from the base of the steam generator or reactor coolant pump to the centers of the projected areas used in the development of the force coefficients. The force and moment coefficients are presented in Table 6.2.1.2-7A, -7B, -8A and -8B for the SG and RCP. The forces and moments plots versus time for the SG and the RCP are presented on Figures 6.2.1.2-21A and 6.2.1.2-22A for the specific break cases identified on the figures.

Feedwater Line Break Analysis

addition, the reservoir of reverse flow is limited since high energy fluid conditions extend only to the letdown heat exchanger.

6.2.1.2.3.8 Radioactive Pipe Chase Subcompartment – A double-ended rupture of the CVCS letdown line is the limiting break in the radioactive pipe chase subcompartment. See Figure 6.2.1.2-8 for a detailed drawing of the area. A node and junction diagram is illustrated on Figure 6.2.1.2-16. The flow model initial conditions, control volumes, inter-compartment flow paths, and corresponding flow coefficients and inertial terms are listed in Tables 6.2.1.2-17 and 6.2.1.2-18. The calculated subcompartment pressure response is shown on Figure 6.2.1.2-28. The calculated and design pressures are compared in Table 6.2.1.2-17. The blowdown rate for the CVCS letdown line break is calculated using ANSI 58.2, Appendix E2 methodology and applying that to a one-dimensional Henry-Fauske model for saturated liquid. Mass and energy release rates are given in Table 6.2.1.2-1L (refer to Section 6.2.1.2.3.1 for more details). Plant operation is assumed to be in the heatup mode. The break is assumed to occur at the Containment penetration. The break area is 0.0884 ft^2 for each end of double-ended break (0.1768 ft^2 total area). A significant restriction to forward flow is the CVCS letdown orifices (0.00166 ft^2) located immediately downstream of the regenerative heat exchanger. For reverse flow, the letdown heat exchanger reduces the line temperature to 115°F and a pressure reducing valve immediately downstream of the letdown heat exchanger reduces the line pressure to 300 psig, thereby limiting the reservoir of high energy fluid downstream of the break.

6.2.1.2.3.9 RHR Valve Room Subcompartment – A double-ended rupture of the CVCS letdown line is the limiting break in the RHR 1A and RHR 1B valve rooms. See Figure 6.2.1.2-9 for a detailed drawing of the area. Because the valve rooms are identical, a break was analyzed for the RHR 1A valve room. The results are representative for both valve rooms. A node and junction diagram is shown on Figure 6.2.1.2-17. The nodal model initial conditions, control volumes, vent areas, and corresponding flow coefficients and inertial terms are listed in Table 6.2.1.2-19 and 6.2.1.2-20. The calculated subcompartment pressure response is shown on Figure 6.2.1.2-29. Calculated and design pressures are compared in Table 6.2.1.2-19. The blowdown rate for the CVCS letdown line break is calculated using ANSI 58.2, Appendix E2 methodology and applying that to a one-dimensional Henry-Fauske model for saturated liquid (refer to Section 6.2.1.2.3.1 for more details). Mass and energy release rates are given in Table 6.2.1.2-1M. Plant operation is assumed to be in the heatup mode. The break is assumed to occur at the penetration of the valve room wall. The break area is 0.0884 ft^2 for each end of the double-ended break (0.1768 ft^2 total area). Significant restrictions to forward flow are the CVCS letdown orifices (0.00166 ft^2) located immediately downstream of the regenerative heat exchanger. For reverse flow, the letdown heat exchanger reduces the line temperature to 115°F and the pressure reducing valve, immediately downstream of the letdown heat exchanger, reduces the line pressure to 300 psig, thereby limiting the reservoir of high energy fluid downstream of the break.

6.2.1.3 Mass and Energy Release Analyses For Postulated Loss of Coolant Accidents.

6.2.1.3.1 Loss of Coolant Accident Mass and Energy Release Phases: The containment receives mass and energy releases following a postulated rupture of the RCS. These releases continue through blowdown and post-blowdown phases. CN-3136

The LOCA transient is divided into the following:

(1) Blowdown – which includes the period from accident initiation (when the reactor is at steady state operation) to the time that the RCS pressure reaches initial equilibrium with containment.

(2) Refill – the period of time when the lower plenum is being filled by accumulator and ECCS water. At the end of blowdown, a large amount of water remains in the cold legs, downcomer, and lower plenum. To conservatively consider the refill period for the purpose of containment mass and energy releases, this water is instantaneously transferred to the lower plenum along with sufficient accumulator water to completely fill the lower plenum. This allows an uninterrupted release of mass and energy to containment. Thus, the refill period is conservatively neglected in the mass and energy release calculation.

(3) Reflood – begins when the water from the lower plenum enters the core and ends when the core is completely quenched.

(4) Post-reflood – describes the period following the end of reflood up to the time the steam generators are depressurized to atmospheric pressure at 3600 seconds. The post-reflood mass and energy releases follow the NRC-approved methodology of WCAP-10325 P-A (Ref. 6.2.1.3-1).

(5) Post-SG Depressurization- After 3600 seconds; the mass and energy release using the revised post-recirculation methodology is used. The mass and release calculation during this long-term phase of the transient use the NRC approved methodology discussed in Reference 6.2.1.3-6. This methodology is summarized in Section 6.2.1.3.4.5.

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6.2.1.3.2 Break Size and Location: Generic studies have been performed with respect to the effect on the LOCA mass and energy releases relative to postulated break size. The double-ended guillotine break has been found to be limiting due to larger mass flow rates during the blowdown phase of the transient. During the reflood and froth phases, the break size has little effect on the releases.

Three distinct locations in the reactor coolant system loop can be postulated for pipe rupture:

- Hot leg (between vessel and steam generator)
- Cold leg (between pump and vessel)
- Pump suction (between steam generator and pump)

The breaks analyzed are the double-ended hot leg (DEHL) guillotine break (9.18 ft^2) and the double-ended pump suction guillotine (DEPS) break (10.48 ft^2). Pump suction break releases have been calculated for the blowdown, reflood, and post-reflood phases of the LOCA. The following information provides a discussion on each break location.

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The DEHL guillotine break has been shown in previous studies to result in the highest blowdown mass and energy release rates. Although the core flooding rate would be highest for this break location, the amount of energy released from the steam generator secondary side is minimal because the majority of the fluid which exits the core bypasses the steam generators in venting to containment. As a result, the reflood mass and energy releases are reduced significantly as compared

to either the pump suction or cold leg break locations where the core exit mixture must pass through the steam generators before venting through the break.

For the hot leg break, there is no reflood peak as determined by generic studies, i.e., from the end of the blowdown period the releases would continually decrease. Therefore, the reflood and subsequent post-reflood releases are not calculated for a hot leg break. For the DEHL analysis, the DEPS mass and energy releases for the post-blowdown period were used. As discussed below for the DEPS break, this assumption results in the highest release rates.

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The cold leg break (DECL) location has been found in previous studies to be much less limiting in terms of the overall containment peak pressure. The cold leg blowdown is faster than that of the pump suction break and more mass is released into the containment. However, the core heat transfer is greatly reduced, resulting in considerably lower energy release into containment. Studies have determined that the blowdown transient for the cold leg is, in general, less limiting than that for the pump suction break. During reflood, the flooding rate is greatly reduced and the energy release rate into the containment is reduced. Therefore, the containment peak pressure for a cold leg break occurs at the end of blowdown. An analysis of the cold leg break is not usually performed because the hot leg break is expected to result in the highest blowdown peak pressure and the pump suction break results in the highest post-blowdown energy releases into containment.

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For the double-ended pump suction break (DEPS), a two-phase mixture exits the core, which passes through the hot legs, and is superheated in the steam generators. After the broken loop steam generator cools, the break flow becomes two phase. The pump suction break combines the effects of the relatively high core flooding rate, as in the hot leg break, and the addition of the stored energy in the steam generators. As a result, the pump suction break yields the highest energy flow rates during the post-blowdown period.

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6.2.1.3.3 Application of Single Failure Criteria: An analysis of the effects of the single failure criteria has been performed on the mass and energy release rates for the DEPS break. For the DEPS break, an inherent assumption in the generation of the mass and energy release is loss of offsite power (LOOP). This results in the actuation of the standby diesel generators, required to power the ECCS.

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The effects of a single failure are considered with both minimum and maximum safeguards. In the minimum safeguards case, the single failure postulated to occur is the loss of one train (out of a three train system) of ECCS equipment due to the failure of a diesel generator to start. This is labeled as a "Two Train" case and it results in the loss of one pumped emergency core cooling train, thereby minimizing the ECCS flow. For the case analyzing maximum ECCS, all six SI pumps are assumed to be available and the limiting single failure occurs in one component of the CHRS (i.e., a spray pump and a fan cooler train). This maximizes ECCS flow by assuming operability of all ECCS pumps. The analysis of both maximum and minimum safeguards cases bounds the effects of credible single failures.

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6.2.1.3.4 Mass and Energy Release Data:

6.2.1.3.4.1 Significant Modeling Assumptions – The following items are incorporated so that the mass and energy releases are conservatively calculated for maximum containment pressure:

- Maximum expected operating temperature of the RCS
- Allowance in temperature for instrument error and dead band (+5.1°F)
- Margin in volume of 3% (composed of 1.6% allowance for thermal expansion and 1.4% for uncertainty)
- Core power level of 3,876 MWt (includes calorimetric errors)
- Conservative coefficients of heat transfer (i.e., SG primary/secondary heat transfer and RCS metal heat transfer)
- Allowance in core stored energy effect of fuel densification
- Margin in core stored energy (+15%)
- Allowance for RCS pressure uncertainty (+46 psi)
- Maximum containment backpressure equal to design pressure.

Nitrogen Injection

During a LOCA, most of the reactor vessel water will be displaced by the steam generated by flashing. The vessel is then refilled by the SI accumulators and the high and low head safety injection systems. For the blowdown, refill and reflood stages, the mass and energy release rates are obtained from the Westinghouse LOCA analysis using NRC-approved methods (Reference 6.2.1.3-1). The releases include water from the ECCS accumulators, but the compressed nitrogen release is modeled separately in the GOTHIC containment analysis model. In the model, a boundary condition injects the nitrogen gas volume into the containment atmosphere consistent with the timing in the mass and energy releases. The nitrogen pressure, temperature, and volume are based on allowable operating ranges in the plant Technical Specifications with consideration of uncertainty. CN-3136

Decay Heat

Two decay heat models are used for calculating the mass and energy releases as discussed below.

Up to 3600 Seconds

After the initial depressurization, the mass and energy releases from the effect of decay heat are based on ANS-5.1-1979 Decay Heat Power (Ref. 6.2.1.3-4), which include the following: CN-3136

- Decay heat sources considered are fission product decay and heavy element decay of U-239 and Np-239.
- Decay heat power from fission isotopes other than U-235 and U-238 are assumed identical to that of U-235. Fast fissions for U-238 are included in a conservative manner.
- Fission rate is constant over the operating history of maximum power level.
- The factor accounting for neutron capture in fission products is taken from Table 10 of ANS-5.1-1979 Standard.
- The fuel is assumed to operate at full power for 10^8 seconds.
- The total recoverable energy associated with one fission is assumed to be 200 MeV.
- Two sigma uncertainty (two times the standard deviation) has been applied to the fission product decay.

After 3600 Seconds

After 3600 seconds, the mass and energy releases are calculated using the revised post-recirculation methodology approved by the NRC in Reference 6.2.1.3-6. The core decay heat is calculated using BTP ASB 9-2 decay heat correlations as defined in Section 9.2.5 of NUREG-0800 (Reference 6.2.1.3-8). The BTP ASB 9-2 decay heat data is presented in Table 6.2.1.3-6A. CN-3136

Table 6.2.1.3-6 shows the decay heat data used in this analysis.

6.2.1.3.4.2 Blowdown Mass and Energy Release Data – The SATAN-VI code is used for computing the blowdown transient and is the same as that used for the ECCS calculation in Reference 6.2.1.3-2. The methodology for the use of this model is described in Reference 6.2.1.3-1.

Tables 6.2.1.3-4 and 6.2.1.3-5 present the calculated mass and energy releases for the blowdown phase of the break analyzed for the DEHL and DEPS breaks, respectively. The mass and energy release for the DEHL break and the DEPS break, given in Table 6.2.1.3-4 and Table 6.2.1.3-5, terminate within 25 seconds after the initiation of the postulated accident. CN-3136

6.2.1.3.4.3 Reflood Mass and Energy Release Data – The WREFLOOD code is used for computing the reflood transient and is a modified version of that used in the ECCS calculation in Reference 6.2.1.3-2. The methodology for the use of this model is described in Reference 6.2.1.3-1.

Steam Water Mixing CN-3136

Even though the Reference 6.2.1.3-1 model credits steam/water mixing only in the intact loop, steam/water mixing in the broken loop has been included in this analysis. This assumption is justified and is supported by test data. It is summarized as follows:

The model assumes a complete mixing condition (i.e., thermal equilibrium) for the steam/water interaction. However, the complete mixing process is made up of two distinct physical processes. The first is a two phase interaction with condensation of steam by cold injection water. The second is a single phase mixing of condensate and injection water. Since the mass and energy of the steam released is the most important influence to the containment pressure transient, the steam condensation part of the mixing process is the only part that need be considered. Any spillage directly heats only the sump.

The most applicable steam/water mixing test data has been reviewed for validation of the containment integrity reflood steam/water mixing model. These data were generated in 1/3 scale tests (Ref. 6.2.1.3-3), which are the largest scale data available. They most closely simulate the flow regimes and gravitational effects that would occur in a pressurized water reactor (PWR). These tests were designed specifically to study the steam/water interaction for PWR reflood conditions. CN-3136

From the entire series of 1/3 scale tests, a group corresponds almost directly to containment integrity reflood conditions. The injection flow rates for this group cover all phases and mixing conditions calculated during the reflood transient. The data from these tests were reviewed and discussed in detail in Reference 6.2.1.3-1. For all of these tests, the data clearly indicates the occurrence of very effective mixing with rapid steam condensation. Therefore, the mixing model used in the containment integrity reflood calculation is supported by the 1/3 scale steam/water mixing data.

Post-Blowdown Phase

The limiting break for the containment integrity peak pressure analysis during the post-blowdown phase is the DEPS break. For this break, two flow paths are available in the RCS by which mass and energy may be released to containment. One is through the outlet of the steam generator, the other via reverse flow through the reactor coolant pump. Steam, which is not condensed by ECCS injection in the intact RCS loops, passes around the downcomer and through the broken loop cold leg and pump in venting to containment. This steam also encounters ECCS injection water as it passes through the broken loop cold leg, complete mixing occurs, and a portion of it is condensed. Credit is taken in this analysis for that portion of steam which is condensed. This assumption is justified by the postulated break location and the physical presence of the ECCS injection nozzle. A description of the test and test results is contained in References 6.2.1.3-1 and 6.2.1.3-3. CN-3136 CN-3136

Table 6.2.1.3-5A and Table 6.2.1.3-5B present the calculated mass and energy release for the reflood phase of the DEPS break, with minimum and maximum ECCS, respectively.

The principal parameters during reflood are given in Tables 6.2.1.3-9 and 6.2.1.3-10 for the minimum and maximum ECCS DEPS break cases. The temperature that was assumed for the RWST for these transients, and therefore the pumped safety injection flow during the injection phase, was 130°F. CN-3136

6.2.1.3.4.4 Post-Reflood Mass and Energy Release Data – The FROTH code (Ref. 6.2.1.3-5) is used for computing the post-reflood transient. The methodology for the use of this model is described in Reference 6.2.1.3-1. The mass and energy release rates calculated by FROTH are used in the containment analysis until the time of containment depressurization.

Table 6.2.1.3-5A presents the two-phase (froth) mass and energy release data for the DEPS break with minimum ECCS. Table 6.2.1.3-5B presents the two-phase mass and energy release data for the DEPS break with maximum ECCS. CN-3136

6.2.1.3.4.5 Post-Depressurization Phase – For the LOCA mass and energy release calculation, the steam generators are conservatively cooled and depressurized to the saturation temperature of 212°F at 14.7 psia at approximately 3600 seconds after accident initiation. In the post-SG depressurization sump recirculation phase (after 3600 seconds), the revised post-recirculation methodology is used (Reference 6.2.1.3-6). The safety injection (SI) flow into the reactor vessel is a mixture of the HHSI and LHSI flows. The HHSI pumps take suction from the sump and injects directly into the reactor vessel. The LHSI pumps also take suction from the sump but the flow is cooled by the RHR heat exchanger and then injected into the reactor vessel. The STP LOCA containment analyses conservatively do not use the HHSI flows in this phase of the transient. In this model, if the enthalpy of the water leaving the core is less than the liquid saturation enthalpy at the containment steam partial pressure, the water is returned to the sump. If the pressure of the water leaving the core is greater than the saturation pressure of the containment, a pressure flash model is used to determine the flow split that is returned to the sump and the steam that is released to the containment atmosphere. During this phase of transient, the BTP-ASB 9-2 decay heat model is used as discussed in Section 6.2.1.3.4.1. CN-3136

6.2.1.3.5 Sources of Mass and Energy: The sources of mass considered in the LOCA mass and energy release analysis for the DEPS breaks are given in Tables 6.2.1.3-13 and 6.2.1.3-14. The

mass inventories for the DEHL break are given in Table 6.2.1.3-15. These sources are the RCS accumulators and pumped ECCS injection.

The energy inventories for the LOCA mass and energy release analysis for the DEPS breaks are given in Tables 6.2.1.3-16 and 6.2.1.3-17. The energy inventories for the DEHL break are given in Table 6.2.1.3-18. The energy sources include: CN-3136

- reactor coolant system water
- accumulator water
- pumped injection water
- decay heat
- core stored energy
- reactor coolant system metal
- steam generator metal
- steam generator secondary energy
- secondary transfer of energy (feedwater into and steam out of the steam generator secondary)

In the mass and energy release data presented, no Zirc-water reaction heat is presented because the clad temperature does not rise high enough for the rate of the Zirc-water reaction heat to be of any significance.

The consideration of the various energy sources in the mass and energy release analysis provides assurance that all available sources of energy have been included in this analysis. Thus the review guidelines presented in Standard Review Plan Section 6.2.1.3 have been satisfied.

The mass and energy inventories are presented at the following times, as appropriate:

- time zero (initial conditions)
- end of blowdown time
- end of refill time
- end of reflood time
- time of broken loop steam generator depressurization
- time of intact loop steam generator depressurization
- one hour after accident initiation

The methods and assumptions used to release the various energy sources are given in Reference 6.2.1.3-1, except as noted in section 6.2.1.3.4.3.

The sequence of events for the DEPS and the DEHL break transients are shown in Table 6.2.1.1-10. CN-3136

6.2.1.4 <u>Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures Inside the Containment.</u>

Following a postulated MSLB or a FWLB inside the Containment, the contents of one SG will be released to the Containment. Most of the contents of the other SGs will be isolated by the main steam isolation valves (MSIVs), main feedwater isolation valves (MFIVs) and the feedwater flow control valves (FCV). Containment pressurization following a secondary side rupture depends on how much of the break fluid enters the Containment atmosphere as steam. Main steam line break flows can be pure steam or two-phase, while FWLB flows are two-phase. With a pure steam release, all of the break flow enters the Containment vapor space atmosphere. With two-phase release, part of the liquid in the break flow boils off in the Containment and is added to the vapor space atmosphere, while the remaining liquid falls to the sump and contributes nothing to Containment pressurization.

For MSLB cases with large break area, steam cannot escape fast enough from the two-phase region of the ruptured SG, and the two-phase level rises rapidly to the steam line nozzle. A two-phase blowdown results. The duration of this release is short, thereby reducing primary-to-secondary heat transfer, and the break flow is largely liquid.

For MSLB cases with small break areas, steam can escape fast enough from the two-phase region of the SG with the ruptured line that the level swell does not reach the steam line nozzle, and a pure steam blowdown results. Because of the pressure reducing effects of active and passive Containment heat sinks, the highest peak Containment pressure resulting from a MSLB for a given set of initial SG conditions occurs for that case where the break area is the maximum at which a pure steam blowdown can occur. For conservatism, the MSLB analysis assumed only pure steam blowdown for all break sizes and power levels.

Main steam line isolation is initiated on the following signals: high-2 Containment pressure, low steam line pressure (above P-11 setpoint), high negative steam line pressure rate (below the P-11 setpoint), and manual. Main feedwater line isolation is initiated by SG high-high water level, reactor trip in conjunction with low T_{avg}, and SI. The MSIV and MFIV closure times are given in Table 16.1-1. The MSLB blowdown calculation conservatively used 8 seconds for MSIV closure and 13 seconds for MFIV closure from the time the isolation setpoint was reached. These values include signal delay and valve closure times. CN-3136

The Auxiliary Feedwater System (AFWS) functions automatically following a secondary system line break to assure that a heat sink is always available to the RCS by supplying cold feedwater to the SGs. For conservatism, it was assumed that the AFWS attains full flow to the SG immediately following the initiation of the event. Following feedwater isolation, only AFW is available to supply feedwater to the SGs. The analysis assumes the following manual operator actions within 30 minutes of the break: (1) isolate the AFW to the faulted steam generator, (2) re-pressurize the RCS using normal pressure control, and (3) control AFW to the intact steam generators and control cooldown. In addition, the analysis includes flashing of fluid located between the MFIV and the affected SG. This fluid then flows through the affected SG and into the Containment.

To determine the effect of MSLB on Containment pressure and temperature response, a spectrum of break sizes was assumed to occur inside the Containment, downstream from the integral steam line flow restrictors and upstream of the MSIVs. The analysis assumed critical flow from the rupture. CN-3136

<u>Feedwater Line Break (FWLB)</u> CN-3136

The feedwater enters the SG in the two-phase region; therefore, FWLB cases always result in two-phase blowdowns through smaller size lines and do not produce peak Containment pressures and temperatures as severe as MSLB cases.

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6.2.1.4.1 Long-Term MSLB Mass and Energy Release Data: The MSLB mass and energy release transient is analyzed by using the RETRAN-02 computer code (Ref. 6.2.1.4-2). Safety analysis methods using this code are described in WCAP-14882 (Ref. 6.2.1.4-3). The code simulates a multiloop system, neutron kinetics, the pressurizer, feedwater system, SG, and SG safety valves. The code computes pertinent plant variables including primary and secondary temperatures and pressures, steam flow, and power level during the cooldown. The DER and split break MSLBs analyzed are listed in Table 6.2.1.1-1.

Table 6.2.1.4-1 presents the mass and energy release rate data for the limiting break for peak pressure, 1.4 ft^2 double-ended rupture at 30% power with failure of one MSIV. Table 6.2.1.4-2 presents the mass and energy release rate data for the peak-temperature case, 1.4 ft^2 double-ended rupture at 0% power with failure of one MSIV.

All mass and energy releases used in the analyses were conservatively assumed to consist of dry steam although considerable entrainment can be expected for double-ended breaks.

Mass and Energy Release Through MSIV Above Seat Drain Line Flow Restriction Orifices

Additional mass and energy are released through the above seat main steam line orifices, since the condensers are assumed not available for steam dump. This has negligible affect on the mass and energy release rates.

The significant parameters affecting the mass and energy releases to Containment following a steam line break are discussed below.

6.2.1.4.2 Plant Power Level: Steam line breaks can be postulated to occur with the plant in any operating condition ranging from hot shutdown to full power. Since SG water mass decreases with increasing power level, breaks occurring at a lower power generally result in a greater total mass release to the Containment. However, because of increased energy storage in the primary plant, increased heat transfer in the SGs, and the additional energy generation in the nuclear fuel, the energy release to the Containment from breaks postulated to occur during power operation may be greater than for breaks occurring with the plant in a hot shutdown condition. Additionally, the steam pressure and the dynamic conditions in the SGs change with increasing power and have significant influence on the rate of release following a steam line break event. The power generated in the core due to the cooldown effect from the negative moderator coefficient is included in the analysis for each power level since it adds to the energy released to Containment. Because of the opposing effect of changing power level on steam line break mass and energy releases, no single power level can be singled out as a worst case initial condition for a steam line break. Therefore, a spectrum of power levels spanning the operating range, as well as the hot zero power conditions, has been considered.

