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49	49-4 through 49-6	720.056
49	49-9 through 49-49	720.056
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55	55-7	DSER OI 19A.2-4 (R1) DSER OI 19A.2-5 (R1) DSER OI 19A.2-6 (R1)
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1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number. RAI number in parenthesis contains a reference to RAI response listed above.

REVISION 2 CHANGE ROADMAP

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1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number.

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1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number.

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59	59-100	DSER OI 19.1.10.3-1 (R1)

1. Changes incorporated as a result of Draft Safety Evaluation Report (DSER) Open Item (OI) Response identified by DSER OI number.

CHAPTER 34

SEVERE ACCIDENT PHENOMENA TREATMENT

34.1 Introduction

This chapter describes how the AP1000 containment addresses challenges from severe accident phenomena, and how the challenges are evaluated in the probabilistic risk assessment (PRA). In the PRA, the Modular Accident Analysis Program (MAAP) version 4.04 code (Reference 34-8) is used to evaluate severe accident scenarios. Severe accident phenomenological uncertainties are treated with Risk-Oriented Accident Analysis Methodology (ROAMM) (Reference 34-2) phenomenological evaluations, with AP1000-specific decomposition event tree phenomenological evaluations or with assumptions that certain low-frequency severe accident phenomena fail the containment. The objective of these studies is to show, with a high degree of confidence, that the AP1000 containment will accommodate the effects of severe accidents in a range of scenarios for at least the first 24 hours after the onset of core damage. Such evaluations demonstrate the robustness of the containment design.

34.2 Treatment of Physical Processes

The following eight issues are identified in Reference 34-1 as being representative of the phenomenological issues pertaining to severe accident conditions.

1. Loss-of-coolant accident (LOCA)
2. Fuel-coolant interaction (steam explosion)
3. Hydrogen combustion and detonation
4. Melt attack on concrete structure or containment pressure boundary
5. High-pressure melt ejection
6. Core-concrete interaction (CCI)
7. Containment pressurization from decay heat
8. Elevated temperature (equipment survivability)

The challenge to the containment integrity from a LOCA blowdown is covered in the containment design basis and is not specifically addressed here. Treatment of physical processes affecting the remaining challenges is discussed in this chapter. For the AP1000 design, issues 4 and 6 above arise primarily from the same physical processes: ex-vessel debris coolability. Therefore, they are discussed together within that subject in Section 34.2.5.

Phenomenological analyses and event trees are developed for key severe accident phenomena to provide a systematic and logical method to investigate the uncertainties in the phenomena.

34.2.1 In-Vessel Retention of Molten Core Debris

In-vessel retention (IVR) of core debris by external reactor vessel cooling is a severe accident mitigation attribute of the AP1000 design; it is discussed in detail in Chapter 39. With the reactor vessel intact and debris retained in the lower head, phenomena such as molten

core-concrete interaction and ex-vessel steam explosion, which occur as a result of core debris relocation to the reactor cavity, are prevented.

The AP1000 reactor vessel insulation and containment geometry promote in-vessel retention. Engineered design features of the AP1000 containment flood the containment reactor cavity region during accidents, and thereby, submerge the reactor vessel in water. Liquid effluent released through the break during a LOCA event is directed to the reactor cavity. The AP1000 functional restoration guidelines include a provision for draining the in-containment refueling water storage tank (IRWST) water into the reactor cavity through an operator action action if automatic draining fails. Therefore, in an accident the reactor pressure vessel is most likely submerged in water.

Chapter 39 presents an AP1000-specific evaluation to determine the likelihood that sufficient heat can be removed from the outside surface of the submerged reactor pressure vessel lower head to prevent reactor vessel failure and relocation of debris to containment. The methodology used to quantify the margin to vessel failure in Reference 34-2 for the AP600 was adapted to the AP1000. For the AP1000 the methodology assumes that:

- The RCS is depressurized.
- The reactor vessel is submerged above the 98-ft elevation in the containment.
- The reflective insulation promotes the two-phase natural circulation in the reactor vessel cooling annulus.
- The external surface treatment promotes wetability of the reactor vessel.

The containment event tree includes a node to ascertain that the reactor coolant system (RCS) is depressurized and a node to determine if adequate water is available in the cavity to achieve two-phase natural circulation. Success at both of these nodes is required to demonstrate that the conditions and assumptions of the IVR analysis presented in Chapter 39 are met. The AP1000 design specifies that the reactor vessel insulation is designed appropriately and that the outer surface of the reactor vessel promotes wetability.

Accounting for the uncertainties in thermal-hydraulic parameters, the heat fluxes to the vessel wall and reactor vessel internals from the debris pool are calculated. These heat fluxes are compared to the critical heat flux limit for the downward-facing curved surface. Vessel failure is assumed if the critical heat flux is exceeded. The results show large margin to failure for the reactor vessel if it is externally cooled by water. Therefore, reactor vessel integrity is assured at node VF in the containment event tree analysis if the reactor coolant system is depressurized and the cavity adequately flooded.

34.2.2 Fuel-Coolant Interaction (Steam Explosions)

A steam explosion may occur as a result of molten metal or oxide core debris mixing with water and interacting thermally. Steam is created at a very high rate, producing a sonic pressure front and dynamic loading on local structures. Steam explosions are postulated to occur inside the reactor vessel when debris relocates from the core region into the lower

plenum and in the reactor cavity if the vessel fails and debris is ejected from it into water in the reactor cavity.

34.2.2.1 In-Vessel Fuel-Coolant Interaction

In-vessel steam explosions were studied extensively in the AP600 analyses. A ROAAM analysis of the AP600 reactor vessel lower head integrity under in-vessel steam explosion loading is presented in Reference 34-3. The analysis focused on failure of the lower head since that steam explosion vessel failure mode would impair the in-vessel retention capability of the reactor vessel. The ROAAM analysis concludes that lower-head vessel failure from in-vessel steam explosion is physically unreasonable with very large margin to failure.

Based on the in-vessel core relocation scenario for the AP1000, the in-vessel steam explosion ROAAM analysis presented for the AP600 can be extended to the AP1000. Molten debris relocation from the upper core region to the lower plenum is expected to occur as a result of a sidewall failure of the core shroud and core barrel. Downward relocation is not considered to be a reasonable relocation mode due to the large heat sink below the active fuel region formed by the fuel rod lower plenum zircaloy plugs, the bottom nozzles of the fuel assemblies and the lower core support plate. The sideward failure allows a limited mass of molten debris to initially relocate to the lower plenum. The mass flow rate, superheat and composition of debris in the relocation from the upper core region to the lower head is expected to be essentially the same as the AP600. The geometry of the lower head of the AP1000 is the same as the AP600. Therefore, it is reasonable to extend the results of the AP600 in-vessel steam explosion ROAAM analysis to the AP1000.

The results of the in-vessel steam explosion ROAAM can also be extended to containment failure induced by in-vessel steam explosions (α-mode containment failure). The sideward failure mode does not initially relocate sufficient debris to the lower head. The in-vessel fuel-coolant interaction cannot generate sufficient energy, in a short time scale, to produce a missile that could fail the AP1000 containment. The likelihood for vessel failure and subsequent containment failure due to in-vessel steam explosion is so small as to be negligible. This conclusion is in agreement with the conclusions of the U.S. Nuclear Regulatory Commission (NRC)-sponsored Steam Explosion Review Group (Reference 34-4).

34.2.2.2 Ex-Vessel Fuel-Coolant Interaction

The first level of defense for ex-vessel steam explosion is the in-vessel retention of the molten core debris. If molten debris does not relocate from the vessel to the containment, there are no conditions for ex-vessel steam explosion. In the event that the reactor cavity is not flooded and the vessel fails, the PRA containment event tree assumes that the containment fails in the early time frame.

An analysis of the structural response of the reactor cavity was performed for the AP600 (Reference 34-5, Appendix B). As in the in-vessel steam explosion analysis, the results of this AP600 ex-vessel steam explosion analysis are extended to the AP1000. The vessel failure modes for AP600 and AP1000 are the same. The initial debris mass, superheat and composition are assumed to be the same as the AP600. The mass assumption is conservative since the AP1000 vessel lower head is closer to the cavity floor resulting in less debris mass

participating in the interaction. The reactor cavity geometry and water depth prior to vessel failure are the same as AP600. Therefore, the results of the AP600 ex-vessel steam explosion analysis are considered to be appropriate for the AP1000.

34.2.3 Hydrogen Combustion and Detonation

A decomposition event tree analysis discussed in Chapter 41 evaluates the potential for hydrogen combustion threatening the containment integrity during a severe accident sequence in the AP1000. The analysis examines diffusion flame burning and local detonation occurring during in-vessel hydrogen generation prior to hydrogen mixing in the containment and global deflagration and detonation, which may occur later when the hydrogen is mixed throughout the containment. Only in-vessel hydrogen generation is considered, since vessel failure and ex-vessel debris relocation is assumed to fail containment.

If the igniters are operational, the potential for diffusion-flame-induced containment failures is considered during the hydrogen generation and release from the reactor coolant system (RCS). Diffusion flames may be formed when high-concentration, nonflammable hydrogen plumes encounter oxygen and burn as a standing flame. Flames that have a large view factor or that impinge on the containment pressure boundary may fail the containment pressure boundary due to the locally high temperatures. The pathways that in-vessel hydrogen can take to containment are reviewed for potential impact on containment integrity. Locations where diffusion flames may be postulated are examined for potential failure of the containment due to creep of the containment shell at high temperature.

The AP1000 provides defense-in-depth to address hydrogen diffusion flames that may challenge containment integrity. The first level of defense is the stage four automatic depressurization system (ADS Stage 4) lines from the RCS, which prevent significant hydrogen releases to the in-containment refueling water storage tank (IRWST) and Passive Core Cooling System (PXS) compartments. The ADS Stage 4 lines provide a path of least resistance to release hydrogen generated in-vessel to the containment. ADS Stage 4 vents from the RCS hot legs to the loop compartments, which are shielded from the containment shell and have a constant source of oxygen from the natural circulation in the containment. Hydrogen can burn as a diffusion flame in the loop compartments without threatening the containment integrity. If ADS Stage 4 fails, the AP1000 has provided design considerations in the IRWST vents to mitigate diffusion flames near the containment walls. Vents from the passive injection system compartments and chemical volume and control system compartment are located away from the containment shell and penetrations in order to mitigate the threat from hydrogen diffusion flames.

Containment failure from a directly initiated detonation wave is not considered to be a credible event for the AP1000 containment. There are no ignition sources of sufficient energy to directly initiate a detonation in the AP1000 containment. Deflagration to detonation transition (DDT) is considered to be the only likely mechanism to produce a detonation in the AP1000 containment.

The likelihood of DDT in the AP1000 containment is evaluated locally in confined compartments during in-vessel hydrogen generation and globally after in-vessel generation is concluded and hydrogen is mixed in the containment. For a DDT to occur, the combination of

the gas mixture sensitivity to detonation and the geometric configuration potential for flame acceleration must be conducive to DDT. Since the hydrogen concentration necessary to form a detonable mixture depends on the size of the enclosure, concentration requirements for DDT in different regions of the AP1000 containment are extrapolated from the FLAME facility data (Reference 34-6) using scaling arguments based on the detonation cell width. The geometric requirement is evaluated considering aspects such as the degree of confinement and the extent and type of obstacles present in the postulated flame propagation path. In all cases, DDT is assumed to result in containment failure in the containment event tree analysis.

Global hydrogen deflagration and the potential for containment failure are modeled on the containment event tree. Adiabatic, isochoric, complete combustion (AICC) is assumed, and peak pressure probability distributions are developed for the accident scenarios. The probability of containment failure due to hydrogen deflagration is evaluated from the containment failure probability distribution combined with the peak pressure probability distribution.

34.2.4 High-Pressure Melt Ejection

The AP1000 incorporates design features that prevent high-pressure core melt. These features include the passive residual heat removal (PRHR) system and the ADS. These design features provide primary system heat removal and depressurization to prevent high pressure core damage conditions. The consequences from postulated high pressure melt ejection (HPME) are mitigated by the containment layout which provides a torturous pathway to the upper compartment and no direct pathway for the impingement of debris on the containment shell.

In high-pressure core damage sequences (i.e., non-LOCA or very small LOCA events with the ADS and PRHR inoperable), the potential exists for creep-rupture-induced failures of the RCS piping at the hot-leg nozzles, the surge line, the steam generator tubes and, given debris relocation to the lower plenum, in the reactor vessel lower head. Failure of the hot-leg nozzle or surge line prior to failures of other components results in the rapid depressurization of the RCS. Failure of the steam generator tubes results in a containment bypass and a large release of fission products to the environment. Failure of the lower head of the reactor vessel results in the potential for HPME.

The AP1000 RCS loops have canned-motor pumps mounted to the steam generator outlet plenum. The coolant loops do not have water-trap loop seals as in conventional plant designs. A large natural-circulation flow heats the reactor coolant loop components in a relatively uniform manner. Hot-leg nozzle failure is expected prior to steam generator tube failure, but because of large uncertainties, hot-leg nozzle creep rupture failure is not credited with preventing steam generator tube failure. In the PRA, steam generator tube failure is assumed for high-pressure sequences in the containment event tree analysis unless operator action to depressurize the RCS with the ADS is successful.

34.2.5 Core Debris Coolability

In accident sequences where the reactor pressure vessel failure is not prevented, core debris may be discharged into the reactor cavity. The likely vessel failure modes produce a low

pressure melt ejection (LPME) to the containment. The AP1000 cavity design provides area for the core debris to spread. Condensate from the passive containment cooling system (PCS) returns to the reactor cavity, thereby providing a long-term supply of water to cool the core debris.

To accommodate the requirements for in-vessel retention of core debris, the AP1000 provides highly reliable RCS depressurization and cavity flooding capability. At vessel failure it is very likely that the cavity will be filled with water from the RCS, core makeup tanks (CMTs), and accumulators to at least the 83-ft elevation. There are significant uncertainties associated with debris spreading into a water-filled cavity. Debris-spreading is mainly a function of the highly uncertain vessel failure mode. A large-scale lower head failure releasing debris at a high rate would enhance spreading, while a localized failure mode would release debris at a slow rate, which would most likely cause the debris to pile up under the reactor vessel and minimize spreading.

Given the uncertainties in the debris-spreading and in non-condensable gas generation and combustion, the containment event tree analysis does not credit containment integrity in the event of failure of the lower head of the vessel and relocation of the core.

A limited set of deterministic analyses of debris spreading and core-concrete interaction in the AP1000 cavity is presented in Appendix B. The analyses show that basemat melt-through is not predicted to occur within 24 hours of the accident initiation. Basemat melt through is predicted to occur before pressurization of the containment by non-condensable gases challenges the containment integrity.

34.2.6 Containment Pressurization from Decay Heat

The AP1000 containment is cooled via the PCS (see Chapter 40). Evaporative water cooling of the containment shell provides long-term containment cooling and limits the containment pressure to less than the design pressure for all severe accident events except hydrogen combustion, which is addressed separately. Containment water is provided to the top of the containment via redundant, diverse system of valves and lines, including a line that can be connected to an outside water source such as a fire truck.

In the unlikely event that water cannot be supplied to the top of the containment shell for an extended period of time, air-only cooling by air flowing through the PCS annulus provides significant cooling to the containment. Under the right environmental conditions, the containment is expected to reach an equilibrium pressure that will not challenge containment integrity. However, under nominal-to-conservative environmental conditions, containment integrity by air-only cooling cannot be assured. In this case, containment failure is predicted to occur more than 24 hours after accident initiation.

A significant amount of time is available for operator action to vent the containment under the severe accident management guidance (SAMG). Containment venting mitigates uncontrolled releases of fission products from a failed containment. The AP1000 can be vented on an ad-hoc basis under the SAMG from a number of containment penetrations. Once venting is concluded, the increased steam concentration in the containment improves the air-only cooling from the PCS such that no further venting is anticipated. Containment

venting also reduces the partial pressure of non-condensable gases in the containment, and thus creates a new containment underpressure failure mode that may occur if containment is cooled after venting.

34.2.7 Elevated Temperature (Equipment Survivability)

Reference 34-7 states that equipment identified as being useful to mitigate the consequences of severe accidents must be designed to provide reasonable assurance that it will continue to operate in a severe accident environment for the length of time needed to accomplish its function. Also, 10 CFR 50.34(f) requires safety equipment to continue performing its function after being exposed to a containment environment created as a consequence of generating a quantity of hydrogen equivalent to that from 100-percent cladding oxidation. As the AP1000 design uses thermal igniters to burn hydrogen in a controlled manner, it is necessary to demonstrate that the safety equipment can continue to perform its function in the high-temperature environment created by the hydrogen burning.

The functions of the equipment in containment for which credit is taken in the AP1000 PRA were reviewed to determine if the equipment is required to operate in a severe accident environment and beyond design basis limits. The equipment and the basis for operation are the same as the AP600. Therefore, the results of the AP600 are extended to the AP1000 for equipment survivability. In the calculation of the large release frequency (LERF), only the containment pressure boundary is credited to perform beyond its design basis. The performance of the AP1000 containment pressure boundary beyond its design basis is evaluated in Chapter 42. Other equipment is credited in the analysis, but either the containment environmental conditions do not exceed the equipment qualification conditions at the time the function is performed, or the design basis for the equipment is a severe accident environment. The radiation environment for equipment qualification for safety-related equipment in containment is based on the severe accident source term involving significant in-vessel fuel melting described in NUREG-1465. The equipment credited in the LERF calculation is assumed to survive the radiation dose associated with the accidents over the time required to perform its function.

Equipment considered to be useful for post-accident monitoring is presented in Table 34-1.

34.2.8 Summary

The potential for and the consequences of severe accident phenomena are evaluated. The preventive and mitigative features of the AP1000 addressing the severe accident phenomena are discussed. This information is applied to the containment event trees and used in the quantification of the LERF.

34.3 Analysis Method

The analyses of the fission-product source terms for the release categories discussed in Chapter 45 are completed with the MAAP4.04 computer code (Reference 34-8).

The following sections are presented for each of the accident classes for the fission-product source term MAAP4.04 analyses. First, the intact containment (IC) analyses are described,

including any sensitivity analyses completed to define the most conservative system assumptions, then the relevant containment failure analyses are presented.

Table 34-2 provides a summary of the accident classes for the AP1000 Level 1 quantification. Table 34-3 summarizes the Level 2 release categories.

34.4 Severe Accident Analyses

34.4.1 Accident Class 3BE – Intact Containment

34.4.1.1 3BE-1

The sequence description and assumptions are listed below.

- DVI line break in PXS compartment (PXS is flooded through broken DVI line)
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 1/2 CMTs
- 1/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed.

The main events of the case are shown in Table 34-4, while relevant plots are presented in Figures 34-1 through 34-17.

34.4.1.2 3BE-2

The sequence description and assumptions are listed below.

- DVI line break in PXS compartment (PXS is not flooded through broken DVI line)
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 1/2 CMTs
- 1/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines

- 2/2 cavity flooding lines
- Hydrogen igniters operating

The main events of the case are shown in Table 34-5, while relevant plots are presented in Figures 34-18 through 34-34. Note that without flooding of the PXS compartment, RCS reflood does not occur.

34.4.1.3 3BE-4

The sequence description and assumptions are listed below.

- One valve of ADS Stage 4 spuriously opens
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating

The main events of the case are shown in Table 34-6, while relevant plots are presented in Figures 34-35 through 34-51.

34.4.1.4 3BE-5

The sequence description and assumptions are listed below.

- 2-inch hot-leg break to steam generator compartment
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating

The main events of the case are shown in Table 34-7, while relevant plots are presented in Figures 34-52 through 34-68.

34.4.1.5 3BE-6

The sequence description and assumptions are listed below.

- 2-inch hot-leg break to steam generator compartment
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 1/2 cavity flooding lines
- Hydrogen igniters operating

The main events of the case are shown in Table 34-8, while relevant plots are presented in Figures 34-69 through 34-85.

34.4.2 Accident Class 3BE – Failed Containment

34.4.2.1 3BE-7

The sequence description and assumptions are listed below.

- 2-inch hot-leg break to steam generator compartment
- Containment failure at peak of debris quench (vessel failure)
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 0/2 cavity flooding lines
- Hydrogen igniters operating

The main events of the case are shown in Table 34-9, while relevant plots are presented in Figures 34-86 through 34-102.

34.4.2.2 3BE-3

The sequence description and assumptions are listed below.

- DVI line break in PXS compartment (PXS is flooded through broken DVI line)
- Hydrogen burn and containment failure after reflood
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 1/2 CMTs
- 1/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- No hydrogen igniters operating

The main events of the case are shown in Table 34-10, while relevant plots are presented in Figures 34-103 through 34-119.

34.4.3 Accident Class 3BL – Intact Containment

34.4.3.1 3BL-1

The sequence description and assumptions are listed below.

- 2-inch hot-leg break to steam generator compartment
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- Hydrogen igniters operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed. Reflooding the core via the hot leg break is not credited.

The main events of the case are shown in Table 34-11, while relevant plots are presented in Figures 34-120 through 34-136.

34.4.3.2 3BL-2

This case compares the results of changes to system assumptions to the dominant sequence discussed above. The results of this comparison are used to define the system assumptions for subsequent 3BL containment failure analyses.

The sequence description and assumptions are listed below.

- DVI line break in PXS compartment (PXS is not flooded through broken DVI line)
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 1/2 CMTs
- 1/2 accumulators
- 1/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- Hydrogen igniters operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

The main events of the case are shown in Table 34-12, while relevant plots are presented in Figures 34-137 through 34-153.

34.4.4 Accident Class 3BR – Intact Containment

34.4.4.1 3BR-1

The sequence description and assumptions are listed below.

- Double-ended guillotine break (DEGB) in the cold leg to the steam generator compartment
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 0/2 accumulators
- 2/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines
- Hydrogen igniters operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed.

The main events of the case are shown in Table 34-13, while relevant plots are presented in Figures 34-154 through 34-170.

34.4.4.2 3BR-1a

The sequence description and assumptions are listed below.

- Double-ended guillotine break (DEGB) in the cold leg to the steam generator compartment
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 0/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- Hydrogen igniters operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed.

The main events of the case are shown in Table 34-14, while relevant plots are presented in Figures 34-171 through 34-187.

34.4.5 Accident Class 3C – Intact Containment

34.4.5.1 3C-1

The sequence description and assumptions are listed below.

- Large LOCA at belt of vessel into cavity
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines
- Hydrogen igniter operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed.

The main events of the case are shown in Table 34-15, while relevant plots are presented in Figures 34-188 through 34-204.

34.4.6 Accident Class 3C – Failed Containment

34.4.6.1 3C-2

The sequence description and assumptions are listed below.

- Large LOCA at belt of vessel into cavity
- Containment failure at start of event
- Failure of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines
- Hydrogen igniter operating
- Cavity flooding unnecessary (IRWST gravity injection successful)

The main events of the case are shown in Table 34-16, while relevant plots are presented in Figures 34-205 through 34-221.

34.4.7 Accident Class 3D – Intact Containment

34.4.7.1 3D-1

The sequence description and assumptions are listed below.

- One valve of ADS Stage 4 spuriously opens
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 0/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding
- Hydrogen igniters operating

No containment failure is considered, and thus, the release category is IC. However, normal leakage from the containment is assumed.

The main events of the case are shown in Table 34-17, while relevant plots are presented in Figures 34-222 through 34-238.

34.4.7.2 3D-2

The sequence description and assumptions are listed below.

- Two valves of ADS Stage 4 spuriously open
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 0/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding
- Hydrogen igniters operating

The main events of the case are shown in Table 34-18, while relevant plots are presented in Figures 34-239 through 34-255.

34.4.7.3 3D-3

The sequence description and assumptions are listed below.

- DVI line break in PXS compartment
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 1/2 CMTs (no low-2 CMT signal)
- 1/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding
- Hydrogen igniters operating

The main events of the case are shown in Table 34-19, while relevant plots are presented in Figures 34-256 through 34-272.

34.4.8 Accident Class 3D – Failed Containment

34.4.8.1 3D-4

The sequence description and assumptions are listed below.

- Two valves of ADS Stage 2 spuriously open
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 0/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating
- Upper compartment failure due to hydrogen release from IRWST

The main events of the case are shown in Table 34-20, while relevant plots are presented in Figures 34-273 through 34-289.

34.4.9 Accident Class 6E – Bypass Containment

34.4.9.1 6E-1

The sequence description and assumptions are listed below.

- Coincident rupture of five hot side steam generator tubes
- Broken steam generator SV fails to reseat upon automatic opening
- Success of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating

This is a containment bypass sequence; thus the release category is BP. Note that due to the lack of ADS Stage 4, no IRWST injection flow is available to provide core cooling.

The main events of the case are shown in Table 34-21, while relevant plots are presented in Figures 34-290 through 34-306.

34.4.10 Accident Class 6L – Bypass Containment

34.4.10.1 6L-1

The sequence description and assumptions are listed below.

- Coincident rupture of 5 hot side steam generator tubes
- Broken steam generator SV fails to reseat upon automatic opening
- Success of PRHR
- 2/2 ADS stage 1 - automatic
- 2/2 ADS stage 2 - automatic
- 2/2 ADS stage 3 - automatic
- 4/4 ADS stage 4 - automatic
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- Cavity flooding unnecessary (IRWST gravity injection successful)
- Hydrogen igniters operating

The main events of the case are shown in Table 34-22, while relevant plots are presented in Figures 34-307 through 34-323.

34.4.11 Accident Class 1AP

34.4.11.1 1AP-1

The sequence description and assumptions are listed below.

- 3/8-inch hot-leg break to steam generator compartment
- Creep rupture of five steam generator tubes
- Success of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 0/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 2/2 cavity flooding lines
- Hydrogen igniters operating

This is a containment bypass sequence; thus the release category is BP.

The main events of the case are shown in Table 34-23, while relevant plots are presented in Figures 34-324 through 34-340. The temperatures of the steam generator tubes were monitored for creep rupture potential based on the Larsen-Miller correlation (Reference 34-9).

34.4.11.2 1AP-2

The sequence description and assumptions are listed below.

- 3/8-inch hot-leg break to steam generator compartment
- Creep rupture of five steam generator tubes
- Success of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 0/2 IRWST recirculation lines
- 0/2 cavity flooding lines
- Hydrogen igniters operating

This is a containment bypass sequence; thus the release category is BP.

The main events of the case are shown in Table 34-24, while relevant plots are presented in Figures 34-341 through 34-357. The temperatures of the hot leg and steam generator tubes were monitored for creep rupture potential based on the Larsen-Miller correlation (Reference 34-9).

34.4.12 Accident Class 1A

34.4.12.1 1A-1

The sequence description and assumptions are listed below.

- Loss of feedwater transient
- Creep rupture of five steam generator tubes
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 2/2 CMTs
- 2/2 accumulators
- 2/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines

- 2/2 cavity flooding lines
- Hydrogen igniters operating

This is a containment bypass sequence; thus the release category is BP.

The main events of the case are shown in Table 34-25, while relevant plots are presented in Figures 34-358 through 34-374. The temperatures of the hot leg and steam generator tubes were monitored for creep rupture potential based on the Larsen-Miller correlation (Reference 34-9).

34.4.12.2 1A-2

The sequence description and assumptions are listed below.

- Loss of feedwater transient
- Creep rupture of five steam generator tubes
- Creep rupture of hot leg
- Failure of PRHR
- 0/2 ADS stage 1
- 0/2 ADS stage 2
- 0/2 ADS stage 3
- 0/4 ADS stage 4
- 0/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 2/2 IRWST recirculation lines
- 0/2 cavity flooding lines
- Hydrogen igniters operating

This is a containment bypass sequence; thus the release category is BP.

The main events of the case are shown in Table 34-26, while relevant plots are presented in Figures 34-375 through 34-391. The temperatures of the hot leg and steam generator tubes were monitored for creep rupture potential based on the Larsen-Miller correlation (Reference 34-9). The steam generator tubes failed first.

34.4.13 Intermediate and Late Containment Failure Cases

34.4.13.1 CFI – Intermediate Containment Failure Case

The sequence description and assumptions are listed below:

- Accident class 3BE DVI line break in the PXS compartment (PXS is flooded through broken DVI line)
- Hydrogen burn and containment failure from deflagration-to-detonation transition (DDT) when containment global hydrogen concentration exceeds 10 percent

- 2/2 ADS stage 1 – automatic
- 2/2 ADS stage 2 – automatic
- 2/2 ADS stage 3 – automatic
- 4/4 ADS stage 4 – automatic
- 1/2 CMTs
- 1/2 accumulators
- 0/2 IRWST gravity injection lines
- 1/2 cavity flooding through recirculation lines
- No hydrogen igniters operating

The accident sequence timing is presented in Table 34-27. Relevant plots are presented in Figures 34-392 through 34-406.

34.4.13.2 CFL – Late Containment Failure Case

The sequence description and assumptions are listed below:

- Accident class 3BE Medium LOCA in a hot leg to the loop compartment
- Failure of passive containment cooling system cooling water
- Containment failure from long-term containment overpressure at 91 psig (ASME service level C)
- 2/2 ADS stage 1 – automatic
- 2/2 ADS stage 2 – automatic
- 2/2 ADS stage 3 – automatic
- 4/4 ADS stage 4 – automatic
- 2/2 CMTs
- 2/2 accumulators
- 0/2 IRWST gravity injection lines
- 1/2 cavity flooding through recirculation lines

- No hydrogen igniters credited; containment is steam inerted

The accident sequence timing is presented in Table 34-28. Relevant plots are presented in Figures 34-407 through 34-425.

34.5 Insights and Conclusions

The analyses of the severe accident phenomena for the AP1000 PRA highlight the following insights and conclusions:

- The design of the AP1000 reactor vessel, vessel insulation and reactor cavity, and the ability to flood the cavity after a severe accident reduce the potential challenges to the containment integrity by maintaining the vessel integrity.
- Should a failure of the reactor vessel occur, the design of the reactor cavity enhances the ability to cool any core debris that exits the vessel.
- Lower head vessel failure due to in-vessel steam explosions is physically unreasonable.
- The ADS and PRHR system are design features that can be used to prevent high-pressure core melt in a severe accident.
- A directly-initiated hydrogen detonation in the AP1000 containment is not a credible event.
- The equipment needed to mitigate the consequences of a severe accident is designed to provide reasonable assurance that it will continue to operate during an accident.

34.6 References

34-1 Letter from D. A. Ward, Advisory Committee on Reactor Safeguards, to K. A. Carr, Chairman, Nuclear Regulatory Commission, "Proposed Criteria to Accommodate Severe Accidents in Containment Design," dated May 17, 1991.

34-2 Theofanous, T. G., et al., "In-Vessel Coolability and Retention of a Core Melt," DOE/ID-10460, July 1995.

34-3 Theofanous, T. G., et al., "Lower Head Integrity Under In-Vessel Steam Explosion Loads," DOE/ID-10541, July 1996.

34-4 NUREG-1116, *A Review of the Current Understanding of the Potential for Containment Failure From In-Vessel Steam Explosions*, 1985.

34-5 GW-GL-022, AP600 Probabilistic Risk Assessment, August 1998.

34-6 Sherman, M. P., Tieszen, S. R., and Benedick, W. B., *FLAME Facility - The Effects of Obstacles and Transverse Venting on Flame Acceleration and Transition to Detonation for Hydrogen-Air Mixtures at Large Scale,* NUREG/CR-5275, April 1989.

34-7 Attachment to letter from D. M. Crutchfield, Office of Nuclear Reactor Regulation, to E. E. Kintner, Advanced Light Water Reactor Steering Committee, "Major Technical and Policy Issues Concerning the Evolutionary and Passive Plant Designs," dated February 27, 1992.

34-8 "EPRI MAAP 4.0 Users Manual."

34-9 Larson, F. R., Miller, J., "A Time-Temperature Relationship for Rupture and Creep Stress," Transactions of the American Society of Mechanical Engineers, pp. 765-775, July 1952.

Table 34-1 (Sheet 1 of 2)

POST-ACCIDENT MONITORING EQUIPMENT

Parameter	Primary Purposes	Method of Measurement (or Estimate)
Steam Generator Water Level	• To determine if there is an RCS heat sink available • To determine if creep rupture of the steam generator tubes is a concern • To mitigate fission-product releases from faulty or leaking steam generator tubes	• Wide-range steam generator level • Narrow-range steam generator level
RCS Pressure	• To determine the ability to inject into the RCS • To determine if high-pressure melt ejection is a concern • To determine if there is an uncontrolled opening in the RCS	• Wide-range RCS pressure • Pressurizer pressure • Accumulator pressure • CMT flow • IRWST flow
Core Temperature (RCS Temperature or Reactor Vessel Level)	• To determine if the core is covered with water	• Core-exit thermocouples • Hot-leg/cold-leg RTDs • Subcooling margin monitor • Reactor vessel level • Source range monitor • Power range monitor
Containment Water Level	• To determine if equipment and instruments are flooded • To determine if core cooling in the recirculation mode is possible • To determine if the outside of the reactor vessel is covered with water • To determine if the core is coolable if reactor vessel failure occurs	• Containment recirculation sump level • IRWST water level
Site Release	• To determine if release mitigation is desired	• Site-specific list

Table 34-1 (Sheet 2 of 2)

POST-ACCIDENT MONITORING EQUIPMENT

Parameter	Primary Purposes	Method of Measurement (or Estimate)
Containment Pressure	• To determine if there is a challenge to the containment due to overpressurization or due to a sub-atmospheric condition • To determine if the containment atmosphere is steam inerted • To determine if there is a challenge to the containment due to hydrogen flammability	• Containment pressure • Wide-range containment pressure • Water levels that use containment as reference leg • Containment hydrogen monitor

Table 34-2

LEVEL 1 ACCIDENT CLASS

FUNCTIONAL DEFINITIONS OF LEVEL 1 ACCIDENT CLASS

Accident Class	Subclass	Definition
1	A	Core damage with RCS at high pressure following transient or RCS leak
1	AP	Core damage with no depressurization following small LOCA and RCS leak with PRHR operating or medium LOCA
1	D	Core damage with partial depressurization of RCS following transient
3	A	Core damage with RCS at high pressure following ATWS or main steam line break inside containment
3	BR	Core damage following large LOCA with full RCS depressurization, but accumulator failed
3	BE	Core damage following large LOCA or other event with full depressurization
3	BL	Core damage at long term following failure of water recirculation to reactor pressure vessel (RPV) after successful gravity injection
3	C	Core damage following vessel rupture
3	D	Core damage following small or medium LOCA with partial depressurization
6	E	Core damage following steam generator tube rupture or interfacing systems LOCA – early core damage (loss of injection)
6	L	Core damage following steam generator tube rupture – late core damage (loss of recirculation)

Table 34-3

SUMMARY OF RELEASE CATEGORIES

Release Category	Release Category Name	Release Category Description
IC	Intact Containment	Containment integrity is maintained throughout the accident, and the release of radiation to the environment is due to nominal leakage.
BP	Bypass Containment	Fission products are released directly from the RCS to the environment via the secondary system or other interfacing system bypass. Containment failure occurs prior to onset of core damage.
CI	Containment Isolation Failure	Fission products are released through a failure of the system or valves that close the penetrations between the containment and the environment. Containment failure occurs prior to onset of core damage.
CFE	Early Containment Failure	Fission products are released through a containment failure caused by dynamic severe accident phenomena occurring after the onset of core damage, but prior to core relocation. Such phenomena include hydrogen detonation, hydrogen diffusion flame, steam explosions, and vessel failure.
CFI	Intermediate Containment Failure	Fission products are released through a containment failure caused by dynamic severe accident phenomena occurring after core relocation, but before 24 hours. Such phenomena include hydrogen detonation and hydrogen deflagration.
CFL	Late Containment Failure	Fission products are released through a containment failure caused by severe accident phenomena occurring after 24 hours. Such phenomena include the failure of containment heat removal (failure of passive containment cooling).

Table 34-4

3BE-1 EVENT SUMMARY

Time (Second)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
56.0	PCS Actuation
615.0	ADS Stage 1 Actuation - Automatic
735.7	ADS Stage 2 Actuation - Automatic
855.7	ADS Stage 3 Actuation - Automatic
901.0	Accumulator Water Depleted
1594.0	ADS Stage 4 Actuation - Automatic
1670.0	Cavity Water Level @ 83'
3359.3	Cavity Flooding Actuation
3405.0	Onset of Core Melting
5050.0	Cavity Water Level @ 98'
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Begin Core Relocation to Lower Plenum
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-5

3BE-2 EVENT SUMMARY

Time (Second)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
56.0	PCS Actuation
616.0	ADS Stage 1 Actuation - Automatic
736.4	ADS Stage 2 Actuation - Automatic
856.4	ADS Stage 3 Actuation - Automatic
901.0	Accumulator Water Depleted
1500.0	Cavity Water Level @ 83'
1594.4	ADS Stage 4 Actuation - Automatic
3359.0	Cavity Flooding Actuation
3406.4	Onset of Core Melting
5100.0	Cavity Water Level @ 98'
5880.0	Begin Core Relocation to Lower Plenum
7500.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-6

3BE-4 EVENT SUMMARY

Time (Second)	Description
0.0	Spurious ADS Stage 4
5.0	Reactor Scram
5.3	Main Coolant Pump Trip
5.3	CMT Actuation
5.3	PCS Actuation
240.0	Cavity Water Level @ 83'
371.5	Accumulator Water Depleted
659.6	ADS Stage 1 Actuation - Automatic
779.6	ADS Stage 2 Actuation - Automatic
899.6	ADS Stage 3 Actuation - Automatic
1416.0	ADS Stage 4 Actuation - Automatic
3156.5	Cavity Flooding Actuation
3406.4	Onset of Core Melting
4650.0	Cavity Water Level @ 98'
5572.0	Begin Core Relocation to Lower Plenum
7400.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-7

3BE-5 EVENT SUMMARY

Time (Second)	Description
0.0	2-inch Hot-Leg Break to Steam Generator Compartment
149.0	Reactor Scram
165.2	Main Coolant Pump Trip
165.2	CMT Actuation
289.3	PCS Actuation
371.5	Accumulator Water Depleted
2047.4	ADS Stage 1 Actuation - Automatic
2167.4	ADS Stage 2 Actuation - Automatic
2287.4	ADS Stage 3 Actuation - Automatic
2300.0	Cavity Water Level @ 83′
2946.0	ADS Stage 4 Actuation - Automatic
4792.3	Cavity Flooding Actuation
4847.5	Onset of Core Melting
6300.0	Cavity Water Level @ 98′
7617.0	Begin Core Relocation to Lower Plenum
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-8

3BE-6 EVENT SUMMARY

Time (Second)	Description
0.0	2-inch Hot-Leg Break to Steam Generator Compartment
149.1	Reactor Scram
165.7	Main Coolant Pump Trip
165.7	CMT Actuation
287.8	PCS Actuation
2046.3	ADS Stage 1 Actuation - Automatic
2163.6	ADS Stage 2 Actuation - Automatic
2283.6	ADS Stage 3 Actuation - Automatic
2300.0	Cavity Water Level @ 83′
2511.5	Accumulator Water Depleted
2948.9	ADS Stage 4 Actuation - Automatic
4793.2	Cavity Flooding Actuation
4847.7	Onset of Core Melting
7525.0	Begin Core Relocation to Lower Plenum
7800.0	Cavity Water Level @ 98′
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-9

3BE-7 EVENT SUMMARY

Time (Second)	Description
0.0	2-inch Hot-Leg Break to Steam Generator Compartment
149.0	Reactor Scram
165.2	Main Coolant Pump Trip
165.2	CMT Actuation
289.3	PCS Actuation
1949.9	ADS Stage 4 Actuation - Automatic
2044.1	ADS Stage 1 Actuation - Automatic
2164.1	ADS Stage 2 Actuation - Automatic
2284.1	ADS Stage 3 Actuation - Automatic
2400.0	Cavity Water Level @ 83'
2512.6	Accumulator Water Depleted
4782.1	Cavity Flooding Actuation
4839.0	Onset of Core Melting
7520.0	Begin Core Relocation to Lower Plenum
9000.0	Lower Plenum Dryout
11302.0	Vessel Failure
11302.0	Containment Failure
N/A	Cavity Water Level @ 98'
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Creep Rupture of RCS

Table 34-10

3BE-3 EVENT SUMMARY

Time (Second)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
58.1	PCS Actuation
613.0	ADS Stage 1 Actuation - Automatic
733.0	ADS Stage 2 Actuation - Automatic
853.0	ADS Stage 3 Actuation - Automatic
898.2	Accumulator Water Depleted
1588.5	ADS Stage 4 Actuation - Automatic
1700.0	Cavity Water Level @ 83'
3347.0	Cavity Flooding Actuation
3394.4	Onset of Core Melting
5000.0	Cavity Water Level @ 98'
10010.0	Containment Failure
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Begin Core Relocation to Lower Plenum
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Creep Rupture of RCS

Table 34-11

3BL-1 EVENT SUMMARY

Time (Second)	Description
0.0	2-inch Hot-Leg Break to Steam Generator Compartment
149.0	Reactor Scram
165.3	Main Coolant Pump Trip
165.3	CMT Actuation
289.5	PCS Actuation
2043.7	ADS Stage 1 Actuation - Automatic
2100.0	Cavity Water Level @ 83'
2163.7	ADS Stage 2 Actuation - Automatic
2283.7	ADS Stage 3 Actuation - Automatic
2511.0	Accumulator Water Depleted
2945.3	ADS Stage 4 Actuation - Automatic
2945.3	IRWST Injection Initiated
5750.0	Cavity Water Level @ 98'
27651.1	Onset of Core Melting
30456.0	Begin Core Relocation to Lower Plenum
40000.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-12

3BL-2 EVENT SUMMARY

Time (Second)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
56.0	PCS Actuation
617.2	ADS Stage 1 Actuation - Automatic
737.2	ADS Stage 2 Actuation - Automatic
857.2	ADS Stage 3 Actuation - Automatic
902.0	Accumulator Water Depleted
1500.0	Cavity Water Level @ 83′
1594.4	ADS Stage 4 Actuation - Automatic
1594.4	IRWST Injection Initiated
8800.0	Cavity Water Level @ 98′
45358.2	Onset of Core Melting
53093.0	Begin Core Relocation to Lower Plenum
64000.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-13

3BR-1 EVENT SUMMARY

Time (Second)	Description
0.0	Large LOCA in Cold Leg to Steam Generator Compartment
0.6	Reactor Scram
1.3	Main Coolant Pump Trip
1.3	CMT Actuation
1.3	PCS Actuation
383.8	ADS Stage 1 Actuation - Automatic
503.8	ADS Stage 2 Actuation - Automatic
618.8	ADS Stage 3 Actuation - Automatic
700.0	Cavity Water Level @ 83'
1134.6	ADS Stage 4 Actuation - Automatic
3900.0	Cavity Water Level @ 98'
N/A	Hot Leg Submerged
N/A	Onset of Core Melting
N/A	Begin Core Relocation to Lower Plenum
N/A	Accumulator Water Depleted
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-14

3BR-1a EVENT SUMMARY

Time (Second)	Description
0.0	Large LOCA in Cold Leg to Steam Generator Compartment
0.2	Reactor Scram
0.7	Main Coolant Pump Trip
0.7	CMT Actuation
0.7	PCS Actuation
372.3	ADS Stage 1 Actuation - Automatic
492.3	ADS Stage 2 Actuation - Automatic
612.3	ADS Stage 3 Actuation - Automatic
1000.0	Cavity Water Level @ 83′
1131.5	ADS Stage 4 Actuation - Automatic
2848.2	Onset of Core Melting
5157.0	Begin Core Relocation to Lower Plenum
7000.0	Lower Plenum Dryout
N/A	Cavity Water Level @ 98′
N/A	Hot Leg Submerged
N/A	Accumulator Water Depleted
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-15

3C-1 EVENT SUMMARY

Time (Second)	Description
0.0	Large LOCA at Belt of Reactor Vessel
0.05	Reactor Scram
0.6	Main Coolant Pump Trip
0.6	CMT Actuation
0.6	PCS Actuation
50.0	Cavity Water Level @ 83′
302.8	Accumulator Water Depleted
555.5	ADS Stage 1 Actuation – Automatic
675.5	ADS Stage 2 Actuation – Automatic
795.5	ADS Stage 3 Actuation – Automatic
1312.5	ADS Stage 4 Actuation - Automatic
1312.5	IRWST Injection Initiated
1511.0	Begin Core Relocation to Lower Plenum
4300.0	Cavity Water Level @ 98′
7611.8	Onset of Core Melting
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-16

3C-2 EVENT SUMMARY

Time (Second)	Description
0.0	Large LOCA at Belt of Reactor Vessel
0.0	Containment Failure
0.1	Reactor Scram
0.6	Main Coolant Pump Trip
0.6	CMT Actuation
0.6	PCS Actuation
30.0	Cavity Water Level @ 83'
293.8	Accumulator Water Depleted
352.8	Onset of Core Melting
561.2	ADS Stage 1 Actuation - Automatic
681.2	ADS Stage 2 Actuation - Automatic
801.2	ADS Stage 3 Actuation - Automatic
1318.0	ADS Stage 4 Actuation - Automatic
1318.0	IRWST Injection Initiated
1533.0	Begin Core Relocation to Lower Plenum
4350.0	Cavity Water Level @ 98'
N/A	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Lower Plenum Dryout
N/A	Vessel Failure
N/A	Creep Rupture of RCS

Table 34-17

3D-1 EVENT SUMMARY

Time (Second)	Description
0.0	Spurious ADS Stage 4
5.0	Reactor Scram
5.3	Main Coolant Pump Trip
5.3	PCS Actuation
300.0	Cavity Water Level @ 83′
372.3	Accumulator Water Depleted
1490.0	Cavity Flooding Actuation
1532.5	Onset of Core Melting
3400.0	Cavity Water Level @ 98′
3468.0	Begin Core Relocation to Lower Plenum
4900.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	CMT Actuation
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-18

3D-2 EVENT SUMMARY

Time (Second)	Description
0.0	Spurious ADS Stage 2
2.9	Reactor Scram
4.0	Main Coolant Pump Trip
22.2	PCS Actuation
1927.5	Accumulator Water Depleted
2000.0	Cavity Water Level @ 83′
3427.4	Cavity Flooding Actuation
3491.3	Onset of Core Melting
5300.0	Cavity Water Level @ 98′
5825.0	Begin Core Relocation to Lower Plenum
7500.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	CMT Actuation
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-19

3D-3 EVENT SUMMARY

Time (Second)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
56.1	PCS Actuation
1800.0	Cavity Water Level @ 83′
4227.9	Accumulator Water Depleted
4767.8	Cavity Flooding Actuation
4881.3	Onset of Core Melting
6400.0	Cavity Water Level @ 98′
7714.0	Begin Core Relocation to Lower Plenum
9500.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-20

3D-4 EVENT SUMMARY

Time (Second)	Description
0.0	Spurious ADS Stage 2
2.9	Reactor Scram
4.0	Main Coolant Pump Trip
22.2	PCS Actuation
1927.5	Accumulator Water Depleted
2000.0	Cavity Water Level @ 83′
3491.3	Onset of Core Melting
4491.0	Containment Failure
5350.0	Cavity Water Level @ 98′
5831.0	Begin Core Relocation to Lower Plenum
7500.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation – Automatic
N/A	ADS Stage 2 Actuation – Automatic
N/A	ADS Stage 3 Actuation – Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	CMT Actuation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Creep Rupture of RCS

Table 34-21

6E-1 EVENT SUMMARY

Time (Second)	Description
0.0	Steam Generator Tube Rupture (five tubes)
147.7	Reactor Scram
164.6	Main Coolant Pump Trip
164.6	CMT Actuation
166.8	PRHR Actuation
3673.3	Accumulator Water Depleted
19184.0	IRWST Injection Initiated
32612.0	Cavity Flooding Actuation
32706.0	Onset of Core Melting
33000.0	Cavity Water Level @ 83′
35050.0	Cavity Water Level @ 98′
36844.0	Begin Core Relocation to Lower Plenum
38500.0	Lower Plenum Dryout
39911.3	IRWST Low Level - Switchover to Recirculation
68637.0	PCS Actuation
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-22

6L-1 EVENT SUMMARY

Time (Second)	Description
0.0	Steam Generator Tube Rupture (five tubes)
148.7	Reactor Scram
165	Main Coolant Pump Trip
165	CMT Actuation
167.0	PRHR Actuation
3672.5	Accumulator Water Depleted
17028.0	ADS Stage 1 Actuation - Automatic
17148.0	ADS Stage 2 Actuation - Automatic
17268.0	ADS Stage 3 Actuation - Automatic
17863.0	ADS Stage 4 Actuation - Automatic
17863.0	IRWST Injection Initiated
18500.0	Cavity Water Level @ 83′
22000.0	Cavity Water Level @ 98′
23793.0	PCS Actuation
44464.0	Onset of Core Melting
48447.0	Begin Core Relocation to Lower Plenum
53000.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure
N/A	Creep Rupture of RCS

Table 34-23

1AP-1 EVENT SUMMARY

Time (Second)	Description
0.0	3/8-inch Hot-Leg Break to Steam Generator Compartment
4689.8	Reactor Scram
4697.2	Main Coolant Pump Trip
4698.0	PRHR Actuation
14001.0	PCS Actuation
36000.0	Cavity Water Level @ 83′
86381.8	Accumulator Water Depleted
133253.0	Creep Rupture of RCS (Steam Generator Tube Creep)
137540.1	Cavity Flooding Actuation
137740.7	Onset of Core Melting
139000.0	Cavity Water Level @ 98′
144724.0	Begin Core Relocation to Lower Plenum
146000.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	CMT Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure

Table 34-24

1AP-2 EVENT SUMMARY

Time (Second)	Description
0.0	3/8-inch Hot-Leg Break to Steam Generator Compartment
4689.8	Reactor Scram
4697.2	Main Coolant Pump Trip
4697.2	CMT Actuation
4698.0	PRHR Actuation
15556.1	PCS Actuation
40000.0	Cavity Water Level @ 83′
92439.2	Accumulator Water Depleted
139113.0	Creep Rupture of RCS (Steam Generator Tube Creep)
150556.0	Onset of Core Melting
157909.0	Begin Core Relocation to Lower Plenum
160000.0	Lower Plenum Dryout
N/A	Cavity Water Level @ 98′
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure

Table 34-25

1A-1 EVENT SUMMARY

Time (Second)	Description
0.0	Feedwater Failure
3.8	Reactor Scram
4015.5	Main Coolant Pump Trip
4015.5	CMT Actuation
4015.5	PCS Actuation
10500.0	Cavity Water Level @ 83′
14000.0	Creep Rupture of RCS (Steam Generator Tube Creep)
15413.0	IRWST Injection Initiated
15721.5	Cavity Flooding Actuation
15864.0	Onset of Core Melting
17700.0	Cavity Water Level @ 98′
19604.0	Begin Core Relocation to Lower Plenum
20500.0	Lower Plenum Dryout
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	Accumulator Water Depleted
N/A	PRHR Actuation
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Vessel Failure
N/A	Containment Failure

Table 34-26

1A-2 EVENT SUMMARY

Time (Second)	Description
0.0	Feedwater Failure
3.8	Reactor Scram
4015.5	Main Coolant Pump Trip
4015.5	PCS Actuation
7000.0	Creep Rupture of RCS (Steam Generator Tube Creep)
8550.1	Onset of Core Melting
11495.0	Begin Core Relocation to Lower Plenum
12250.0	Lower Plenum Dryout
22175.0	Creep Rupture of RCS (Hot-Leg Creep)
22333.8	Accumulator Water Depleted
22500.0	Cavity Water Level @ 83'
N/A	Cavity Water Level @ 98'
N/A	Hot Leg Submerged
N/A	ADS Stage 1 Actuation - Automatic
N/A	ADS Stage 2 Actuation - Automatic
N/A	ADS Stage 3 Actuation - Automatic
N/A	ADS Stage 4 Actuation - Automatic
N/A	CMT Actuation
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level - Switchover to Recirculation
N/A	Cavity Flooding Actuation
N/A	Vessel Failure
N/A	Containment Failure

Table 34-27

CFI EVENT SUMMARY

Time (Seconds)	Description
0.0	DVI Line Break to PXS Compartment
20.5	Reactor Scram
25.3	Main Coolant Pump Trip
25.3	CMT Actuation
57.2	PCS Actuation
617.4	ADS Stage 1 Actuation – Automatic
737.4	ADS Stage 2 Actuation – Automatic
857.4	ADS Stage 3 Actuation – Automatic
904.8	Accumulator Water Depleted
1298.0	Containment Water Level @ 83′
1587.8	ADS Stage 4 Actuation – Automatic
2480.0	Core Uncovery
3370.9	Cavity Flooding Actuation
3422.0	Onset of Core Melting (TCRHOT > 2500K)
6250.0	Containment Water Level @ 98′
N/A	Core Relocation to Lower Plenum
N/A	Lower Plenum Dryout
7080.0	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level – Switchover to Recirculation
N/A	Vessel Failure
25000.0	Global Hydrogen Burn and DDT
25002.0	Containment Failure

Table 34-28

CFL EVENT SUMMARY

Time (Seconds)	Description
0.0	MLOCA Hot Leg Break to Loop Compartment
35.0	Reactor Scram
42.7	Main Coolant Pump Trip
42.7	CMT Actuation
N/A	PCS Actuation
690.0	Containment Water Level @ 83′
757.4	ADS Stage 1 Actuation – Automatic
877.4	ADS Stage 2 Actuation – Automatic
977.4	ADS Stage 3 Actuation – Automatic
1070.8	Accumulator Water Depleted
1729.5	ADS Stage 4 Actuation – Automatic
2461.1	Core Uncovery
3315.5	Cavity Flooding Actuation
3402.0	Onset of Core Melting (TCRHOT > 2500K)
4990.0	Containment Water Level @ 98′
N/A	Core Relocation to Lower Plenum
N/A	Lower Plenum Dryout
5621.0	Hot Leg Submerged
N/A	PRHR Actuation
N/A	IRWST Injection Initiated
N/A	IRWST Low Level – Switchover to Recirculation
N/A	Vessel Failure
108573.0	Containment Failure

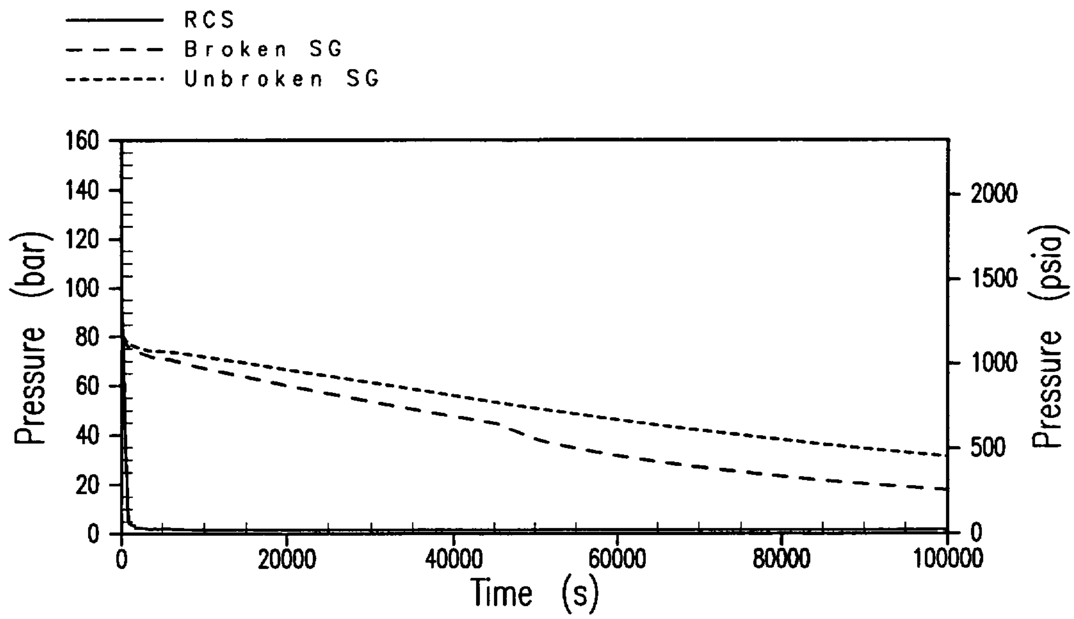


Figure 34-1

Case 3BE-1: Reactor Coolant System and Steam Generator Pressure DVI Line Break, Containment Water Level