6.2.1.4.3 Break Type, Area, and Location:

1. Break Type

There are two possible types of pipe ruptures which must be considered in evaluating steam line breaks.

The first is a split rupture in which a hole opens at some point on the side of the steam pipe or steam header but does not result in a complete severance of the pipe. A single, distinct break area is fed uniformly by all SGs until steam line isolation occurs. The releases from the individual SGs are not independent since fluid coupling exists between all steam lines. Because of the flow limiting orifices in each SG, the largest possible split rupture can have an effective area prior to isolation that is no greater than the throat area of the flow restrictor times the number of plant primary coolant loops. Following isolation, the effective break area for the SG with the broken line can be no greater than the flow restrictor throat area. CN-3136

The second break type is the double-ended guillotine rupture (DER) in which the steam pipe is completely severed and the ends of the break displace from each other. Guillotine ruptures are characterized by two distinct break locations, each of equal area but being fed by different SGs. The largest possible guillotine rupture can have an effective area per SG no greater than the throat area of one steam line flow restrictor.

2. Break Area

The breaks analyzed include a spectrum of break areas (full double-ended and split ruptures) at each of the four initial power levels, as follows:

a. A full double-ended pipe rupture downstream of the steam line flow restrictor. For this case, the actual break area equals the cross-sectional area of the steam line (4.2 ft^2), but the mass and energy release from the SG with the broken line is controlled by the flow restrictor throat area (1.4 ft^2). The reverse flow from the intact SGs is controlled by the smaller of the pipe cross section or the total flow restrictor throat area in the intact loops.

b. Split breaks that represent the largest break which will not generate a steam line isolation signal from the primary protection equipment. Steam and feedwater line isolation signals with be generated for these cases by high Containment pressure signals.

3. Break Location

Break location affects steam line blowdown by virtue of the pressure losses which would occur in the length of piping between the SG and the break. The effect of the pressure loss is to reduce the effective break area seen by the SG. Although this would reduce the rate of mass and energy release, it would not significantly change the total energy release to the Containment. Piping loss effects have been considered in the MSLB mass and energy release calculation.

6.2.1.4.4 <u>Main Feedwater Addition Prior to Feedwater Line Isolation</u>: All of the double-ended ruptures generate main steam and feedwater isolation signals very quickly following the break. Isolation of the steam lines due to low steam line pressure is assumed to be complete following a time delay sufficiently long to allow for instrument response time and signal processing delay and valve closing time (total of 8 seconds). The total delay time assumed for feedwater isolation is 13 seconds.

3. During the transient, the SG pressure and temperature are assumed to remain constant at the initial conditions. This is conservative, because the actual SG pressure would decrease during this event.

4. The quality of the moisture carryover is conservatively assumed to be 4% and is assumed to continue until the mass of the affected steam generator (including AFW flow) is depleted. The 4% quality assumption is taken from Appendix E of ANSI 58.2-1980.

5. The analysis continues until the water mass in the affected steam generator (included AFW flow) is depleted. After the mass in the affected steam generator is depleted, the mass and energy release from this generator is significantly reduced. At this time, the MSIVs are also assumed to close. This is conservative because MSIV closure is expected to occur at approximately 15 seconds based on a low steam line pressure signal.

6. AFW flow begins at the time of the break at the runout flow 1250 gal/min.

7. A sink volume is maintained at a constant pressure of 14.7 psia.

8. A throat with an area of 1.388 ft^2 is assumed to limit the MSLB mass and energy release from the SG side.

The feedwater line break short-term mass and energy release analysis was performed using the RETRAN-03 (Ref. 6.2.1.2-8) computer program. Assumptions used in this analysis include:

1. Feedwater inlet nozzle area of 1.1175 ft^2

2. One millisecond break opening time.

3. Break junctions releasing mass into an environment that is maintained at a constant temperature and pressure of 120°F and 14.7 psia.

4. Feedwater pump characteristics are not included in this analysis

5. The mass and energy release analysis was evaluated for three bounding plant operating conditions.

   - at hot zero power (1350 psia and 211°F feedwater conditions),
   - at hot full power (1150 psia and 448°F feedwater conditions), and
   - at hot full power (1194 psia and 390°F feedwater conditions).

The short-term mass and energy release rates were used in subcompartment pressurization analysis discussed in Section 6.2.1.2.

6.2.1.5 <u>Minimum Containment Pressure Analysis for Performance Capability Studies of Emergency Core Cooling System</u>. The Containment backpressure used for the limiting case C_D=0.8 (Min. SI, High T_{avg}), double-ended cold leg guillotine break for the ECCS analysis presented in Section 15.6.5 is presented on Figure 6.2.1.5-1. Containment backpressure is calculated using the CN-3136

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Section 6.2:

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6.2.5-1 Wilson, J. F., "Qualification Testing for Model B Electric Hydrogen Recombiner," WCAP-9346 and WCAP-7709L, Supplements 1 to 7.

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6.2.5-3 Cottrell, W. B., "ORNL Nuclear Safety Research and Development Program, Bimonthly Report for September-October 1968," Report No. ORNL-TM-2425, January 1969, p. 53.

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TABLE 6.2.1.1-1

CONTAINMENT DESIGN ACCIDENTS

CONTAINMENT DESIGN PARAMETER	POSTULATED ACCIDENTS ANALYZED
	Loss-of-Coolant Accidents (LOCA)
	DEPS, Min. SI, Min. CHRS
Containment Peak Pressure/Temperature	DEPS, Max. SI, Min. CHRS
	DEHL, Min. SI, Min. CHRS
	DEHL, Max. SI, Min. CHRS
	Secondary System Breaks (MSLB)
	1.4 ft^2 DER @ HFP, Minimum CHRS
	1.4 ft^2 DER @ HFP, MSIV Failure
	1.4 ft^2 DER @ HFP, MFIV Failure
	1.4 ft^2 DER @ 70% Power, Minimum CHRS
	1.4 ft^2 DER @ 70% Power, MSIV Failure
	1.4 ft^2 DER @ 70% Power, MFIV Failure
	1.4 ft^2 DER @ 30% Power, Minimum CHRS
	1.4 ft^2 DER @ 30% Power, MSIV Failure
	1.4 ft^2 DER @ 30% Power, MFIV Failure
	1.4 ft^2 DER @ 0% Power, Minimum CHRS
	1.4 ft^2 DER @ 0% Power, MSIV Failure
	1.4 ft^2 DER @ 0% Power, MFIV Failure
Containment Peak Pressure/Temperature	1.08 ft^2 Split Break @HFP, Minimum CHRS
	1.08 ft^2 Split Break @HFP, MSIV Failure
	1.08 ft^2 Split Break @HFP, MFIV Failure
	1.22 ft^2 Split Break @ 70% Power, Minimum CHRS
	1.22 ft^2 Split Break @ 70% Power, MSIV Failure
	1.22 ft^2 Split Break @ 70% Power, MFIV Failure
	1.43 ft^2 Split Break @ 30% Power, Minimum CHRS
	1.43 ft^2 Split Break @ 30% Power, MSIV Failure
	1.43 ft^2 Split Break @ 30% Power, MFIV Failure
	1.47 ft^2 Split Break @ 0% Power, Minimum CHRS
	1.47 ft^2 Split Break @ 0% Power, MSIV Failure
	1.47 ft^2 Split Break @ 0% Power, MFIV Failure
	SG Loop Compartment
Sub-compartment Peak Pressure	DER - RHR 12" Line
	DER - FW 16" Line at SG Nozzle
	Pressurizer Subcompartment
Sub-compartment Peak Pressure	Spray Line Break on Pressurizer Side
	Surge Line Subcompartments
Sub-compartment Peak Pressure	Surge Line Break in Pressurizer Skirt Area
	Surge Line Break in Vestibule
	Steam Line Subcompartment
Sub-compartment Peak Pressure	Double-ended MS Line Break at Containment Wall

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TABLE 6.2.1.1-1 (Continued)

CONTAINMENT DESIGN ACCIDENTS

CONTAINMENT DESIGN PARAMETER	POSTULATED ACCIDENTS ANALYZED
Sub-compartment Peak Pressure	Feedwater Line Subcompartment Double-ended FW Line Break at Containment Wall
Sub-compartment Peak Pressure	Miscellaneous High Energy Lines CVCS Line Break in Regenerative HX Compartment CVCS Letdown Line Break in Radioactive Pipe Chase Compartment CVCS Letdown Line Break in RHR Valve Room Sub-compartment
External Pressure	Inadvertent Spray Actuation

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NOTES:

DER	Double-ended Rupture
CHRS	Containment Heat Removal System
CVCS	Chemical Volume and Control System
DEHL	Double-ended Hot Leg Break
DEPS	Double-ended Pump Suction Break
FWLB	Feedwater Line Break
MFIV	Main Feedwater Line Isolation Valve
MSIV	Main Steam Line Isolation Valve
MSLB	Main Steam Line Break
RHR	Residual Heat Removal
SI	Safety Injection

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TABLE 6.2.1.1-2

DESIGN BASIS ACCIDENT CALCULATED PRESSURES IN CONTAINMENT

Parameter [5]	Design Basis Accident [1]	Design Pressure	Peak Pressure	Time of Peak Pressure	Peak Pressure Margin	Peak Temperature
Peak Internal Pressure	LOCA- Double-Ended Hot Leg Break (DEHL) with Minimum Safety Injection and Minimum Containment Heat Removal Systems (CHRS) in Operation	56.5 psig	40.1 psig [2, 3, 4]	21.5 sec	29%	258°F
Peak Internal Pressure	LOCA - DEHL with Maximum Safety Injection and Minimum CHRS	56.5 psig	40.1 psig [2, 3, 4]	21.5 sec	29%	258°F
Peak Internal Pressure	LOCA - Double-Ended Pump Suction Break (DEPS) with Minimum Safety Injection and Minimum CHRS	56.5 psig	38.6 psig	22 sec	32%	256°F
Peak Internal Pressure	LOCA- DEPS with Maximum Safety Injection and Minimum CHRS	56.5 psig	38.6 psig	22 sec	32%	256°F
External Pressure	Inadvertent Operation of the Containment Spray System	(-) 3.5 psid	(-) 3.1 psid		11.4%	

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1. DEHL Break Area= 4.587 ft² per side (9.18 ft² total), Pipe inside diameter = 2.42 ft.
   DEPS Break Area= 5.241 ft² per side (10.48 ft² total), Pipe inside diameter= 2.58 ft.
2. STP uses a conservative value of 41.2 psig as the peak calculated internal containment pressure in Technical 6.8.3j, Technical Specification Bases 3/4.6.1.2 and 3/4.6.1.4, and UFSAR Tables 3.11-1 and 6.5-2.
3. At 24 hours, the Containment pressure is less than 50% of the peak.
4. Section 6.2.1.3 provides a discussion of post-blowdown period mass and energy release rates for this case.
5. For each LOCA case, two analyses were performed by selecting inputs to give either a high pressure or a high temperature in the containment.

TABLE 6.2.1.1-3

CONTAINMENT DATA USED IN P/T ANALYSIS

General Information

Internal Design Pressure		56.5 psig		
External Design Pressure		(-)3.5 psig		
Structural Design Temperature		286°F		
Free Volume		3.41E6 ft^3		[1]
Design Leak Rate		0.3% per day		

Initial Conditions for M&E and P/T Analyses (CN-3136)

Reactor Coolant System (at design overpower and at normal liquid levels)				
Reactor Power Level		3,876 Mwt		[2] (CN-3136)
Nominal SG Outlet Coolant Temperature		549.4 to 560.8°F		
Nominal Reactor Vessel Outlet Temperature		614.8 to 624.8°F		
Reactor Coolant Mass		See Tables 6.2.1.3-13 to -18		
Liquid Plus Steam Energy		See Tables 6.2.1.3-13 to -18		
Containment	**Pressure [2]**	**Temperature**		**Humidity**
LOCA Peak Pressure Case	15.1 psia	61.8°F [2]		20%
LOCA Peak Temperature Case	15.1 psia	114°F [2]		100%
MSLB Peak Pressure Case	15.1 psia	114°F [2]		20%
MSLB Peak Temperature Case	14.5 psia	114°F [2]		20%
Essential Cooling Water Temperature		103°F [2]		
Refueling Water Temperature		130°F		
Outside Temperature		110°F		
Stored Water (as applicable)				
Refueling Water Storage Tank		360,000 gal		[2]
All Accumulators (safety injection tanks)		3,600 ft^3		

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1. An error band of +0.1%, -0.85% applies to the calculated free volume. A volume of 3.3×10^6 ft^3 was used in the analysis.
2. Includes uncertainties.

TABLE 6.2.1.1-5

ENGINEERED SAFETY FEATURES SYSTEM INFORMATION USED IN CONTAINMENT ANALYSIS

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	Design / Capacity	Used for Containment Mass & Energy Release and Pressure/ Temperature Analysis (Minimum SI)	Used for Containment Mass & Energy Release and Pressure/ Temperature Analysis (Maximum SI)
A. Passive Safety Injection System			
1. No. of Accumulators	3	3	3
2. Pressure Setpoint (psig)			
M&E (liquid release)	670	585	585
M&E (nitrogen gas release)	670	710	710
B. Active Safety Injection Systems			
B.1 Up To End of SG Depressurization (3600 seconds)			
1. High Head Safety Injection System			
a. Number of Lines	3	2	3
b. Number of Pumps	3	2	3
2. Low Head Safety Injection System			
a. Number of lines	3	2	3
b. Number of Pumps	3	2	3
3. High Head + Low Head Safety Injection	Minimum SI		
a. Total SI Flow	7851 gpm (1049.5 lbm/sec) Flow for 2 SI trains Maximum SI 12717 gpm (1757 lbm/sec) Flow for 3 SI trains	Function of RCS Pressure See Table 6.2.1.3-2	Function of RCS Pressure See Table 6.2.1.3-3
B.2 After 3600 seconds			
1. High Head Safety Injection System			
a. Number of Lines	3	0	0
b. Number of Pumps	3	0	0
2. Low Head Safety Injection System			
a. Number of lines	3	2	2
b. Number of Pumps	3	2	2

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TABLE 6.2.1.1-5 (Continued)

ENGINEERED SAFETY FEATURES SYSTEM INFORMATION USED IN CONTAINMENT ANALYSIS

	Design / Capacity	Used for Containment Pressure & Temperature Analysis **(Minimum SI)**	Used for Containment Pressure & Temperature Analysis **(Maximum SI)**
C. Containment Spray System (CSS) [1]			
1. Number of Lines	3	2	2
2. Number of Pumps	3	2	2
3. Flow Rate (gpm)	3,863 [2]	3,663 [2]	3,663 [2]
D. Reactor Containment Fan Coolers (RCFC) [1]			
1. Number of Units	6	3	3
2. Air Side Flow Rate, cfm	53,500	53,500	53,500
3. Heat Removal rate, Btu/hr Function of CCW temperature and Containment atmosphere saturation temperature. (Value shown is at 125°F CCW, 0.0005 fouling factor, and 235°F containment saturation temperature)	77.8e6	62.2e6 [3]	62.2e6 [3]
E. Recirculation Systems			
RHR Heat Exchanger [1]			
a. Number	3	2	2
b. Type	Vert. U-tube	Vert. U-tube	Vert. U-tube
c. Overall Heat Transfer Coefficient U, Btu/hr-ft^2-°F	387	Calculated by GOTHIC	Calculated by GOTHIC
d. Heat Transfer Area (A), ft^2	5440	4532	4532
f. Flow rates/Unit			
1) Recirculation side (LHSI), lbm/hr (each)	1.5×10^6 (3000 gpm)	2531 gpm	2531 gpm
2) Exterior side (CCW), (lbm/hr)	2.6×10^6	2.6×10^6	2.6×10^6
g. Source of Cooling Water	CCW [3]	CCW [3]	CCW [3]
h. Recirculation Cooling Begins, (sec)	N/A	1465	1000
F. Others			
Component Cooling Water Heat Exchanger			
a. Number	3	Not Modeled	Not Modeled

NOTES:
1. CSS and RCFCs were not used in M&E release analysis, but were used in P/T analysis. RHR Heat Exchangers were used in both M&E and P/T analysis after 3600 seconds.
2. Data for 2 trains.
3. CCW supply temperatures used in P/T analysis: 125°F from 0 – 5 hrs
   115°F from 5 – 10 hrs
   110°F after 10 hrs
   125°F for MSLB P/T analysis

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TABLE 6.2.1.1-7

MODELING OF STRUCTURAL HEAT SINKS FOR CONTAINMENT ANALYSES

Heat Sink No.	Passive Heat Sinks	Material	Thickness	Exposed Surface (ft^2)
1	Containment Dome	Amercote 90 Paint Dimetcote 6 Paint Carbon-Steel Liner Air Concrete	8 mils 4 mils 0.375in 2 mils 36.0 in	35300
2	Containment Wall	Amercote 90 Paint Carbon-Steel Liner Air Concrete	16 mils 0.375in 2 mils 48.0 in	76800
3	Containment Floor	Nutech Paint Concrete	50 mils 20 ft	14700
4	Concrete Internal Structure	Nutech Paint Concrete	50 mils 15.36 in	123400
5	Concrete Internal Wall (4.39 ft)	Nutech Paint Concrete	50 mils 52.68 in	8800
6	Internal Wall	Amercote Paint Dimetcote Paint Carbon-Steel Air Concrete	8 mils 6 mils 0.475 in 2 mils 27.29 in	24700
7	Internal Walls	Amercote Paint Dimetcote Paint Carbon-Steel Air Concrete	8 mils 6 mils 0.786 in 2 mils 17.64 in	12800
8	Stainless Steel Walls	Stainless Steel	0.576 in	400
9	Carbon Steel Wall	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.35 in	301500
10	Carbon Steel Components $t < 0.125$ in	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.109 in	6800
11	Carbon Steel Components 0.125 in. $< t < 0.25$ in	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.156 in	800
12	Carbon Steel Components 0.25 in. $< t < 0.5$ in	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.409 in	8100

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TABLE 6.2.1.1-7 (continued)

MODELING OF STRUCTURAL HEAT SINKS FOR CONTAINMENT ANALYSES

Heat Sink No.	Passive Heat Sinks	Material	Thickness	Exposed Surface (ft^2)
13	Carbon Steel Components 0.5 in. < t < 1.0 in	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.827 in	10900
14	Carbon Steel Components 1.0 in. < t < 2.5 in	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 1.859 in	9500
15	Carbon Steel Components t > 2.5 in.	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 3.696 in	2000
16	Stainless Steel Components	Stainless Steel	0.40 in	1700
17	Stainless Steel Piping	Stainless Steel	0.264 in	3900
18	Carbon Steel Piping	Amercote Paint Dimetcote Paint Carbon-Steel	8 mils 6 mils 0.231 in	700
19	Electrical Components (not painted)	Carbon-Steel (galvanized)	0.11 in	115300
20	Electrical Components (painted)	Amercote Paint Carbon-Steel	16 mils 0.117 in	15200
21	Carbon Steel Components thickness <0.125 in	Carbon Steel	0.075 in	15400
22	Carbon Steel Components 0.125 in. < t < 0.25 in	Carbon Steel	0.23 in	29500
23	Carbon Steel Components t >0.25 in	Carbon Steel	0.458 in	4400
			TOTAL	822600

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NOTE:

This table provides passive heat sink data used in containment peak pressure/temperature response analyses. In peak P/T analyses, it is conservative to ignore additional heat sinks since it will give higher containment pressures and temperatures.

TABLE 6.2.1.1-8

THERMOPHYSICAL PROPERTIES OF STRUCTURAL HEAT SINK MATERIALS FOR CONTAINMENT ANALYSIS

Material	Density *(lbm/ft³)*	Thermal Conductivity *(Btu/hr-ft-°F)*	Specific Heat *(Btu/lbm-°F)*
Paint (Amercote, Organic, Topcoat)	109.8	0.375	0.454
Paint (Dimetcote, Inorganic Primer)	293.0	0.633	0.074
Paint (Nutech)	121.7	0.126	0.232
Air	0.0523	0.0174	0.174
Carbon Steel	490.0	25.0	0.110
Concrete	144.0	0.8	0.208
Stainless Steel	488.0	9.4	0.111
Copper	558.0	200	0.092

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TABLE 6.2.1.1-9

CONTAINMENT HEAT SINK SURFACE HEAT TRANSFER MODEL

	Interface	Convective Heat Transfer Coefficient	Condensation Heat Transfer Coefficient	Notes
1	Containment Structure (Dome, Wall) to Ambient Air	2.0 Btu/hr-ft^2-°F	N/A	Heat transfer coefficient to outside atmosphere.
2	Containment Vapor & Liquid to Containment Structures (except Sump Floor)	Natural Convection	Diffusion Layer Model (DLM)	The DLM model calculates the condensation rate and sensible heat transfer rate.
3	Containment Vapor & Liquid to Sump Floor for LOCA	Natural Convection	N/A	GOTHIC Correlation Set with Split option heat transfer model. The Split option switches heat transfer from the vapor to the liquid phase as the liquid level in the containment floor builds up. The Correlation Set is Natural Convection. It allows sensible heat transfer by convection to the liquid or vapor phase based on the liquid volume fraction and the Split option settings. The Correlation Set with Split Option excludes any direct condensation on the floor before it is covered with water.
4	Containment Vapor & Liquid to Sump Floor for MSLB	Natural Convection	Diffusion Layer Model (DLM)	Natural Convection and DLM condensation Split option. The Split option switches heat transfer from the vapor to the liquid phase as the liquid level in the containment floor builds up.

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TABLE 6.2.1.1-10

ACCIDENT CHRONOLOGY FOR DBA LOCA ANALYSIS [1]

EVENT	DEHL [1,2] Min. SI [3, 4, 5] Time (sec)	DEHL [1,2] Max. SI [3, 4, 5] Time (sec)	DEPS [1,2] Min. SI [3, 4] Time (sec)	DEPS [1,2] Max. SI [3, 4] Time (sec)
Accident Initiation – Pipe Break Coincident with LOOP	0.0	0.0	0.0	0.0
Pressurizer Low Pressure Reactor Trip Setpoint Reached	2.4	2.4	3.0	3.0
Accumulators Begin to Inject	15.7	15.7	18.9	18.9
End of Blowdown Phase	24.8	24.8	25.2	25.2
Pumped SI Begins	33.0	33.0	33.0	33.0
RCFCs at Full Speed	45.0	45.0	45.0	45.0
Accumulator Injection Ends	46.9	47.2	46.9	47.2
Containment Spray Flow Delivered to Containment Atmosphere	85.0	85.0	85.0	85.0
End of Reflood Phase	173.1	220.0	173.1	220.0
Broken Loop SG Depressurizes to Containment Design Pressure	640.0	1045.7	640.0	1045.7
Switchover to Sump Recirculation Occurs	1465	1000	1465	1000
Intact Loop SGs Depressurize to Containment Design Pressure	1613.1	1754.4	1613.1	1754.4
All SGs Forced to Depressurize to 14.7 psia and 212°F	3600.0	3600.0	3600.0	3600.0
Transient Simulation Ends	3.6×10^6	3.6×10^6	3.6×10^6	3.6×10^6

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Notes:

1. DEHL = double-ended hot leg break.
   DEPS = double-ended pump suction break.
2. All cases analyzed with minimum containment heat removal systems in operation (3 RCFC units and 2 Containment Sprays).
3. Minimum SI = 2 LHSI + 2 HHSI flow up to end of SG depressurization phase (3600 seconds).
   Maximum SI = 3 LHSI + 3 HHSI flow up to end of SG depressurization phase (3600 seconds).
4. 2 LHSI / 2 RHR trains during post-SG depressurization phase (3600+ seconds).
5. For the DEHL cases, the calculated mass and energy release data ends at 24.8 seconds and the DEPS M&E releases for the post-blowdown period were used. As discussed in Section 6.2.1.3.2, this results in the highest release rates.