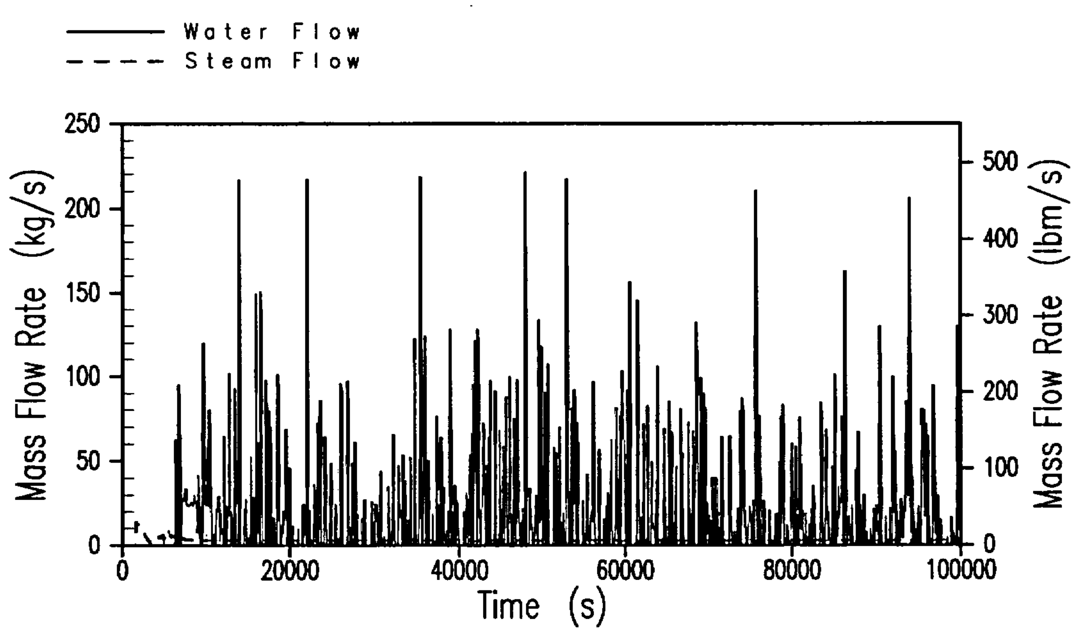


Figure 34-2

Case 3BE-1: ADS Stage 4 Flow Rates DVI Line Break, Containment Water Level

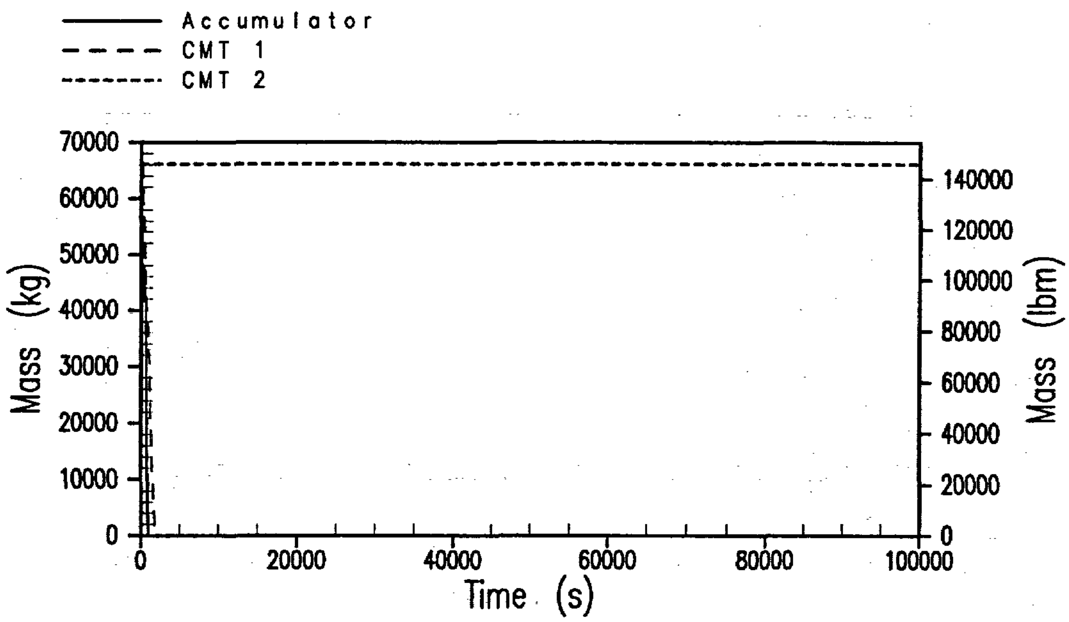


Figure 34-3

Case 3BE-1: Accumulator/CMT Water Mass DVI Line Break, Containment Water Level

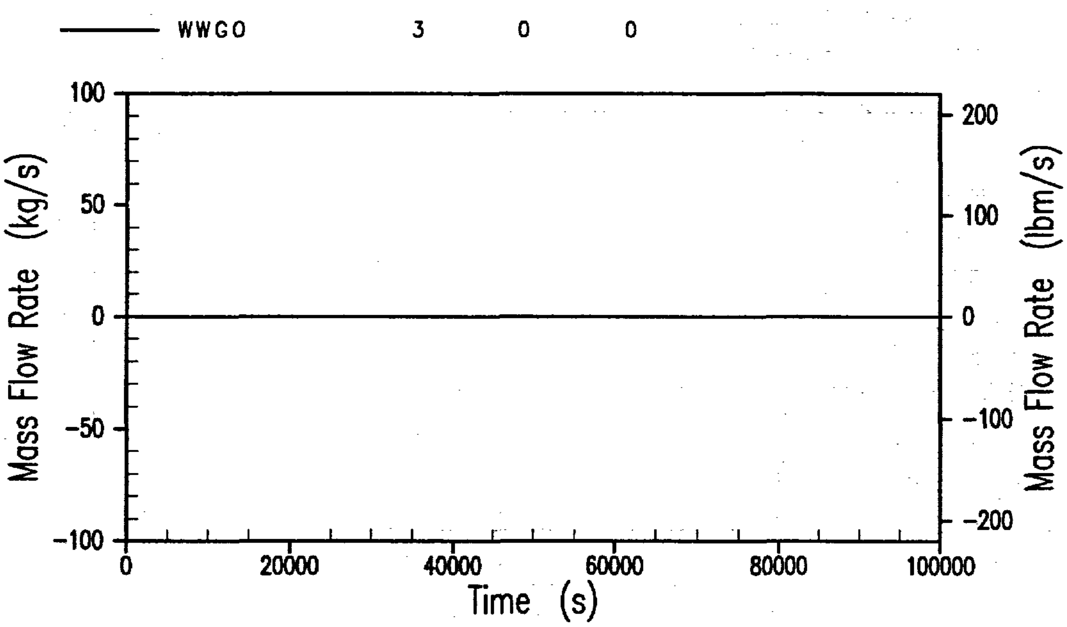


Figure 34-4

Case 3BE-1: IRWST Injection Flow Rate DVI Line Break, Containment Water Level

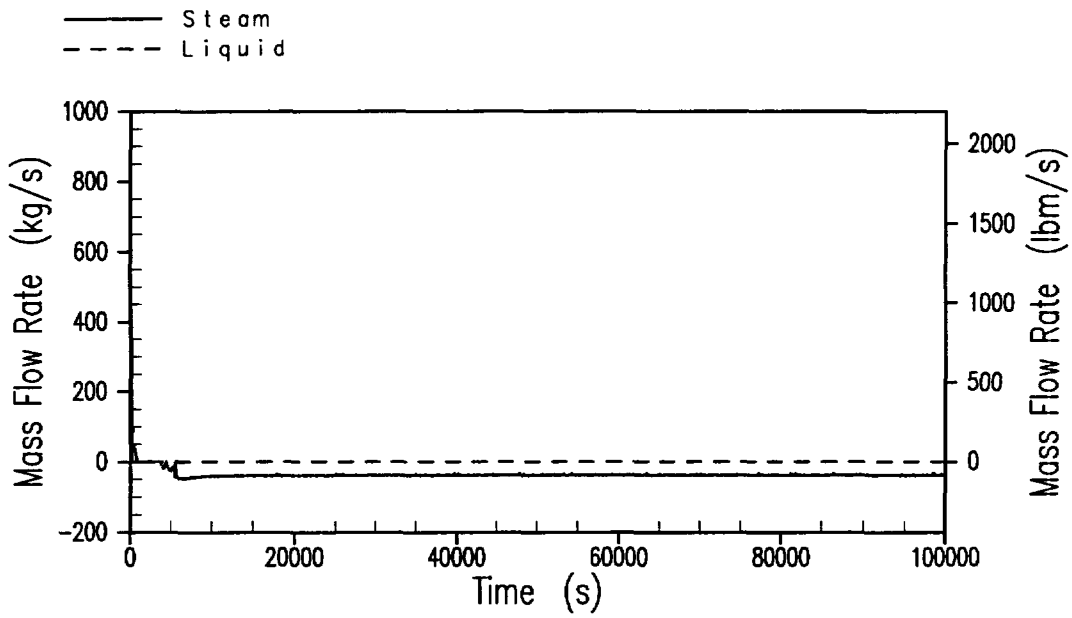


Figure 34-5

Case 3BE-1: Break Flow Rate
DVI Line Break, Containment Water Level

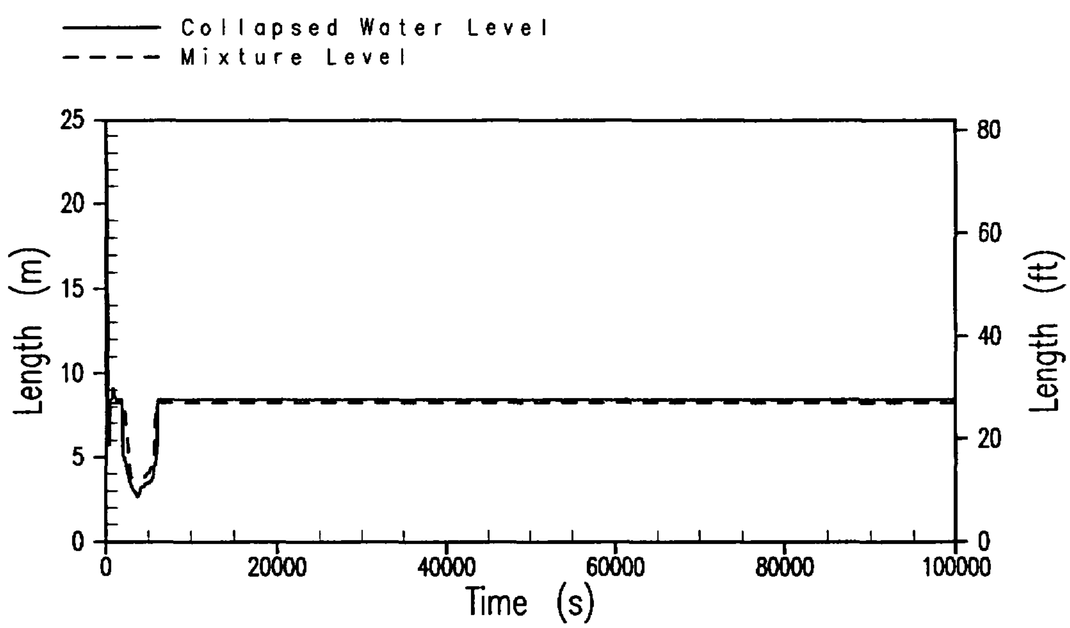


Figure 34-6

Case 3BE-1: Reactor Vessel Water Level
DVI Line Break, Containment Water Level

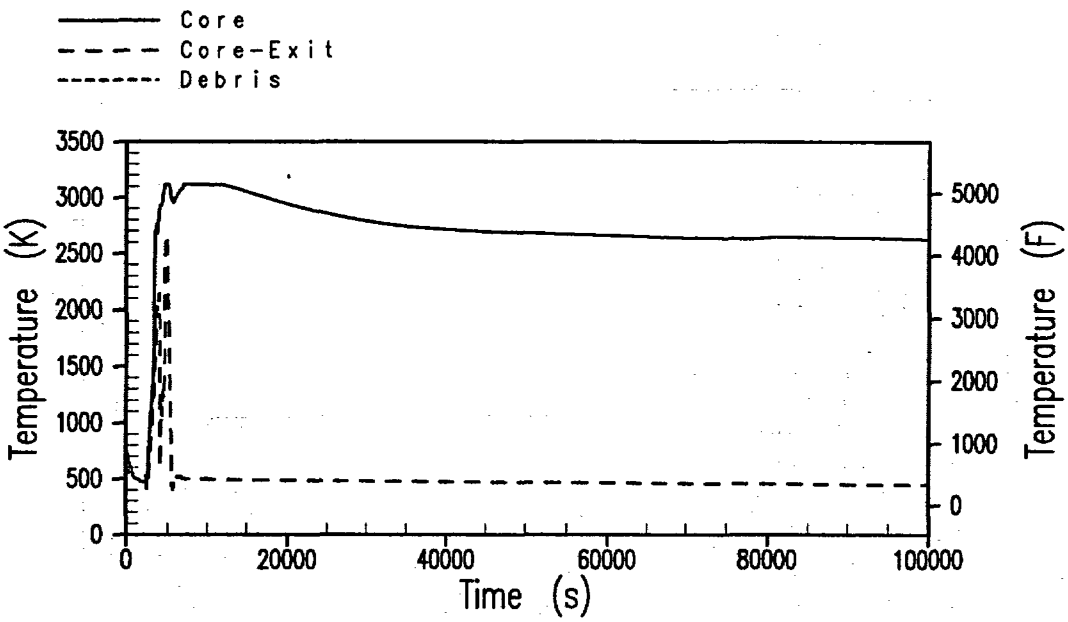


Figure 34-7

Case 3BE-1: Core Temperatures
DVI Line Break, Containment Water Level

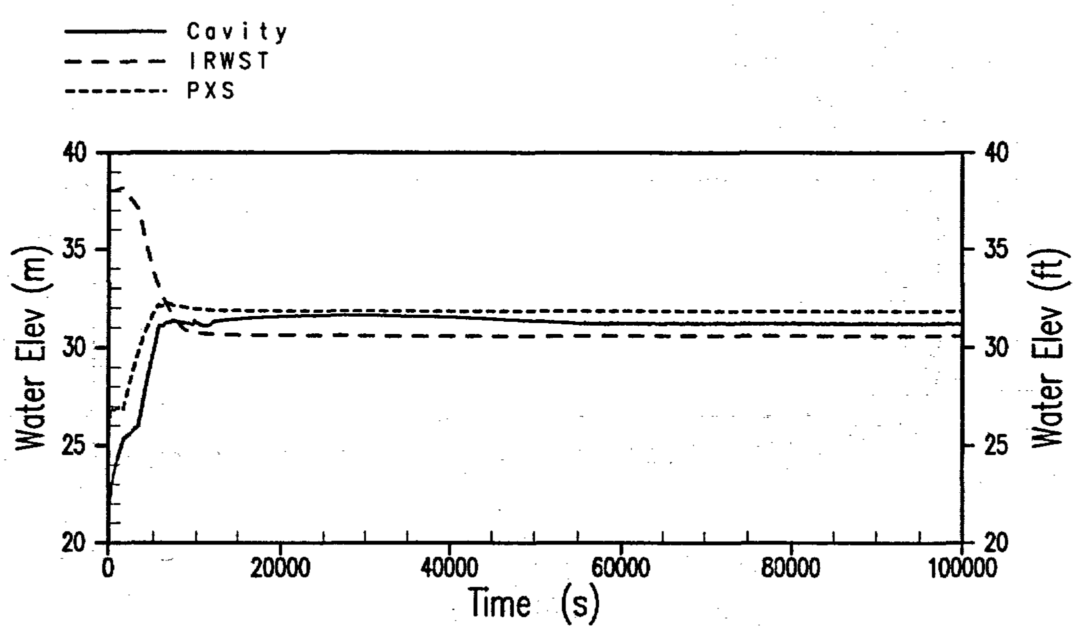


Figure 34-8

Case 3BE-1: Containment Water Pool Elevations
DVI Line Break, Containment Water Level

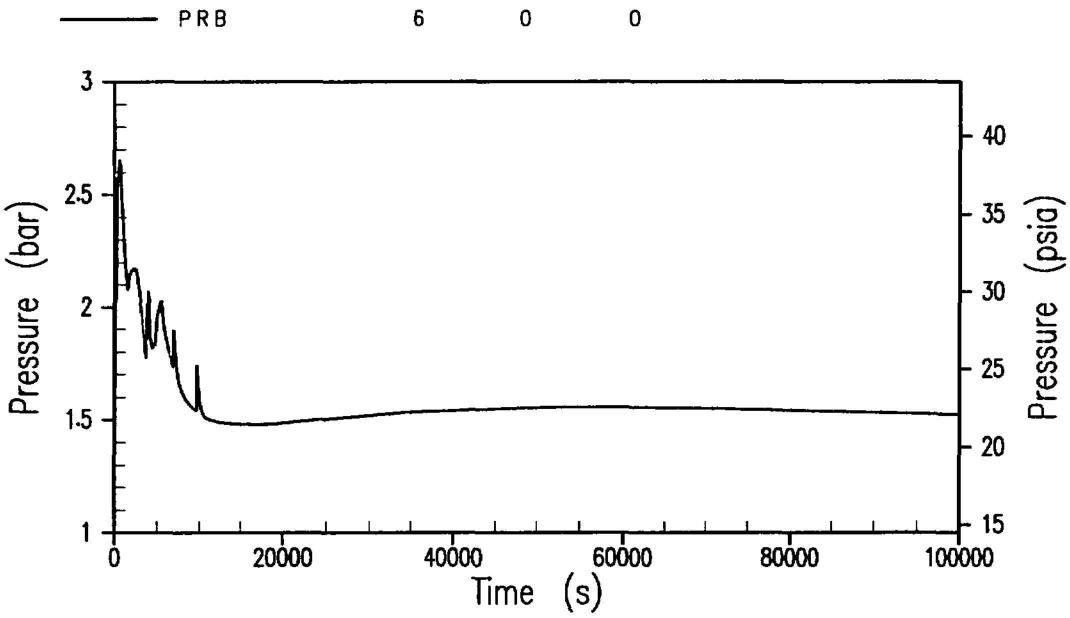


Figure 34-9

Case 3BE-1: Containment Pressure
DVI Line Break, Containment Water Level

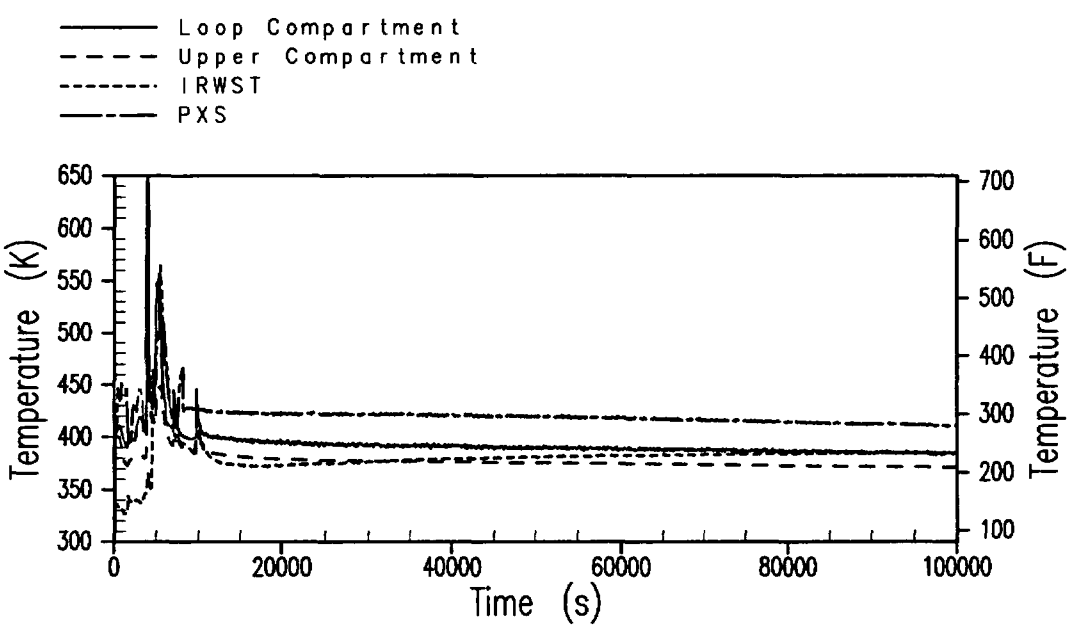


Figure 34-10

Case 3BE-1: Containment Gas Temperatures
DVI Line Break, Containment Water Level

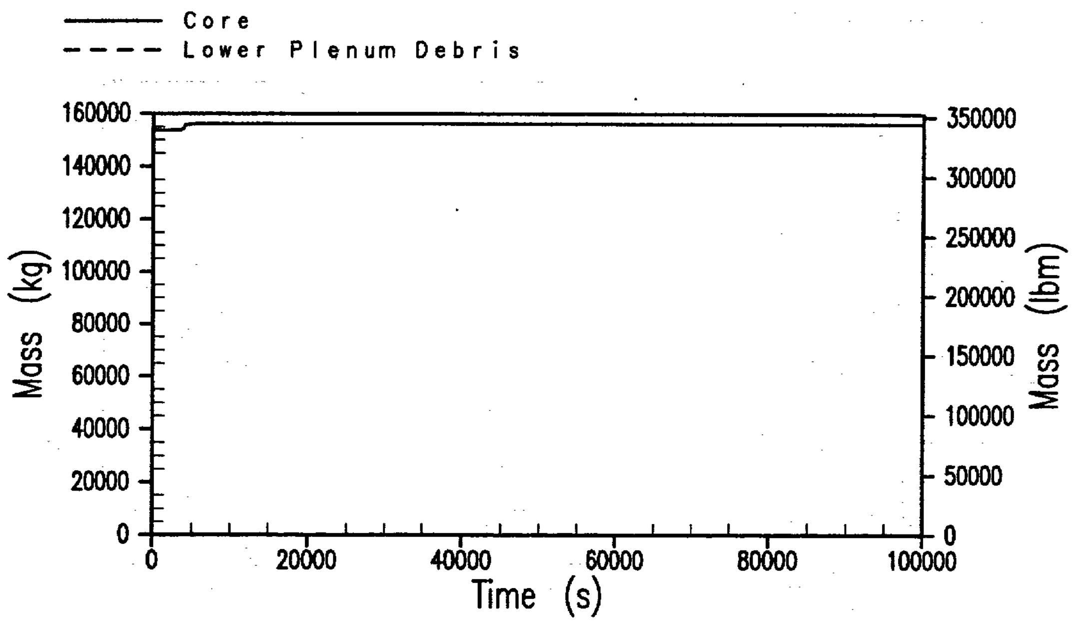


Figure 34-11

Case 3BE-1: Core Mass
DVI Line Break, Containment Water Level

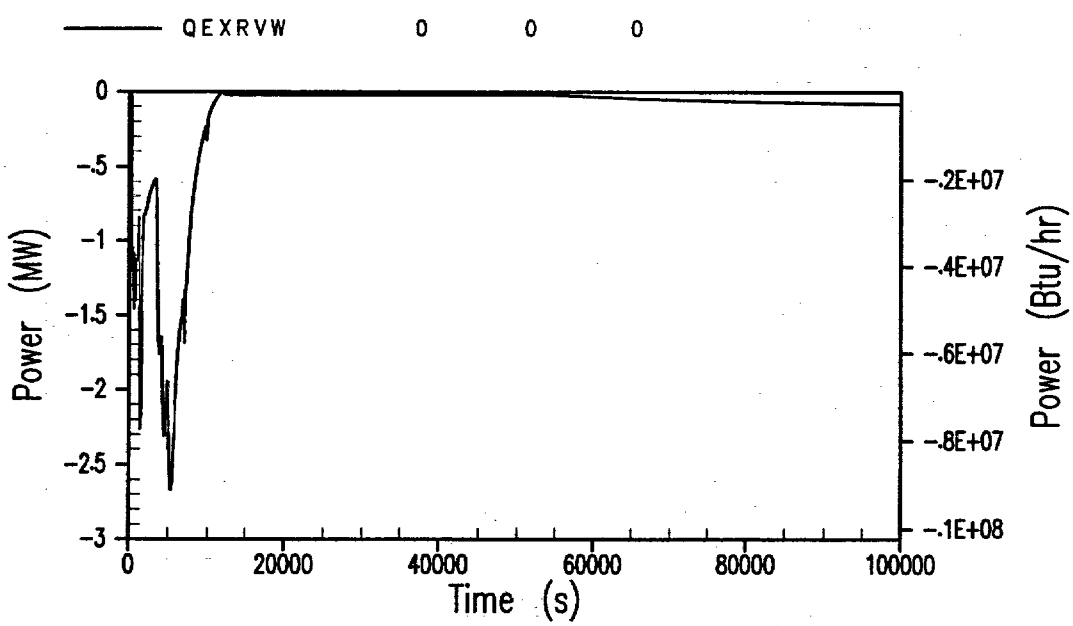


Figure 34-12

Case 3BE-1: Reactor Pressure Vessel to Cavity Water Heat Transfer
DVI Line Break, Containment Water Level

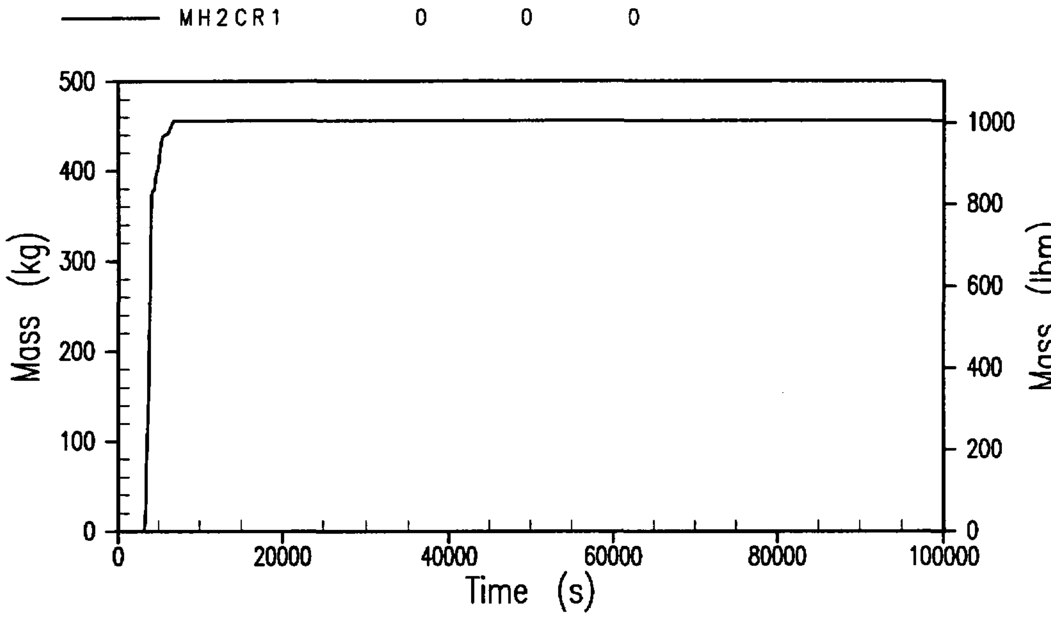


Figure 34-13

Case 3BE-1: In-Vessel Hydrogen Generation DVI Line Break, Containment Water Level

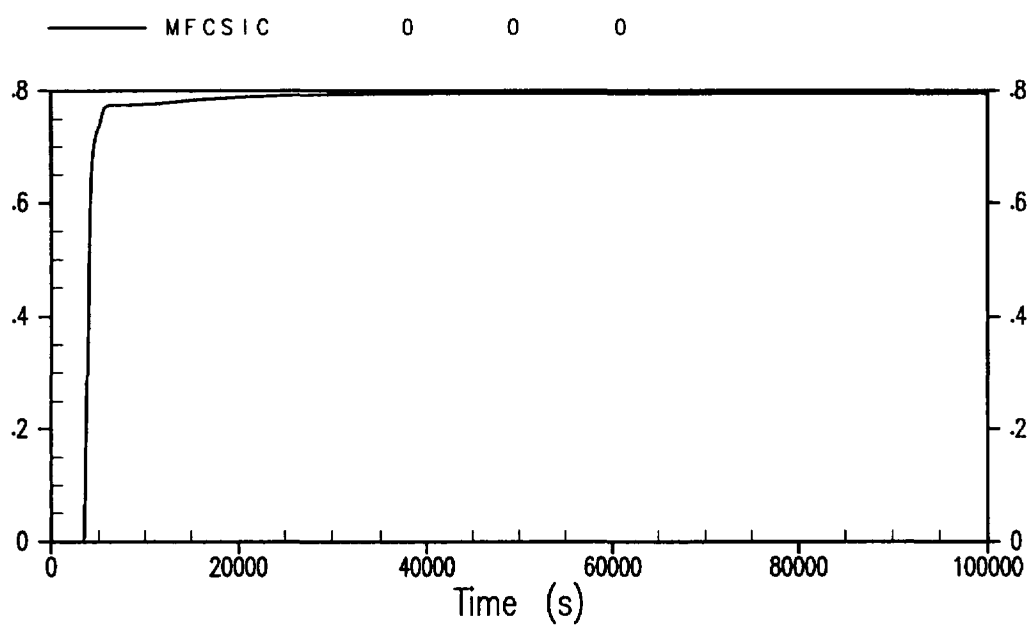


Figure 34-14

Case 3BE-1: Mass Fraction of CsI Released to Containment DVI Line Break, Containment Water Level

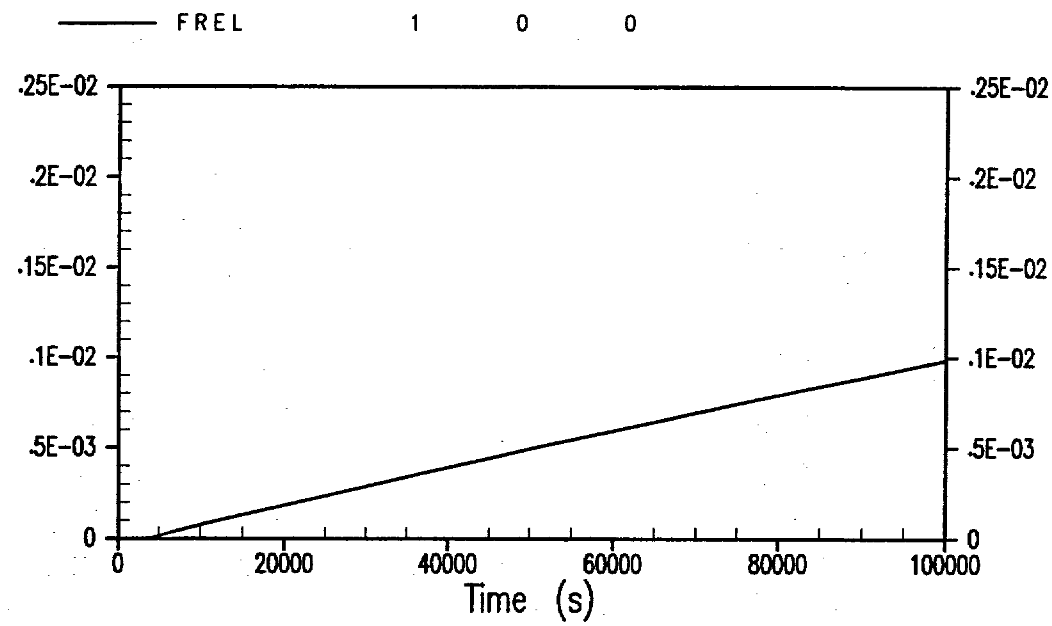


Figure 34-15

Case 3BE-1: Mass Fraction of Noble Gases Released to Environment DVI Line Break, Containment Water Level

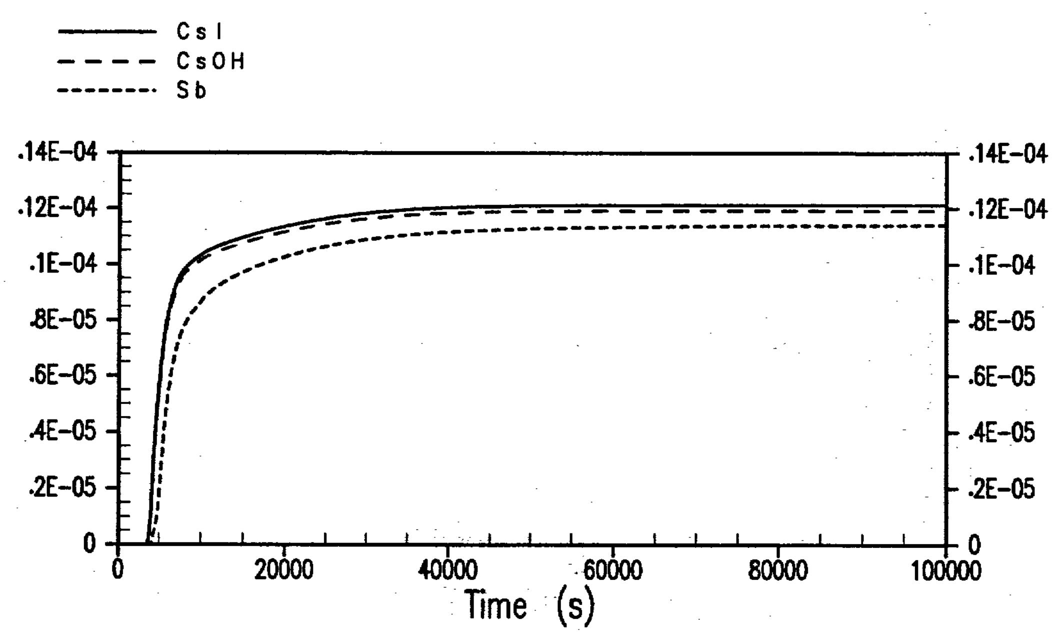


Figure 34-16

Case 3BE-1: Mass Fraction of Fission Products Released to Environment DVI Line Break, Containment Water Level

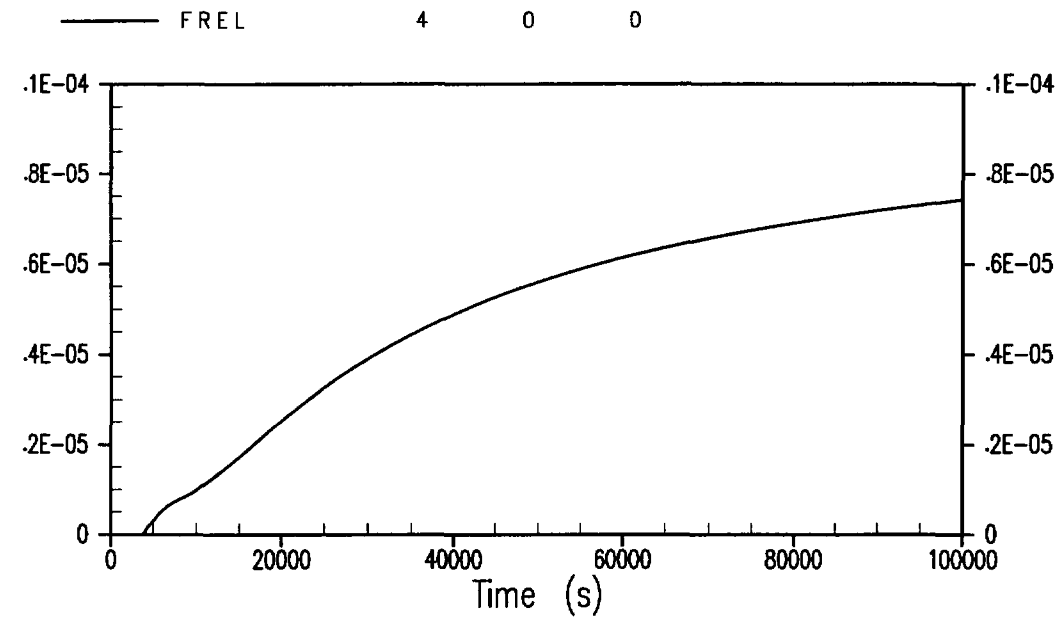


Figure 34-17

Case 3BE-1: Mass Fraction of SrO Released to Environment
DVI Line Break, Containment Water Level

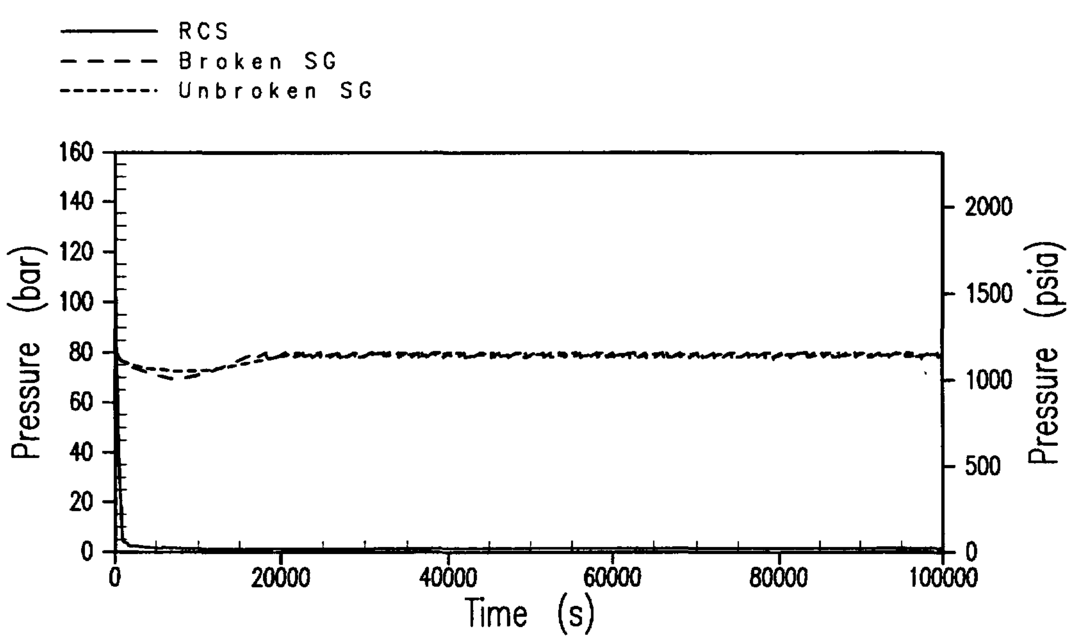


Figure 34-18

Case 3BE-2: Reactor Coolant System and Steam Generator Pressure
DVI Line Break, Fail Gravity Injection, No DVI Flooding

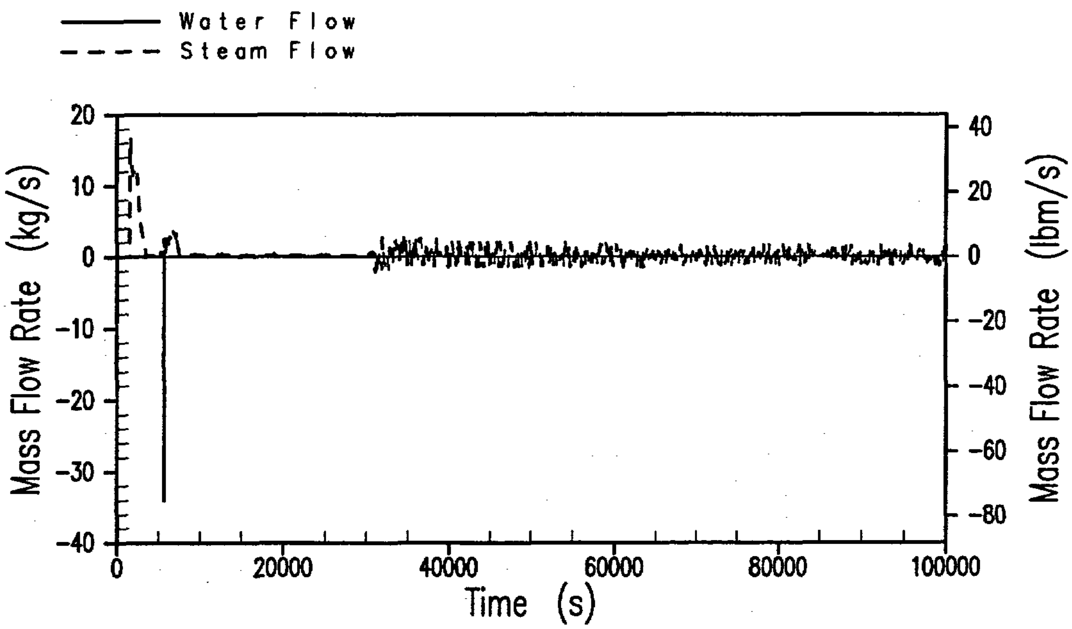


Figure 34-19

Case 3BE-2: ADS Stage 4 Flow Rates
DVI Line Break, Fail Gravity Injection, No DVI Flooding

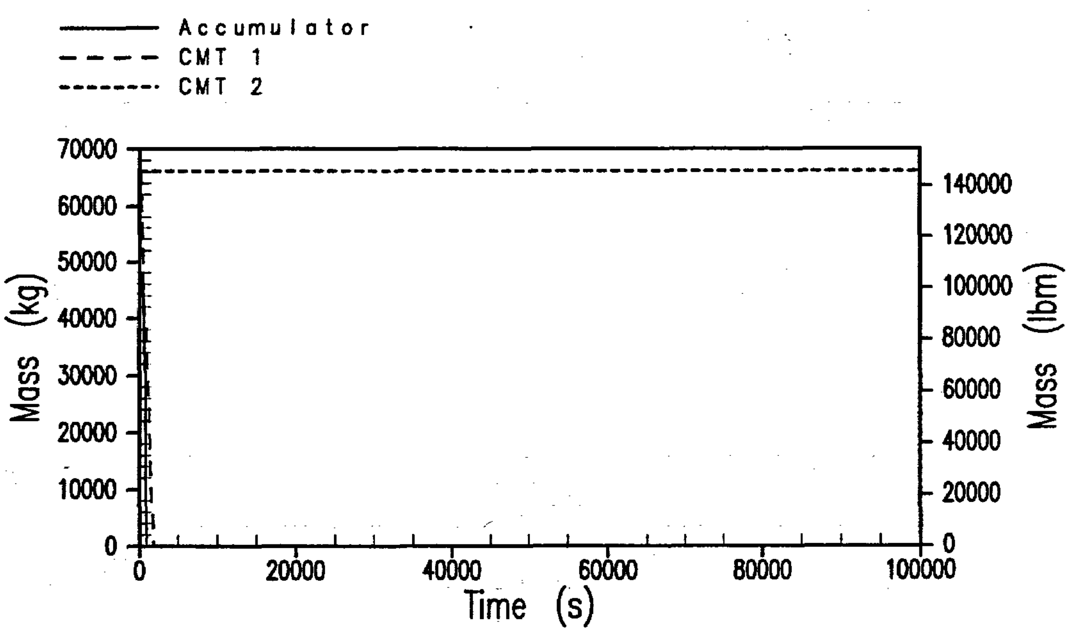


Figure 34-20

Case 3BE-2: Accumulator/CMT Water Mass
DVI Line Break, Fail Gravity Injection, No DVI Flooding

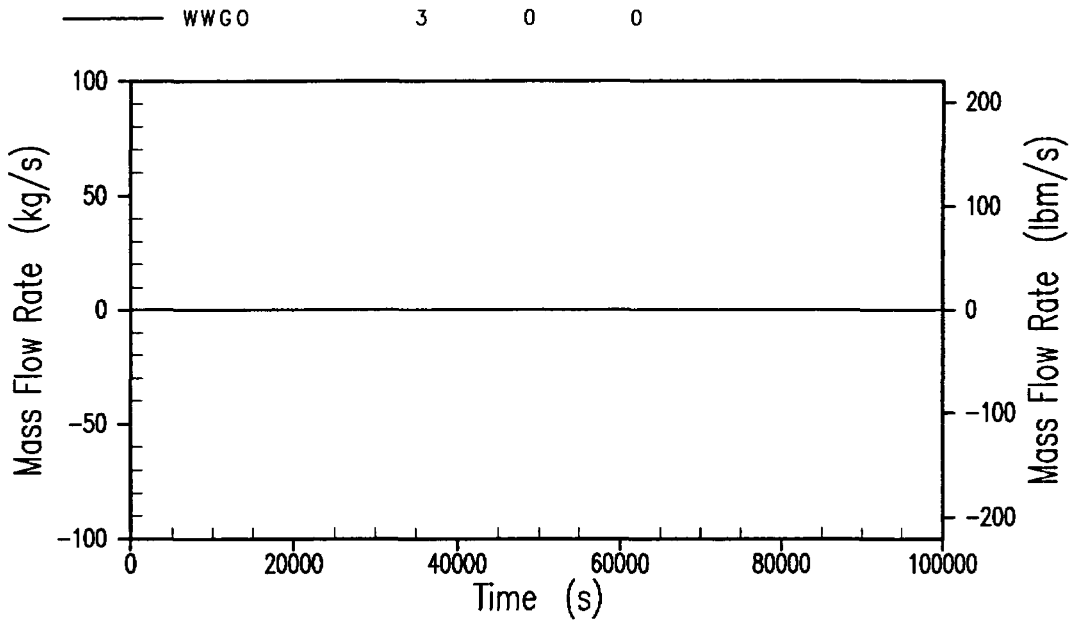


Figure 34-21

Case 3BE-2: IRWST Injection Flow Rate
DVI Line Break, Fail Gravity Injection, No DVI Flooding

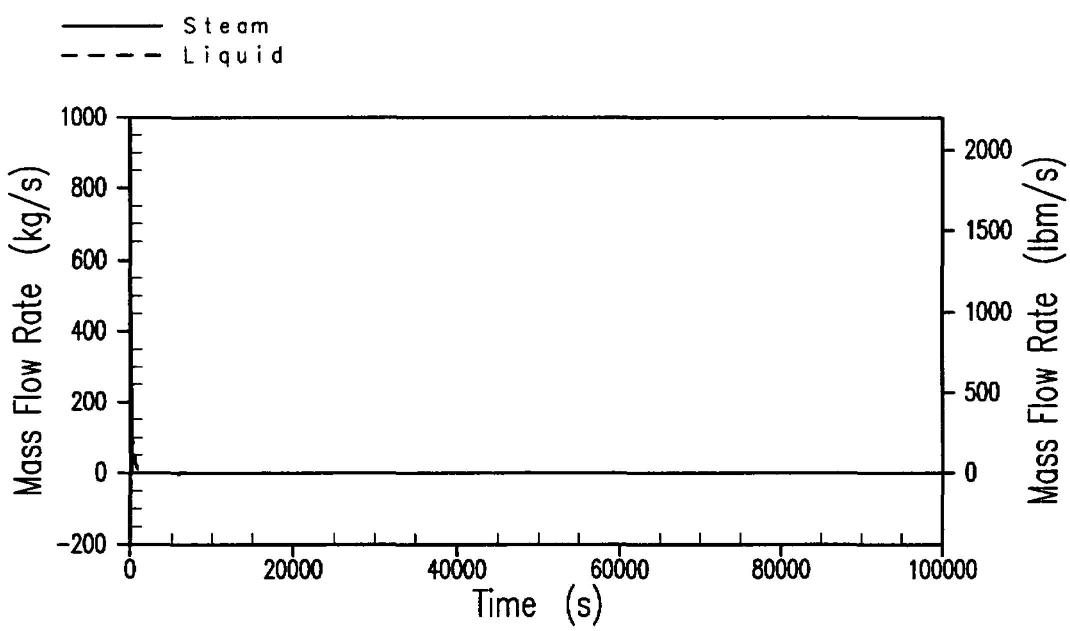


Figure 34-22

Case 3BE-2: Break Flow Rate
DVI Line Break, Fail Gravity Injection, No DVI Flooding

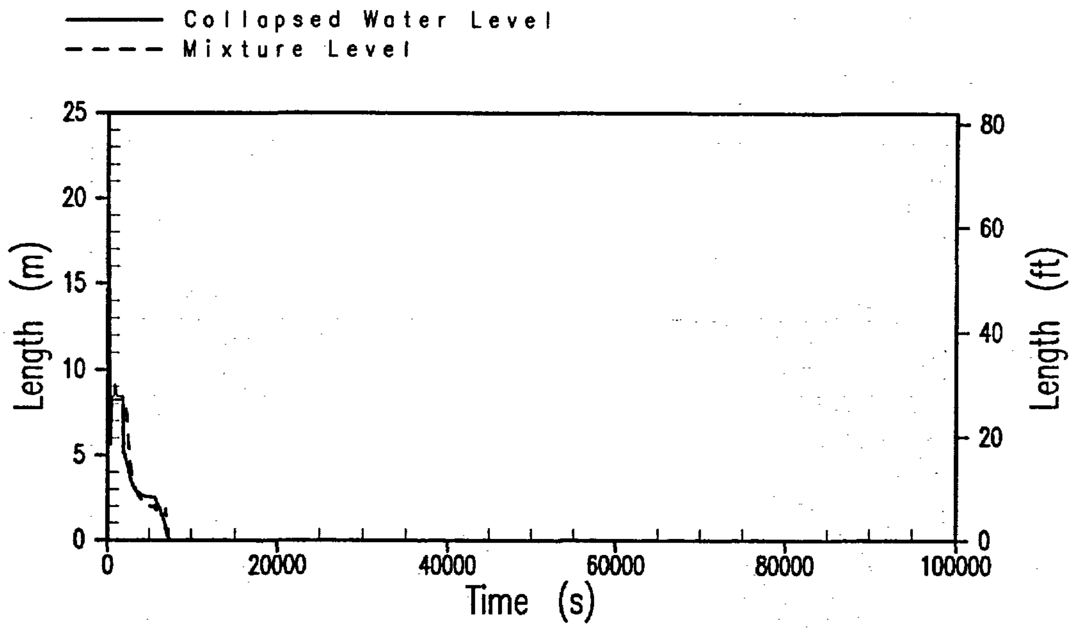


Figure 34-23

Case 3BE-2: Reactor Vessel Water Level
DVI Line Break, Fail Gravity Injection, No DVI Flooding

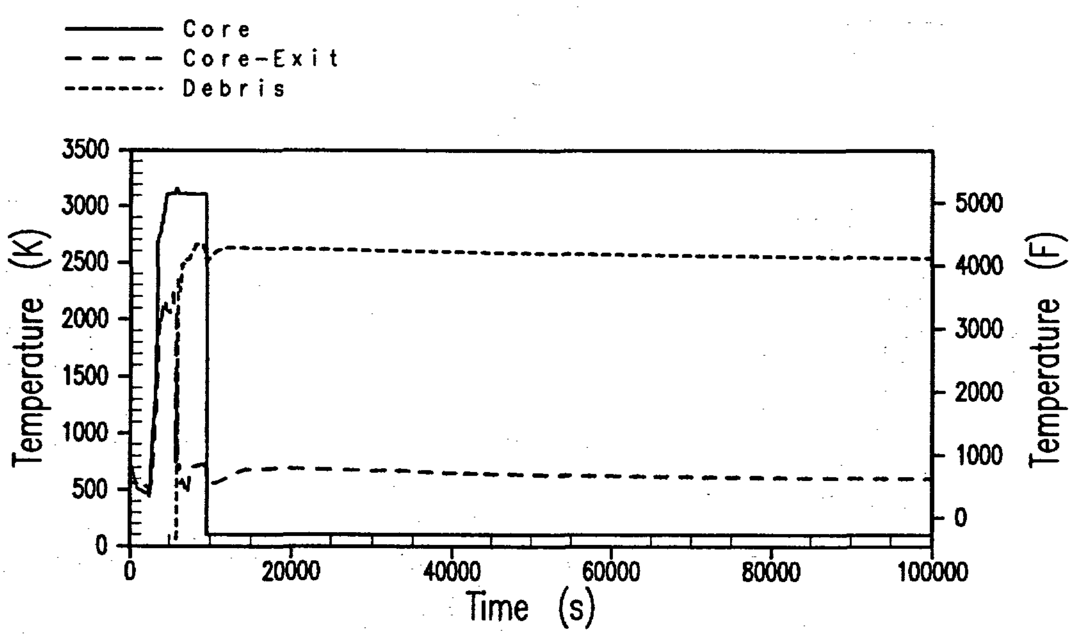


Figure 34-24

Case 3BE-2: Core Temperatures
DVI Line Break, Fail Gravity Injection, No DVI Flooding

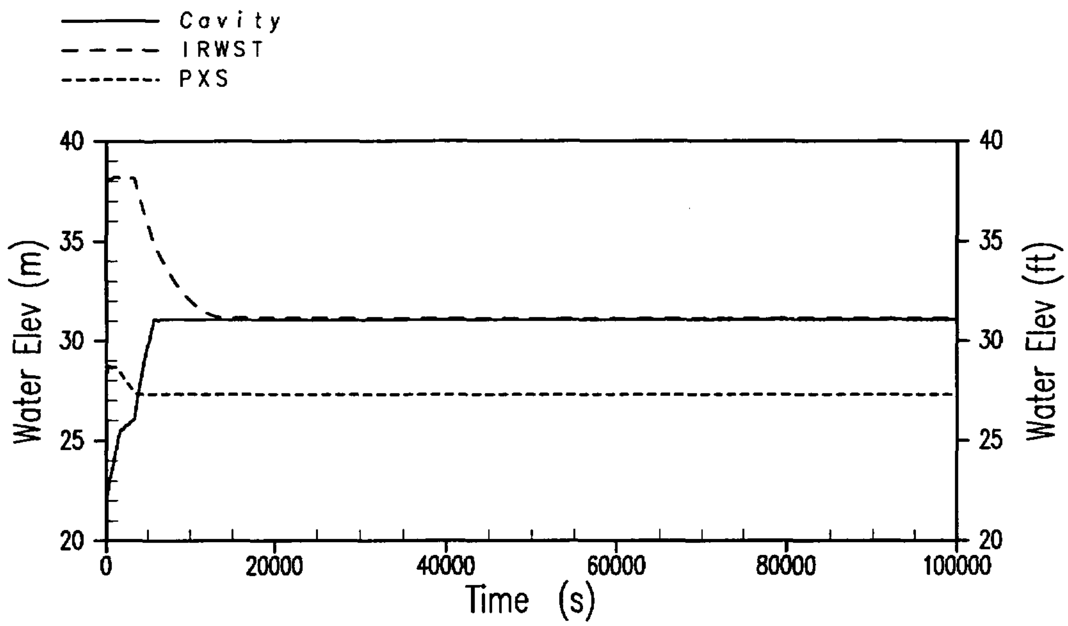


Figure 34-25

Case 3BE-2: Containment Water Pool Elevations
DVI Line Break, Fail Gravity Injection, No DVI Flooding