TABLE 6.2.1.2-5A

STEAM GENERATOR LOOP COMPARTMENT PEAK PRESSURE SUMMARY FOR RHR LINE BREAK ANALYSIS

Elevation	Node No.	Volume (ft3)	Maximum Differential Pressure (psid)	Break Node	Break Type	Design Pressure (psid)	Margin (percent) [b]
	1	715.4	4.4	# 12	12" RHR	7.125	63
	2	1369.0	5.7	# 12	12" RHR	7.125	25
	3	1918.4	4.4	# 12	12" RHR	7.125	64
19' 0"	4	1920.6	6.2	# 4	12" RHR	7.125	15
	5	1920.6	4.6	# 4	12" RHR	7.125	55
to	6	4002.8	2.2	# 4	12" RHR	7.125	230
	7	6020.7	1.7	# 4	12" RHR	7.125	325
28' 0½"	8	4594.7	0.9	# 12	12" RHR	7.125	719
	9	4409.2	0.7	# 4	12" RHR	7.125	915
	10	4594.7	0.9	# 12	12" RHR	7.125	712
	11	3021.8	3.2	# 12	12" RHR	7.125	123
	12	1419.5	6.8	# 12	12" RHR	13.0	92
	13	757.6	3.5	# 4	12" RHR	13.0	279
28' 0½"	14	2159.1	3.6	# 4	12" RHR	13.0	267
	15	2166.4	5.7	# 15	12" RHR	13.0	128
to	16	2186.6	2.8	# 4	12" RHR	13.0	365
	17	4372.1	2.1	# 4	12" RHR	13.0	521
38' 4"	18	4372.1	0.9	# 12	12" RHR	13.0	1450
	19	4373.1	0.7	# 12	12" RHR	13.0	1869
	20	4372.1	0.9	# 12	12" RHR	13.0	1429
	21	2052.4	2.4	# 12	12" RHR	3.625	55
	22	3669.0	3.1	# 12	12" RHR	3.625	18
38' 4"	23	6103.0	2.6	# 15	12" FW	3.625	39
	24	5312.3	2.3	# 15	12" RHR	3.625	62
to	25	5312.3	2.1	# 15	12" RHR	3.625	80
	26	11792.4	2.0	# 12	12" RHR	3.625	89
66' 7½"	27	11792.4	0.9	# 12	12" RHR	3.625	340
	28	10646.0	0.8	# 4	12" RHR	3.625	387
	29	11792.4	0.7	# 4	12" RHR	3.625	490

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TABLE 6.2.1.3-1

SYSTEM PARAMETER INITIAL CONDITIONS
(LOCA MASS AND ENERGY ANALYSIS)

Parameter	Value
Core Thermal Power (MWt) (with uncertainty)	3,876
Reactor Coolant System Total Flowrate (lbm/sec) [1]	40,366
Vessel Outlet Temperature (°F) [1]	629.9
Core Inlet Temperature (°F) [1]	565.4
Vessel Average Temperature (°F)	597.7
Initial Steam Generator Steam Pressure (psia)	1102.0
Steam Generator Design	Δ 94
Steam Generator Tube Plugging (%)	0
Initial Steam Generator Secondary Side Mass (lbm) [1]	178,761
Assumed Maximum Containment Backpressure (psia)	71.2
Accumulator	
Water Volume (ft^3) per accumulator	1,200
N_2 Cover Gas Pressure for liquid release (psia)	600.0
Temperature (°F)	120
RWST Temperature (°F)	130
Safety Injection Delay, total (sec) from beginning of event	
Two Trains of SI	30
Three Trains of SI	24.1
Flow:	
Minimum SI	Table 6.2.1.3-2
Maximum SI	Table 6.2.1.3-3
Time to cold leg recirculation (switchover to sump) (sec)	Tables 6.2.1.3-2, 6.2.1.3-3

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[1] Includes appropriate uncertainty and/or allowance.

TABLE 6.2.1.3-2

LOCA-TOTAL PUMPED ECCS FLOW RATE FOR TWO TRAINS OF SI OPERATING

INJECTION MODE (REFLOOD PHASE)

RCS Pressure (psia)	Total Flow (lbm/sec)
14.7	1049.5
114.7	871.9
214.7	601.0

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RECIRCULATION MODE

Time (sec)	Enthalpy (BTU/lbm)	Flow
1465	239.0	656.69 lbm/sec
3600	239.0	659.96 lbm/sec
>3600	At transient Sump temperature Figures 6.2.1.1-31 and 6.2.1.1-37	5062 gpm (2 LHSI)

TABLE 6.2.1.3-3

LOCA-TOTAL PUMPED ECCS FLOW RATE FOR THREE TRAINS OF SI OPERATING CN-3136

INJECTION MODE (REFLOOD PHASE)

RCS Pressure (psia)	Total Flow (lbm/sec)
14.7	1757.0
114.7	1479.0
214.7	1152.0
314.7	664.0

RECIRCULATION MODE

Time (sec)	Enthalpy (BTU/lbm)	Flow
1000	239.0	1649.8 lbm/sec
3600	239.0	1649.8 lbm/sec
>3600	At transient Sump temperature Figures 6.2.1.1-31 and 6.2.1.1-37	5062 gpm (2 LHSI)

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TABLE 6.2.1.3-4

DOUBLE-ENDED HOT LEG BREAK MASS AND ENERGY RELEASES

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Reactor Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
0.00	0.0	0.0	0	0.0	0.0	0	0.0	0.0
0.001118	48,161.3	31,617.2	656.5	48,159.3	31,614.5	656.5	96,320.5	63,231.7
0.10	43,479.9	29,082.3	668.9	29,157.0	19,106.3	655.3	72,636.9	48,188.6
0.20	37,455.1	25,208.7	673.0	25,850.5	16,855.8	652.0	63,305.5	42,064.4
0.30	36,887.7	24,896.8	674.9	23,217.8	14,996.2	645.9	60,105.5	39,893.0
0.40	36,127.8	24,441.2	676.5	21,962.5	14,004.1	637.6	58,090.3	38,445.3
0.50	35,740.4	24,222.2	677.7	21,260.8	13,380.2	629.3	57,001.2	37,602.4
0.60	35,453.0	24,065.9	678.8	20,731.5	12,888.5	621.7	56,184.5	36,954.4
0.70	35,161.5	23,906.5	679.9	20,406.3	12,547.9	614.9	55,567.9	36,454.4
0.80	34,748.6	23,669.2	681.2	20,121.9	12,255.4	609.1	54,870.4	35,924.6
0.90	34,219.4	23,358.1	682.6	19,942.1	12,047.4	604.1	54,161.5	35,405.5
1.00	33,679.8	23,043.6	684.2	19,785.1	11,869.8	599.9	53,464.9	34,913.4
1.10	33,229.5	22,793.8	686.0	19,657.1	11,721.9	596.3	52,886.7	34,515.7
1.20	32,837.3	22,585.7	687.8	19,557.7	11,601.1	593.2	52,395.0	34,186.8
1.30	32,452.0	22,382.2	689.7	19,500.8	11,513.3	590.4	51,952.7	33,895.5
1.40	32,124.8	22,222.2	691.7	19,424.8	11,421.7	588.0	51,549.5	33,643.9
1.50	31,704.0	21,986.7	693.5	19,394.0	11,361.1	585.8	51,098.0	33,347.7
1.60	31,296.5	21,742.6	694.7	19,379.8	11,314.3	583.8	50,676.3	33,056.9
1.70	30,973.2	21,544.3	695.6	19,383.7	11,281.8	582.0	50,356.9	32,826.2
1.80	30,711.6	21,381.6	696.2	19,409.1	11,264.8	580.4	50,120.8	32,646.4
1.90	30,428.7	21,200.4	696.7	19,447.4	11,257.6	578.9	49,876.1	32,458.0
2.00	30,068.4	20,959.8	697.1	19,487.0	11,253.3	577.5	49,555.4	32,213.1
2.10	29,694.8	20,706.8	697.3	19,526.6	11,251.5	576.2	49,221.3	31,958.3
2.20	29,351.0	20,476.2	697.6	19,564.8	11,250.5	575.0	48,915.8	31,726.7
2.30	29,043.3	20,273.0	698.0	19,601.0	11,250.4	574.0	48,644.3	31,523.4
2.40	28,724.0	20,060.4	698.4	19,633.2	11,250.0	573.0	48,357.2	31,310.3
2.50	28,351.9	19,804.0	698.5	19,659.7	11,248.0	572.1	48,011.6	31,052.0
2.60	27,968.5	19,534.0	698.4	19,678.6	11,243.3	571.3	47,647.1	30,777.2
2.70	27,656.0	19,316.2	698.4	19,693.5	11,238.0	570.6	47,349.6	30,554.2
2.80	27,390.1	19,133.3	698.5	19,706.0	11,232.6	570.0	47,096.1	30,365.9
2.90	27,113.3	18,937.3	698.4	19,712.2	11,225.3	569.5	46,825.5	30,162.5
3.00	26,805.4	18,709.1	698.0	19,710.9	11,214.9	569.0	46,516.3	29,924.0
3.10	26,516.3	18,486.9	697.2	19,701.3	11,201.1	568.5	46,217.6	29,688.0
3.20	26,294.9	18,313.2	696.5	19,687.1	11,185.8	568.2	45,982.0	29,499.0
3.30	26,110.3	18,163.1	695.6	19,667.6	11,168.6	567.9	45,777.9	29,331.7
3.40	25,929.1	18,007.0	694.5	19,641.3	11,148.5	567.6	45,570.4	29,155.5
3.50	25,776.7	17,863.0	693.0	19,607.4	11,125.1	567.4	45,384.1	28,988.1
3.60	25,674.9	17,749.9	691.3	19,567.1	11,098.9	567.2	45,242.0	28,848.8
3.70	25,610.1	17,656.4	689.4	19,521.5	11,070.6	567.1	45,131.7	28,727.0
3.80	25,578.7	17,575.2	687.1	19,467.7	11,038.3	567.0	45,046.4	28,613.5
3.90	25,622.7	17,541.6	684.6	19,406.9	11,002.8	567.0	45,029.6	28,544.5
4.00	25,749.0	17,557.1	681.9	19,339.6	10,964.3	566.9	45,088.6	28,521.4
4.20	15,546.7	12,991.0	835.6	19,174.3	10,871.7	567.0	34,721.0	23,862.7
4.40	17,784.1	13,682.5	769.4	18,983.0	10,766.5	567.2	36,767.1	24,449.0
4.60	18,349.4	13,806.4	752.4	18,734.9	10,631.0	567.4	37,084.3	24,437.5
4.80	18,984.7	14,075.3	741.4	18,476.4	10,491.6	567.8	37,461.0	24,566.9
5.20	20,896.6	14,901.7	713.1	17,886.4	10,175.7	568.9	38,783.1	25,077.4
5.40	30,394.4	21,316.2	701.3	17,575.3	10,010.1	569.6	47,969.7	31,326.3
5.60	28,621.1	19,694.3	688.1	17,236.0	9,829.6	570.3	45,857.1	29,523.9
5.80	28,594.7	19,284.6	674.4	16,890.6	9,646.5	571.1	45,485.3	28,931.1
6.00	29,735.9	19,668.9	661.5	16,513.4	9,445.8	572.0	46,249.3	29,114.8
6.20	30,986.6	20,173.2	651.0	16,084.4	9,216.2	573.0	47,071.0	29,389.4
6.40	31,918.1	20,547.4	643.8	15,686.5	9,006.3	574.1	47,604.5	29,553.7
6.60	32,569.4	20,827.6	639.5	15,287.0	8,796.6	575.4	47,856.4	29,624.2
6.80	33,008.1	21,013.7	636.6	14,851.0	8,566.6	576.8	47,859.1	29,580.3
7.00	33,293.7	21,127.3	634.6	14,399.0	8,328.4	578.4	47,692.6	29,455.7

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TABLE 6.2.1.3-4 Continued)

DOUBLE-ENDED HOT LEG BREAK MASS AND ENERGY RELEASES

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Reactor Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
7.20	33,488.8	21,200.7	633.1	13,913.6	8,072.0	580.2	47,402.4	29,272.7
7.40	33,619.0	21,247.0	632.0	13,421.4	7,812.7	582.1	47,040.4	29,059.6
7.60	33,707.9	21,276.7	631.2	12,936.2	7,558.3	584.3	46,644.1	28,835.0
7.80	33,784.6	21,303.1	630.6	12,451.8	7,305.0	586.7	46,236.4	28,608.1
8.00	33,808.6	21,288.7	629.7	11,977.4	7,057.9	589.3	45,786.0	28,346.6
8.20	33,810.8	21,260.6	628.8	11,515.8	6,818.4	592.1	45,326.6	28,079.0
8.40	33,756.0	21,200.4	628.0	11,061.1	6,582.7	595.1	44,817.1	27,783.0
8.60	33,627.1	21,098.1	627.4	10,628.3	6,359.3	598.3	44,255.4	27,457.3
8.80	33,420.0	20,951.7	626.9	10,218.8	6,148.9	601.7	43,638.8	27,100.5
9.00	33,138.5	20,766.5	626.7	9,833.6	5,951.9	605.3	42,972.2	26,718.4
9.20	32,795.4	20,541.2	626.3	9,472.0	5,767.8	608.9	42,267.4	26,308.9
9.40	32,398.9	20,291.1	626.3	9,130.6	5,594.8	612.8	41,529.5	25,885.9
9.60	31,594.2	19,778.5	626.0	8,807.7	5,431.9	616.7	40,401.9	25,210.4
9.80	30,463.6	19,042.9	625.1	8,502.2	5,278.5	620.8	38,965.8	24,321.4
10.00	28,855.6	17,997.2	623.7	8,219.2	5,137.1	625.0	37,074.8	23,134.3
10.20	18,648.6	11,318.0	606.9	7,962.3	5,010.9	629.3	26,611.0	16,328.9
10.40	12,416.3	8,786.5	707.7	7,701.0	4,881.2	633.8	20,117.3	13,667.7
10.60	12,484.2	8,797.3	704.7	7,490.3	4,782.1	638.4	19,974.5	13,579.3
10.80	11,600.1	8,643.0	745.1	7,337.4	4,713.9	642.5	18,937.4	13,356.9
11.00	11,834.8	8,691.0	734.4	7,195.4	4,643.8	645.4	19,030.2	13,334.8
11.20	11,727.9	8,617.7	734.8	7,095.2	4,593.2	647.4	18,823.1	13,211.0
11.40	12,284.0	8,821.4	718.1	7,022.3	4,551.3	648.1	19,306.3	13,372.7
11.60	12,771.6	9,043.4	708.1	6,967.7	4,514.7	647.9	19,739.3	13,558.1
11.80	13,273.6	9,307.5	701.2	6,928.1	4,484.0	647.2	20,201.7	13,791.5
12.00	14,145.7	9,806.5	693.3	6,889.6	4,452.4	646.2	21,035.3	14,258.9
12.20	16,007.3	11,129.5	695.3	6,848.6	4,420.1	645.4	22,855.9	15,549.6
12.40	16,333.8	11,425.4	699.5	6,791.0	4,379.7	644.9	23,124.7	15,805.1
12.60	15,926.3	11,101.4	697.0	6,713.8	4,330.8	645.1	22,640.1	15,432.3
12.80	15,838.9	11,001.4	694.6	6,604.6	4,267.3	646.1	22,443.5	15,268.7
13.00	15,794.9	10,945.5	693.0	6,473.3	4,197.5	648.4	22,268.2	15,143.0
13.20	15,712.7	10,885.1	692.8	6,323.2	4,123.3	652.1	22,035.9	15,008.4
13.40	15,563.5	10,802.0	694.1	6,157.0	4,045.7	657.1	21,720.5	14,847.8
13.60	15,352.0	10,705.7	697.4	5,982.5	3,967.6	663.2	21,334.4	14,673.3
13.80	12,307.7	8,493.9	690.1	5,799.4	3,887.6	670.3	18,107.0	12,381.5
14.00	12,898.5	8,570.7	664.5	5,617.3	3,810.0	678.3	18,515.8	12,380.7
14.20	13,470.2	8,706.0	646.3	5,439.4	3,735.5	686.7	18,909.6	12,441.5
14.40	8,500.2	6,722.1	790.8	5,278.5	3,670.0	695.3	13,778.8	10,392.1
14.60	9,004.6	6,938.0	770.5	5,143.5	3,616.5	703.1	14,148.1	10,554.5
14.80	9,205.6	7,102.4	771.5	5,035.0	3,572.8	709.6	14,240.6	10,675.3
15.00	9,310.4	7,258.9	779.7	4,948.3	3,530.3	713.4	14,258.6	10,789.2
15.20	9,706.9	7,649.1	788.0	4,887.4	3,494.2	714.9	14,594.3	11,143.3
15.40	10,793.8	8,776.6	813.1	4,839.4	3,458.4	714.6	15,633.2	12,235.0
15.60	9,215.3	8,085.6	877.4	4,795.6	3,423.1	713.8	14,010.9	11,508.7
15.80	8,411.9	7,691.3	914.3	4,739.7	3,382.2	713.6	13,151.6	11,073.6
16.00	8,048.6	7,393.2	918.6	4,657.0	3,330.9	715.2	12,705.5	10,724.1
16.20	5,900.9	5,600.4	949.1	4,534.7	3,266.5	720.3	10,435.6	8,866.8
16.40	5,260.1	5,189.5	986.6	4,375.5	3,195.4	730.3	9,635.7	8,384.9
16.60	5,018.9	5,046.9	1,005.6	4,181.0	3,121.5	746.6	9,199.9	8,168.4
16.80	4,775.4	4,887.3	1,023.4	3,965.9	3,052.8	769.8	8,741.3	7,940.1
17.00	4,529.6	4,704.8	1,038.7	3,735.6	2,982.4	798.4	8,265.2	7,687.2
17.20	4,256.9	4,491.0	1,055.0	3,492.3	2,904.4	831.7	7,749.2	7,395.4
17.40	3,964.5	4,297.9	1,084.1	3,245.9	2,820.1	868.8	7,210.3	7,118.0
17.60	3,686.5	4,123.6	1,118.6	3,004.0	2,736.4	910.9	6,690.4	6,860.0
17.80	3,445.5	3,960.7	1,149.5	2,775.3	2,662.3	959.3	6,220.7	6,622.9
18.00	3,272.4	3,824.7	1,168.8	2,544.4	2,589.7	1,017.8	5,816.8	6,414.4
18.20	3,120.2	3,667.9	1,175.5	2,323.7	2,515.5	1,082.6	5,443.9	6,183.4
18.40	2,955.1	3,489.4	1,180.8	2,123.1	2,430.4	1,144.8	5,078.2	5,919.9
18.60	2,775.9	3,294.8	1,186.9	1,931.4	2,302.7	1,192.2	4,707.3	5,597.4
18.80	2,581.4	3,074.8	1,191.1	1,771.9	2,165.7	1,222.2	4,353.4	5,240.5
19.00	2,412.6	2,884.0	1,195.4	1,613.8	1,992.1	1,234.4	4,026.4	4,876.1
19.20	2,298.2	2,757.9	1,200.0	1,461.9	1,813.1	1,240.2	3,760.1	4,571.0
19.40	2,225.1	2,690.2	1,209.0	1,329.7	1,654.9	1,244.6	3,554.8	4,345.1

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TABLE 6.2.1.3-4 Continued)
DOUBLE-ENDED HOT LEG BREAK MASS AND ENERGY RELEASES

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Reactor Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
19.60	2,043.1	2,466.3	1,207.1	1,228.1	1,532.9	1,248.2	3,271.2	3,999.1
19.80	1,942.8	2,363.9	1,216.7	1,160.4	1,451.8	1,251.2	3,103.2	3,815.8
20.00	1,853.2	2,264.2	1,221.8	1,109.3	1,390.0	1,253.1	2,962.4	3,654.2
20.20	1,770.0	2,177.2	1,230.0	1,065.0	1,336.2	1,254.7	2,835.0	3,513.4
20.40	1,646.3	2,032.5	1,234.6	1,022.2	1,284.3	1,256.3	2,668.6	3,316.8
20.60	1,511.6	1,865.7	1,234.3	985.1	1,239.0	1,257.8	2,496.7	3,104.8
20.80	1,369.3	1,686.9	1,231.9	949.0	1,194.7	1,259.0	2,318.3	2,881.6
21.00	1,235.6	1,517.5	1,228.1	914.0	1,151.7	1,260.1	2,149.6	2,669.2
21.20	1,137.2	1,394.5	1,226.2	883.9	1,114.7	1,261.1	2,021.1	2,509.2
21.40	1,054.6	1,294.2	1,227.1	855.3	1,079.5	1,262.2	1,909.9	2,373.7
21.60	922.8	1,131.9	1,226.5	827.3	1,045.0	1,263.1	1,750.1	2,176.9
21.80	796.1	975.2	1,225.1	800.6	1,011.9	1,263.9	1,596.6	1,987.1
22.00	692.5	849.2	1,226.2	766.3	969.1	1,264.6	1,458.9	1,818.3
22.20	584.4	716.9	1,226.7	723.8	915.9	1,265.3	1,308.2	1,632.8
22.40	454.9	555.6	1,221.5	680.2	861.5	1,266.5	1,135.1	1,417.1
22.60	375.7	460.1	1,224.9	654.4	830.0	1,268.4	1,030.1	1,290.2
22.80	270.6	330.1	1,220.1	642.8	815.5	1,268.6	913.4	1,145.6
23.00	201.7	245.1	1,215.1	625.0	793.3	1,269.3	826.7	1,038.4
23.20	70.2	84.0	1,196.7	600.3	762.2	1,269.6	670.5	846.1
23.40	0.0	0.0	0	555.7	705.7	1,270.0	555.7	705.7
23.60	0.0	0.0	0	506.3	643.5	1,271.1	506.3	643.5
23.80	0.0	0.0	0	457.1	581.7	1,272.4	457.1	581.7
24.00	0.0	0.0	0	405.4	516.3	1,273.6	405.4	516.3
24.20	0.0	0.0	0	339.3	432.6	1,275.0	339.3	432.6
24.40	0.0	0.0	0	260.4	332.6	1,277.3	260.4	332.6
24.60	0.0	0.0	0	185.2	237.2	1,280.5	185.2	237.2
24.80	0.0	0.0	0	77.7	100.1	1,287.8	77.7	100.1
24.84	**0.0**	**0.0**	**0**	**66.4**	**85.7**	**1,290.2**	**66.4**	**85.7**

End of Blowdown [2, 3, 4, 5]

NOTES:

1. Hot Leg Break Area = 4.587 ft^2, Pipe inside diameter = 2.42 ft
2. The blowdown phase mass and energy releases are the same for Minimum and Maximum SI cases.
3. For DEHL Minimum SI post-blowdown phase, the DEPS Min. SI post-blowdown M&E releases are used (Table 6.2.1.3-5A), as discussed in Section 6.2.1.3.2.
4. For DEHL Maximum SI post-blowdown phase, the DEPS Max. SI post-blowdown M&E releases are used (Table 6.2.1.3-5B), as discussed in Section 6.2.1.3.2.
5. After 3600 seconds, the revised post recirculation methodology is used, as discussed in Section 6.2.1.3.4.5.