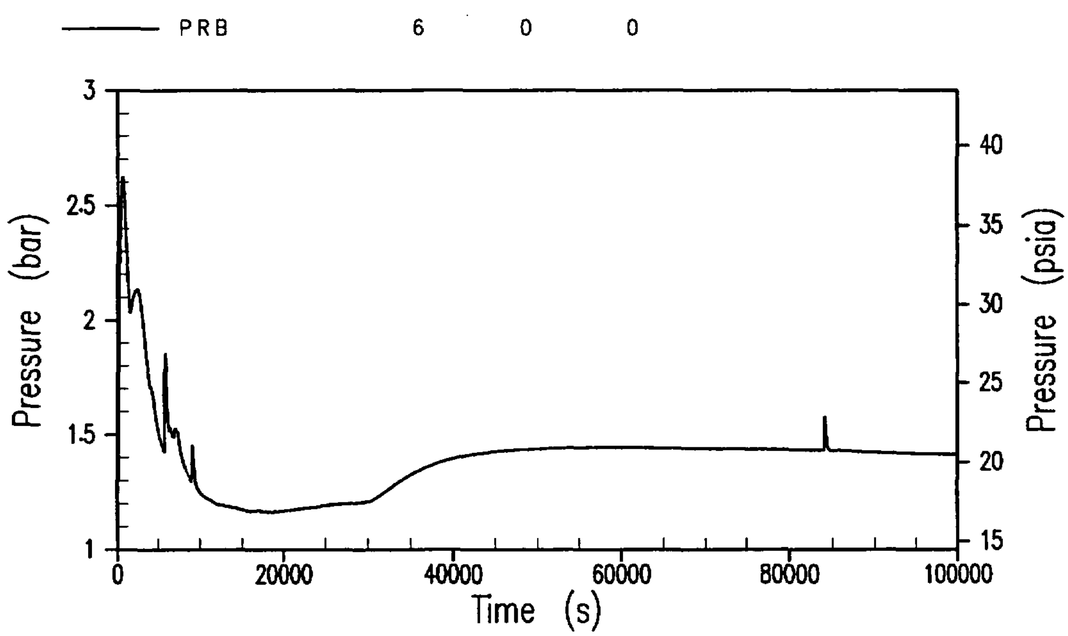


Figure 34-26

Case 3BE-2: Containment Pressure
DVI Line Break, Fail Gravity Injection, No DVI Flooding

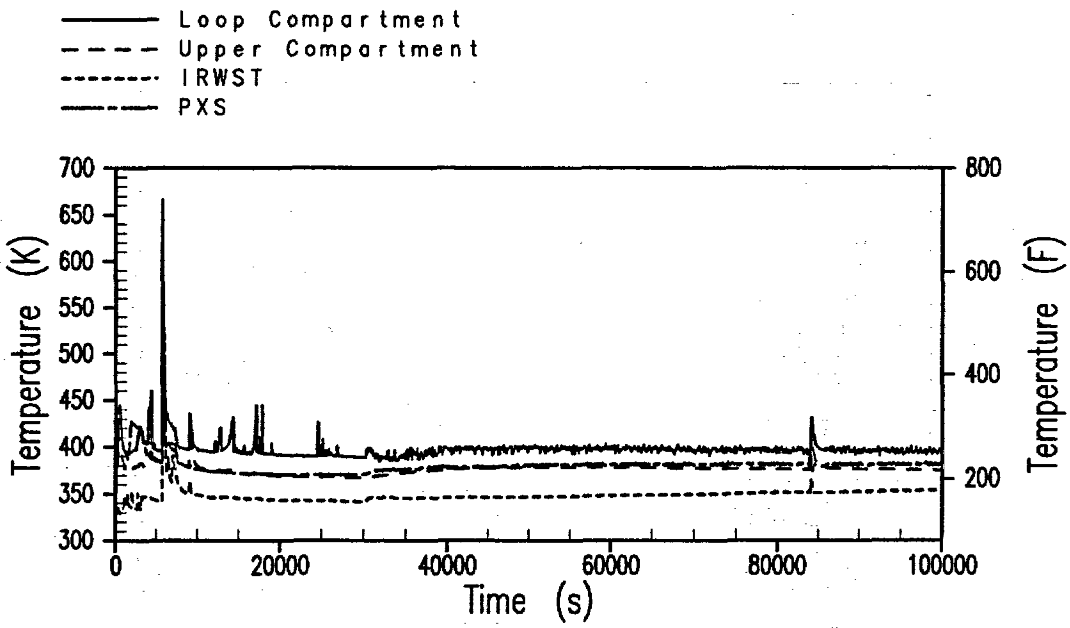


Figure 34-27

Case 3BE-2: Containment Gas Temperatures
DVI Line Break, Fail Gravity Injection, No DVI Flooding

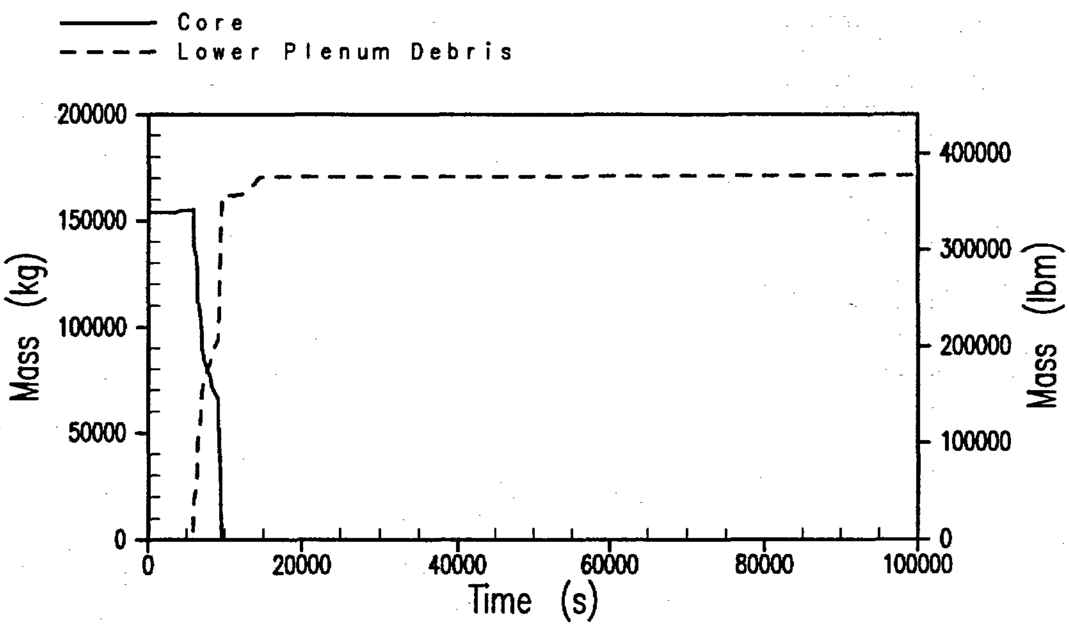


Figure 34-28

Case 3BE-2: Core Mass
DVI Line Break, Fail Gravity Injection, No DVI Flooding

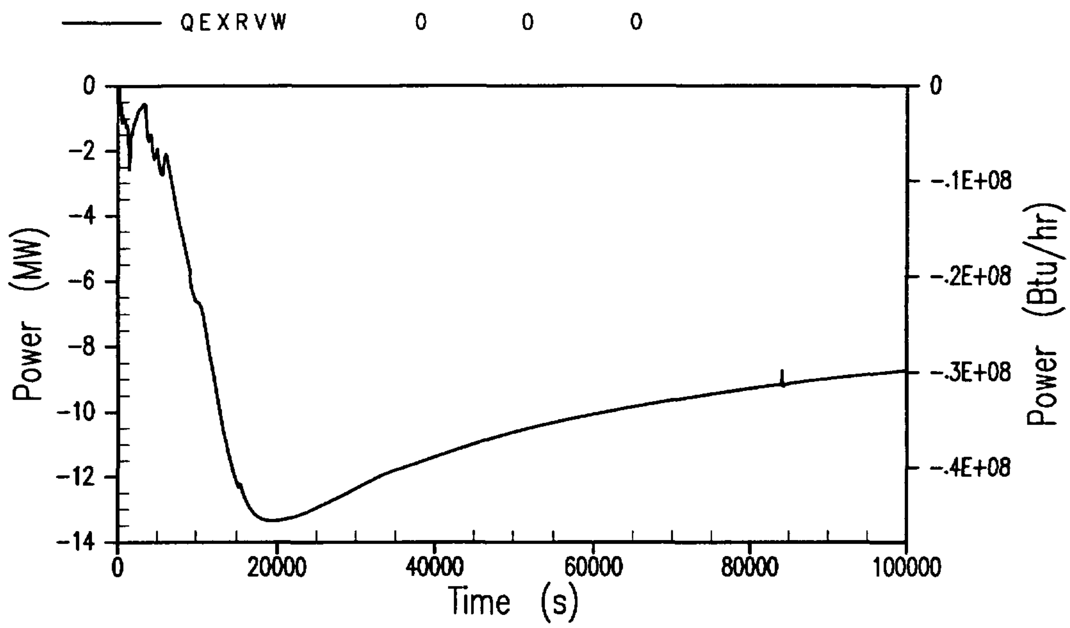


Figure 34-29

Case 3BE-2: Reactor Pressure Vessel to Cavity Water Heat Transfer DVI Line Break, Fail Gravity Injection, No DVI Flooding

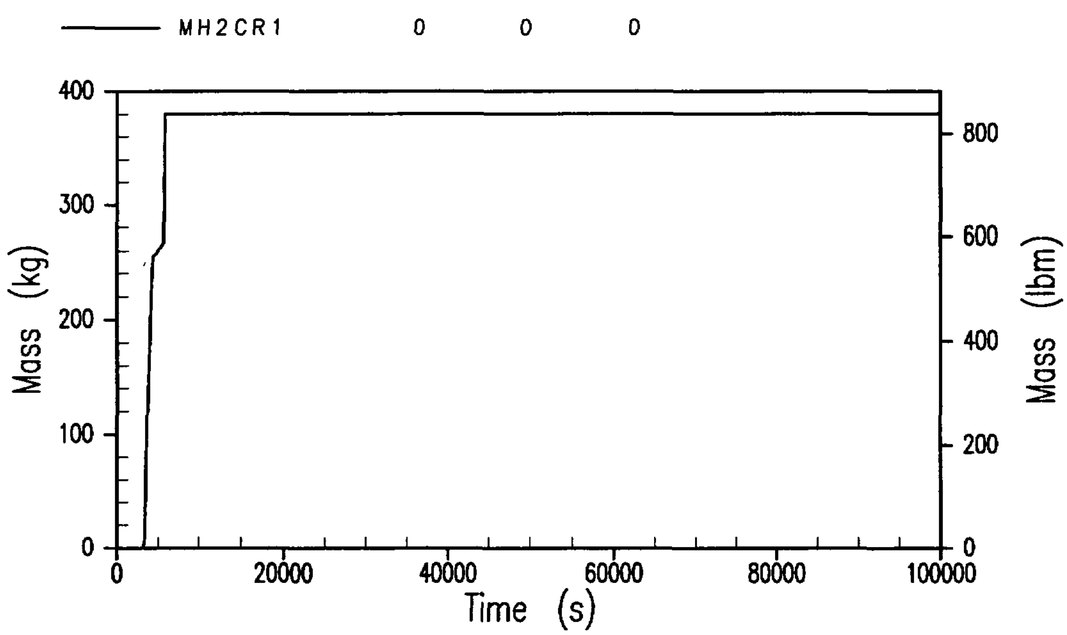


Figure 34-30

Case 3BE-2: In-Vessel Hydrogen Generation DVI Line Break, Fail Gravity Injection, No DVI Flooding

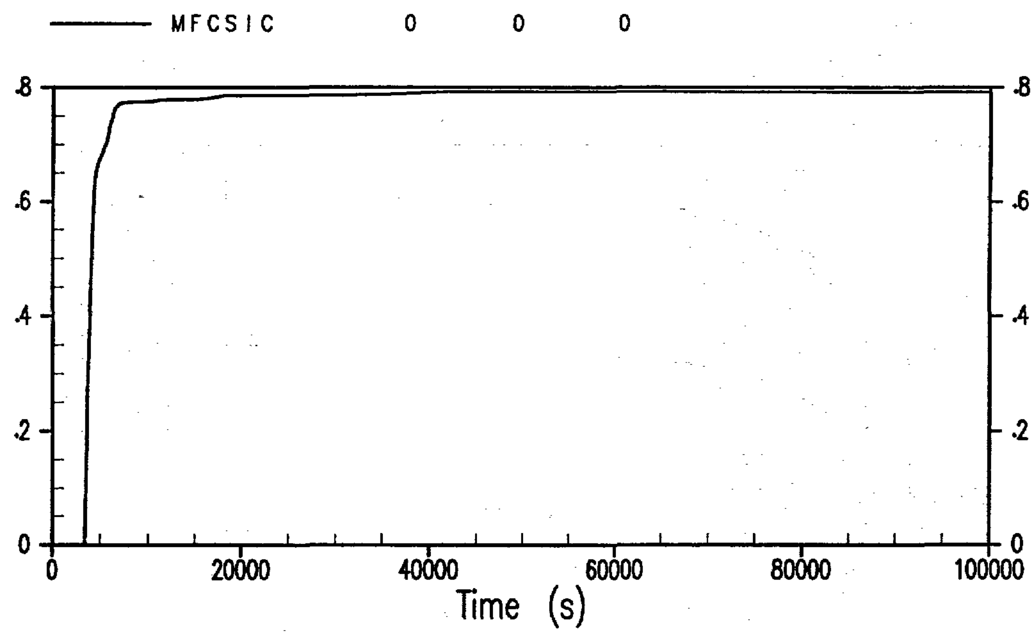


Figure 34-31

Case 3BE-2: Mass Fraction of CsI Released to Containment DVI Line Break, Fail Gravity Injection, No DVI Flooding

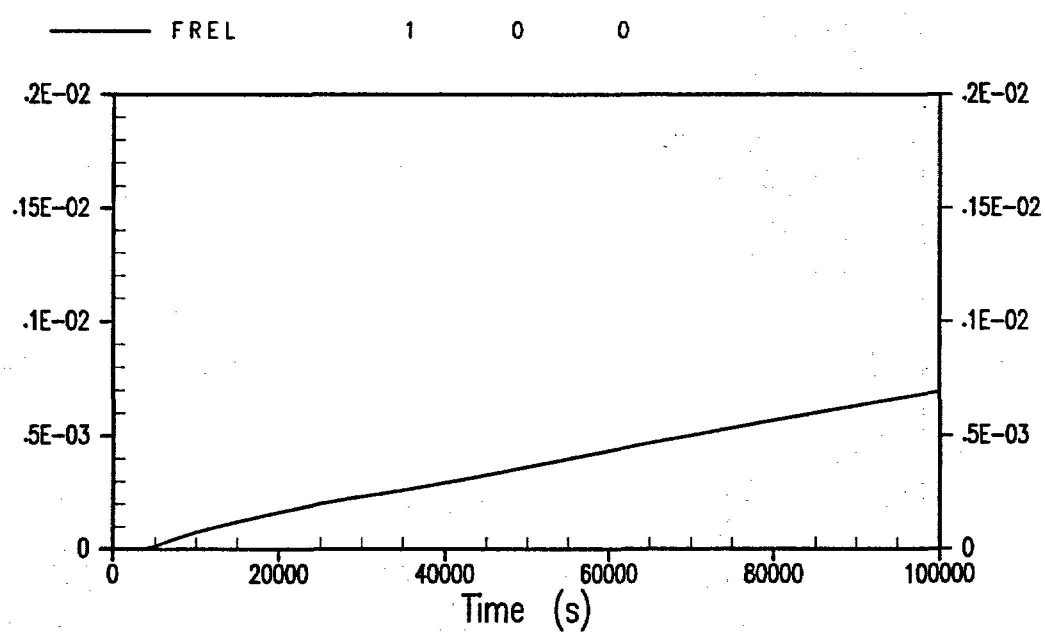


Figure 34-32

Case 3BE-2: Mass Fraction of Noble Gases Released to Environment DVI Line Break, Fail Gravity Injection, No DVI Flooding

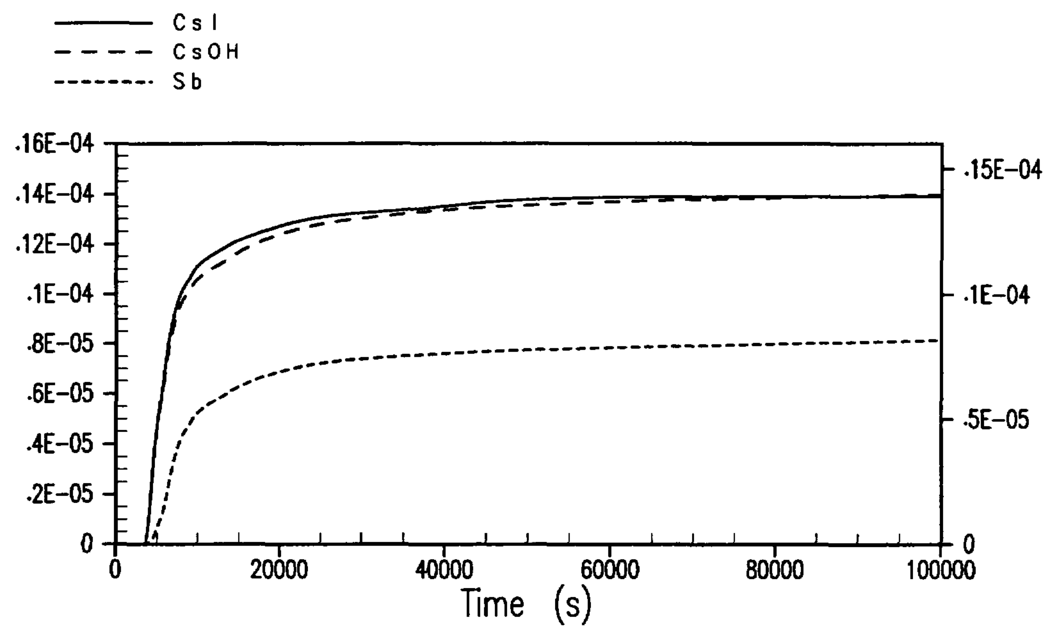


Figure 34-33

Case 3BE-2: Mass Fraction of Fission Products Released to Environment DVI Line Break, Fail Gravity Injection, No DVI Flooding

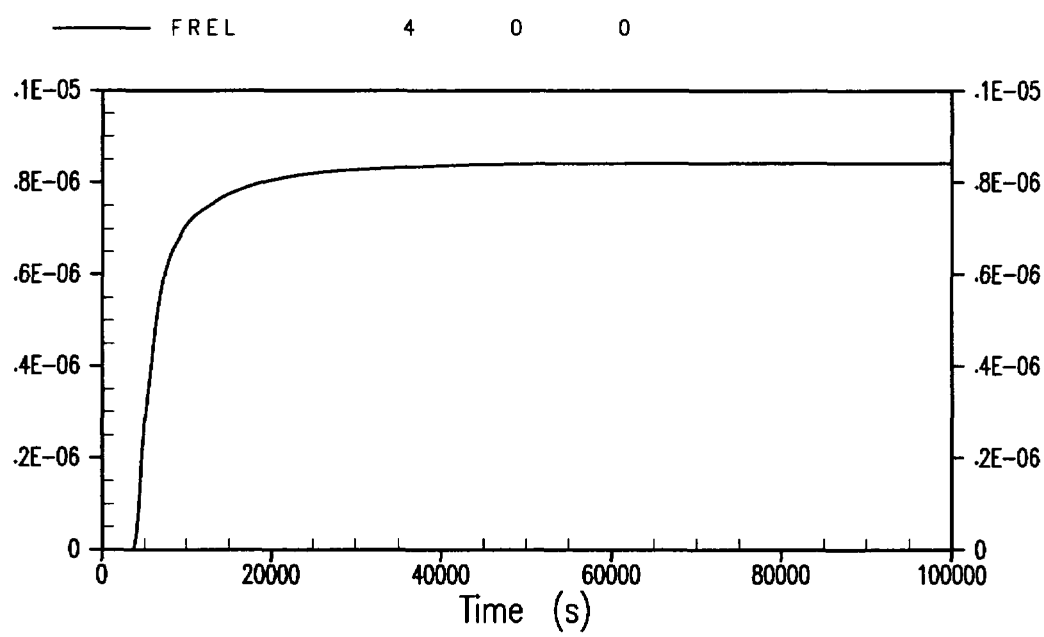


Figure 34-34

Case 3BE-2: Mass Fraction of SrO Released to Environment DVI Line Break, Fail Gravity Injection, No DVI Flooding

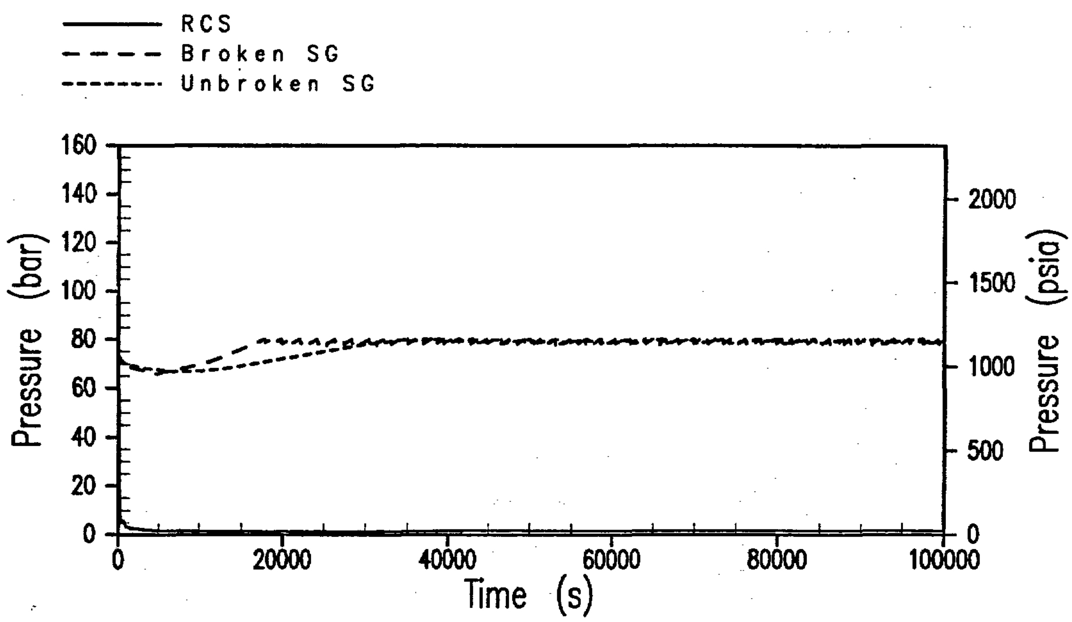


Figure 34-35

Case 3BE-4: Reactor Coolant System and Steam Generator Pressure
Spurious ADS, Failed Gravity Injection

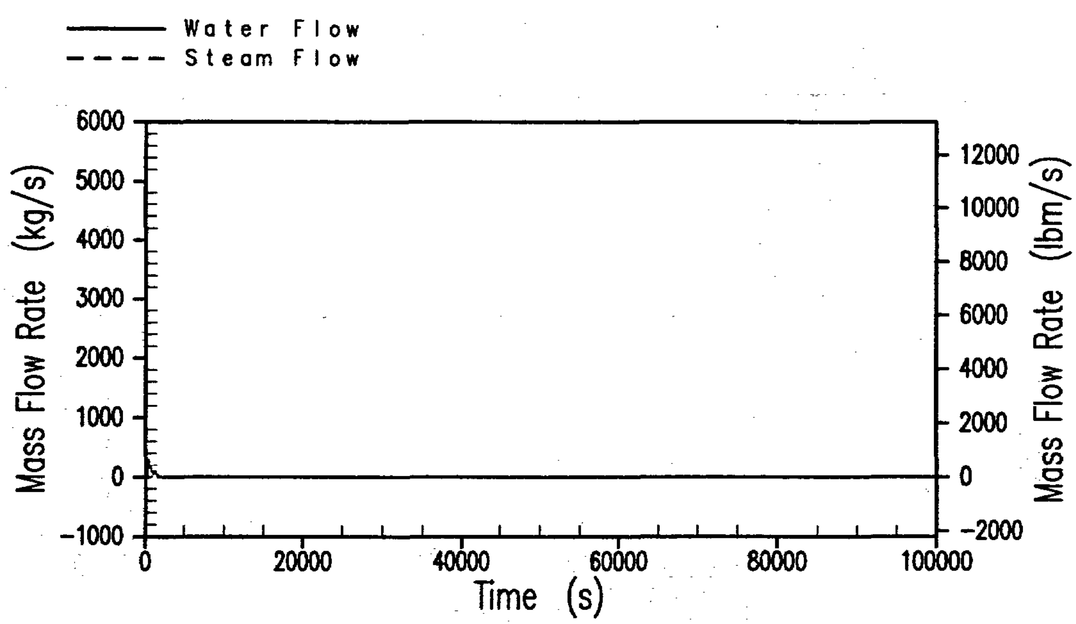


Figure 34-36

Case 3BE-4: ADS Stage 4 Flow Rates
Spurious ADS, Failed Gravity Injection

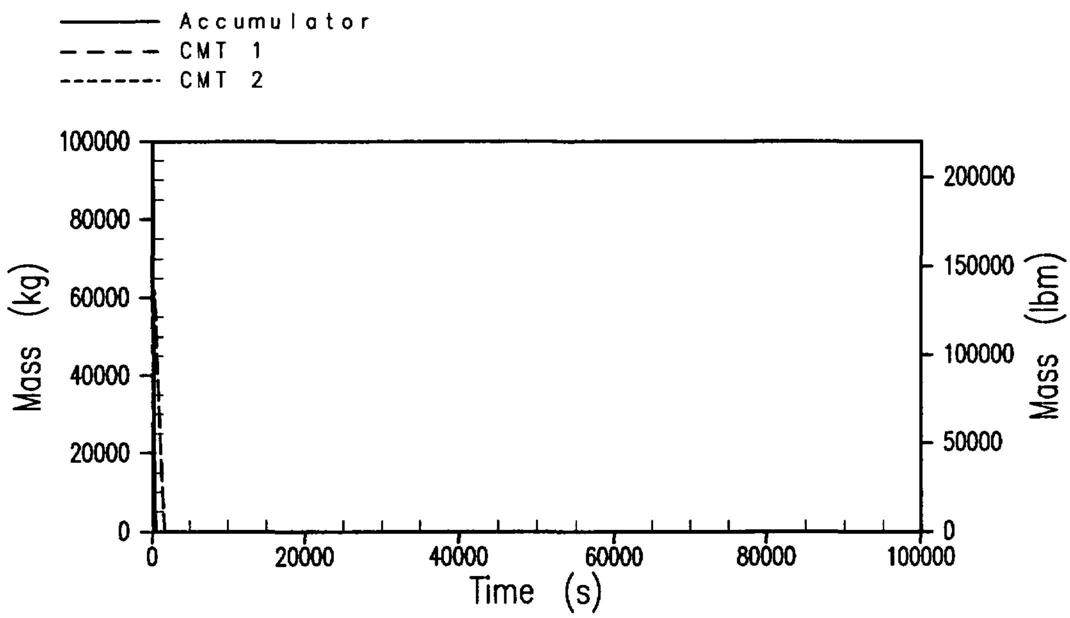


Figure 34-37

Case 3BE-4: Accumulator/CMT Water Mass
Spurious ADS, Failed Gravity Injection

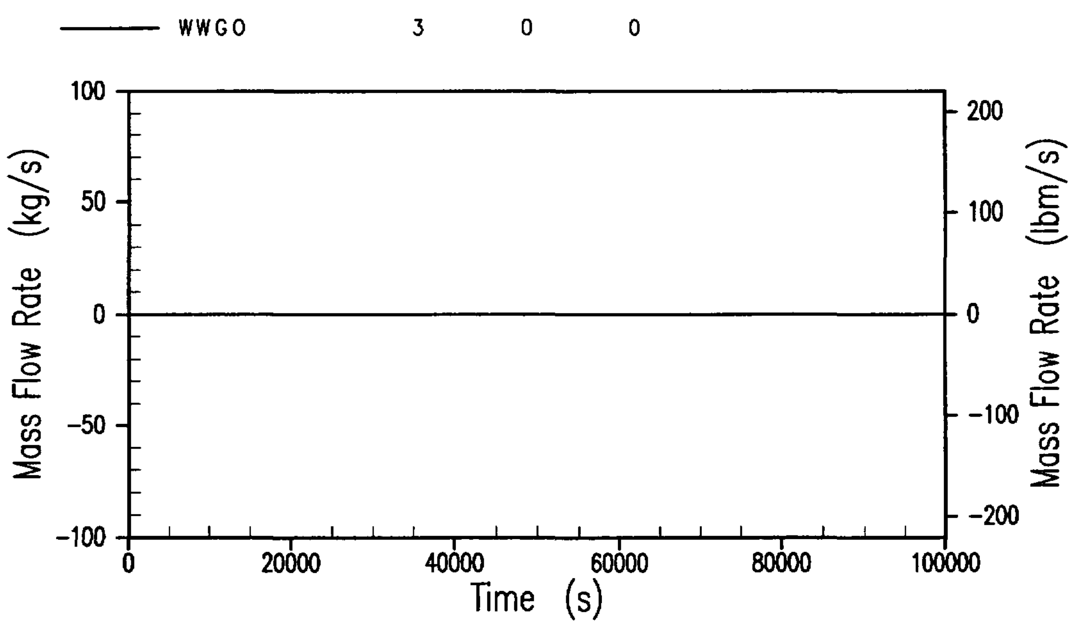


Figure 34-38

Case 3BE-4: IRWST Injection Flow Rate
Spurious ADS, Failed Gravity Injection

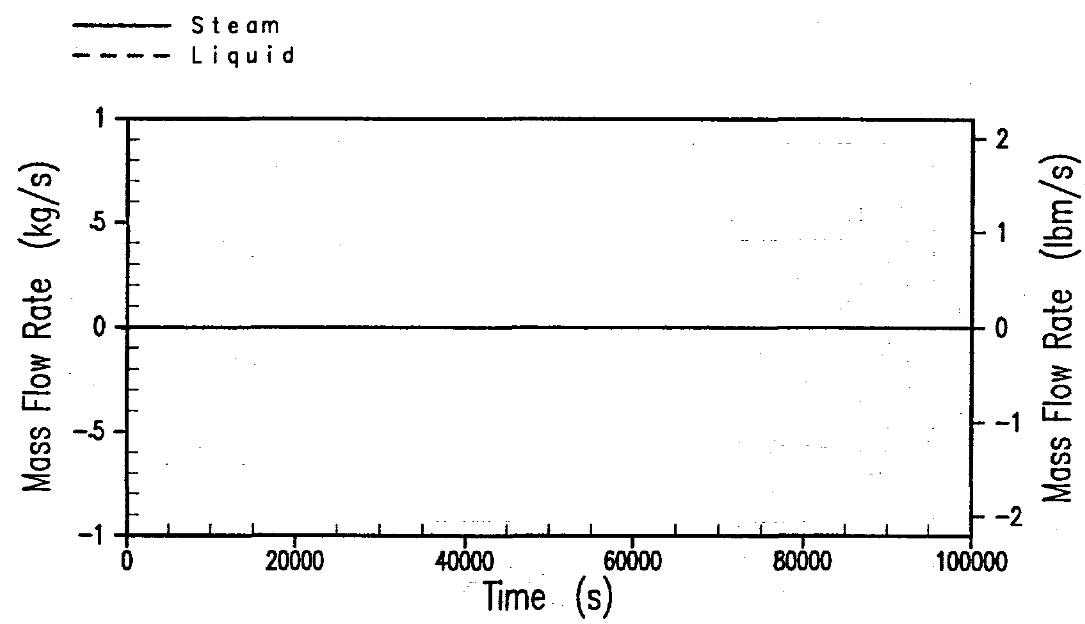


Figure 34-39

Case 3BE-4: Break Flow Rate
Spurious ADS, Failed Gravity Injection

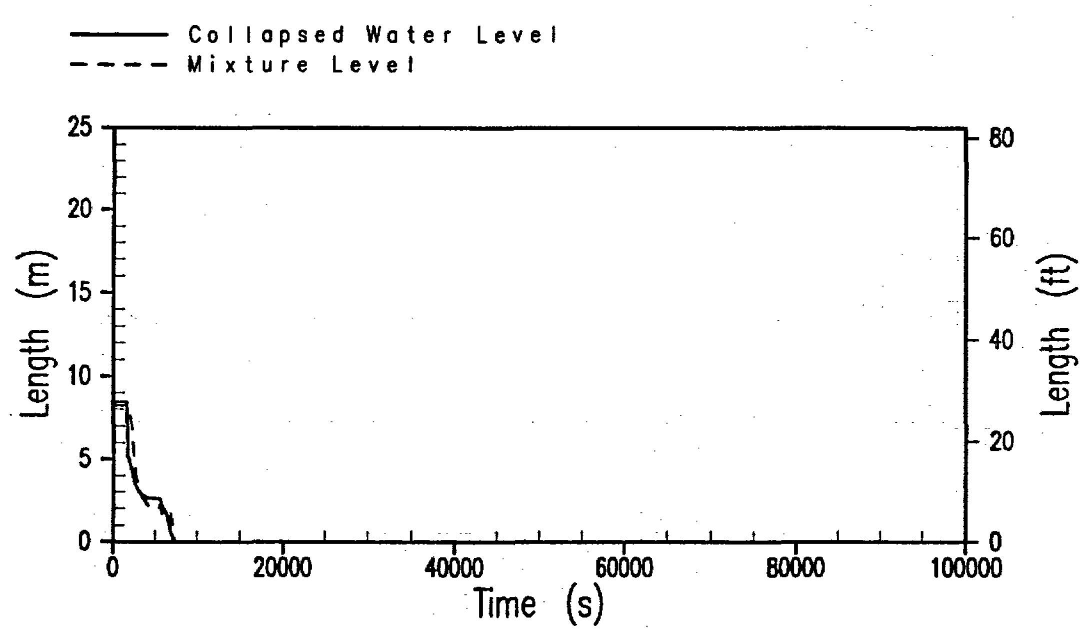


Figure 34-40

Case 3BE-4: Reactor Vessel Water Level
Spurious ADS, Failed Gravity Injection

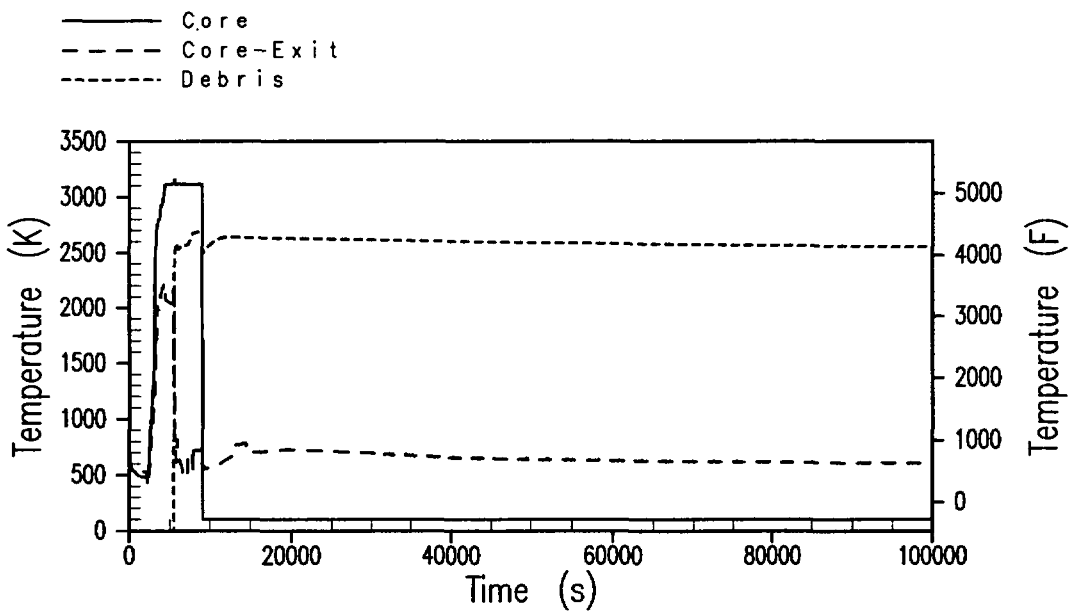


Figure 34-41

Case 3BE-4: Core Temperatures
Spurious ADS, Failed Gravity Injection

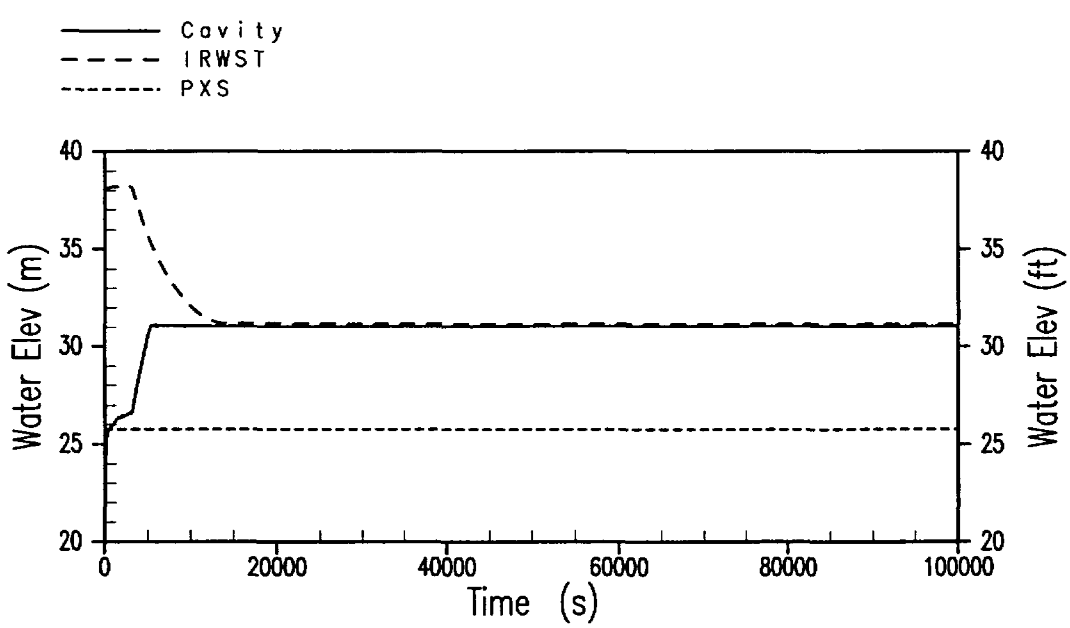


Figure 34-42

Case 3BE-4: Containment Water Pool Elevations
Spurious ADS, Failed Gravity Injection

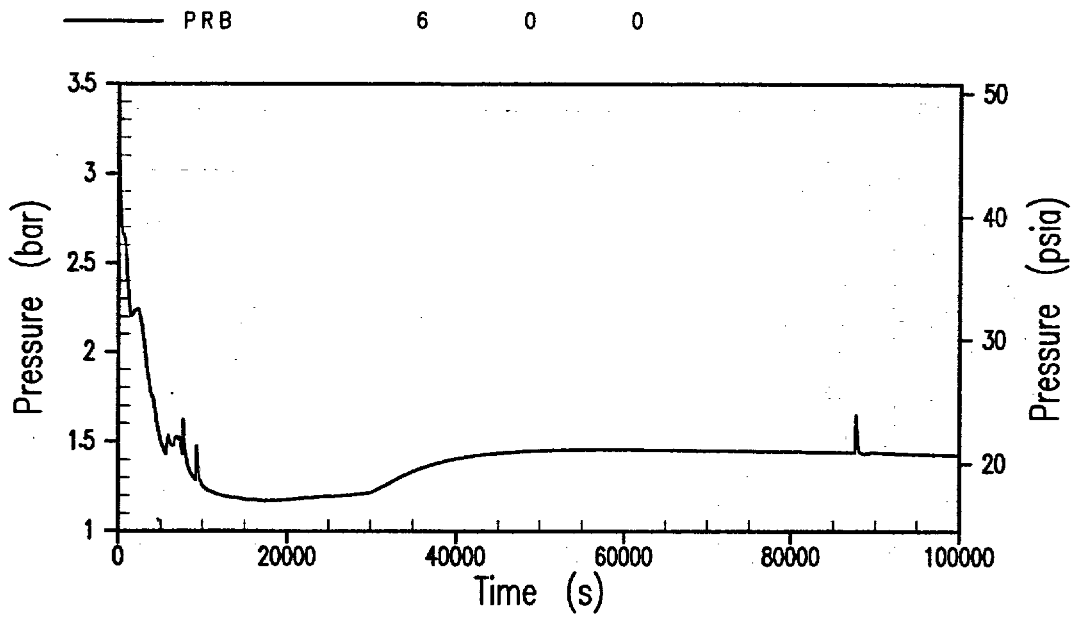


Figure 34-43

Case 3BE-4: Containment Pressure
Spurious ADS, Failed Gravity Injection

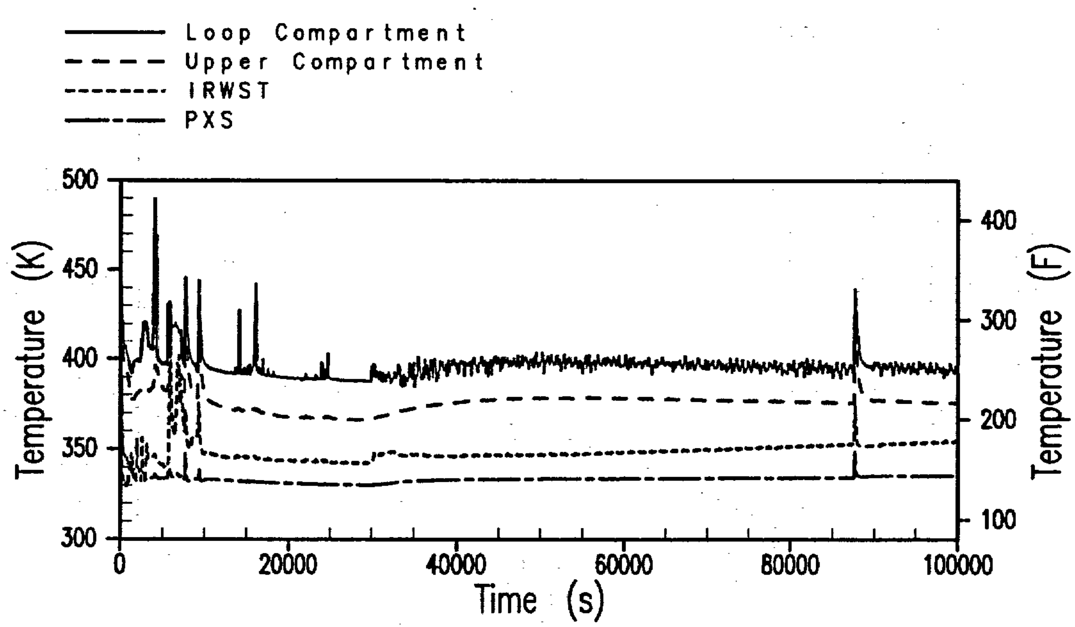


Figure 34-44

Case 3BE-4: Containment Gas Temperatures
Spurious ADS, Failed Gravity Injection

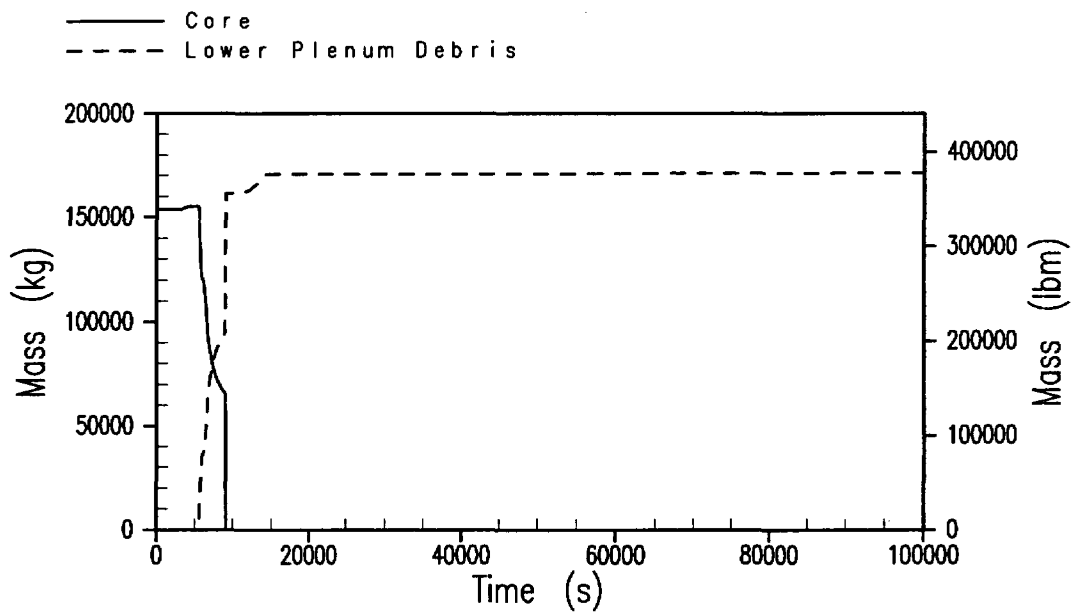


Figure 34-45

Case 3BE-4: Core Mass
Spurious ADS, Failed Gravity Injection

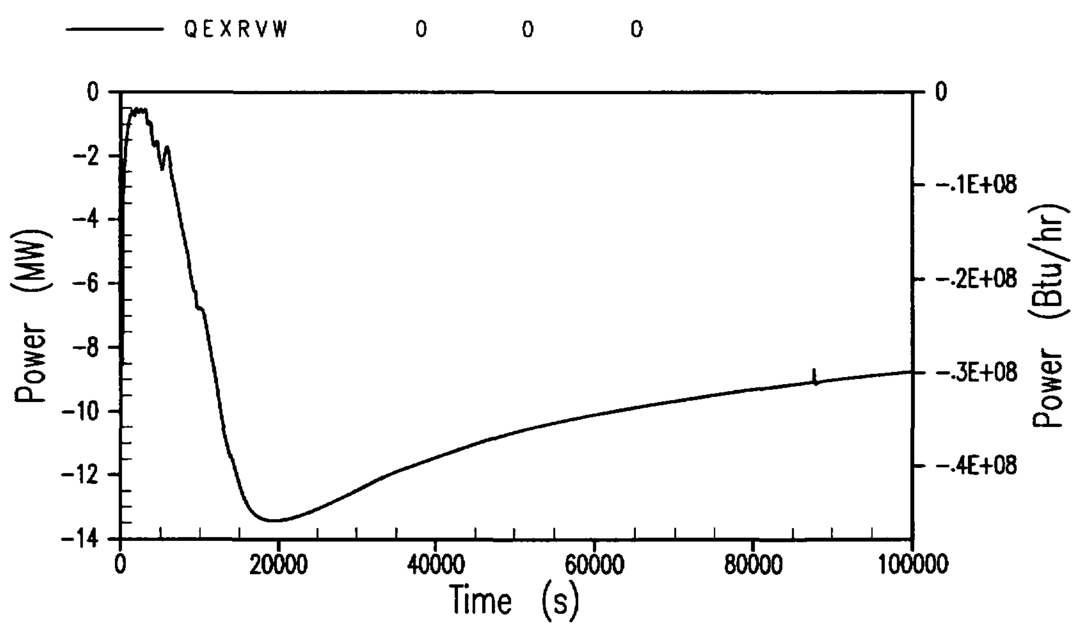


Figure 34-46

Case 3BE-4: Reactor Pressure Vessel to Cavity Water Heat Transfer
Spurious ADS, Failed Gravity Injection

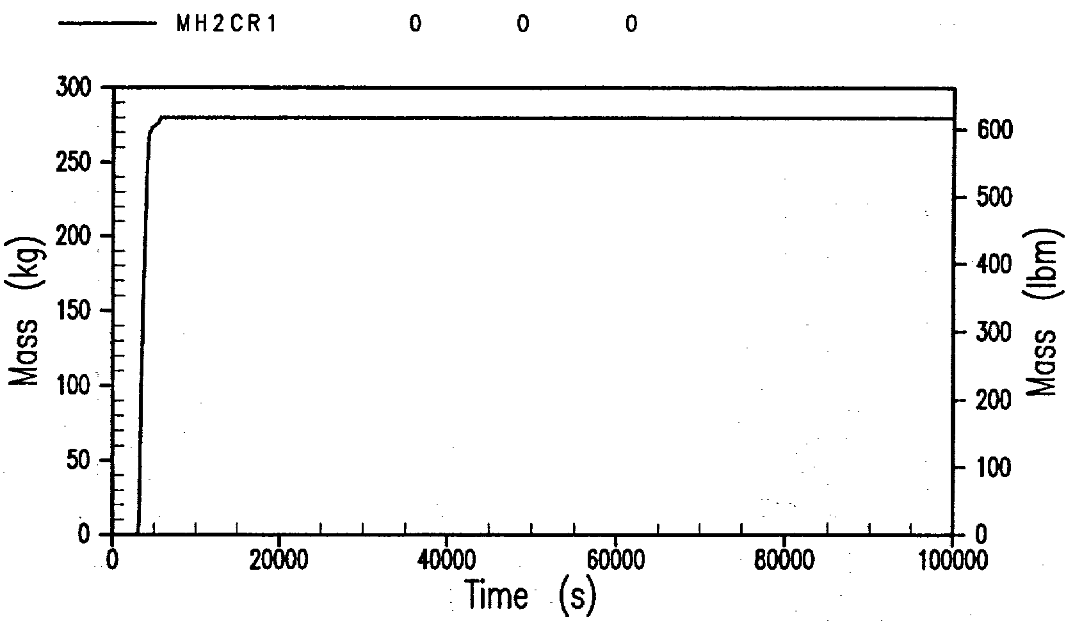


Figure 34-47

Case 3BE-4: In-Vessel Hydrogen Generation Spurious ADS, Failed Gravity Injection

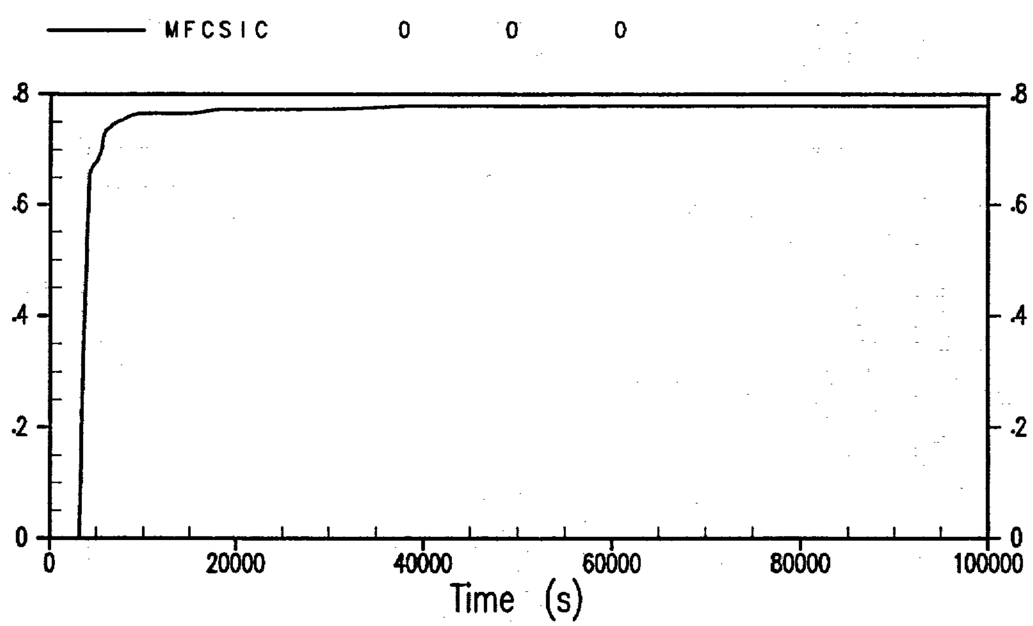


Figure 34-48

Case 3BE-4: Mass Fraction of CsI Released to Containment Spurious ADS, Failed Gravity Injection

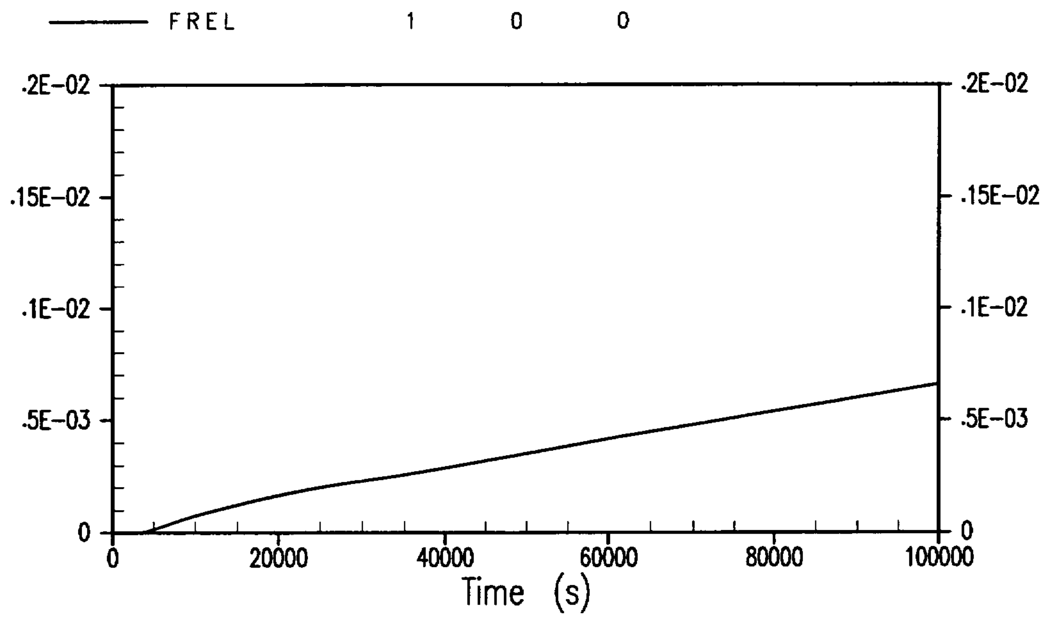


Figure 34-49

Case 3BE-4: Mass Fraction of Noble Gases Released to Environment Spurious ADS, Failed Gravity Injection

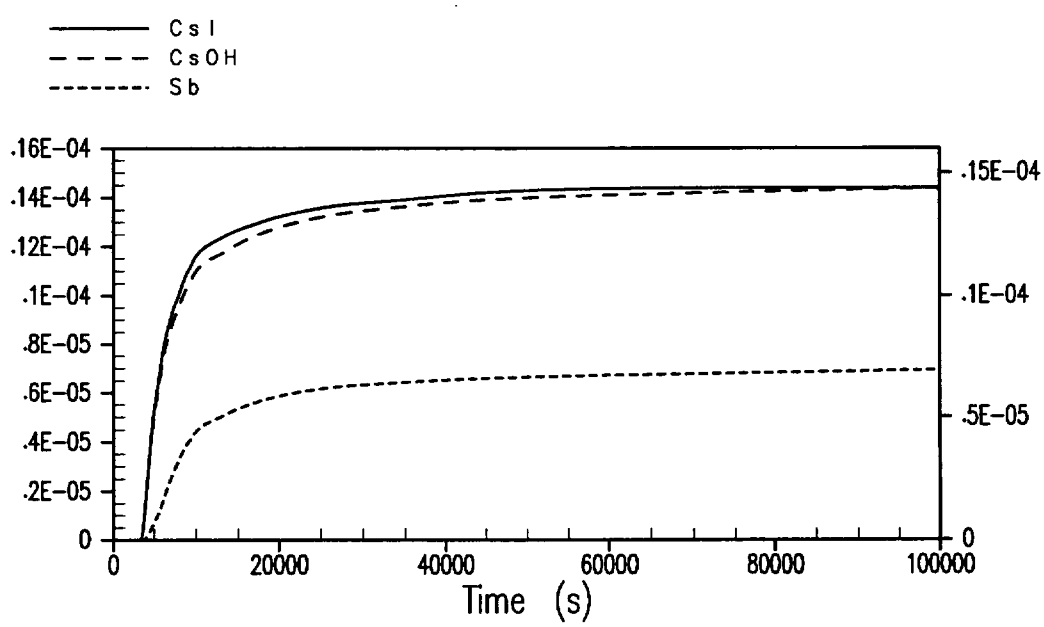


Figure 34-50

Case 3BE-4: Mass Fraction of Fission Products Released to Environment Spurious ADS, Failed Gravity Injection