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TABLE 6.2.1.3-5A
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.00114	97,158.3	54,746.8	563.5	43,339.6	24,348.1	561.8	140,497.9	79,094.8
0.10	43,480.5	24,471.9	562.8	21,547.8	12,088.3	561.0	65,028.3	36,560.2
0.20	51,982.9	29,373.7	565.1	24,528.6	13,777.6	561.7	76,511.5	43,151.3
0.30	51,633.9	29,319.5	567.8	25,873.5	14,546.5	562.2	77,507.4	43,866.0
0.40	51,282.7	29,294.9	571.2	25,649.9	14,432.9	562.7	76,932.6	43,727.8
0.50	50,920.4	29,294.0	575.3	24,960.9	14,057.0	563.2	75,881.3	43,351.0
0.60	50,714.3	29,407.1	579.9	24,416.8	13,760.3	563.6	75,131.1	43,167.3
0.70	49,896.9	29,180.0	584.8	24,052.4	13,561.7	563.8	73,949.4	42,741.7
0.80	48,045.5	28,330.9	589.7	23,753.6	13,396.9	564.0	71,799.1	41,727.8
0.90	47,471.7	28,211.3	594.3	23,440.1	13,222.0	564.1	70,911.8	41,433.3
1.00	47,553.0	28,462.2	598.5	23,099.6	13,030.6	564.1	70,652.7	41,492.8
1.10	47,301.6	28,504.7	602.6	22,771.3	12,845.1	564.1	70,072.9	41,349.8
1.20	46,713.0	28,337.7	606.6	22,488.7	12,685.9	564.1	69,201.7	41,023.6
1.30	45,879.3	28,014.4	610.6	22,307.8	12,584.1	564.1	68,187.1	40,598.6
1.40	44,977.2	27,652.8	614.8	22,153.8	12,497.8	564.1	67,131.0	40,150.5
1.50	44,069.3	27,288.9	619.2	22,023.9	12,425.0	564.2	66,093.2	39,713.9
1.60	43,087.0	26,882.9	623.9	21,910.8	12,361.3	564.2	64,997.8	39,244.1
1.70	42,038.7	26,434.8	628.8	21,829.6	12,315.5	564.2	63,868.3	38,750.3
1.80	40,932.5	25,950.6	634.0	21,785.3	12,290.8	564.2	62,717.8	38,241.4
1.90	39,839.5	25,469.8	639.3	21,742.5	12,267.2	564.2	61,582.0	37,737.0
2.00	38,715.4	24,965.0	644.8	21,660.5	12,221.1	564.2	60,375.9	37,186.1
2.10	37,556.9	24,426.6	650.4	21,545.6	12,156.0	564.2	59,102.4	36,582.6
2.20	36,371.7	23,856.7	655.9	21,371.8	12,057.1	564.2	57,743.5	35,913.8
2.30	35,147.2	23,250.1	661.5	21,088.3	11,896.7	564.1	56,235.5	35,146.8
2.40	34,060.0	22,718.5	667.0	20,894.6	11,787.9	564.2	54,954.6	34,506.4
2.50	32,996.1	22,186.4	672.4	20,712.4	11,685.5	564.2	53,708.6	33,871.9
2.60	31,939.8	21,643.1	677.6	20,514.2	11,573.9	564.2	52,454.0	33,217.0
2.70	30,932.3	21,118.9	682.7	20,313.0	11,460.6	564.2	51,245.3	32,579.6
2.80	29,765.0	20,472.0	687.8	20,113.0	11,348.2	564.2	49,878.0	31,820.2
2.90	27,445.6	18,995.3	692.1	19,902.8	11,230.2	564.2	47,348.4	30,225.5
3.00	25,766.4	17,965.5	697.2	19,688.4	11,109.8	564.3	45,454.8	29,075.2
3.10	24,813.9	17,434.4	702.6	19,480.3	10,993.1	564.3	44,294.2	28,427.6
3.20	23,807.7	16,826.2	706.8	19,276.4	10,879.0	564.4	43,084.1	27,705.1
3.30	22,807.1	16,193.0	710.0	19,070.0	10,763.4	564.4	41,877.1	26,956.4
3.40	22,078.1	15,737.9	712.8	18,852.2	10,641.4	564.5	40,930.3	26,379.3
3.50	21,448.8	15,339.9	715.2	18,643.2	10,524.4	564.5	40,092.0	25,864.3
3.60	20,878.1	14,972.0	717.1	18,453.8	10,418.7	564.6	39,331.9	25,390.8
3.70	20,389.7	14,654.9	718.7	18,266.8	10,314.4	564.7	38,656.5	24,969.4
3.80	19,938.4	14,356.3	720.0	18,076.3	10,208.1	564.7	38,014.7	24,564.4
3.90	19,505.0	14,064.6	721.1	17,883.0	10,100.1	564.8	37,388.1	24,164.7
4.00	19,114.4	13,799.7	722.0	17,705.0	10,000.9	564.9	36,819.4	23,800.6
4.20	18,464.4	13,353.2	723.2	17,375.2	9,817.4	565.0	35,839.6	23,170.6
4.40	17,903.6	12,954.7	723.6	17,046.4	9,634.3	565.2	34,950.0	22,589.0
4.60	17,483.5	12,645.2	723.3	16,753.7	9,471.7	565.3	34,237.2	22,116.9
4.80	17,144.9	12,380.3	722.1	16,458.5	9,307.4	565.5	33,603.4	21,687.7
5.20	17,002.0	12,201.1	717.6	15,778.8	8,926.8	565.7	32,780.7	21,127.8

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
5.40	17,031.9	12,141.1	712.8	15,592.9	8,826.8	566.1	32,624.8	20,967.8
5.60	16,900.2	12,240.9	724.3	15,241.3	8,629.2	566.2	32,141.5	20,870.0
5.80	15,466.8	11,897.2	769.2	15,053.8	8,528.0	566.5	30,520.6	20,425.2
6.00	14,376.0	11,430.7	795.1	16,196.3	9,180.7	566.8	30,572.3	20,611.4
6.20	14,657.9	11,492.0	784.0	15,895.2	9,009.6	566.8	30,553.2	20,501.7
6.40	15,346.8	11,800.3	768.9	15,813.2	8,967.1	567.1	31,160.1	20,767.5
6.60	15,997.4	12,107.9	756.9	15,629.5	8,865.9	567.3	31,626.9	20,973.8
6.80	16,544.7	12,356.4	746.9	15,430.6	8,756.7	567.5	31,975.3	21,113.1
7.00	16,993.7	12,521.2	736.8	15,310.6	8,692.4	567.7	32,304.3	21,213.6
7.20	17,301.2	12,567.4	726.4	15,127.2	8,590.1	567.9	32,428.4	21,157.5
7.40	17,454.4	12,526.1	717.6	14,903.7	8,463.6	567.9	32,358.1	20,989.7
7.60	17,610.0	12,526.9	711.4	14,723.3	8,361.1	567.9	32,333.3	20,888.0
7.80	17,829.7	12,592.3	706.3	14,506.8	8,237.2	567.8	32,336.4	20,829.6
8.00	17,924.5	12,575.6	701.6	14,289.4	8,113.0	567.8	32,213.9	20,688.6
8.20	17,836.0	12,454.6	698.3	14,107.1	8,009.0	567.7	31,943.1	20,463.6
8.40	17,825.2	12,420.5	696.8	13,922.3	7,903.6	567.7	31,747.5	20,324.1
8.60	17,956.9	12,483.5	695.2	13,698.3	7,775.5	567.6	31,655.2	20,259.0
8.80	17,676.8	12,241.5	692.5	13,487.0	7,655.0	567.6	31,163.8	19,896.5
9.00	17,077.6	11,811.4	691.6	13,366.6	7,586.8	567.6	30,444.2	19,398.2
9.20	16,898.6	11,709.6	692.9	13,192.2	7,486.7	567.5	30,090.8	19,196.3
9.40	17,090.6	11,826.0	692.0	12,944.4	7,344.6	567.4	30,035.1	19,170.6
9.60	16,910.7	11,644.8	688.6	12,758.2	7,238.8	567.4	29,668.9	18,883.5
9.80	14,830.5	10,196.8	687.6	12,709.0	7,211.9	567.5	27,539.5	17,408.8
10.00	12,649.1	8,828.0	697.9	13,118.2	7,446.2	567.6	25,767.3	16,274.2
10.20	12,658.6	9,020.5	712.6	12,514.9	7,092.9	566.8	25,173.5	16,113.4
10.40	12,797.8	9,094.0	710.6	12,318.5	6,983.1	566.9	25,116.3	16,077.1
10.60	11,922.0	8,448.1	708.6	12,796.2	7,260.6	567.4	24,718.1	15,708.6
10.80	11,736.9	8,446.7	719.7	12,339.2	6,994.1	566.8	24,076.0	15,440.8
11.00	12,081.0	8,773.4	726.2	12,043.5	6,825.4	566.7	24,124.5	15,598.8
11.20	11,784.2	8,497.8	721.1	12,135.5	6,881.3	567.0	23,919.7	15,379.1
11.40	11,410.1	8,242.3	722.4	12,060.5	6,838.9	567.1	23,470.5	15,081.3
11.60	12,022.0	8,705.2	724.1	11,676.4	6,616.5	566.7	23,698.5	15,321.8
11.80	12,800.0	9,129.8	713.3	11,454.4	6,491.8	566.7	24,254.4	15,621.5
12.00	11,778.0	8,305.9	705.2	11,582.3	6,569.0	567.2	23,360.3	14,874.9
12.20	10,425.1	7,479.6	717.5	11,903.4	6,749.6	567.0	22,328.4	14,229.3
12.40	10,397.9	7,613.8	732.2	11,064.1	6,264.2	566.2	21,462.1	13,877.9
12.60	10,018.5	7,345.8	733.2	11,629.6	6,594.0	567.0	21,648.1	13,939.8
12.80	9,733.9	7,184.7	738.1	11,276.7	6,388.8	566.5	21,010.6	13,573.5
13.00	9,876.1	7,359.2	745.2	11,100.7	6,292.2	566.8	20,976.8	13,651.4
13.20	9,734.1	7,235.4	743.3	11,058.9	6,270.0	567.0	20,792.9	13,505.4
13.40	9,607.8	7,128.7	742.0	10,975.5	6,225.1	567.2	20,583.3	13,353.7
13.60	9,972.8	7,373.1	739.3	10,604.9	6,014.2	567.1	20,577.6	13,387.3
13.80	9,909.5	7,230.9	729.7	10,672.5	6,057.1	567.5	20,582.0	13,288.1
14.00	9,207.4	6,740.9	732.1	10,751.1	6,104.7	567.8	19,958.5	12,845.6
14.20	9,198.0	6,827.9	742.3	10,242.6	5,817.7	568.0	19,440.7	12,645.5
14.40	8,859.7	6,572.9	741.9	10,609.9	6,035.7	568.9	19,469.6	12,608.5
14.60	8,566.4	6,402.9	747.4	10,296.8	5,861.4	569.2	18,863.2	12,264.3
14.80	8,533.4	6,474.8	758.8	10,211.7	5,827.7	570.7	18,745.1	12,302.5
15.00	8,216.2	6,319.6	769.2	10,063.9	5,745.5	570.9	18,280.1	12,065.1
15.20	8,116.9	6,272.4	772.8	9,886.0	5,654.2	571.9	18,002.9	11,926.6
15.40	8,111.4	6,214.1	766.1	9,718.4	5,562.7	572.4	17,829.8	11,776.8
15.60	7,997.5	6,067.5	758.7	9,736.5	5,583.5	573.5	17,734.0	11,651.0
15.80	7,981.8	6,028.7	755.3	9,444.5	5,428.5	574.8	17,426.2	11,457.2

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
16.00	7,827.7	5,894.1	753.0	9,559.1	5,508.9	576.3	17,386.9	11,403.1
16.20	7,670.7	5,794.8	755.4	9,331.2	5,405.3	579.3	17,001.9	11,200.0
16.40	7,560.1	5,759.4	761.8	9,310.0	5,419.4	582.1	16,870.1	11,178.8
16.60	7,435.8	5,732.5	770.9	9,144.5	5,356.4	585.8	16,580.2	11,088.9
16.80	7,286.3	5,686.3	780.4	8,976.1	5,287.4	589.0	16,262.4	10,973.6
17.00	7,157.4	5,633.2	787.0	8,762.9	5,196.7	593.0	15,920.4	10,829.9
17.20	7,050.4	5,571.8	790.3	8,538.6	5,097.8	597.0	15,589.0	10,669.6
17.40	6,958.0	5,516.4	792.8	8,327.4	5,015.3	602.3	15,285.4	10,531.7
17.60	6,849.1	5,460.8	797.3	8,119.3	4,942.0	608.7	14,968.4	10,402.8
17.80	6,723.1	5,414.2	805.3	7,902.6	4,875.6	617.0	14,625.7	10,289.8
18.00	6,585.5	5,382.0	817.3	7,668.1	4,807.5	626.9	14,253.6	10,189.5
18.20	6,430.2	5,356.2	833.0	7,441.3	4,749.7	638.3	13,871.6	10,105.9
18.40	6,261.9	5,327.1	850.7	7,187.1	4,681.0	651.3	13,448.9	10,008.0
18.60	6,107.3	5,301.0	868.0	6,981.9	4,661.7	667.7	13,089.2	9,962.7
18.80	5,941.4	5,251.4	883.9	6,470.9	4,522.9	699.0	12,412.3	9,774.3
19.00	5,702.7	5,205.0	912.7	5,996.7	4,374.5	729.5	11,699.4	9,579.5
19.20	5,251.8	5,128.4	976.5	5,581.4	4,262.8	763.7	10,833.1	9,391.1
19.40	4,598.8	4,953.8	1,077.2	5,082.1	4,145.8	815.8	9,680.9	9,099.6
19.60	3,926.3	4,649.5	1,184.2	4,413.1	4,052.0	918.2	8,339.4	8,701.5
19.80	3,408.6	4,188.7	1,228.9	2,536.6	2,869.1	1,131.1	5,945.1	7,057.8
20.00	3,024.3	3,747.2	1,239.0	1,724.2	2,095.5	1,215.3	4,748.5	5,842.7
20.20	2,731.6	3,399.5	1,244.5	1,504.4	1,859.6	1,236.2	4,236.0	5,259.1
20.40	2,468.3	3,081.6	1,248.5	1,351.9	1,681.7	1,243.9	3,820.2	4,763.3
20.60	2,239.0	2,803.8	1,252.3	1,229.0	1,535.2	1,249.1	3,468.0	4,339.0
20.80	2,048.2	2,571.6	1,255.6	1,110.7	1,392.9	1,254.1	3,158.9	3,964.5
21.00	1,892.3	2,381.5	1,258.5	1,480.9	1,611.7	1,088.4	3,373.2	3,993.2
21.20	1,796.6	2,265.5	1,261.0	2,572.9	1,432.5	556.7	4,369.5	3,698.0
21.40	1,711.4	2,160.7	1,262.5	2,837.4	1,364.0	480.7	4,548.9	3,524.7
21.60	1,619.6	2,046.9	1,263.8	3,167.8	1,406.2	443.9	4,787.4	3,453.0
21.80	1,501.7	1,899.3	1,264.8	3,156.0	1,336.7	423.5	4,657.7	3,236.0
22.00	1,388.1	1,758.3	1,266.8	2,799.3	1,149.5	410.6	4,187.4	2,907.8
22.20	1,275.2	1,617.3	1,268.2	2,433.4	977.0	401.5	3,708.6	2,594.3
22.40	1,171.6	1,487.4	1,269.6	2,162.1	850.7	393.5	3,333.7	2,338.2
22.60	1,045.0	1,328.9	1,271.7	1,952.0	751.4	385.0	2,996.9	2,080.3
22.80	946.3	1,204.8	1,273.1	1,774.9	666.0	375.2	2,721.2	1,870.8
23.00	877.3	1,118.2	1,274.7	1,635.9	597.7	365.3	2,513.1	1,715.9
23.20	831.5	1,060.7	1,275.6	1,731.5	613.6	354.4	2,563.0	1,674.3
23.40	802.0	1,023.6	1,276.4	2,058.5	696.1	338.2	2,860.5	1,719.8
23.60	775.7	990.4	1,276.9	2,539.4	819.5	322.7	3,315.1	1,810.0
23.80	727.1	928.6	1,277.1	3,217.9	995.9	309.5	3,945.1	1,924.5
24.00	557.7	712.0	1,276.5	3,471.3	1,035.2	298.2	4,029.0	1,747.1
24.20	453.5	579.7	1,278.3	2,353.0	685.2	291.2	2,806.5	1,264.9
24.40	375.8	480.8	1,279.4	1,269.5	365.6	288.0	1,645.3	846.4
24.60	279.1	357.3	1,280.4	543.6	156.0	286.9	822.6	513.3
24.80	168.9	216.5	1,281.9	91.9	26.4	287.1	260.8	242.9
25.00	37.6	48.4	1,285.8	0.0	0.0	0.0	37.6	48.4
25.20	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
				End of Blowdown				
25.65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
26.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26.28	56.5	66.7	1,180.8	0.0	0.0	0.0	56.5	66.7
26.38	58.3	68.9	1,180.8	0.0	0.0	0.0	58.3	68.9
26.48	66.1	78.0	1,180.9	0.0	0.0	0.0	66.1	78.0
26.58	73.8	87.2	1,180.9	0.0	0.0	0.0	73.8	87.2
26.68	81.1	95.8	1,180.9	0.0	0.0	0.0	81.1	95.8
26.78	88.1	104.0	1,181.0	0.0	0.0	0.0	88.1	104.0
26.85	93.1	109.9	1,181.0	0.0	0.0	0.0	93.1	109.9
26.88	94.7	111.8	1,181.0	0.0	0.0	0.0	94.7	111.8
26.98	101.0	119.2	1,181.1	0.0	0.0	0.0	101.0	119.2
27.08	107.0	126.3	1,181.1	0.0	0.0	0.0	107.0	126.3
27.18	112.7	133.1	1,181.1	0.0	0.0	0.0	112.7	133.1
27.28	118.2	139.7	1,181.2	0.0	0.0	0.0	118.2	139.7
27.38	123.6	146.0	1,181.2	0.0	0.0	0.0	123.6	146.0
27.48	128.7	152.1	1,181.3	0.0	0.0	0.0	128.7	152.1
27.58	133.7	158.0	1,181.3	0.0	0.0	0.0	133.7	158.0
27.68	138.6	163.7	1,181.3	0.0	0.0	0.0	138.6	163.7
27.78	143.3	169.2	1,181.4	0.0	0.0	0.0	143.3	169.2
27.88	147.8	174.6	1,181.4	0.0	0.0	0.0	147.8	174.6
27.98	152.3	179.9	1,181.5	0.0	0.0	0.0	152.3	179.9
28.08	156.6	185.0	1,181.5	0.0	0.0	0.0	156.6	185.0
28.18	160.9	190.1	1,181.5	0.0	0.0	0.0	160.9	190.1
28.28	165.0	195.0	1,181.6	0.0	0.0	0.0	165.0	195.0
29.28	202.1	238.9	1,182.0	0.0	0.0	0.0	202.1	238.9
30.00	768.7	915.4	1,190.8	6,636.7	910.3	137.2	7,405.4	1,825.7
30.30	808.8	963.9	1,191.8	6,942.3	988.6	142.4	7,751.1	1,952.5
31.30	806.1	960.8	1,191.9	6,925.2	997.7	144.1	7,731.3	1,958.5
32.30	795.6	948.1	1,191.7	6,828.4	986.0	144.4	7,624.0	1,934.1
32.70	790.1	941.4	1,191.6	6,786.0	980.9	144.5	7,576.1	1,922.3
33.30	847.2	1,010.1	1,192.3	7,265.8	1,044.6	143.8	8,113.0	2,054.7
34.30	826.4	985.3	1,192.3	7,140.1	1,026.7	143.8	7,966.5	2,012.0
35.30	815.3	971.9	1,192.1	7,034.1	1,013.3	144.1	7,849.4	1,985.2
35.90	808.9	964.1	1,191.9	6,971.1	1,005.3	144.2	7,780.0	1,969.5
36.30	804.7	959.1	1,191.9	6,929.5	1,000.1	144.3	7,734.2	1,959.1
37.30	794.1	946.3	1,191.6	6,827.9	987.4	144.6	7,622.0	1,933.6
38.30	782.1	931.9	1,191.4	6,730.7	975.5	144.9	7,512.8	1,907.4
39.30	770.7	918.1	1,191.2	6,636.5	964.1	145.3	7,407.2	1,882.2
39.50	768.5	915.4	1,191.2	6,618.0	961.8	145.3	7,386.5	1,877.2
40.30	759.7	904.9	1,191.1	6,545.4	953.1	145.6	7,305.1	1,858.0
41.30	749.2	892.2	1,190.9	6,457.2	942.5	146.0	7,206.4	1,834.7
42.30	739.2	880.1	1,190.7	6,371.9	932.3	146.3	7,111.1	1,812.4
43.30	729.5	868.5	1,190.5	6,289.4	922.5	146.7	7,018.9	1,791.0
43.40	728.6	867.4	1,190.5	6,281.3	921.5	146.7	7,009.9	1,788.9
44.30	720.2	857.3	1,190.4	6,209.6	913.0	147.0	6,929.8	1,770.3
45.30	711.3	846.6	1,190.2	6,132.3	903.8	147.4	6,843.6	1,750.4
46.30	702.7	836.3	1,190.1	6,057.5	894.9	147.7	6,760.2	1,731.2
47.30	409.3	485.0	1,184.9	220.8	198.5	899.3	630.1	683.5
48.30	409.9	485.7	1,185.0	218.8	199.2	910.6	628.6	684.9
49.30	409.6	485.3	1,185.0	219.9	198.8	903.9	629.5	684.1
50.30	409.4	485.1	1,184.9	221.1	198.4	897.2	630.5	683.4
51.30	409.2	484.9	1,184.9	222.3	198.0	890.4	631.5	682.8
52.30	409.0	484.7	1,184.9	223.6	197.6	883.8	632.6	682.2
53.30	408.9	484.5	1,184.9	224.8	197.2	877.2	633.7	681.7

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
53.90	408.8	484.4	1,184.9	225.6	197.0	873.2	634.3	681.3
54.30	408.7	484.3	1,184.9	226.1	196.8	870.6	634.8	681.1
55.30	408.6	484.1	1,184.9	227.3	196.4	864.1	635.9	680.5
56.30	408.4	483.9	1,184.9	228.6	196.1	857.7	637.0	680.0
57.30	408.3	483.8	1,184.9	229.9	195.7	851.2	638.2	679.5
58.30	408.1	483.6	1,184.9	231.2	195.3	844.8	639.3	678.9
59.30	408.0	483.4	1,184.9	232.6	195.0	838.4	640.5	678.4
60.30	407.8	483.3	1,184.9	233.9	194.6	832.1	641.7	677.9
61.30	407.7	483.1	1,184.9	235.3	194.3	825.6	643.0	677.3
62.30	407.5	482.9	1,184.9	236.7	193.9	819.2	644.2	676.8
63.30	407.4	482.7	1,184.9	238.2	193.6	812.8	645.5	676.3
64.30	407.2	482.5	1,184.9	239.6	193.2	806.3	646.8	675.7
65.30	407.0	482.3	1,184.9	241.1	192.9	799.9	648.1	675.1
66.30	406.8	482.0	1,184.9	242.7	192.5	793.4	649.5	674.6
66.40	406.8	482.0	1,184.9	242.8	192.5	792.8	649.6	674.5
67.30	406.6	481.8	1,184.9	244.2	192.2	786.9	650.8	674.0
68.30	406.4	481.6	1,184.9	245.8	191.8	780.4	652.2	673.4
69.30	406.2	481.3	1,184.9	247.4	191.5	773.9	653.6	672.8
70.30	406.0	481.1	1,184.9	249.1	191.1	767.4	655.1	672.2
71.30	405.8	480.8	1,184.9	250.8	190.8	760.8	656.5	671.6
72.30	405.5	480.5	1,184.9	252.5	190.5	754.3	658.0	671.0
73.30	405.3	480.2	1,184.9	254.3	190.1	747.7	659.5	670.3
74.30	405.0	479.9	1,184.9	256.1	189.8	741.1	661.1	669.7
75.30	404.8	479.6	1,184.9	257.9	189.4	734.6	662.6	669.0
76.30	404.5	479.2	1,184.9	259.7	189.1	728.0	664.2	668.3
77.30	404.2	478.9	1,184.9	261.7	188.8	721.5	665.8	667.7
78.30	403.9	478.5	1,184.9	263.6	188.4	714.9	667.5	667.0
79.30	403.5	478.1	1,184.9	265.5	188.1	708.4	669.1	666.2
79.70	403.4	478.0	1,184.8	266.3	188.0	705.8	669.7	665.9
80.30	403.2	477.7	1,184.8	267.5	187.8	701.9	670.7	665.5
81.30	402.8	477.2	1,184.8	269.5	187.4	695.4	672.3	664.7
82.30	402.4	476.8	1,184.8	271.6	187.1	689.0	673.9	663.9
83.30	402.0	476.2	1,184.8	273.6	186.8	682.6	675.6	663.0
84.30	401.5	475.7	1,184.8	275.7	186.4	676.2	677.2	662.1
85.30	401.0	475.1	1,184.8	277.8	186.1	669.9	678.8	661.2
86.30	400.5	474.6	1,184.8	279.9	185.7	663.7	680.4	660.3
88.30	399.5	473.3	1,184.8	284.1	185.1	651.3	683.6	658.3
90.30	398.3	471.9	1,184.8	288.5	184.4	639.1	686.8	656.3
92.30	397.1	470.5	1,184.7	292.9	183.7	627.1	690.0	654.2
94.20	395.9	469.0	1,184.7	297.2	183.1	616.0	693.0	652.0
94.30	395.8	468.9	1,184.7	297.4	183.0	615.4	693.2	651.9
96.30	394.4	467.3	1,184.7	302.0	182.4	603.9	696.4	649.6
98.30	393.0	465.5	1,184.7	306.6	181.7	592.6	699.6	647.2
100.30	391.4	463.7	1,184.7	311.3	181.1	581.6	702.7	644.8
102.30	389.8	461.7	1,184.6	316.1	180.4	570.8	705.9	642.2
104.30	388.1	459.7	1,184.6	320.9	179.8	560.3	709.0	639.5
106.30	386.3	457.6	1,184.6	325.9	179.2	550.0	712.2	636.8
108.30	384.5	455.4	1,184.5	330.9	178.6	539.9	715.3	634.0
110.00	382.8	453.5	1,184.5	335.1	178.2	531.6	718.0	631.6
110.30	382.5	453.1	1,184.5	335.9	178.1	530.2	718.4	631.2
112.30	380.6	450.8	1,184.5	341.0	177.5	520.6	721.6	628.3
114.30	378.5	448.3	1,184.4	346.2	177.0	511.4	724.7	625.4
116.30	376.4	445.8	1,184.4	351.4	176.5	502.4	727.8	622.3

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
118.30	374.2	443.2	1,184.4	356.7	176.1	493.7	730.9	619.3
120.30	372.0	440.6	1,184.3	362.0	175.6	485.2	734.0	616.2
122.30	369.7	437.8	1,184.3	367.4	175.2	476.9	737.1	613.1
124.30	367.3	435.0	1,184.3	372.9	174.8	468.9	740.2	609.9
126.30	364.9	432.1	1,184.2	378.4	174.5	461.2	743.3	606.6
127.70	363.2	430.1	1,184.2	382.3	174.3	455.9	745.5	604.3
128.30	362.4	429.2	1,184.2	384.0	174.2	453.6	746.4	603.4
130.30	359.9	426.2	1,184.2	389.6	173.9	446.3	749.5	600.0
132.30	357.3	423.1	1,184.1	395.3	173.6	439.2	752.6	596.7
134.30	354.6	419.9	1,184.1	401.1	173.4	432.3	755.7	593.3
136.30	351.9	416.6	1,184.0	406.9	173.2	425.7	758.8	589.9
138.30	349.1	413.3	1,184.0	412.9	173.1	419.2	762.0	586.4
140.30	346.2	409.9	1,183.9	418.9	173.0	412.9	765.1	582.9
142.30	343.3	406.4	1,183.9	424.9	172.9	406.8	768.2	579.3
144.30	340.3	402.9	1,183.8	431.1	172.8	400.9	771.4	575.7
146.30	337.3	399.3	1,183.8	437.3	172.8	395.2	774.6	572.1
148.20	334.3	395.7	1,183.8	443.4	172.9	389.9	777.7	568.6
148.30	334.2	395.6	1,183.8	443.7	172.9	389.6	777.8	568.4
150.30	331.0	391.8	1,183.7	450.1	173.0	384.3	781.1	564.7
152.30	327.7	387.9	1,183.7	456.7	173.1	379.0	784.4	560.9
154.30	324.3	383.9	1,183.6	463.4	173.3	373.9	787.7	557.1
156.30	320.9	379.8	1,183.6	470.2	173.5	369.0	791.0	553.3
158.30	317.4	375.6	1,183.5	477.1	173.7	364.2	794.5	549.4
160.30	313.8	371.4	1,183.5	484.1	174.1	359.6	797.9	545.4
162.30	309.9	366.8	1,183.4	491.0	174.3	355.0	801.0	541.1
164.30	305.8	361.9	1,183.3	497.1	174.4	350.8	802.9	536.3
166.30	301.7	357.0	1,183.3	503.2	174.5	346.8	804.9	531.5
168.30	297.6	352.1	1,183.2	509.3	174.7	342.9	806.9	526.8
170.30	293.2	346.9	1,183.2	515.5	174.8	339.1	808.8	521.7
172.30	288.6	341.5	1,183.1	521.0	174.8	335.5	809.7	516.3
173.10	**286.8**	**339.3**	**1,183.1**	**523.3**	**174.8**	**334.1**	**810.1**	**514.1**
				End of Reflood				
173.20	324.5	404.1	1,245.4	622.7	204.6	328.6	947.1	608.7
178.20	300.8	374.5	1,245.4	646.4	202.7	313.7	947.1	577.3
183.20	300.1	373.7	1,245.4	647.1	202.7	313.2	947.1	576.4
188.20	298.2	371.3	1,245.4	649.0	202.9	312.7	947.1	574.2
193.20	297.4	370.4	1,245.4	649.7	202.9	312.2	947.1	573.3
198.20	296.7	369.5	1,245.4	650.5	202.8	311.8	947.1	572.3
203.20	296.1	368.8	1,245.4	651.0	202.7	311.4	947.1	571.5
208.20	295.6	368.1	1,245.4	651.5	202.6	311.0	947.1	570.7
213.20	293.8	365.9	1,245.4	653.3	202.8	310.5	947.1	568.8
218.20	293.3	365.2	1,245.4	653.9	202.8	310.1	947.1	568.0
223.20	292.7	364.5	1,245.4	654.5	202.7	309.7	947.1	567.1
228.20	292.0	363.6	1,245.4	655.2	202.6	309.3	947.1	566.2
233.20	291.3	362.8	1,245.4	655.9	202.6	308.8	947.1	565.3
238.20	289.4	360.4	1,245.4	657.8	202.8	308.4	947.1	563.2
243.20	288.6	359.4	1,245.4	658.5	202.8	307.9	947.1	562.2
248.20	287.8	358.4	1,245.4	659.4	202.8	307.5	947.1	561.2
253.20	286.9	357.3	1,245.4	660.2	202.8	307.1	947.1	560.1
258.20	286.0	356.1	1,245.4	661.2	202.8	306.7	947.1	558.9
263.20	285.0	354.9	1,245.4	662.1	202.8	306.3	947.1	557.7
268.20	284.0	353.7	1,245.4	663.2	202.8	305.8	947.1	556.5

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TABLE 6.2.1.3-5A (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Minimum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
273.20	284.0	353.6	1,245.4	663.2	202.6	305.4	947.1	556.2
278.20	282.8	352.2	1,245.4	664.3	202.6	305.0	947.1	554.8
283.20	281.6	350.7	1,245.4	665.6	202.7	304.6	947.1	553.4
288.20	280.3	349.1	1,245.4	666.9	202.8	304.1	947.1	551.9
293.20	280.0	348.7	1,245.4	667.2	202.7	303.7	947.1	551.3
298.20	278.5	346.9	1,245.4	668.6	202.8	303.3	947.1	549.7
303.20	278.0	346.2	1,245.4	669.1	202.7	302.9	947.1	548.9
308.20	276.4	344.2	1,245.4	670.8	202.9	302.4	947.1	547.1
313.20	275.7	343.3	1,245.4	671.5	202.8	302.0	947.1	546.1
318.20	274.9	342.3	1,245.4	672.3	202.8	301.6	947.1	545.1
323.20	273.9	341.1	1,245.4	673.3	202.8	301.2	947.1	543.9
328.20	272.8	339.7	1,245.4	674.3	202.8	300.8	947.1	542.6
333.20	271.6	338.2	1,245.4	675.6	202.9	300.3	947.1	541.1
338.20	271.1	337.6	1,245.4	676.0	202.8	300.0	947.1	540.4
343.20	269.6	335.7	1,245.4	677.6	202.9	299.5	947.1	538.6
348.20	268.7	334.6	1,245.4	678.4	202.9	299.1	947.1	537.6
353.20	267.6	333.3	1,245.4	679.5	203.0	298.7	947.1	536.3
358.20	266.3	331.7	1,245.4	680.8	203.1	298.2	947.1	534.7
363.20	265.6	330.7	1,245.4	681.6	203.0	297.8	947.1	533.7
368.20	264.5	329.4	1,245.4	682.7	203.0	297.4	947.1	532.4
373.20	263.8	328.5	1,245.4	683.4	203.0	297.0	947.1	531.5
378.20	262.7	327.1	1,245.4	684.5	203.0	296.6	947.1	530.1
383.20	261.0	325.1	1,245.4	686.1	203.2	296.2	947.1	528.3
388.20	260.2	324.1	1,245.4	686.9	203.2	295.8	947.1	527.3
393.20	258.7	322.2	1,245.4	688.4	203.3	295.3	947.1	525.5
398.20	257.6	320.8	1,245.4	689.6	203.4	294.9	947.1	524.2
403.20	256.6	319.6	1,245.4	690.5	203.4	294.5	947.1	523.0
408.20	255.3	317.9	1,245.4	691.9	203.5	294.1	947.1	521.4
413.20	254.0	316.3	1,245.4	693.2	203.6	293.7	947.1	519.9
639.85	254.0	316.3	1,245.4	693.2	203.6	293.7	947.1	519.9
639.95	106.3	131.2	1,235.2	840.9	239.7	285.1	947.1	371.0
643.20	106.2	131.1	1,235.2	841.0	239.6	284.8	947.1	370.7
1,464.90	**106.2**	**131.1**	**1,235.2**	**841.0**	**239.6**	**284.8**	**947.1**	**370.7**
Start of sump recirculation								
1,465.00	89.1	109.9	1,233.3	567.6	295.3	520.3	656.7	405.2
1,613.06	89.1	109.9	1,233.3	567.6	295.3	520.3	656.7	405.2
1,613.16	85.5	98.3	1,150.6	571.2	175.3	306.9	656.7	273.6
3,600.00	**70.0**	**80.6**	**1,150.6**	**586.6**	**178.1**	**303.6**	**656.7**	**258.7**
Start of revised post-recirculation methodology [4]								

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NOTES:

1. Pump Suction Break Area = 5.24 ft^2. Pipe inside diameter = 2.58 ft.
2. The blowdown phase mass and energy releases are the same for Minimum and Maximum SI cases.
3. Blowdown ends at 25.2 seconds. Reflood ends at 173.1 seconds. Sump recirculation begins at 1465 seconds. All SGs depressurized to atmospheric pressure at 3600 seconds.
4. After 3600 seconds, the revised post recirculation methodology is used, as discussed in Section 6.2.1.3.4.5.

TABLE 6.2.1.3-5B
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.00114	97,158.3	54,746.8	563.5	43,339.6	24,348.1	561.8	140,497.9	79,094.8
0.10	43,480.5	24,471.9	562.8	21,547.8	12,088.3	561.0	65,028.3	36,560.2
0.20	51,982.9	29,373.7	565.1	24,528.6	13,777.6	561.7	76,511.5	43,151.3
0.30	51,633.9	29,319.5	567.8	25,873.5	14,546.5	562.2	77,507.4	43,866.0
0.40	51,282.7	29,294.9	571.2	25,649.9	14,432.9	562.7	76,932.6	43,727.8
0.50	50,920.4	29,294.0	575.3	24,960.9	14,057.0	563.2	75,881.3	43,351.0
0.60	50,714.3	29,407.1	579.9	24,416.8	13,760.3	563.6	75,131.1	43,167.3
0.70	49,896.9	29,180.0	584.8	24,052.4	13,561.7	563.8	73,949.4	42,741.7
0.80	48,045.5	28,330.9	589.7	23,753.6	13,396.9	564.0	71,799.1	41,727.8
0.90	47,471.7	28,211.3	594.3	23,440.1	13,222.0	564.1	70,911.8	41,433.3
1.00	47,553.0	28,462.2	598.5	23,099.6	13,030.6	564.1	70,652.7	41,492.8
1.10	47,301.6	28,504.7	602.6	22,771.3	12,845.1	564.1	70,072.9	41,349.8
1.20	46,713.0	28,337.7	606.6	22,488.7	12,685.9	564.1	69,201.7	41,023.6
1.30	45,879.3	28,014.4	610.6	22,307.8	12,584.1	564.1	68,187.1	40,598.6
1.40	44,977.2	27,652.8	614.8	22,153.8	12,497.8	564.1	67,131.0	40,150.5
1.50	44,069.3	27,288.9	619.2	22,023.9	12,425.0	564.2	66,093.2	39,713.9
1.60	43,087.0	26,882.9	623.9	21,910.8	12,361.3	564.2	64,997.8	39,244.1
1.70	42,038.7	26,434.8	628.8	21,829.6	12,315.5	564.2	63,868.3	38,750.3
1.80	40,932.5	25,950.6	634.0	21,785.3	12,290.8	564.2	62,717.8	38,241.4
1.90	39,839.5	25,469.8	639.3	21,742.5	12,267.2	564.2	61,582.0	37,737.0
2.00	38,715.4	24,965.0	644.8	21,660.5	12,221.1	564.2	60,375.9	37,186.1
2.10	37,556.9	24,426.6	650.4	21,545.6	12,156.0	564.2	59,102.4	36,582.6
2.20	36,371.7	23,856.7	655.9	21,371.8	12,057.1	564.2	57,743.5	35,913.8
2.30	35,147.2	23,250.1	661.5	21,088.3	11,896.7	564.1	56,235.5	35,146.8
2.40	34,060.0	22,718.5	667.0	20,894.6	11,787.9	564.2	54,954.6	34,506.4
2.50	32,996.1	22,186.4	672.4	20,712.4	11,685.5	564.2	53,708.6	33,871.9
2.60	31,939.8	21,643.1	677.6	20,514.2	11,573.9	564.2	52,454.0	33,217.0
2.70	30,932.3	21,118.9	682.7	20,313.0	11,460.6	564.2	51,245.3	32,579.6
2.80	29,765.0	20,472.0	687.8	20,113.0	11,348.2	564.2	49,878.0	31,820.2
2.90	27,445.6	18,995.3	692.1	19,902.8	11,230.2	564.2	47,348.4	30,225.5
3.00	25,766.4	17,965.5	697.2	19,688.4	11,109.8	564.3	45,454.8	29,075.2
3.10	24,813.9	17,434.4	702.6	19,480.3	10,993.1	564.3	44,294.2	28,427.6
3.20	23,807.7	16,826.2	706.8	19,276.4	10,879.0	564.4	43,084.1	27,705.1
3.30	22,807.1	16,193.0	710.0	19,070.0	10,763.4	564.4	41,877.1	26,956.4
3.40	22,078.1	15,737.9	712.8	18,852.2	10,641.4	564.5	40,930.3	26,379.3
3.50	21,448.8	15,339.9	715.2	18,643.2	10,524.4	564.5	40,092.0	25,864.3
3.60	20,878.1	14,972.0	717.1	18,453.8	10,418.7	564.6	39,331.9	25,390.8
3.70	20,389.7	14,654.9	718.7	18,266.8	10,314.4	564.7	38,656.5	24,969.4
3.80	19,938.4	14,356.3	720.0	18,076.3	10,208.1	564.7	38,014.7	24,564.4
3.90	19,505.0	14,064.6	721.1	17,883.0	10,100.1	564.8	37,388.1	24,164.7
4.00	19,114.4	13,799.7	722.0	17,705.0	10,000.9	564.9	36,819.4	23,800.6
4.20	18,464.4	13,353.2	723.2	17,375.2	9,817.4	565.0	35,839.6	23,170.6
4.40	17,903.6	12,954.7	723.6	17,046.4	9,634.3	565.2	34,950.0	22,589.0
4.60	17,483.5	12,645.2	723.3	16,753.7	9,471.7	565.3	34,237.2	22,116.9

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
4.80	17,144.9	12,380.3	722.1	16,458.5	9,307.4	565.5	33,603.4	21,687.7
5.20	17,002.0	12,201.1	717.6	15,778.8	8,926.8	565.7	32,780.7	21,127.8
5.40	17,031.9	12,141.1	712.8	15,592.9	8,826.8	566.1	32,624.8	20,967.8
5.60	16,900.2	12,240.9	724.3	15,241.3	8,629.2	566.2	32,141.5	20,870.0
5.80	15,466.8	11,897.2	769.2	15,053.8	8,528.0	566.5	30,520.6	20,425.2
6.00	14,376.0	11,430.7	795.1	16,196.3	9,180.7	566.8	30,572.3	20,611.4
6.20	14,657.9	11,492.0	784.0	15,895.2	9,009.6	566.8	30,553.2	20,501.7
6.40	15,346.8	11,800.3	768.9	15,813.2	8,967.1	567.1	31,160.1	20,767.5
6.60	15,997.4	12,107.9	756.9	15,629.5	8,865.9	567.3	31,626.9	20,973.8
6.80	16,544.7	12,356.4	746.9	15,430.6	8,756.7	567.5	31,975.3	21,113.1
7.00	16,993.7	12,521.2	736.8	15,310.6	8,692.4	567.7	32,304.3	21,213.6
7.20	17,301.2	12,567.4	726.4	15,127.2	8,590.1	567.9	32,428.4	21,157.5
7.40	17,454.4	12,526.1	717.6	14,903.7	8,463.6	567.9	32,358.1	20,989.7
7.60	17,610.0	12,526.9	711.4	14,723.3	8,361.1	567.9	32,333.3	20,888.0
7.80	17,829.7	12,592.3	706.3	14,506.8	8,237.2	567.8	32,336.4	20,829.6
8.00	17,924.5	12,575.6	701.6	14,289.4	8,113.0	567.8	32,213.9	20,688.6
8.20	17,836.0	12,454.6	698.3	14,107.1	8,009.0	567.7	31,943.1	20,463.6
8.40	17,825.2	12,420.5	696.8	13,922.3	7,903.6	567.7	31,747.5	20,324.1
8.60	17,956.9	12,483.5	695.2	13,698.3	7,775.5	567.6	31,655.2	20,259.0
8.80	17,676.8	12,241.5	692.5	13,487.0	7,655.0	567.6	31,163.8	19,896.5
9.00	17,077.6	11,811.4	691.6	13,366.6	7,586.8	567.6	30,444.2	19,398.2
9.20	16,898.6	11,709.6	692.9	13,192.2	7,486.7	567.5	30,090.8	19,196.3
9.40	17,090.6	11,826.0	692.0	12,944.4	7,344.6	567.4	30,035.1	19,170.6
9.60	16,910.7	11,644.8	688.6	12,758.2	7,238.8	567.4	29,668.9	18,883.5
9.80	14,830.5	10,196.8	687.6	12,709.0	7,211.9	567.5	27,539.5	17,408.8
10.00	12,649.1	8,828.0	697.9	13,118.2	7,446.2	567.6	25,767.3	16,274.2
10.20	12,658.6	9,020.5	712.6	12,514.9	7,092.9	566.8	25,173.5	16,113.4
10.40	12,797.8	9,094.0	710.6	12,318.5	6,983.1	566.9	25,116.3	16,077.1
10.60	11,922.0	8,448.1	708.6	12,796.2	7,260.6	567.4	24,718.1	15,708.6
10.80	11,736.9	8,446.7	719.7	12,339.2	6,994.1	566.8	24,076.0	15,440.8
11.00	12,081.0	8,773.4	726.2	12,043.5	6,825.4	566.7	24,124.5	15,598.8
11.20	11,784.2	8,497.8	721.1	12,135.5	6,881.3	567.0	23,919.7	15,379.1
11.40	11,410.1	8,242.3	722.4	12,060.5	6,838.9	567.1	23,470.5	15,081.3
11.60	12,022.0	8,705.2	724.1	11,676.4	6,616.5	566.7	23,698.5	15,321.8
11.80	12,800.0	9,129.8	713.3	11,454.4	6,491.8	566.7	24,254.4	15,621.5
12.00	11,778.0	8,305.9	705.2	11,582.3	6,569.0	567.2	23,360.3	14,874.9
12.20	10,425.1	7,479.6	717.5	11,903.4	6,749.6	567.0	22,328.4	14,229.3
12.40	10,397.9	7,613.8	732.2	11,064.1	6,264.2	566.2	21,462.1	13,877.9
12.60	10,018.5	7,345.8	733.2	11,629.6	6,594.0	567.0	21,648.1	13,939.8
12.80	9,733.9	7,184.7	738.1	11,276.7	6,388.8	566.5	21,010.6	13,573.5
13.00	9,876.1	7,359.2	745.2	11,100.7	6,292.2	566.8	20,976.8	13,651.4
13.20	9,734.1	7,235.4	743.3	11,058.9	6,270.0	567.0	20,792.9	13,505.4
13.40	9,607.8	7,128.7	742.0	10,975.5	6,225.1	567.2	20,583.3	13,353.7
13.60	9,972.8	7,373.1	739.3	10,604.9	6,014.2	567.1	20,577.6	13,387.3
13.80	9,909.5	7,230.9	729.7	10,672.5	6,057.1	567.5	20,582.0	13,288.1
14.00	9,207.4	6,740.9	732.1	10,751.1	6,104.7	567.8	19,958.5	12,845.6
14.20	9,198.0	6,827.9	742.3	10,242.6	5,817.7	568.0	19,440.7	12,645.5
14.40	8,859.7	6,572.9	741.9	10,609.9	6,035.7	568.9	19,469.6	12,608.5
14.60	8,566.4	6,402.9	747.4	10,296.8	5,861.4	569.2	18,863.2	12,264.3
14.80	8,533.4	6,474.8	758.8	10,211.7	5,827.7	570.7	18,745.1	12,302.5