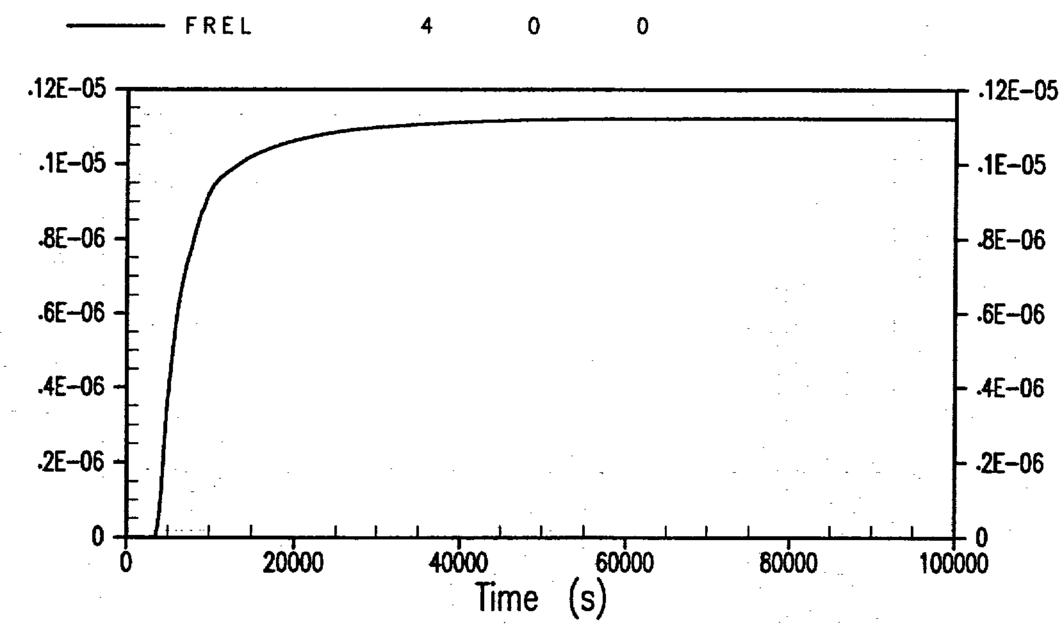


Figure 34-51

Case 3BE-4: Mass Fraction of SrO Released to Environment Spurious ADS, Failed Gravity Injection

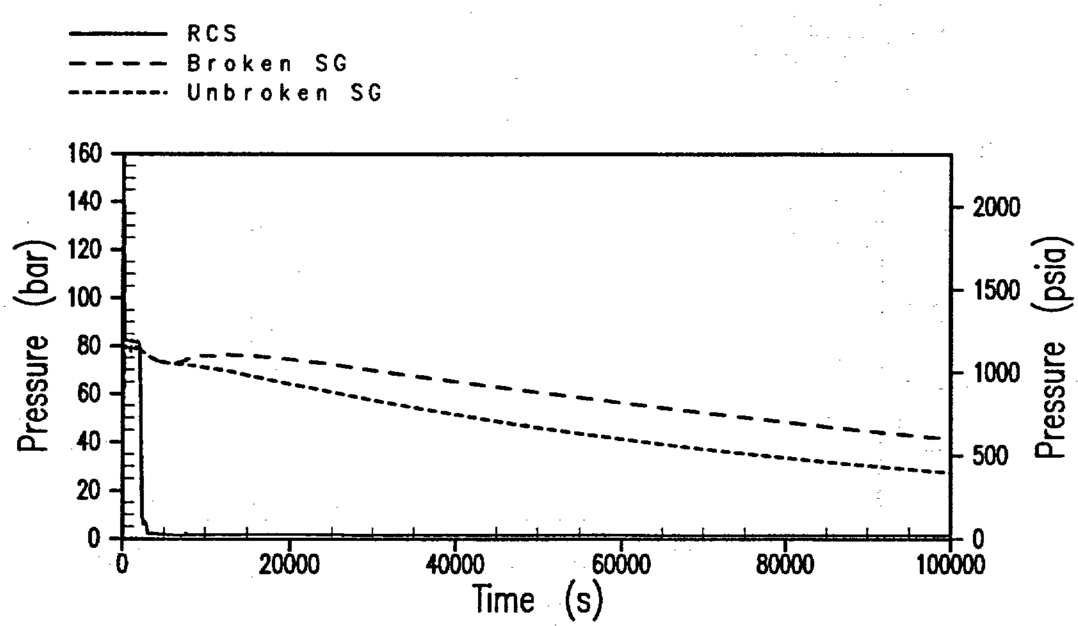


Figure 34-52

Case 3BE-5: Reactor Coolant System and Steam Generator Pressure SBLOCA with Failed Gravity Injection

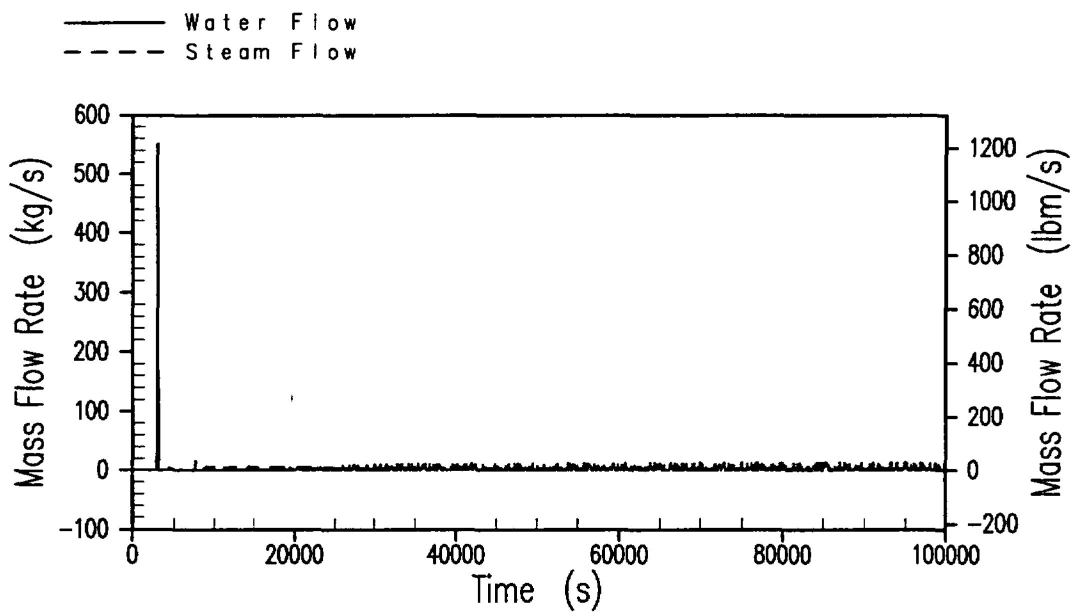


Figure 34-53

Case 3BE-5: ADS Stage 4 Flow Rates
SBLOCA with Failed Gravity Injection

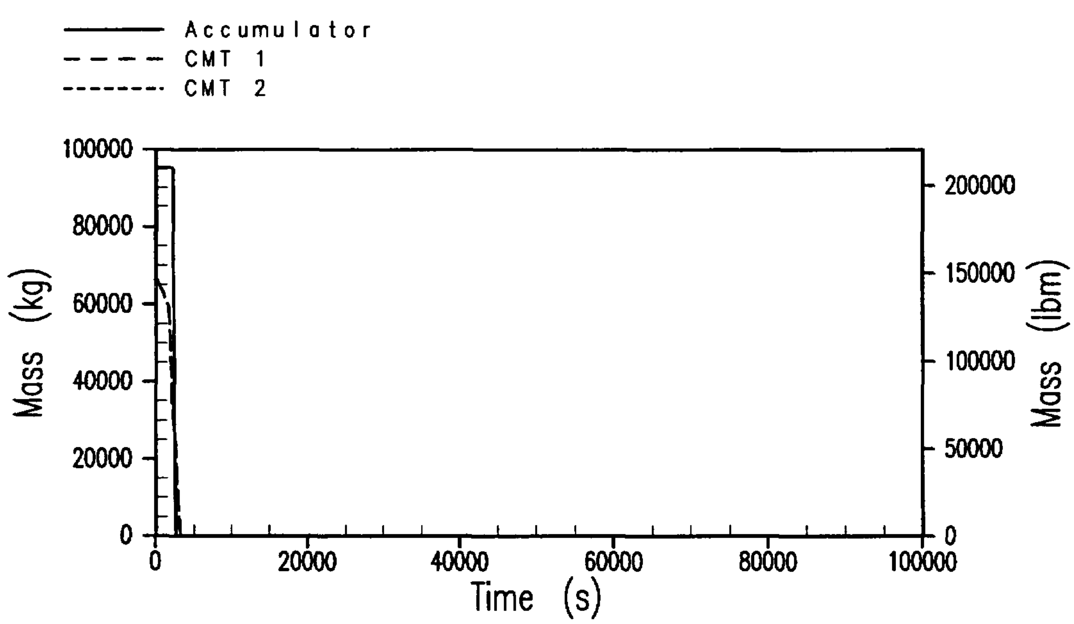


Figure 34-54

Case 3BE-5: Accumulator/CMT Water Mass
SBLOCA with Failed Gravity Injection

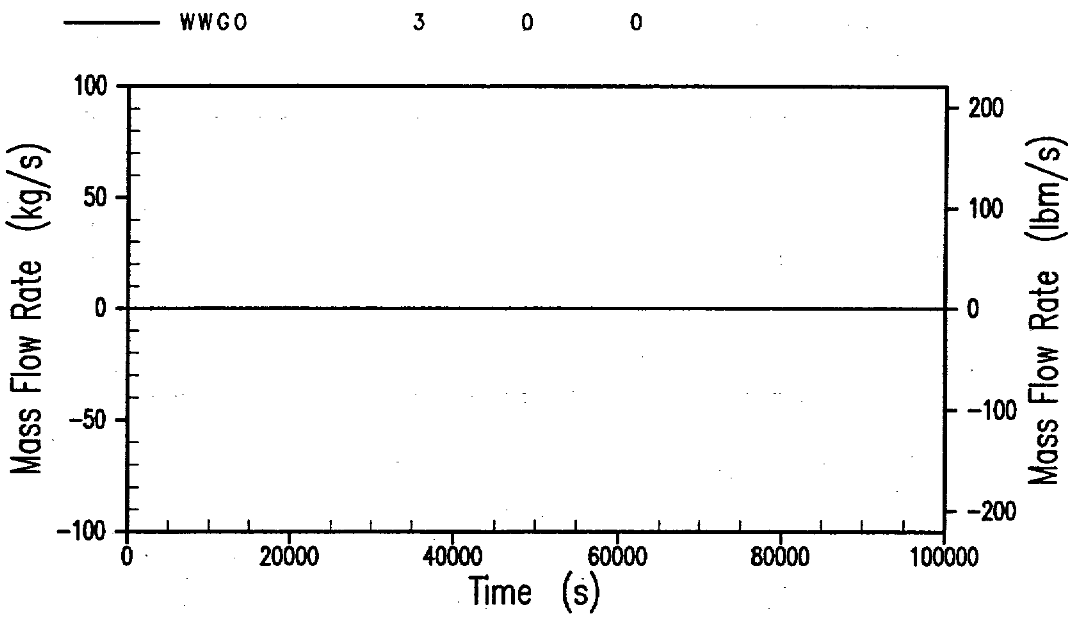


Figure 34-55

Case 3BE-5: IRWST Injection Flow Rate SBLOCA with Failed Gravity Injection

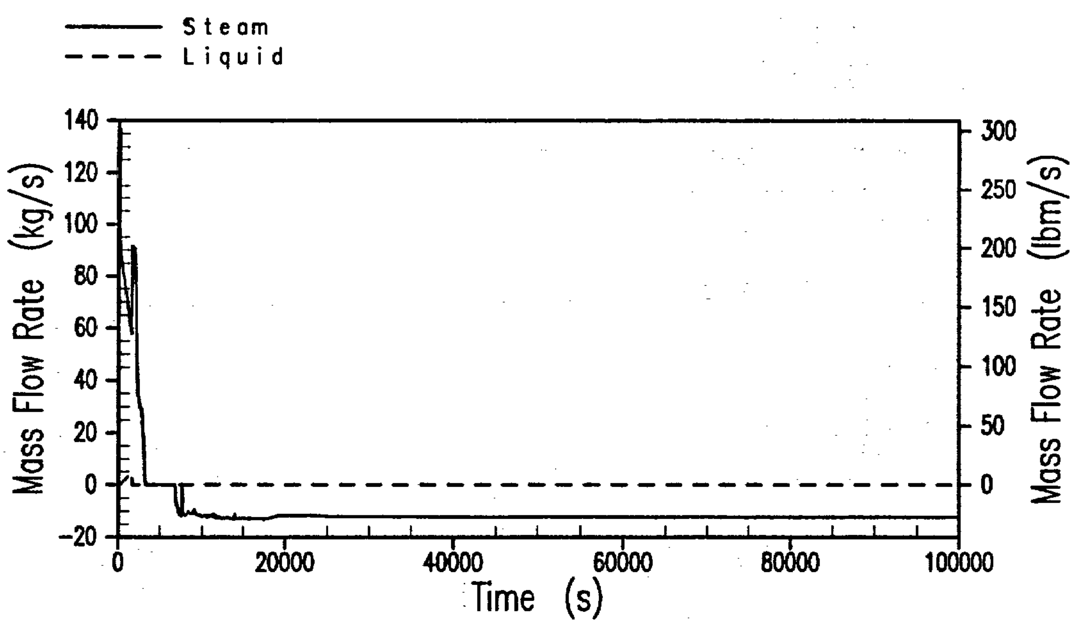


Figure 34-56

Case 3BE-5: Break Flow Rate SBLOCA with Failed Gravity Injection

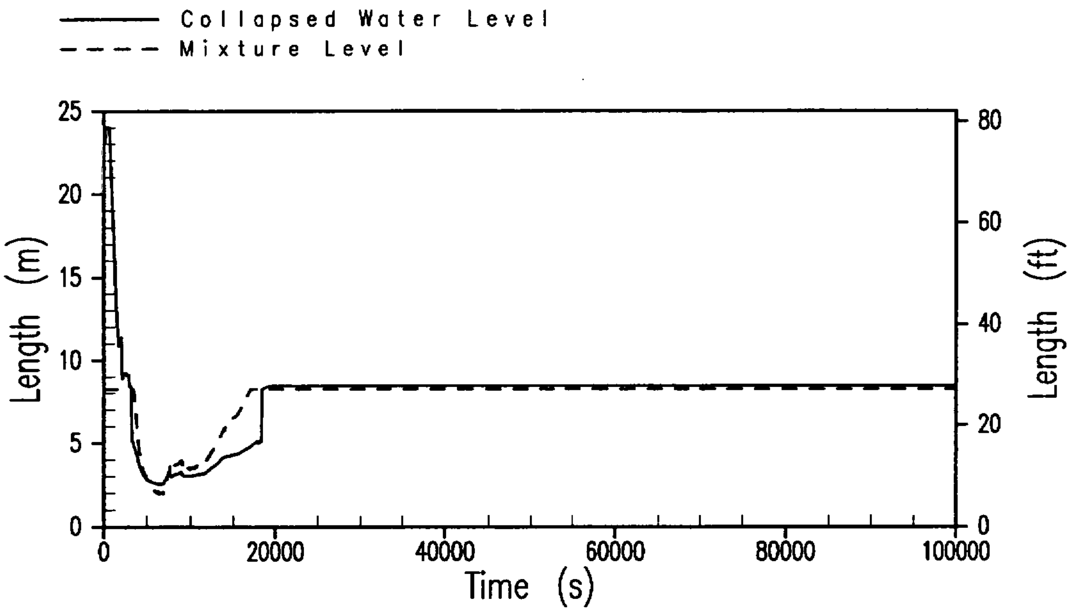


Figure 34-57

Case 3BE-5: Reactor Vessel Water Level SBLOCA with Failed Gravity Injection

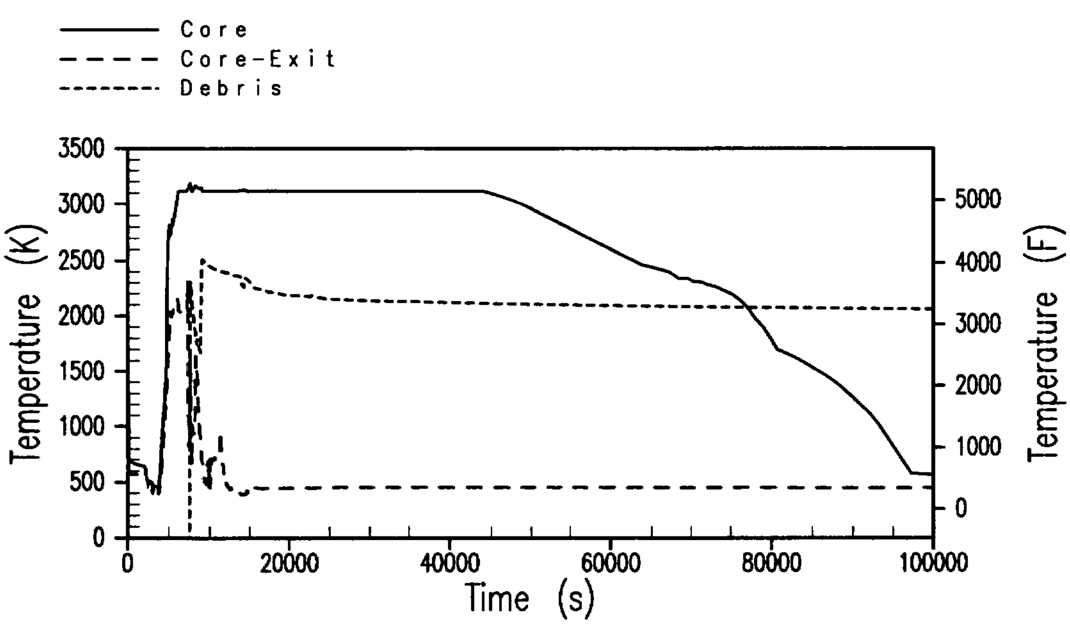


Figure 34-58

Case 3BE-5: Core Temperatures SBLOCA with Failed Gravity Injection

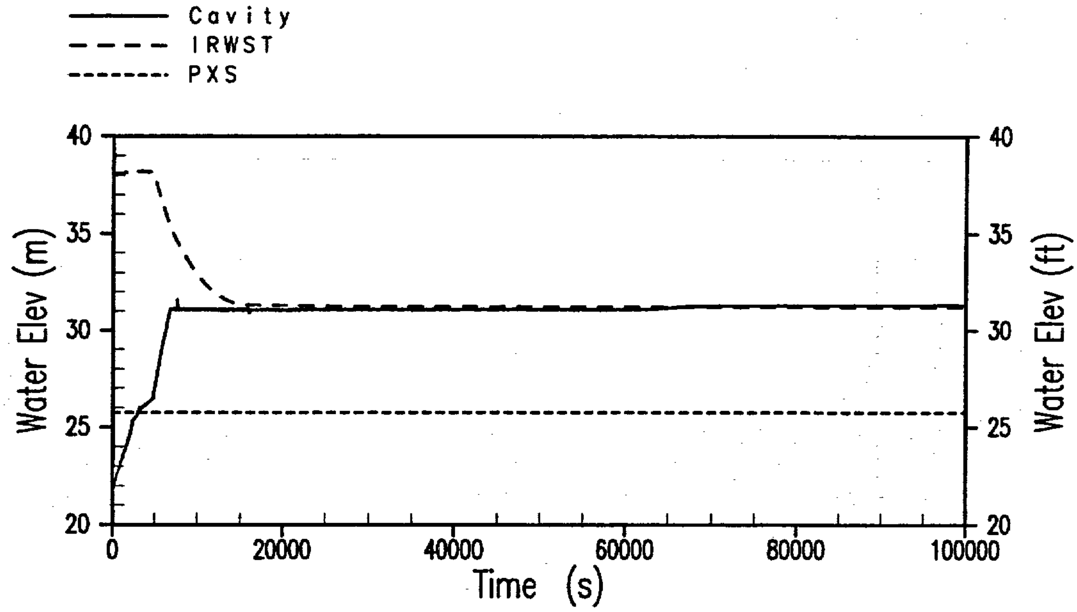


Figure 34-59

Case 3BE-5: Containment Water Pool Elevations
SBLOCA with Failed Gravity Injection

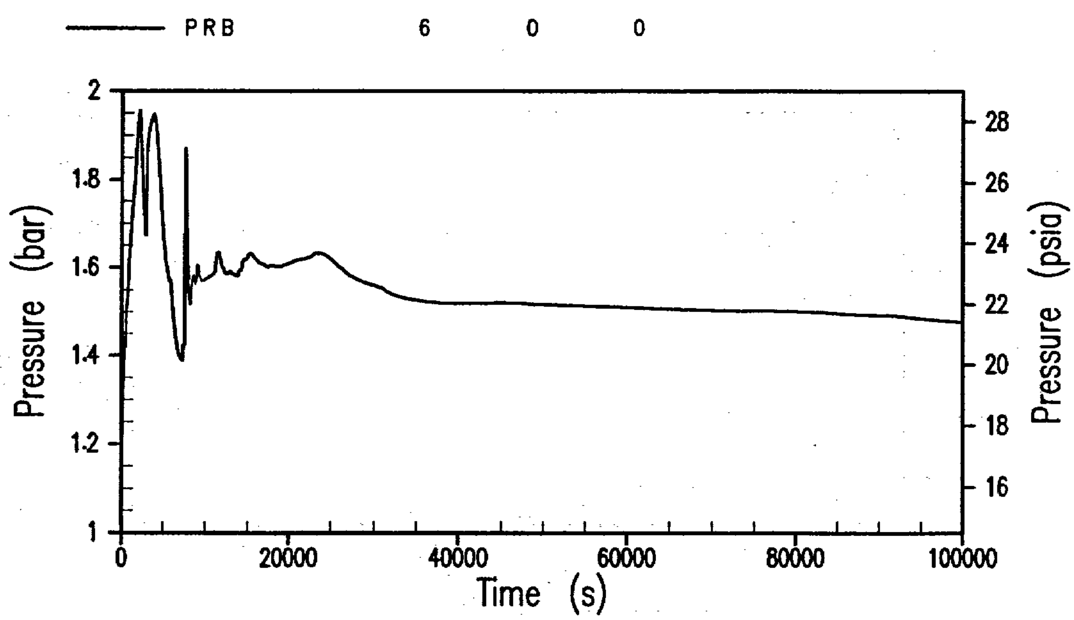


Figure 34-60

Case 3BE-5: Containment Pressure
SBLOCA with Failed Gravity Injection

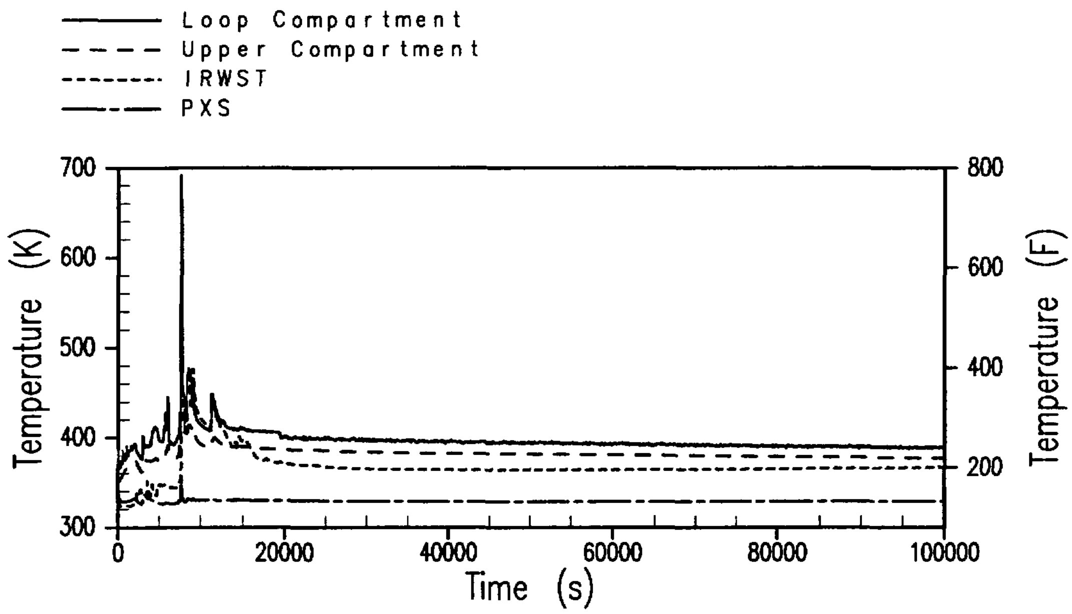


Figure 34-61

Case 3BE-5: Containment Gas Temperature SBLOCA with Failed Gravity Injection

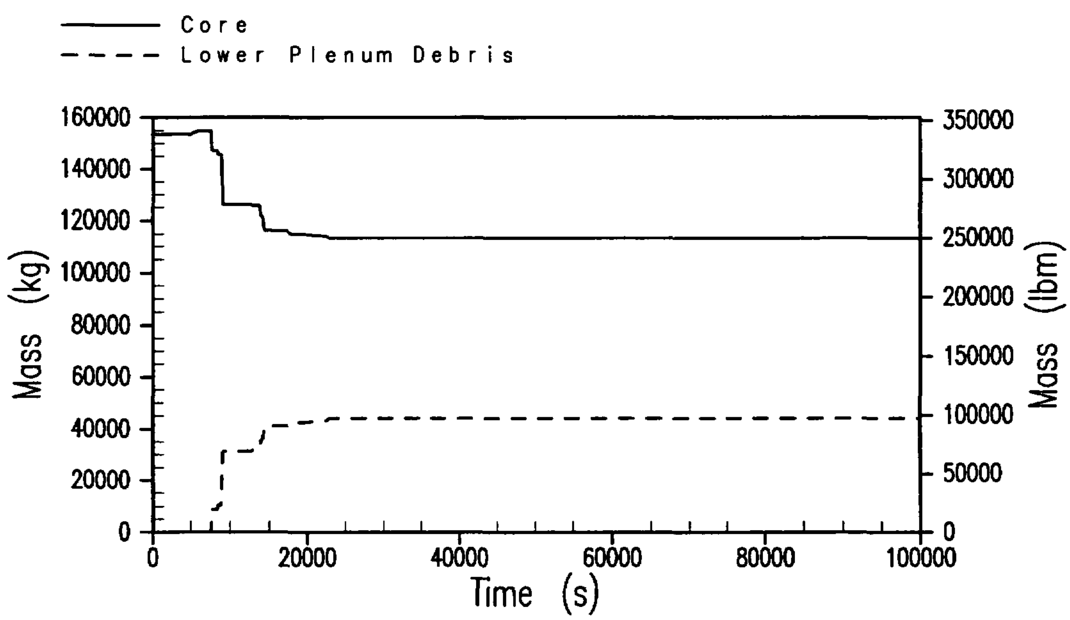


Figure 34-62

Case 3BE-5: Core Mass SBLOCA with Failed Gravity Injection

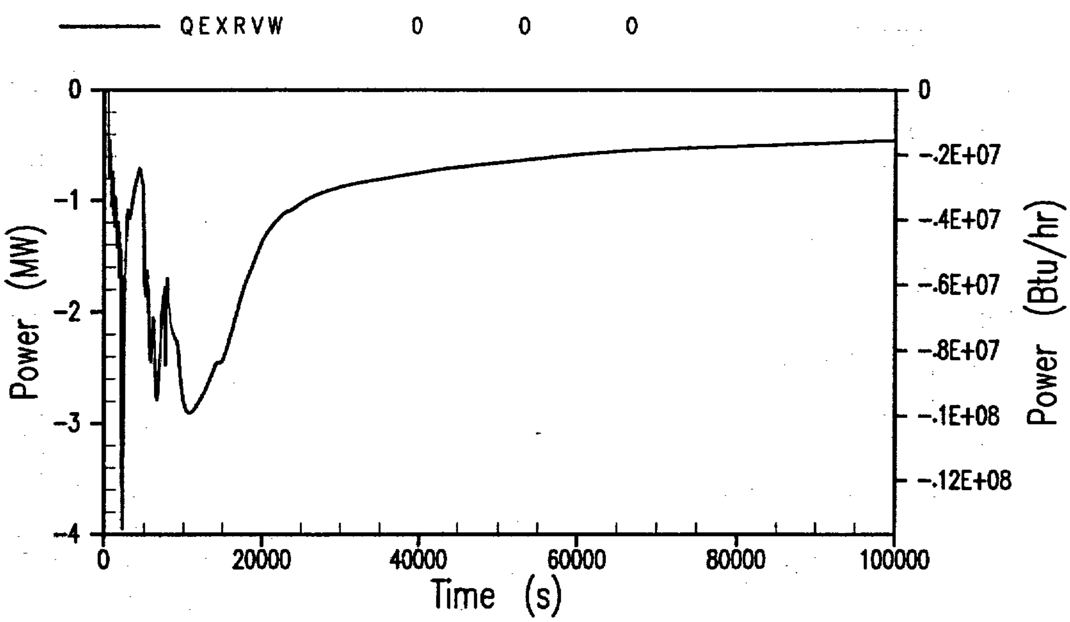


Figure 34-63

Case 3BE-5: Reactor Pressure Vessel to Cavity Water Heat Transfer SBLOCA with Failed Gravity Injection