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
15.00	8,216.2	6,319.6	769.2	10,063.9	5,745.5	570.9	18,280.1	12,065.1
15.20	8,116.9	6,272.4	772.8	9,886.0	5,654.2	571.9	18,002.9	11,926.6
15.40	8,111.4	6,214.1	766.1	9,718.4	5,562.7	572.4	17,829.8	11,776.8
15.60	7,997.5	6,067.5	758.7	9,736.5	5,583.5	573.5	17,734.0	11,651.0
15.80	7,981.8	6,028.7	755.3	9,444.5	5,428.5	574.8	17,426.2	11,457.2
16.00	7,827.7	5,894.1	753.0	9,559.1	5,508.9	576.3	17,386.9	11,403.1
16.20	7,670.7	5,794.8	755.4	9,331.2	5,405.3	579.3	17,001.9	11,200.0
16.40	7,560.1	5,759.4	761.8	9,310.0	5,419.4	582.1	16,870.1	11,178.8
16.60	7,435.8	5,732.5	770.9	9,144.5	5,356.4	585.8	16,580.2	11,088.9
16.80	7,286.3	5,686.3	780.4	8,976.1	5,287.4	589.0	16,262.4	10,973.6
17.00	7,157.4	5,633.2	787.0	8,762.9	5,196.7	593.0	15,920.4	10,829.9
17.20	7,050.4	5,571.8	790.3	8,538.6	5,097.8	597.0	15,589.0	10,669.6
17.40	6,958.0	5,516.4	792.8	8,327.4	5,015.3	602.3	15,285.4	10,531.7
17.60	6,849.1	5,460.8	797.3	8,119.3	4,942.0	608.7	14,968.4	10,402.8
17.80	6,723.1	5,414.2	805.3	7,902.6	4,875.6	617.0	14,625.7	10,289.8
18.00	6,585.5	5,382.0	817.3	7,668.1	4,807.5	626.9	14,253.6	10,189.5
18.20	6,430.2	5,356.2	833.0	7,441.3	4,749.7	638.3	13,871.6	10,105.9
18.40	6,261.9	5,327.1	850.7	7,187.1	4,681.0	651.3	13,448.9	10,008.0
18.60	6,107.3	5,301.0	868.0	6,981.9	4,661.7	667.7	13,089.2	9,962.7
18.80	5,941.4	5,251.4	883.9	6,470.9	4,522.9	699.0	12,412.3	9,774.3
19.00	5,702.7	5,205.0	912.7	5,996.7	4,374.5	729.5	11,699.4	9,579.5
19.20	5,251.8	5,128.4	976.5	5,581.4	4,262.8	763.7	10,833.1	9,391.1
19.40	4,598.8	4,953.8	1,077.2	5,082.1	4,145.8	815.8	9,680.9	9,099.6
19.60	3,926.3	4,649.5	1,184.2	4,413.1	4,052.0	918.2	8,339.4	8,701.5
19.80	3,408.6	4,188.7	1,228.9	2,536.6	2,869.1	1,131.1	5,945.1	7,057.8
20.00	3,024.3	3,747.2	1,239.0	1,724.2	2,095.5	1,215.3	4,748.5	5,842.7
20.20	2,731.6	3,399.5	1,244.5	1,504.4	1,859.6	1,236.2	4,236.0	5,259.1
20.40	2,468.3	3,081.6	1,248.5	1,351.9	1,681.7	1,243.9	3,820.2	4,763.3
20.60	2,239.0	2,803.8	1,252.3	1,229.0	1,535.2	1,249.1	3,468.0	4,339.0
20.80	2,048.2	2,571.6	1,255.6	1,110.7	1,392.9	1,254.1	3,158.9	3,964.5
21.00	1,892.3	2,381.5	1,258.5	1,480.9	1,611.7	1,088.4	3,373.2	3,993.2
21.20	1,796.6	2,265.5	1,261.0	2,572.9	1,432.5	556.7	4,369.5	3,698.0
21.40	1,711.4	2,160.7	1,262.5	2,837.4	1,364.0	480.7	4,548.9	3,524.7
21.60	1,619.6	2,046.9	1,263.8	3,167.8	1,406.2	443.9	4,787.4	3,453.0
21.80	1,501.7	1,899.3	1,264.8	3,156.0	1,336.7	423.5	4,657.7	3,236.0
22.00	1,388.1	1,758.3	1,266.8	2,799.3	1,149.5	410.6	4,187.4	2,907.8
22.20	1,275.2	1,617.3	1,268.2	2,433.4	977.0	401.5	3,708.6	2,594.3
22.40	1,171.6	1,487.4	1,269.6	2,162.1	850.7	393.5	3,333.7	2,338.2
22.60	1,045.0	1,328.9	1,271.7	1,952.0	751.4	385.0	2,996.9	2,080.3
22.80	946.3	1,204.8	1,273.1	1,774.9	666.0	375.2	2,721.2	1,870.8
23.00	877.3	1,118.2	1,274.7	1,635.9	597.7	365.3	2,513.1	1,715.9
23.20	831.5	1,060.7	1,275.6	1,731.5	613.6	354.4	2,563.0	1,674.3
23.40	802.0	1,023.6	1,276.4	2,058.5	696.1	338.2	2,860.5	1,719.8
23.60	775.7	990.4	1,276.9	2,539.4	819.5	322.7	3,315.1	1,810.0
23.80	727.1	928.6	1,277.1	3,217.9	995.9	309.5	3,945.1	1,924.5
24.00	557.7	712.0	1,276.5	3,471.3	1,035.2	298.2	4,029.0	1,747.1
24.20	453.5	579.7	1,278.3	2,353.0	685.2	291.2	2,806.5	1,264.9
24.40	375.8	480.8	1,279.4	1,269.5	365.6	288.0	1,645.3	846.4
24.60	279.1	357.3	1,280.4	543.6	156.0	286.9	822.6	513.3
24.80	168.9	216.5	1,281.9	91.9	26.4	287.1	260.8	242.9
25.00	37.6	48.4	1,285.8	0.0	0.0	0.0	37.6	48.4
25.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
End of Blowdown								
25.65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26.28	56.5	66.7	1,180.8	0.0	0.0	0.0	56.5	66.7
26.38	58.3	68.9	1,180.8	0.0	0.0	0.0	58.3	68.9
26.48	66.1	78.0	1,180.9	0.0	0.0	0.0	66.1	78.0
26.58	73.8	87.2	1,180.9	0.0	0.0	0.0	73.8	87.2
26.68	81.1	95.8	1,180.9	0.0	0.0	0.0	81.1	95.8
26.78	88.1	104.0	1,181.0	0.0	0.0	0.0	88.1	104.0
26.85	93.1	109.9	1,181.0	0.0	0.0	0.0	93.1	109.9
26.88	94.7	111.8	1,181.0	0.0	0.0	0.0	94.7	111.8
26.98	101.0	119.2	1,181.1	0.0	0.0	0.0	101.0	119.2
27.08	107.0	126.3	1,181.1	0.0	0.0	0.0	107.0	126.3
27.18	112.7	133.1	1,181.1	0.0	0.0	0.0	112.7	133.1
27.28	118.2	139.7	1,181.2	0.0	0.0	0.0	118.2	139.7
27.38	123.6	146.0	1,181.2	0.0	0.0	0.0	123.6	146.0
27.48	128.7	152.1	1,181.3	0.0	0.0	0.0	128.7	152.1
27.58	133.7	158.0	1,181.3	0.0	0.0	0.0	133.7	158.0
27.68	138.6	163.7	1,181.3	0.0	0.0	0.0	138.6	163.7
27.78	143.3	169.2	1,181.4	0.0	0.0	0.0	143.3	169.2
27.88	147.8	174.6	1,181.4	0.0	0.0	0.0	147.8	174.6
27.98	152.3	179.9	1,181.5	0.0	0.0	0.0	152.3	179.9
28.08	156.6	185.0	1,181.5	0.0	0.0	0.0	156.6	185.0
28.18	160.9	190.1	1,181.5	0.0	0.0	0.0	160.9	190.1
28.28	165.0	195.0	1,181.6	0.0	0.0	0.0	165.0	195.0
29.28	202.1	238.9	1,182.0	0.0	0.0	0.0	202.1	238.9
30.00	768.7	915.4	1,190.8	6,636.7	910.3	137.2	7,405.4	1,825.7
30.30	808.8	963.9	1,191.8	6,942.3	988.6	142.4	7,751.1	1,952.5
31.30	806.1	960.8	1,191.9	6,925.2	997.7	144.1	7,731.3	1,958.5
32.30	795.6	948.1	1,191.7	6,828.4	986.0	144.4	7,624.0	1,934.1
32.70	790.1	941.4	1,191.6	6,786.0	980.9	144.5	7,576.1	1,922.3
33.30	895.8	1,068.6	1,192.9	7,651.0	1,096.6	143.3	8,546.8	2,165.2
34.30	865.2	1,032.2	1,193.1	7,506.6	1,074.0	143.1	8,371.8	2,106.3
35.30	854.0	1,018.7	1,192.9	7,404.2	1,061.0	143.3	8,258.2	2,079.7
35.80	848.6	1,012.1	1,192.8	7,353.3	1,054.6	143.4	8,201.8	2,066.7
36.30	843.2	1,005.7	1,192.7	7,302.8	1,048.2	143.5	8,146.0	2,053.9
37.30	832.9	993.2	1,192.4	7,203.6	1,035.8	143.8	8,036.5	2,029.0
38.30	823.1	981.3	1,192.2	7,107.1	1,023.7	144.0	7,930.2	2,005.1
39.30	813.8	970.1	1,192.0	7,013.3	1,012.1	144.3	7,827.1	1,982.2
40.30	805.0	959.4	1,191.9	6,922.5	1,001.0	144.6	7,727.5	1,960.4
41.30	796.6	949.2	1,191.7	6,834.6	990.3	144.9	7,631.1	1,939.5
42.30	786.7	937.3	1,191.5	6,751.1	980.3	145.2	7,537.8	1,917.6
43.00	780.0	929.3	1,191.4	6,694.3	973.6	145.4	7,474.2	1,902.9
43.30	777.2	925.9	1,191.3	6,670.3	970.8	145.5	7,447.4	1,896.6
44.30	768.0	914.9	1,191.2	6,592.0	961.5	145.9	7,360.1	1,876.4
45.30	759.3	904.3	1,191.0	6,516.2	952.6	146.2	7,275.5	1,856.9
46.30	750.8	894.1	1,190.9	6,442.8	943.9	146.5	7,193.6	1,838.0
47.30	562.3	669.5	1,190.8	1,683.5	491.7	292.1	2,245.7	1,161.2
48.30	346.6	410.4	1,184.0	953.2	280.8	294.5	1,299.8	691.1

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
49.30	326.1	386.0	1,183.7	986.4	285.7	289.6	1,312.5	671.7
50.30	315.5	373.4	1,183.5	1,003.5	288.4	287.4	1,319.0	661.7
51.30	306.6	362.9	1,183.4	1,017.8	290.7	285.6	1,324.4	653.5
52.30	297.9	352.4	1,183.2	1,031.9	293.0	284.0	1,329.7	645.5
53.30	288.7	341.5	1,183.1	1,046.6	295.5	282.4	1,335.2	637.1
53.40	287.7	340.4	1,183.1	1,048.1	295.8	282.2	1,335.8	636.2
54.30	278.9	329.9	1,183.0	1,062.1	298.2	280.8	1,341.0	628.1
55.30	268.3	317.4	1,182.8	1,078.8	301.2	279.2	1,347.1	618.6
56.30	256.8	303.7	1,182.7	1,096.7	304.5	277.7	1,353.5	608.2
57.30	244.4	289.0	1,182.5	1,116.9	308.4	276.1	1,361.3	597.4
58.30	234.3	277.1	1,182.4	1,132.4	311.5	275.0	1,366.8	588.5
59.30	227.1	268.5	1,182.3	1,143.9	313.4	274.0	1,371.0	581.9
60.30	226.1	267.3	1,182.3	1,145.9	313.5	273.6	1,372.0	580.8
61.30	225.7	266.8	1,182.3	1,147.1	313.4	273.2	1,372.7	580.2
62.30	225.3	266.3	1,182.3	1,148.2	313.3	272.9	1,373.5	579.6
63.30	224.8	265.8	1,182.2	1,149.4	313.2	272.5	1,374.2	579.0
64.30	224.4	265.3	1,182.2	1,150.6	313.1	272.1	1,375.0	578.5
65.30	224.0	264.9	1,182.2	1,151.8	313.0	271.8	1,375.8	577.9
66.30	223.6	264.4	1,182.2	1,153.0	312.9	271.4	1,376.6	577.3
67.30	223.2	263.9	1,182.2	1,154.1	312.9	271.1	1,377.4	576.8
68.30	222.8	263.4	1,182.2	1,155.3	312.8	270.7	1,378.2	576.2
69.30	222.4	263.0	1,182.2	1,156.6	312.7	270.4	1,379.0	575.7
69.60	222.3	262.8	1,182.2	1,156.9	312.7	270.3	1,379.2	575.5
70.30	222.0	262.5	1,182.2	1,157.8	312.6	270.0	1,379.8	575.1
71.30	221.6	262.0	1,182.2	1,159.0	312.5	269.7	1,380.6	574.6
72.30	221.3	261.6	1,182.2	1,160.2	312.5	269.3	1,381.5	574.0
73.30	220.9	261.1	1,182.2	1,161.5	312.4	269.0	1,382.3	573.5
74.30	220.5	260.7	1,182.2	1,162.7	312.3	268.6	1,383.2	573.0
75.30	220.1	260.2	1,182.2	1,163.9	312.2	268.3	1,384.0	572.4
76.30	219.7	259.7	1,182.2	1,165.2	312.2	267.9	1,384.9	571.9
77.30	219.3	259.3	1,182.2	1,166.4	312.1	267.5	1,385.8	571.4
78.30	219.0	258.8	1,182.2	1,167.7	312.0	267.2	1,386.7	570.9
79.30	218.6	258.4	1,182.2	1,169.0	311.9	266.8	1,387.6	570.3
80.30	218.2	258.0	1,182.2	1,170.3	311.9	266.5	1,388.5	569.8
81.30	217.8	257.5	1,182.2	1,171.5	311.8	266.1	1,389.4	569.3
82.30	217.5	257.1	1,182.2	1,172.8	311.7	265.8	1,390.3	568.8
83.30	217.1	256.6	1,182.2	1,174.1	311.7	265.4	1,391.2	568.3
84.30	216.7	256.2	1,182.2	1,175.5	311.6	265.1	1,392.2	567.8
85.30	216.3	255.7	1,182.1	1,176.8	311.5	264.7	1,393.1	567.3
86.30	216.0	255.3	1,182.1	1,178.1	311.5	264.4	1,394.1	566.7
87.40	215.6	254.8	1,182.1	1,179.6	311.4	264.0	1,395.1	566.2
88.30	215.2	254.4	1,182.1	1,180.8	311.3	263.7	1,396.0	565.7
90.30	214.5	253.5	1,182.1	1,183.4	311.2	263.0	1,397.9	564.7
92.30	213.8	252.7	1,182.1	1,186.0	311.0	262.3	1,399.7	563.7
94.30	213.0	251.8	1,182.1	1,188.6	310.9	261.5	1,401.6	562.7
96.30	212.3	251.0	1,182.1	1,191.1	310.7	260.8	1,403.4	561.7
98.30	211.6	250.1	1,182.1	1,193.7	310.5	260.1	1,405.3	560.6
100.30	210.9	249.3	1,182.1	1,196.2	310.4	259.4	1,407.1	559.6
102.30	210.2	248.4	1,182.1	1,198.7	310.2	258.7	1,408.9	558.6
104.30	209.5	247.6	1,182.1	1,201.2	310.0	258.0	1,410.7	557.6
106.30	208.8	246.8	1,182.1	1,203.7	309.8	257.3	1,412.5	556.5
106.90	208.6	246.5	1,182.1	1,204.4	309.7	257.1	1,413.0	556.2
108.30	208.1	245.9	1,182.0	1,206.2	309.6	256.6	1,414.2	555.5

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
110.30	207.4	245.1	1,182.0	1,208.6	309.4	256.0	1,416.0	554.5
112.30	206.7	244.3	1,182.0	1,211.0	309.1	255.3	1,417.8	553.5
114.30	206.0	243.5	1,182.0	1,213.5	308.9	254.6	1,419.5	552.5
116.30	205.4	242.8	1,182.0	1,215.9	308.7	253.9	1,421.2	551.5
118.30	204.7	242.0	1,182.0	1,218.2	308.5	253.2	1,423.0	550.5
120.30	204.1	241.2	1,182.0	1,220.6	308.2	252.5	1,424.7	549.5
122.30	203.4	240.5	1,182.0	1,222.9	308.0	251.9	1,426.4	548.5
124.30	202.8	239.7	1,182.0	1,225.3	307.8	251.2	1,428.1	547.5
126.30	202.2	239.0	1,182.0	1,227.6	307.5	250.5	1,429.8	546.5
128.30	201.6	238.3	1,182.0	1,229.9	307.3	249.9	1,431.5	545.6
128.70	201.5	238.1	1,182.0	1,230.4	307.3	249.7	1,431.8	545.4
130.30	201.0	237.6	1,182.0	1,232.2	307.1	249.2	1,433.2	544.6
132.30	200.4	236.9	1,182.0	1,234.5	306.8	248.6	1,434.9	543.7
134.30	199.8	236.2	1,182.0	1,236.8	306.6	247.9	1,436.6	542.8
136.30	199.3	235.5	1,181.9	1,239.0	306.4	247.3	1,438.3	541.9
138.30	198.7	234.8	1,181.9	1,241.3	306.1	246.6	1,440.0	541.0
140.30	198.1	234.2	1,181.9	1,243.6	305.9	246.0	1,441.7	540.1
142.30	197.6	233.5	1,181.9	1,245.8	305.7	245.4	1,443.4	539.2
144.30	197.1	232.9	1,181.9	1,248.0	305.4	244.7	1,445.1	538.3
146.30	196.5	232.3	1,181.9	1,250.3	305.2	244.1	1,446.8	537.5
148.30	196.0	231.7	1,181.9	1,252.5	305.0	243.5	1,448.5	536.7
150.30	195.5	231.1	1,181.9	1,254.8	304.7	242.9	1,450.3	535.8
152.30	195.0	230.5	1,181.9	1,257.0	304.5	242.3	1,452.0	535.0
153.60	194.7	230.1	1,181.9	1,258.5	304.4	241.9	1,453.2	534.5
154.30	194.5	229.9	1,181.9	1,259.3	304.3	241.6	1,453.8	534.2
156.30	194.0	229.3	1,181.9	1,261.5	304.1	241.0	1,455.6	533.4
158.30	193.6	228.8	1,181.9	1,263.8	303.9	240.4	1,457.3	532.6
160.30	193.1	228.2	1,181.9	1,266.1	303.7	239.8	1,459.2	531.9
162.30	192.6	227.7	1,181.9	1,268.4	303.5	239.2	1,461.0	531.1
164.30	192.2	227.1	1,181.9	1,270.7	303.3	238.7	1,462.8	530.4
166.30	191.8	226.6	1,181.9	1,273.0	303.1	238.1	1,464.7	529.7
168.30	191.3	226.1	1,181.9	1,275.3	302.9	237.5	1,466.6	529.0
170.30	190.9	225.6	1,181.9	1,277.7	302.7	236.9	1,468.6	528.4
172.30	190.5	225.2	1,181.9	1,280.0	302.6	236.4	1,470.6	527.7
174.30	190.1	224.7	1,181.8	1,282.4	302.4	235.8	1,472.6	527.1
176.30	189.7	224.3	1,181.8	1,284.9	302.3	235.3	1,474.6	526.5
178.30	189.4	223.8	1,181.8	1,287.4	302.2	234.7	1,476.8	526.0
180.30	189.0	223.4	1,181.8	1,289.9	302.1	234.2	1,478.9	525.5
182.30	188.7	223.0	1,181.8	1,292.5	302.0	233.6	1,481.2	525.0
183.80	188.5	222.7	1,181.8	1,294.5	301.9	233.3	1,482.9	524.7
184.30	188.4	222.6	1,181.8	1,295.1	301.9	233.1	1,483.5	524.6
186.30	188.1	222.3	1,181.8	1,297.9	301.9	232.6	1,485.9	524.2
188.30	187.8	221.9	1,181.8	1,300.7	301.9	232.1	1,488.5	523.8
190.30	187.5	221.6	1,181.8	1,303.6	301.9	231.6	1,491.1	523.5
192.30	187.1	221.1	1,181.8	1,304.2	301.3	231.1	1,491.2	522.4
194.30	186.6	220.6	1,181.8	1,304.7	300.8	230.6	1,491.4	521.4
196.30	186.2	220.1	1,181.8	1,305.3	300.3	230.1	1,491.5	520.4
198.30	185.8	219.6	1,181.8	1,305.8	299.8	229.6	1,491.6	519.4
200.30	185.3	219.0	1,181.8	1,305.4	299.0	229.0	1,490.7	518.0
202.30	184.8	218.4	1,181.8	1,304.0	298.0	228.5	1,488.8	516.4
204.30	184.2	217.7	1,181.8	1,303.0	297.1	228.0	1,487.2	514.9
206.30	183.7	217.1	1,181.8	1,302.2	296.3	227.5	1,486.0	513.4
208.30	183.3	216.6	1,181.8	1,301.7	295.5	227.0	1,485.0	512.1

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
210.30	182.8	216.0	1,181.8	1,301.4	294.8	226.5	1,484.1	510.8
212.30	182.3	215.4	1,181.8	1,301.2	294.0	226.0	1,483.5	509.5
214.30	181.8	214.9	1,181.8	1,301.2	293.3	225.4	1,483.0	508.2
216.30	181.4	214.3	1,181.8	1,301.3	292.7	224.9	1,482.7	507.0
218.30	180.9	213.8	1,181.8	1,301.6	292.0	224.4	1,482.5	505.8
220.00	**180.5**	**213.3**	**1,181.7**	**1,301.9**	**291.5**	**223.9**	**1,482.5**	**504.9**
				End of Reflood				
220.10	201.8	254.2	1,259.3	1,395.0	290.2	208.0	1,596.9	544.4
225.10	202.9	255.5	1,259.3	1,394.0	289.7	207.8	1,596.9	545.2
230.10	202.3	254.7	1,259.3	1,394.6	289.6	207.7	1,596.9	544.3
235.10	201.6	253.9	1,259.3	1,395.2	289.6	207.5	1,596.9	543.5
240.10	202.7	255.2	1,259.3	1,394.2	289.0	207.3	1,596.9	544.3
245.10	202.0	254.4	1,259.3	1,394.8	289.0	207.2	1,596.9	543.4
250.10	201.4	253.7	1,259.3	1,395.4	288.9	207.0	1,596.9	542.5
255.10	202.4	254.9	1,259.3	1,394.4	288.4	206.8	1,596.9	543.3
260.10	201.8	254.1	1,259.3	1,395.1	288.3	206.7	1,596.9	542.4
265.10	201.2	253.3	1,259.3	1,395.7	288.2	206.5	1,596.9	541.6
270.10	202.1	254.5	1,259.3	1,394.7	287.7	206.3	1,596.9	542.3
275.10	201.5	253.7	1,259.3	1,395.4	287.7	206.2	1,596.9	541.4
280.10	200.8	252.9	1,259.3	1,396.0	287.6	206.0	1,596.9	540.5
285.10	201.8	254.1	1,259.3	1,395.1	287.1	205.8	1,596.9	541.2
290.10	201.1	253.3	1,259.3	1,395.7	287.0	205.7	1,596.9	540.3
295.10	200.5	252.4	1,259.3	1,396.4	287.0	205.5	1,596.9	539.4
300.10	201.4	253.6	1,259.3	1,395.5	286.5	205.3	1,596.9	540.1
305.10	200.7	252.7	1,259.3	1,396.2	286.4	205.1	1,596.9	539.2
310.10	200.0	251.9	1,259.3	1,396.8	286.4	205.0	1,596.9	538.2
315.10	200.9	253.0	1,259.3	1,395.9	285.9	204.8	1,596.9	538.9
320.10	200.2	252.1	1,259.3	1,396.6	285.8	204.6	1,596.9	537.9
325.10	201.1	253.2	1,259.3	1,395.8	285.3	204.4	1,596.9	538.5
330.10	200.4	252.3	1,259.3	1,396.5	285.3	204.3	1,596.9	537.6
335.10	199.7	251.5	1,259.3	1,397.2	285.2	204.1	1,596.9	536.7
340.10	200.5	252.5	1,259.3	1,396.3	284.7	203.9	1,596.9	537.2
345.10	199.8	251.6	1,259.3	1,397.1	284.7	203.8	1,596.9	536.3
350.10	200.6	252.6	1,259.3	1,396.3	284.2	203.6	1,596.9	536.8
355.10	199.9	251.7	1,259.3	1,397.0	284.2	203.4	1,596.9	535.9
360.10	199.1	250.8	1,259.3	1,397.7	284.1	203.3	1,596.9	534.9
365.10	199.9	251.7	1,259.3	1,397.0	283.7	203.1	1,596.9	535.4
370.10	199.2	250.8	1,259.3	1,397.7	283.6	202.9	1,596.9	534.4
375.10	199.9	251.7	1,259.3	1,397.0	283.2	202.7	1,596.9	534.9
380.10	199.1	250.8	1,259.3	1,397.7	283.1	202.6	1,596.9	533.9
385.10	198.4	249.8	1,259.3	1,398.5	283.1	202.4	1,596.9	532.9
390.10	199.1	250.7	1,259.3	1,397.8	282.6	202.2	1,596.9	533.3
395.10	198.3	249.7	1,259.3	1,398.6	282.6	202.1	1,596.9	532.3
400.10	199.0	250.6	1,259.3	1,397.9	282.1	201.8	1,596.9	532.7
405.10	198.3	249.8	1,259.3	1,398.5	282.1	201.7	1,596.9	531.8
410.10	199.2	250.8	1,259.3	1,397.7	281.6	201.5	1,596.9	532.4
415.10	198.5	250.0	1,259.3	1,398.3	281.5	201.3	1,596.9	531.5
420.10	197.9	249.2	1,259.3	1,399.0	281.5	201.2	1,596.9	530.6
425.10	198.6	250.1	1,259.3	1,398.2	281.0	201.0	1,596.9	531.1
430.10	198.0	249.3	1,259.3	1,398.9	280.9	200.8	1,596.9	530.2
435.10	198.7	250.2	1,259.3	1,398.2	280.5	200.6	1,596.9	530.7
440.10	198.0	249.3	1,259.3	1,398.8	280.4	200.5	1,596.9	529.8

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
445.10	197.3	248.5	1,259.3	1,399.5	280.4	200.3	1,596.9	528.8
450.10	198.0	249.4	1,259.3	1,398.8	279.9	200.1	1,596.9	529.3
455.10	197.3	248.5	1,259.3	1,399.6	279.9	200.0	1,596.9	528.3
460.10	198.0	249.3	1,259.3	1,398.9	279.4	199.8	1,596.9	528.7
465.10	197.2	248.4	1,259.3	1,399.6	279.4	199.6	1,596.9	527.8
470.10	197.8	249.1	1,259.3	1,399.0	279.0	199.4	1,596.9	528.1
475.10	197.1	248.2	1,259.3	1,399.8	278.9	199.3	1,596.9	527.1
480.10	197.7	248.9	1,259.3	1,399.2	278.5	199.1	1,596.9	527.4
485.10	196.9	248.0	1,259.3	1,399.9	278.5	198.9	1,596.9	526.4
490.10	197.5	248.7	1,259.3	1,399.4	285.5	204.0	1,596.9	534.1
495.10	196.7	247.6	1,259.3	1,400.2	285.4	203.8	1,596.9	533.1
500.10	197.2	248.3	1,259.3	1,399.7	285.0	203.6	1,596.9	533.3
505.10	196.3	247.2	1,259.3	1,400.5	285.0	203.5	1,596.9	532.2
510.10	196.8	247.8	1,259.3	1,400.1	284.5	203.2	1,596.9	532.4
515.10	195.9	246.8	1,259.3	1,400.9	284.5	203.1	1,596.9	531.3
520.10	196.4	247.3	1,259.3	1,400.5	284.1	202.9	1,596.9	531.4
525.10	196.8	247.8	1,259.3	1,400.1	283.7	202.6	1,596.9	531.5
530.10	195.9	246.6	1,259.3	1,401.0	283.7	202.5	1,596.9	530.3
535.10	196.2	247.1	1,259.3	1,400.7	283.3	202.3	1,596.9	530.4
540.10	196.5	247.5	1,259.3	1,400.4	283.0	202.1	1,596.9	530.4
545.10	195.5	246.3	1,259.3	1,401.3	282.9	201.9	1,596.9	529.2
550.10	195.8	246.6	1,259.3	1,401.0	282.6	201.7	1,596.9	529.2
555.10	196.0	246.9	1,259.3	1,400.8	282.2	201.5	1,596.9	529.1
560.10	196.2	247.1	1,259.3	1,400.6	281.9	201.3	1,596.9	529.0
565.10	195.2	245.8	1,259.3	1,401.7	281.9	201.1	1,596.9	527.7
570.10	195.3	245.9	1,259.3	1,401.5	281.6	200.9	1,596.9	527.5
575.10	195.4	246.1	1,259.3	1,401.5	281.3	200.7	1,596.9	527.3
580.10	195.4	246.1	1,259.3	1,401.4	281.0	200.5	1,596.9	527.1
585.10	195.5	246.1	1,259.3	1,401.4	280.7	200.3	1,596.9	526.8
590.10	195.4	246.1	1,259.3	1,401.4	280.4	200.1	1,596.9	526.5
595.10	195.3	246.0	1,259.3	1,401.5	280.1	199.9	1,596.9	526.1
600.10	195.2	245.8	1,259.3	1,401.6	279.9	199.7	1,596.9	525.7
605.10	195.1	245.7	1,259.3	1,401.7	279.6	199.5	1,596.9	525.3
610.10	194.9	245.5	1,259.3	1,401.9	279.4	199.3	1,596.9	524.9
615.10	194.7	245.2	1,259.3	1,402.1	279.2	199.1	1,596.9	524.4
620.10	194.5	244.9	1,259.3	1,402.4	279.0	198.9	1,596.9	523.8
625.10	194.1	244.5	1,259.3	1,402.7	278.8	198.7	1,596.9	523.2
630.10	194.8	245.3	1,259.3	1,402.1	278.3	198.5	1,596.9	523.6
635.10	194.3	244.7	1,259.3	1,402.5	278.1	198.3	1,596.9	522.9
640.10	194.8	245.3	1,259.3	1,402.0	277.7	198.1	1,596.9	523.0
645.10	194.2	244.5	1,259.3	1,402.7	277.6	197.9	1,596.9	522.1
650.10	194.5	244.9	1,259.3	1,402.4	277.2	197.7	1,596.9	522.1
655.10	193.7	243.9	1,259.3	1,403.2	277.1	197.5	1,596.9	521.1
660.10	193.8	244.0	1,259.3	1,403.1	276.8	197.3	1,596.9	520.8
665.10	193.7	243.9	1,259.3	1,403.2	276.6	197.1	1,596.9	520.5
670.10	193.5	243.7	1,259.3	1,403.3	276.3	196.9	1,596.9	520.0
675.10	194.1	244.4	1,259.3	1,402.8	275.9	196.7	1,596.9	520.2
680.10	193.5	243.7	1,259.3	1,403.3	275.7	196.5	1,596.9	519.4
685.10	193.7	243.9	1,259.3	1,403.2	275.4	196.3	1,596.9	519.3
690.10	193.6	243.7	1,259.3	1,403.3	275.1	196.1	1,596.9	518.9
695.10	193.2	243.3	1,259.3	1,403.7	274.9	195.9	1,596.9	518.2
995.10	85.5	107.6	1,259.3	1,511.4	296.7	196.3	1,596.9	404.3

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TABLE 6.2.1.3-5B (continued)
DOUBLE-ENDED PUMP SUCTION BREAK MASS AND ENERGY RELEASES
(Maximum SI)

Time	Break Path No. 1 Flow (SG Side)			Break Path No. 2 Flow (Pump Side)			Total Mass From Both Sides	Total Energy From Both Sides
(seconds)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)	Enthalpy (Btu/lbm)	(lbm/sec)	Thousand (Btu/sec)
Start of sump recirculation								
1,000.00	85.4	107.5	1,259.3	1,564.4	534.2	341.4	1,649.8	641.7
1,045.56	85.4	107.5	1,259.3	1,564.4	534.2	341.4	1,649.8	641.7
1,045.66	95.1	118.6	1,247.3	1,554.7	534.6	343.9	1,649.8	653.2
1,050.00	95.0	118.5	1,247.3	1,554.8	534.3	343.6	1,649.8	652.7
1,754.45	95.0	118.5	1,247.3	1,554.8	534.3	343.6	1,649.8	652.7
1,754.55	82.8	95.3	1,150.6	1,567.0	407.7	260.2	1,649.8	503.0
3,600.00	69.1	79.5	1,150.6	1,580.7	410.2	259.5	1,649.8	489.7
Start of revised post-recirculation methodology [4]								

NOTES:

1. Pump Suction Break Area = 5.24 ft^2. Pipe inside diameter = 2.58 ft.
2. The blowdown phase mass and energy releases are the same for Minimum and Maximum SI cases.
3. Blowdown ends at 25.2 seconds. Reflood ends at 220.0 seconds. Sump recirculation begins at 1000 seconds. All SGs depressurized to atmospheric pressure at 3600 seconds.
4. After 3600 seconds, the revised post recirculation methodology is used, as discussed in Section 6.2.1.3.4.5.

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TABLE 6.2.1.3-6

DECAY HEAT DATA BASED ON ANS-5.1-1979, PLUS 2 SIGMA UNCERTAINTY

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Time (sec)	Decay Heat Generation Rate (Btu/Btu) (Fraction of Full Power)
1.00E+01	0.053876
1.50E+01	0.050401
2.00E+01	0.048018
4.00E+01	0.042401
6.00E+01	0.039244
8.00E+01	0.037065
1.00E+02	0.035466
1.50E+02	0.032724
2.00E+02	0.030936
4.00E+02	0.027078
6.00E+02	0.024931
8.00E+02	0.023389
1.00E+03	0.022156
1.50E+03	0.019921
2.00E+03	0.018315
4.00E+03	0.014781
6.00E+03	0.013040
8.00E+03	0.012000
1.00E+04	0.011262
1.50E+04	0.010097
2.00E+04	0.009350
4.00E+04	0.007778
6.00E+04	0.006958
8.00E+04	0.006424
1.00E+05	0.006021
1.50E+05	0.005323
4.00E+05	0.003770
6.00E+05	0.003201
8.00E+05	0.002834
1.00E+06	0.002580

TABLE 6.2.1.3-6A

DECAY HEAT DATA BASED ON STANDARD REVIEW PLAN ASB 9-2 CORRELATIONS

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Time (seconds)	Decay Heat (Btu/hr)
9.0E+00	1.03E+09
1.1E+02	5.80E+08
5.0E+02	3.84E+08
1.0E+03	3.06E+08
2.0E+03	2.56E+08
3.0E+03	2.24E+08
3.6E+03	2.11E+08
4.0E+03	2.03E+08
5.0E+03	1.88E+08
6.0E+03	1.78E+08
7.0E+03	1.70E+08
8.0E+03	1.64E+08
9.0E+03	1.59E+08
1.0E+04	1.55E+08
2.0E+04	1.29E+08
3.0E+04	1.13E+08
4.0E+04	1.02E+08
5.0E+04	9.49E+07
6.0E+04	8.96E+07
7.0E+04	8.57E+07
8.0E+04	8.25E+07
9.0E+04	8.00E+07
1.0E+05	7.78E+07
2.0E+05	6.33E+07
3.0E+05	5.42E+07
4.0E+05	4.81E+07
5.0E+05	4.38E+07
6.0E+05	4.06E+07
7.0E+05	3.82E+07
8.0E+05	3.63E+07
9.0E+05	3.48E+07
1.0E+06	3.34E+07
1.1E+06	3.23E+07
1.2E+06	3.13E+07
1.3E+06	3.04E+07
1.4E+06	2.95E+07
1.5E+06	2.87E+07
1.6E+06	2.80E+07
1.7E+06	2.73E+07
1.8E+06	2.67E+07
1.9E+06	2.61E+07
2.0E+06	2.55E+07
2.5E+06	2.30E+07
3.0E+06	2.10E+07
3.5E+06	1.94E+07
4.0E+06	1.81E+07
4.5E+06	1.70E+07
5.0E+06	1.60E+07
6.0E+06	1.46E+07
7.0E+06	1.34E+07
8.0E+06	1.25E+07
9.0E+06	1.17E+07

TABLE 6.2.1.3-6A (Continued)

DECAY HEAT DATA
BASED ON STANDARD REVIEW PLAN
ASB 9-2 CORRELATIONS

Time (seconds)	Decay Heat (Btu/hr)
1.0E+07	1.10E+07
2.0E+07	6.90E+06
3.0E+07	4.99E+06
4.0E+07	3.96E+06
5.0E+07	3.32E+06
6.0E+07	2.90E+06
7.0E+07	2.60E+06
8.0E+07	2.37E+06
9.0E+07	2.21E+06
1.0E+08	2.08E+06

TABLE 6.2.1.3-9

DOUBLE-ENDED PUMP SUCTION BREAK
PRINCIPAL PARAMETERS DURING REFLOOD
(Minimum SI)

Time (seconds)	Flooding Temp (°F)	Flooding Rate (in/sec)	Carryover Fraction	Core Height (ft)	Downcomer Height (ft)	Flow Fraction	Injection (lbm/sec) Total	Injection (lbm/sec) Accumulator	Spill	Enthalpy (Btu/lbm)
25.2	196.5	0.000	0.000	0.00	0.00	0.250	0.0	0.0	0.0	0.0
25.9	192.4	26.017	0.000	0.60	2.29	0.000	11135.7	11135.7	0.0	89.5
26.1	189.7	31.875	0.000	1.08	2.37	0.000	11067.7	11067.7	0.0	89.5
26.9	187.8	3.653	0.307	1.50	5.59	0.324	10760.5	10760.5	0.0	89.5
27.8	187.5	3.423	0.456	1.67	9.88	0.360	10483.6	10483.6	0.0	89.5
30.0	186.9	7.415	0.630	2.00	18.29	0.654	8989.9	8989.9	0.0	89.5
30.3	186.7	7.529	0.649	2.07	18.31	0.646	8792.9	8792.9	0.0	89.5
31.3	186.1	7.102	0.686	2.27	18.31	0.644	8545.2	8545.2	0.0	89.5
32.7	185.7	6.719	0.712	2.51	18.31	0.645	8282.1	8282.1	0.0	89.5
33.3	185.6	6.980	0.719	2.60	18.31	0.653	8833.6	8017.3	0.0	90.28
35.9	185.7	6.603	0.735	3.00	18.31	0.651	8418.4	7592.6	0.0	90.33
39.5	186.8	6.233	0.744	3.50	18.31	0.648	7967.0	7125.2	0.0	90.40
43.4	188.9	5.927	0.749	4.00	18.31	0.642	7551.3	6695.0	0.0	90.46
47.3	191.5	3.964	0.747	4.46	18.31	0.543	922.4	0.0	0.0	97.98
48.3	192.3	3.957	0.747	4.54	18.31	0.542	922.0	0.0	0.0	97.98
53.9	198.3	3.915	0.750	5.01	18.31	0.545	922.0	0.0	0.0	97.98
60.3	207.7	3.867	0.753	5.52	18.31	0.548	921.9	0.0	0.0	97.98
66.4	218.3	3.818	0.756	6.00	18.31	0.552	921.8	0.0	0.0	97.98
73.3	231.1	3.757	0.760	6.53	18.31	0.556	921.8	0.0	0.0	97.98
79.7	243.0	3.693	0.765	7.00	18.31	0.559	921.8	0.0	0.0	97.98
88.3	256.6	3.599	0.771	7.61	18.31	0.564	921.9	0.0	0.0	97.98
94.2	264.2	3.530	0.775	8.01	18.31	0.567	922.1	0.0	0.0	97.98
102.3	273.0	3.431	0.780	8.53	18.31	0.570	922.5	0.0	0.0	97.98
110.0	279.8	3.332	0.784	9.00	18.31	0.573	923.1	0.0	0.0	97.98
120.3	287.1	3.195	0.790	9.60	18.31	0.576	924.1	0.0	0.0	97.98
127.7	291.4	3.094	0.795	10.00	18.31	0.578	924.9	0.0	0.0	97.98
138.3	296.3	2.945	0.801	10.54	18.31	0.579	926.3	0.0	0.0	97.98
148.2	300.0	2.800	0.808	11.00	18.31	0.578	927.9	0.0	0.0	97.98
160.3	303.5	2.613	0.817	11.51	18.31	0.575	930.1	0.0	0.0	97.98
173.1	303.3	2.427	0.818	12.00	18.31	0.566	932.9	0.0	0.0	97.98

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TABLE 6.2.1.3-10

DOUBLE-ENDED PUMP SUCTION BREAK
PRINCIPAL PARAMETERS DURING REFLOOD
(Maximum SI)

Time (seconds)	Flooding Temp (°F)	Flooding Rate (in/sec)	Carryover Fraction	Core Height (ft)	Downcomer Height (ft)	Flow Fraction	Injection (lbm/sec) Total	Injection (lbm/sec) Accumulator	Spill	Enthalpy (Btu/lbm)
25.2	196.5	0.000	0.000	0.00	0.00	0.250	0.0	0.0	0.0	0.0
25.9	192.4	26.017	0.000	0.60	2.29	0.000	11135.7	11135.7	0.0	89.5
26.1	189.7	31.875	0.000	1.08	2.37	0.000	11067.7	11067.7	0.0	89.5
26.9	187.8	3.653	0.307	1.50	5.59	0.324	10760.5	10760.5	0.0	89.5
27.8	187.5	3.423	0.456	1.67	9.88	0.360	10483.6	10483.6	0.0	89.5
30.0	186.9	7.415	0.630	2.00	18.29	0.654	8989.9	8989.9	0.0	89.5
30.3	186.7	7.529	0.649	2.07	18.31	0.646	8792.9	8792.9	0.0	89.5
31.3	186.1	7.102	0.686	2.27	18.31	0.644	8545.2	8545.2	0.0	89.5
32.7	185.7	6.719	0.712	2.51	18.31	0.645	8282.1	8282.1	0.0	89.5
33.3	185.6	7.250	0.720	2.60	18.31	0.658	9299.3	7905.3	0.0	90.77
35.8	185.6	6.880	0.734	3.01	18.31	0.656	8869.0	7468.3	0.0	90.84
39.3	186.6	6.534	0.744	3.51	18.31	0.654	8436.8	7016.4	0.0	90.93
43.0	188.5	6.257	0.749	4.01	18.31	0.651	8046.5	6608.5	0.0	91.02
47.3	191.3	3.990	0.752	4.56	18.31	0.489	2673.6	1218.7	0.0	94.11
48.3	192.0	3.558	0.745	4.64	18.31	0.509	1570.7	0.0	0.0	97.98
53.4	196.7	3.198	0.743	5.00	18.31	0.473	1582.2	0.0	0.0	97.98
61.3	205.9	2.814	0.741	5.50	18.31	0.424	1592.1	0.0	0.0	97.98
69.6	216.9	2.752	0.744	6.00	18.31	0.425	1592.0	0.0	0.0	97.98
78.3	229.2	2.687	0.748	6.50	18.31	0.427	1592.0	0.0	0.0	97.98
87.4	242.0	2.617	0.753	7.00	18.31	0.428	1591.9	0.0	0.0	97.98
98.3	255.3	2.535	0.759	7.58	18.31	0.430	1591.8	0.0	0.0	97.98
106.9	263.9	2.472	0.764	8.00	18.31	0.432	1591.7	0.0	0.0	97.98
118.3	273.4	2.391	0.771	8.54	18.31	0.435	1591.6	0.0	0.0	97.98
128.7	280.4	2.320	0.777	9.00	18.31	0.437	1591.5	0.0	0.0	97.98
142.3	287.8	2.231	0.786	9.57	18.31	0.441	1591.3	0.0	0.0	97.98
153.6	292.8	2.160	0.794	10.00	18.31	0.444	1591.2	0.0	0.0	97.98
168.3	298.0	2.069	0.807	10.52	18.31	0.449	1591.1	0.0	0.0	97.98
183.8	302.4	1.973	0.824	11.00	18.31	0.454	1590.9	0.0	0.0	97.98
202.3	303.3	1.902	0.829	11.50	18.31	0.459	1590.9	0.0	0.0	97.98
220.0	301.7	1.865	0.818	12.00	18.31	0.463	1590.9	0.0	0.0	97.98

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TABLE 6.2.1.3-13

DOUBLE-ENDED PUMP SUCTION BREAK MASS BALANCE (Minimum SI)

	Time (seconds)	0.00	25.20	25.20	173.10	639.95	1613.06	3600.0
					Mass (Thousand lbm)			
Initial Mass	In RCS and Accumulator	933.50	933.50	933.50	933.50	933.50	933.50	933.50
Added Mass	Pumped Injection	0.00	.00	.00	128.39	570.47	1442.38	2753.95
	Total Added	0.00	.00	.00	128.39	570.47	1442.38	2753.95
*** Total Available ***		933.50	933.50	933.50	1061.89	1503.98	2375.89	3687.45
Distribution	Reactor Coolant	625.85	54.54	59.94	129.38	129.38	129.38	129.38
	Accumulator	307.65	256.21	250.81	0.00	0.00	0.00	0.00
	Total Contents	933.50	310.75	310.75	129.38	129.38	129.38	129.38
Effluent	Break Flow	0.00	622.73	622.73	841.65	1283.74	2162.39	3467.20
	ECCS Spill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Effluent	0.00	622.73	622.73	841.65	1283.74	2162.39	3467.20
*** Total Available ***		933.50	933.48	933.48	971.04	1413.12	2291.78	3596.58

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TABLE 6.2.1.3-14

DOUBLE-ENDED PUMP SUCTION BREAK MASS BALANCE (Maximum SI)

	Time (seconds)	0.00	25.20	25.20	220.0	1045.66	1754.45	3600.0
					Mass (Thousand lbm)			
Initial Mass	In RCS and Accumulator	933.50	933.50	933.50	933.50	933.50	933.50	933.50
Added Mass	Pumped Injection	0.00	0.00	0.00	295.06	1615.78	2785.14	5829.93
	Total Added	0.00	0.00	0.00	295.06	1615.78	2785.14	5829.93
*** Total Available ***		933.50	933.50	933.50	1228.57	2549.28	3718.64	6763.43
Distribution	Reactor Coolant	625.85	54.54	59.94	131.30	131.30	131.309	131.30
	Accumulator	307.65	256.21	250.81	0.00	0.00	0.00	0.00
	Total Contents	933.50	310.75	310.75	131.30	131.30	131.30	131.30
Effluent	Break Flow	0.00	622.73	622.73	1006.42	2327.13	3496.62	6541.41
	ECCS Spill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Effluent	0.00	622.73	622.73	1006.42	2327.13	3496.62	6541.41
*** Total Available ***		933.50	933.48	933.48	1137.71	2458.43	3627.92	6672.71

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TABLE 6.2.1.3-15

DOUBLE-ENDED HOT LEG BREAK MASS BALANCE

	Time (seconds)	0.00	24.8	24.8
		Mass (Thousand lbm)		
Initial Mass	In RCS and Accumulator	933.50	933.50	933.50
Added Mass	Pumped Injection	0.00	0.00	0.00
	Total Added	0.00	0.00	0.00
*** Total Available ***		933.50	933.50	933.50
Distribution	Reactor Coolant	625.85	90.85	96.82
	Accumulator	307.65	232.24	226.28
	Total Contents	933.50	323.10	323.10
Effluent	Break Flow	0.00	610.39	610.39
	ECCS Spill	0.00	0.00	0.00
	Total Effluent	0.00	610.39	610.39
*** Total Available ***		933.50	933.490	933.49

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TABLE 6.2.1.3-16

DOUBLE-ENDED PUMP SUCTION BREAK ENERGY BALANCE (Minimum SI)

	Time (seconds)	0.00	25.20	25.20	173.10	639.95	1613.06	3600.0
					Energy (Million Btu)			
Initial Energy	In RCS, Accumulator, SG	1219.15	1219.15	1219.15	1219.15	1219.15	1219.15	1219.15
Added Energy	Pumped Injection	0.00	0.00	0.00	12.58	55.90	157.19	467.55
	Decay Heat	0.00	8.68	8.68	28.58	75.85	153.68	279.01
	Heat From Secondary	0.00	8.76	8.76	8.76	20.06	26.30	26.30
	Total Added	0.00	17.44	17.44	49.92	151.80	337.18	772.86
*** Total Available ***		1219.15	1236.58	1236.58	1269.06	1370.95	1556.32	1992.01
Distribution	Reactor Coolant	375.72	12.28	12.76	36.52	36.52	36.52	36.52
	Accumulator	27.53	22.93	22.45	0.00	0.00	0.00	0.00
	Core Stored	31.45	15.37	15.37	5.87	5.36	4.87	3.88
	Primary Metal	204.93	194.62	194.62	173.42	125.06	93.04	72.25
	Secondary Metal	161.72	158.13	158.13	143.93	116.37	81.03	62.30
	Steam Generator	417.80	431.42	431.42	386.36	315.58	222.96	174.42
	Total Contents	1219.15	834.75	834.75	746.09	598.90	438.43	349.38
Effluent	Break Flow	0.00	401.15	401.15	512.53	761.61	1128.39	1657.23
	ECCS Spill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Effluent	0.00	401.15	401.15	512.53	761.61	1128.39	1657.23
*** Total Available ***		1219.15	1235.90	1235.90	1258.63	1360.51	1566.82	2006.61

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TABLE 6.2.1.3-17

DOUBLE-ENDED PUMP SUCTION BREAK ENERGY BALANCE (Maximum SI)

	Time (seconds)	0.00	25.20	25.20	220.0	1045.66	1754.45	3600.0
		Energy (Million Btu)						
Initial Energy	In RCS, Accumulator, SG	1219.15	1219.15	1219.15	1219.15	1219.15	1219.15	1219.15
Added Energy	Pumped Injection	0.00	0.00	0.00	28.91	168.94	448.41	1176.12
	Decay Heat	0.00	8.68	8.68	33.95	110.45	163.70	278.94
	Heat From Secondary	0.00	8.76	8.76	8.76	26.30	26.30	26.30
	Total Added	0.00	17.44	17.44	71.62	305.70	638.42	1481.37
*** Total Available ***		1219.15		1236.58	1236.58	1524.84	1857.56	2700.51
Distribution	Reactor Coolant	375.72	12.76	12.76	36.86	36.86	36.86	36.86
	Accumulator	27.53	22.45	22.45	0.00	0.00	0.00	0.00
	Core Stored	31.45	15.37	15.37	5.87	5.06	4.73	3.88
	Primary Metal	204.93	194.62	194.62	170.66	112.47	89.68	72.84
	Secondary Metal	161.72	158.13	158.13	145.46	103.22	77.94	63.04
	Steam Generator	417.80	431.42	431.42	390.48	283.11	214.76	176.32
	Total Contents	1219.15	834.75	834.75	749.32	540.71	423.98	352.95
Effluent	Break Flow	0.00	401.15	401.15	530.99	973.67	1416.40	2332.44
	ECCS Spill	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Effluent	0.00	401.15	401.15	530.99	973.67	1416.4	2332.44
*** Total Available ***		1219.15	1235.90	1235.90	1280.31	1514.39	1840.38	2685.39

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TABLE 6.2.1.3-18

DOUBLE-ENDED HOT LEG BREAK ENERGY BALANCE

	Time (seconds)	0.00	24.84	24.84
		Energy (Million Btu)		
Initial Energy	In RCS, Accumulator, SG	1219.15	1219.15	1219.15
Added Energy	Pumped Injection	0.00	0.00	0.00
	Decay Heat	0.00	9.19	9.19
	Heat From Secondary	0.00	-13.31	-13.31
	Total Added	0.00	-4.12	-4.12
	*** Total Available ***	1219.15	1215.03	1215.03
Distribution	Reactor Coolant	375.72	19.01	19.54
	Accumulator	27.53	20.79	20.25
	Core Stored	31.45	13.70	13.70
	Primary Metal	204.93	192.02	192.02
	Secondary Metal	161.72	156.81	156.81
	Steam Generator	417.80	401.73	401.73
	Total Contents	1219.15	804.06	804.06
Effluent	Break Flow	0.00	410.27	410.27
	ECCS Spill	0.00	0.00	0.00
	Total Effluent	0.00	410.27	410.27
	*** Total Available ***	1219.15	1214.33	1214.33

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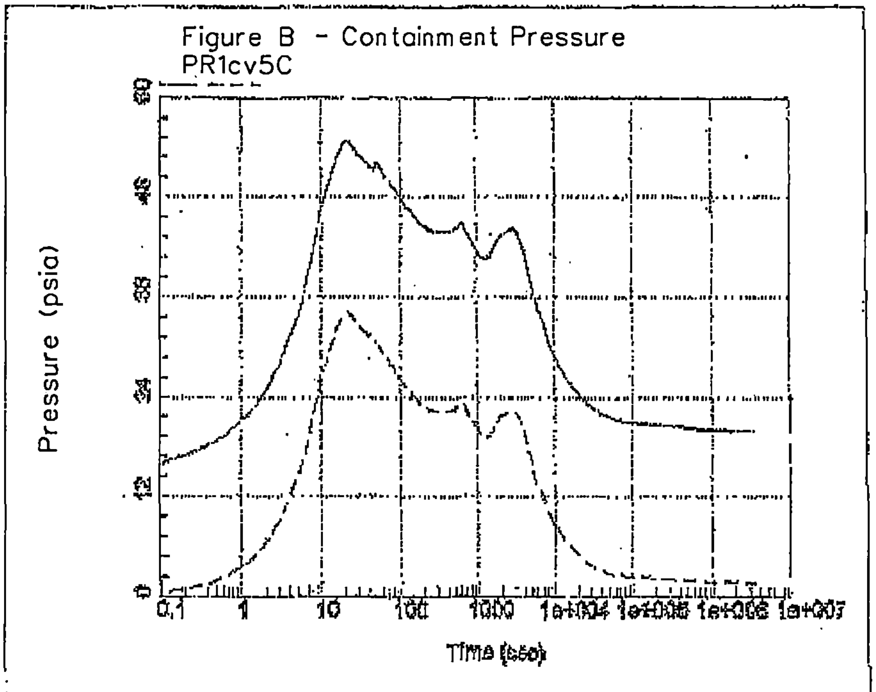
Figure 6.2.1.1-30
DEHL - Minimum SI, Minimum CHRS
Containment Pressure



PR1	Containment Pressure
cv5C	Containment Steam (Vapor) Pressure

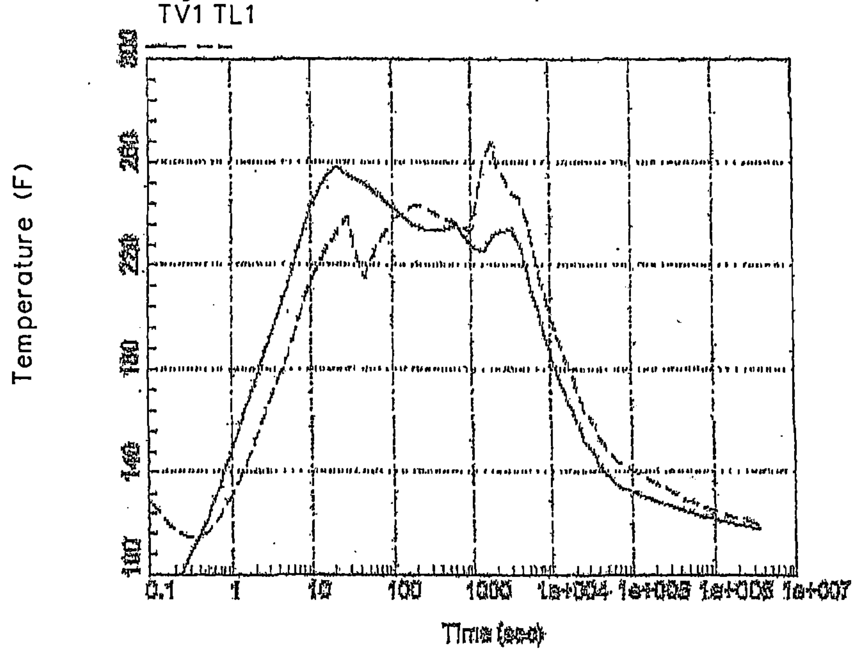
SOUTH TEXAS PROJECT
UNITS 1 & 2

CONTAINMENT PRESSURE
LOCA - DEHL
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-30 REVISION 18

UFSARFIG6.2.1.1-30.DGN
UFSARFIG6.2.1.1-30.CIT

Figure 6.2.1.1-31
DEHL - Minimum SI, Minimum CHRS
Containment Temperature



TV1	Containment Vapor Temperature
TL1	Containment Liquid (Sump) Temperature

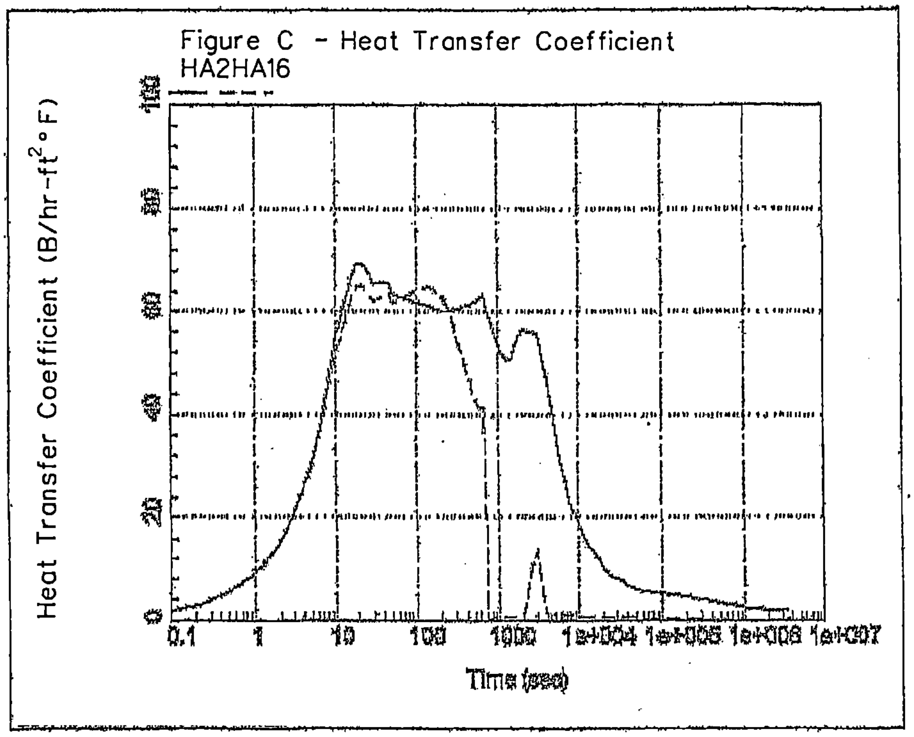
SOUTH TEXAS PROJECT
UNITS 1 & 2

CONTAINMENT TEMPERATURES
LOCA - DEHL
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-31 REVISION 18

UFSARFIG6.2.1.1-31.DGN
UFSARFIG6.2.1.1-31.CIT

Figure 6.2.1.1-32
DEHL - Minimum SI, Minimum CHRS
Containment Heat Transfer Coefficient



HA2	Inside Containment Wall
HA16	Stainless Steel Componentst

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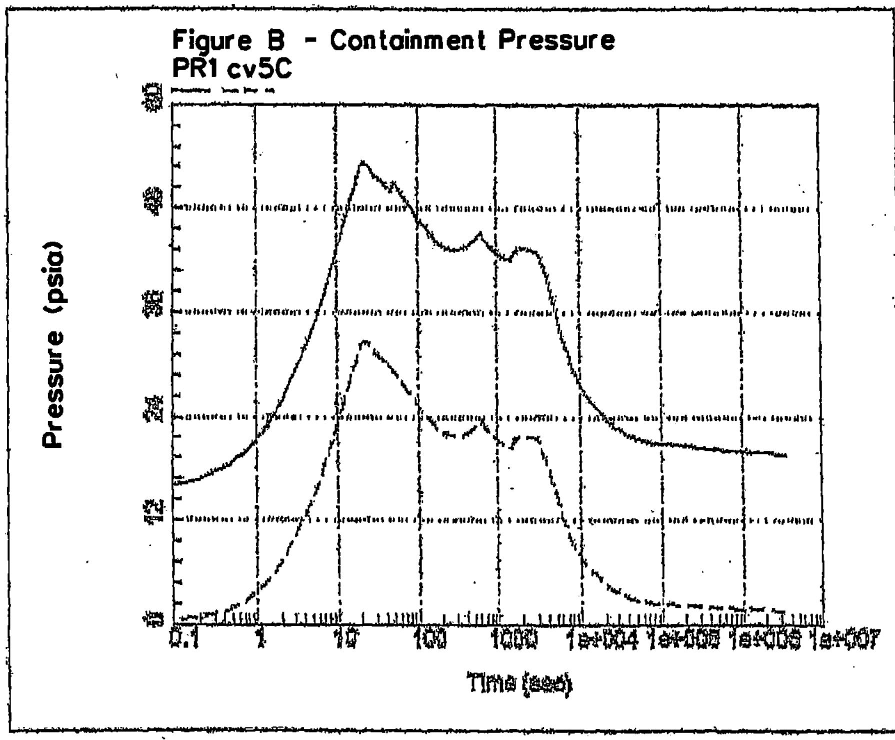
UNITS 1 & 2

HEAT TRANSFER COEFFICIENT
LOCA - DEHL
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-32 REVISION 18

UFSARFIG6.2.1.1-32.DGN
UFSARFIG6.2.1.1-32.CIT

Figure 6.2.1.1-33
DEPS - Minimum SI, Minimum CHRS
Containment Pressure



PR1	Containment Pressure
cv5C	Containment Steam (Vapor) Pressure

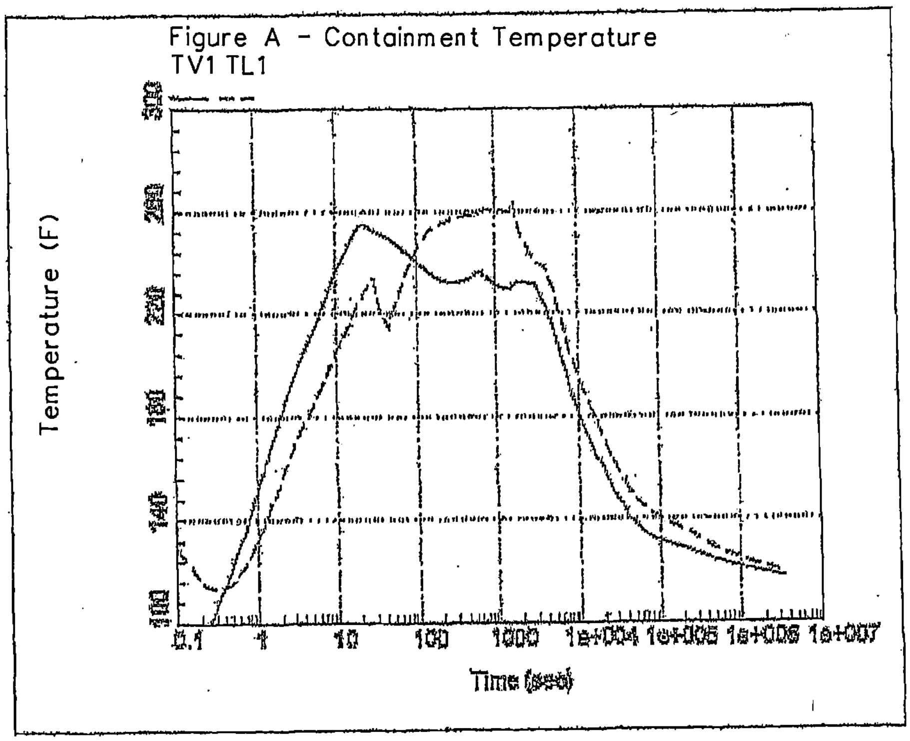
SOUTH TEXAS PROJECT
UNITS 1 & 2

CONTAINMENT PRESSURE
LOCA - DEPSG
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-33 REVISION 18

UFSARFIG6.2.1.1-33.DGN
UFSARFIG6.2.1.1-33.CIT

Figure 6.2.1.1-34
DEPS - Minimum SI, Minimum CHRS
Containment Temperature



TV1	Containment Vapor Temperature
TL1	Containment Liquid (Sump) Temperature

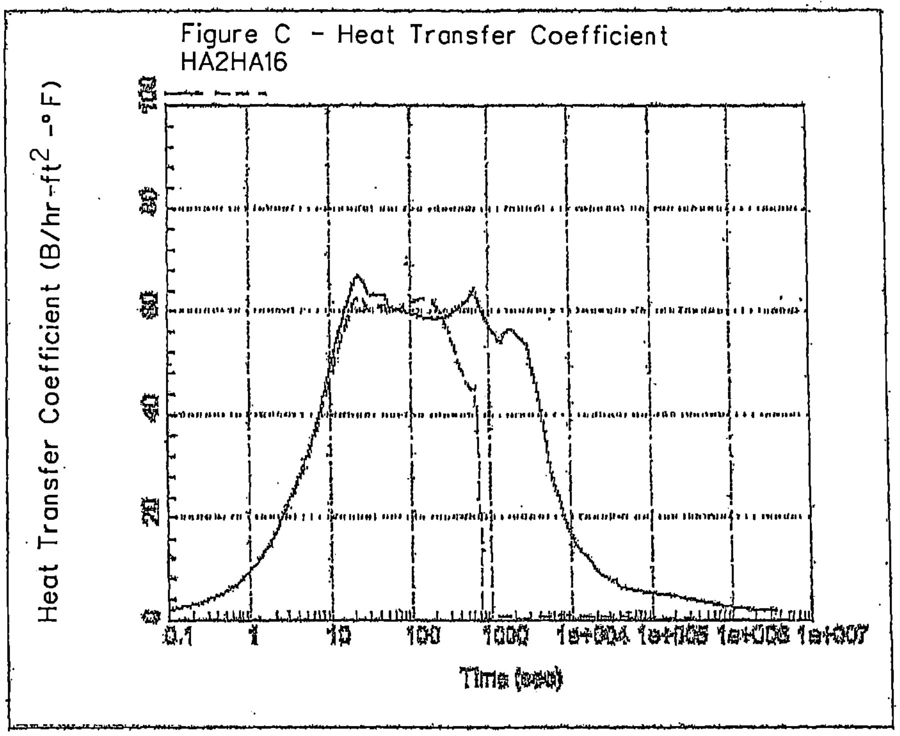
SOUTH TEXAS PROJECT
UNITS 1 & 2

CONTAINMENT TEMPERATURES
LOCA - DEPSG
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-34 REVISION 18

UFSARFIG6.2.1.1-34.DGN
UFSARFIG6.2.1.1-34.CIT

Figure 6.2.1.1-35
DEPS - Minimum SI, Minimum CHRS
Containment Heat Transfer Coefficient



HA2	Inside Containment Wall
HA16	Stainless Steel Components

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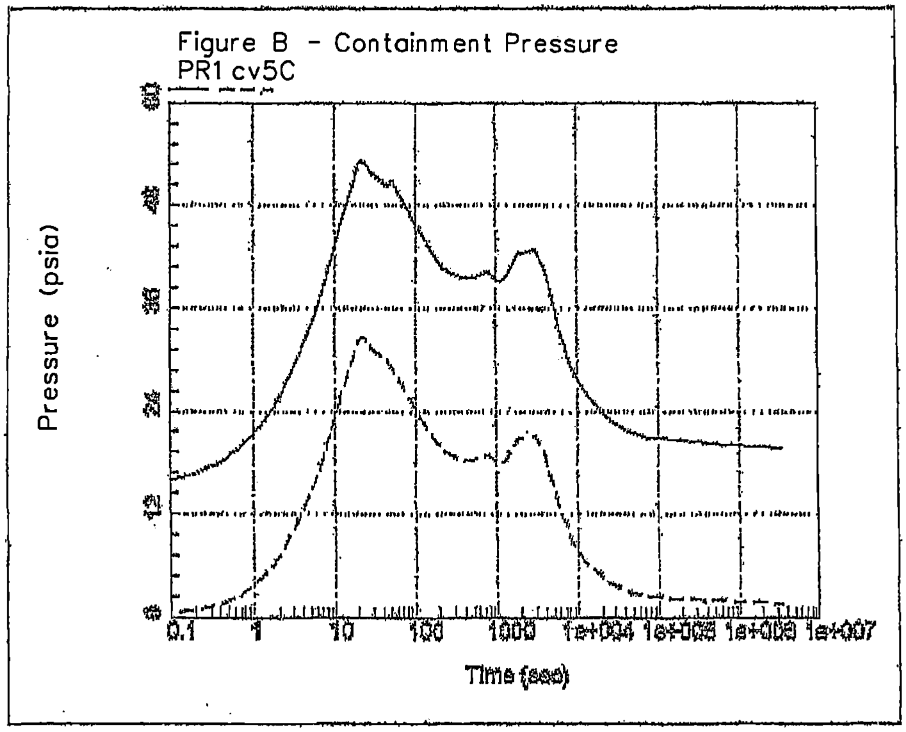
HEAT TRANSFER COEFFICIENT
LOCA - DEPSG
MINIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-35 REVISION 18

Figure 6.2.1.1-36
DEPS - Maximum SI, Minimum CHRS
Containment Pressure



PR1	Containment Pressure
cv5C	Containment Steam (Vapor) Pressure

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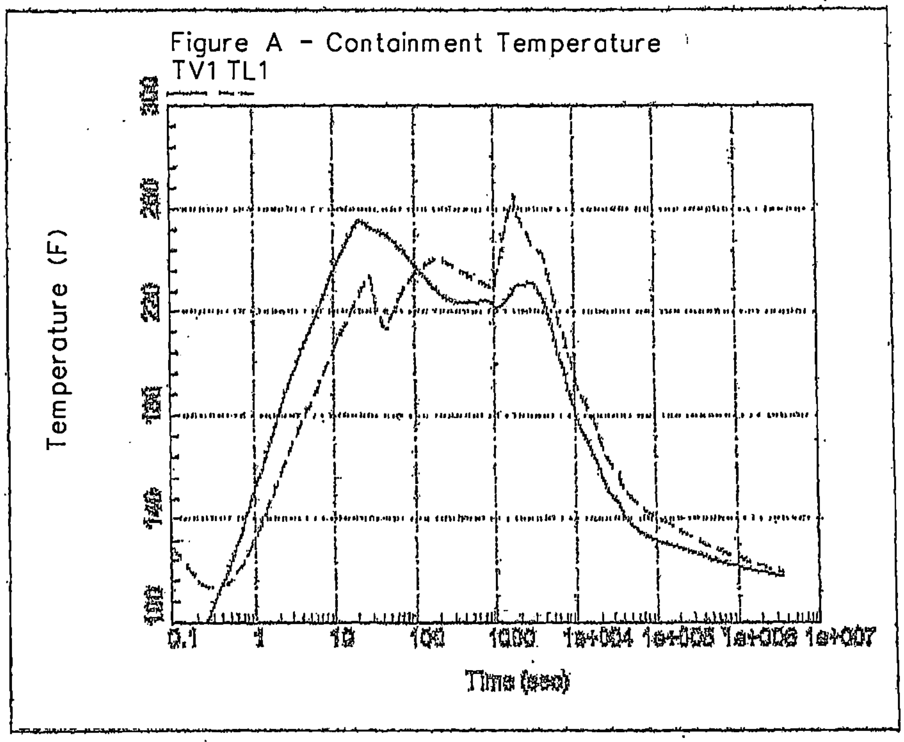
CONTAINMENT PRESSURE
LOCA - DEPSG
MAXIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-36 REVISION 18

UFSARFIG6.2.1.1-36.DGN
UFSARFIG6.2.1.1-36.CIT

Figure 6.2.1.1-37
DEPS - Maximum SI, Minimum CHRS
Containment Temperature



TV1	Containment Vapor Temperature
TL1	Containment Liquid (Sump) Temperature

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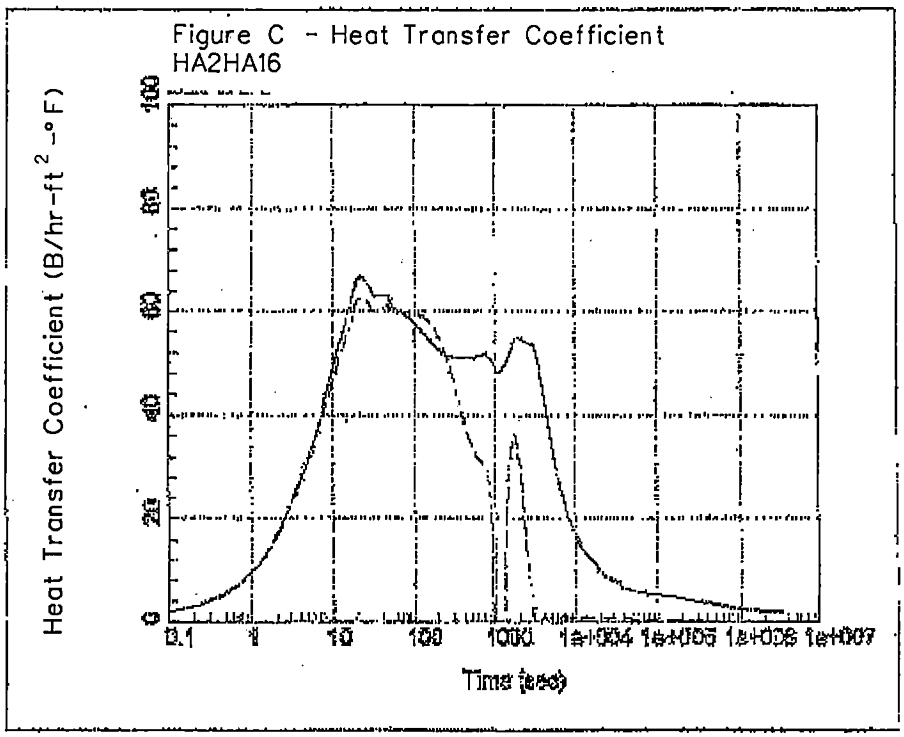
CONTAINMENT TEMPERATURES
LOCA - DEPSG
MAXIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-37 REVISION 18

UFSARFIG6.2.1.1-37.DGN
UFSARFIG6.2.1.1-37.CIT

Figure 6.2.1.1-38
DEPS - Maximum SI, Minimum CHRS
Containment Heat Transfer Coefficient



HA2	Inside Containment Wall
HA16	Stainless Steel Components

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HEAT TRANFER COEFFICIENT
LOCA - DEPSG
MAXIMUM SI, MINIMUM CHRS

FIGURE 6.2.1.1-38 REVISION 18

UFSARFIG6.2.1.1-38.DGN
UFSARFIG6.2.1.1-38.CIT