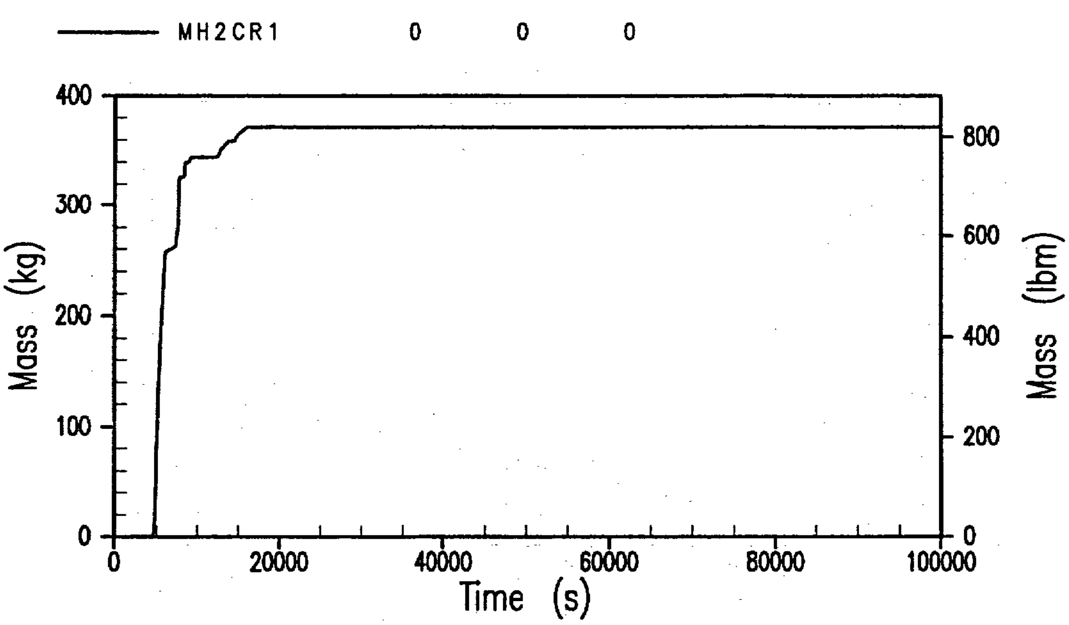


Figure 34-64

Case 3BE-5: In-Vessel Hydrogen Generation SBLOCA with Failed Gravity Injection

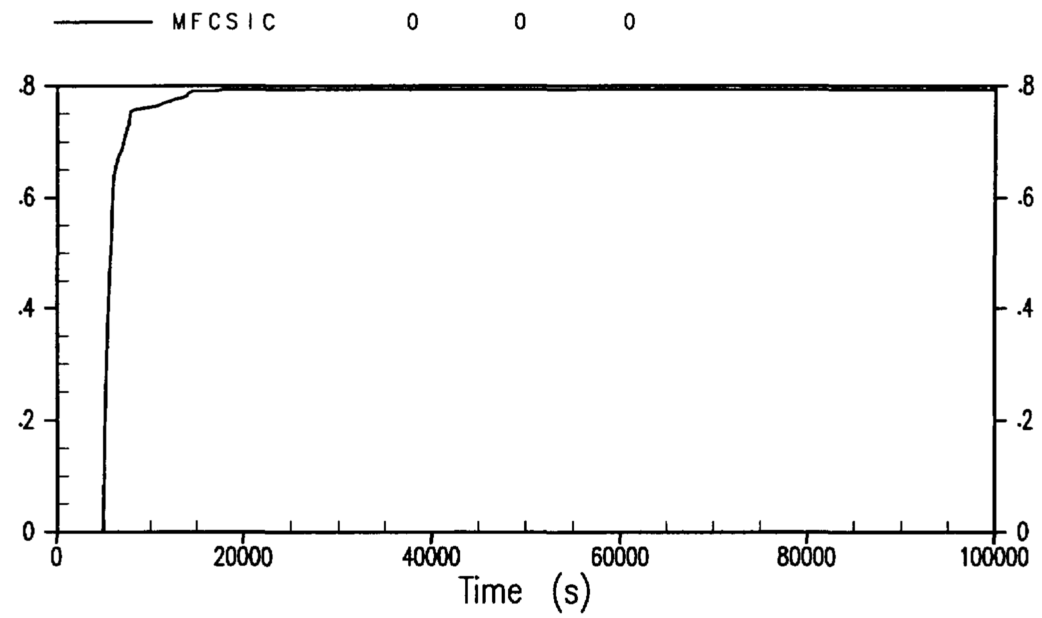


Figure 34-65

Case 3BE-5: Mass Fraction of CsI Released to Containment SBLOCA with Failed Gravity Injection

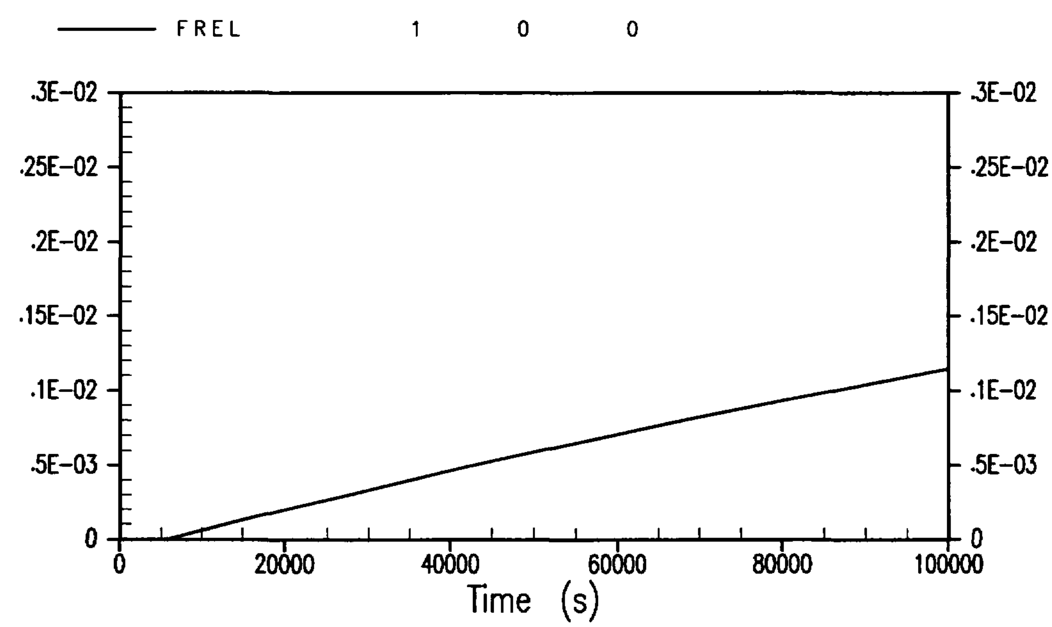


Figure 34-66

Case 3BE-5: Mass Fraction of Noble Gases Released to Environment SBLOCA with Failed Gravity Injection

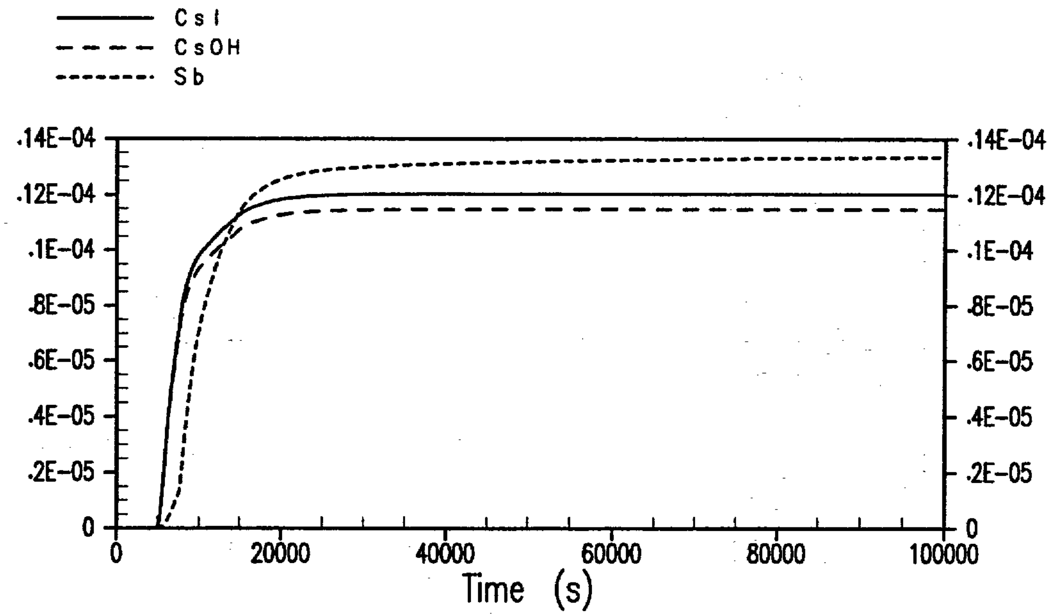


Figure 34-67

Case 3BE-5: Mass Fraction of Fission Products Released to Environment SBLOCA with Failed Gravity Injection

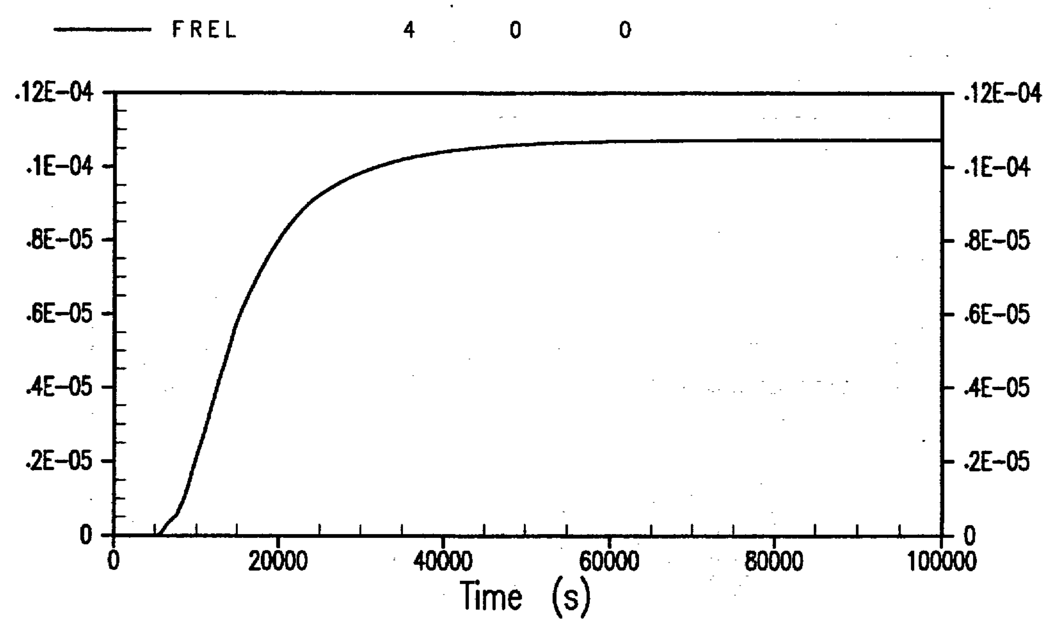


Figure 34-68

Case 3BE-5: Mass Fraction of SrO Released to Environment SBLOCA with Failed Gravity Injection

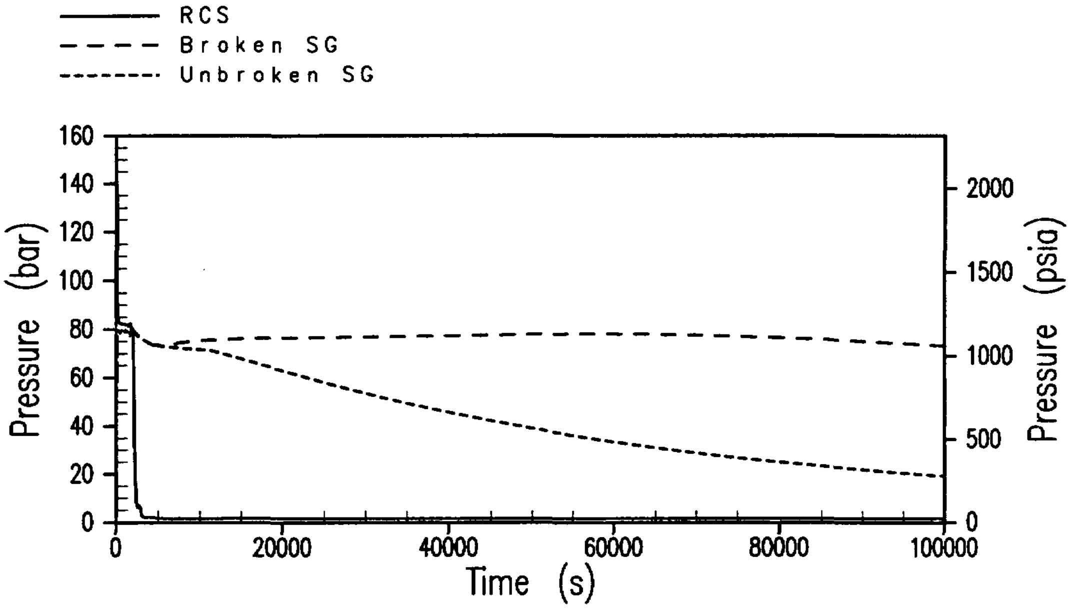


Figure 34-69

Case 3BE-6: Reactor Coolant System and Steam Generator Pressure SBLOCA with Failed Gravity Injection

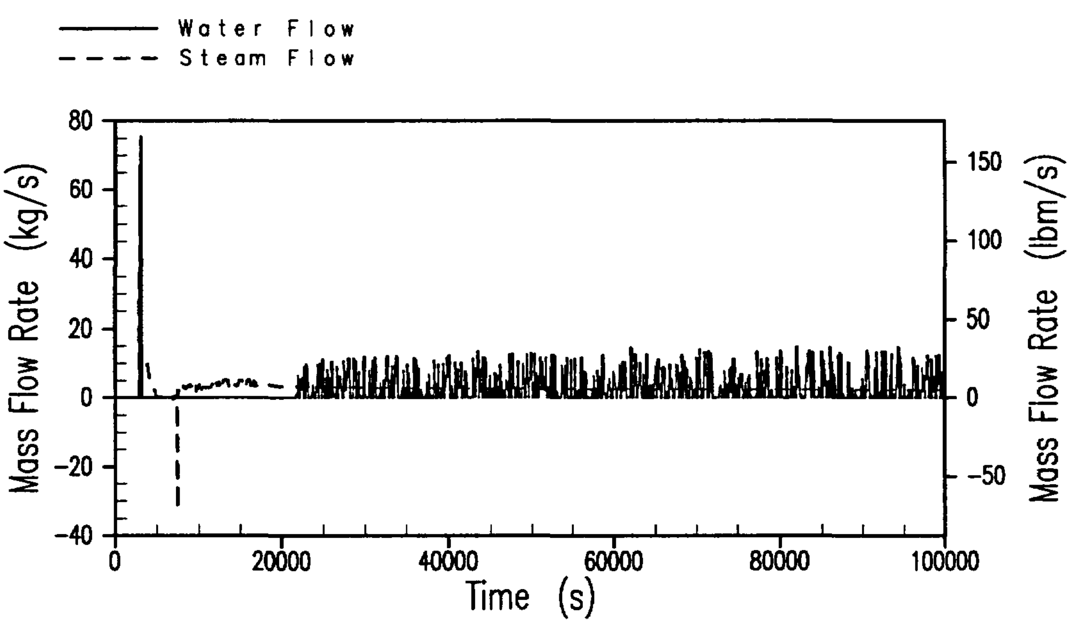


Figure 34-70

Case 3BE-6: ADS Stage 4 Flow Rates SBLOCA with Failed Gravity Injection

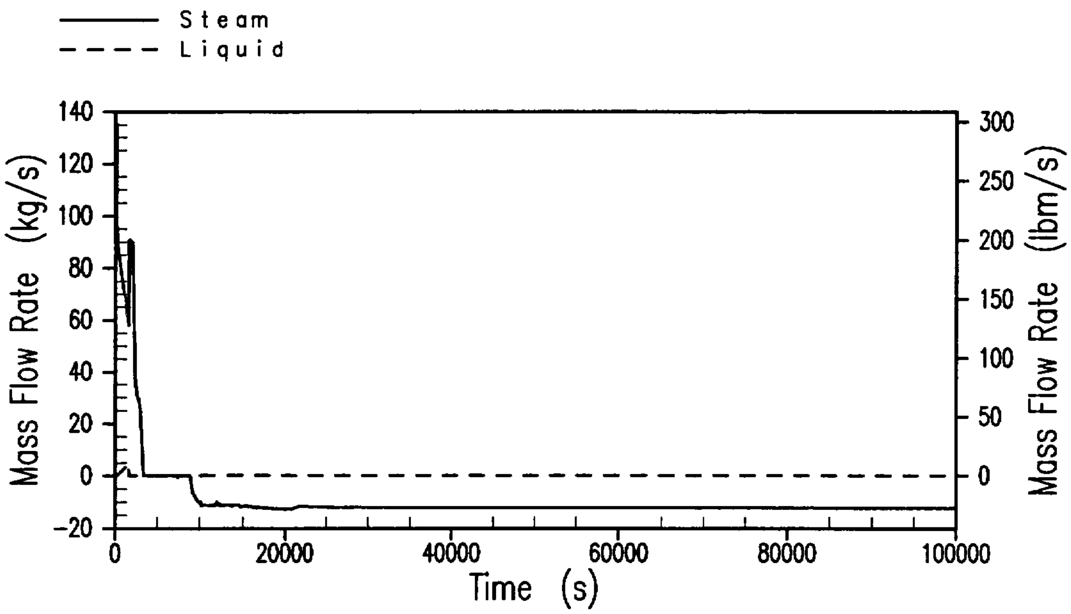


Figure 34-73

Case 3BE-6: Break Flow Rate
SBLOCA with Failed Gravity Injection

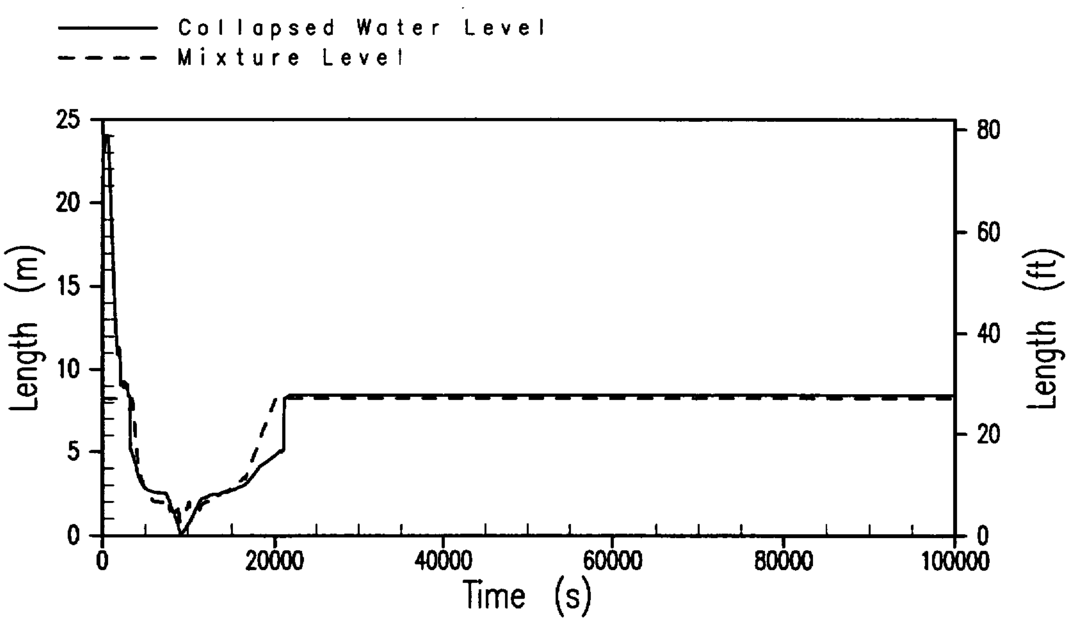


Figure 34-74

Case 3BE-6: Reactor Vessel Water Level
SBLOCA with Failed Gravity Injection

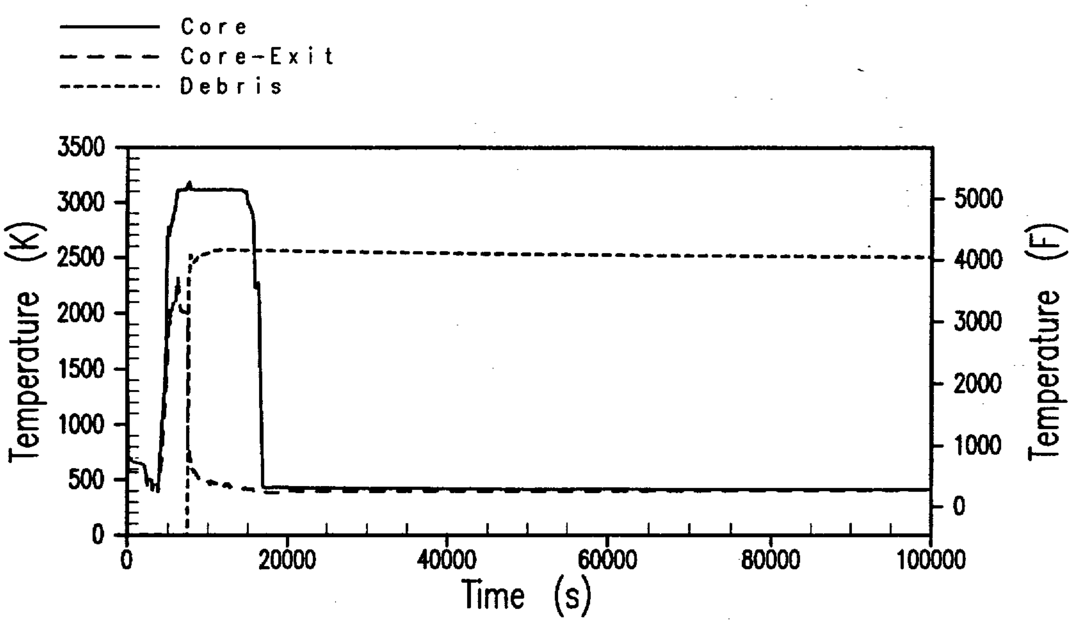


Figure 34-75

Case 3BE-6: Core Temperatures
SBLOCA with Failed Gravity Injection

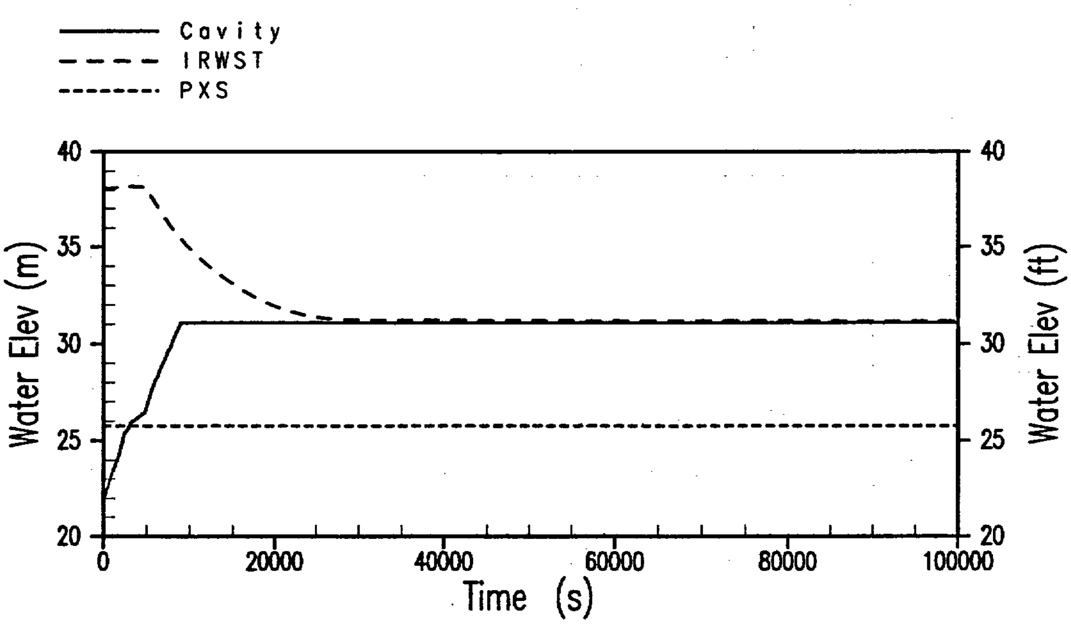


Figure 34-76

Case 3BE-6: Containment Water Pool Elevations
SBLOCA with Failed Gravity Injection

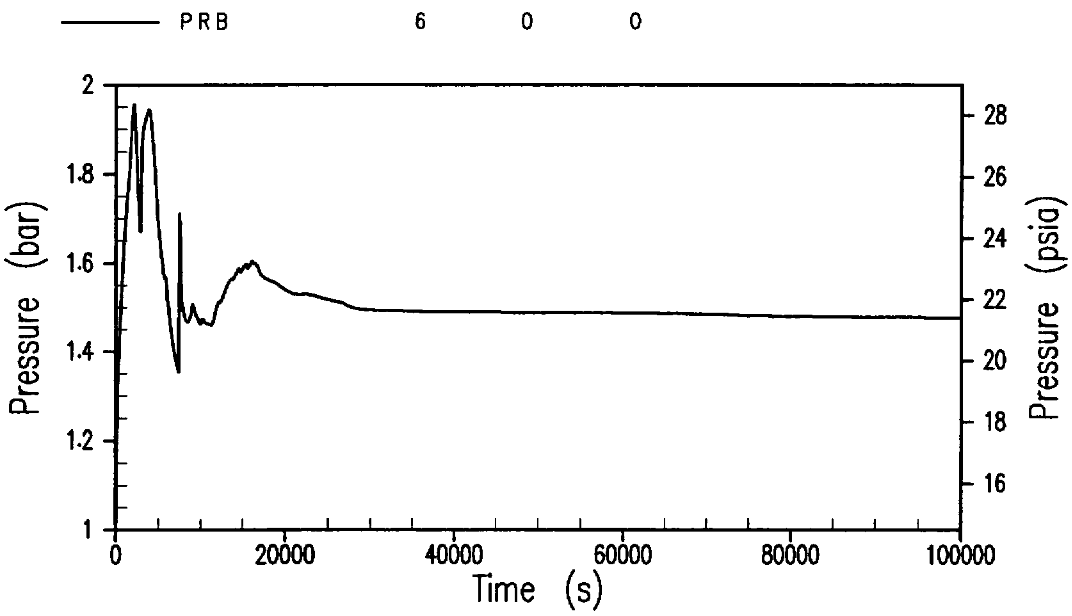


Figure 34-77

Case 3BE-6: Containment Pressure SBLOCA with Failed Gravity Injection

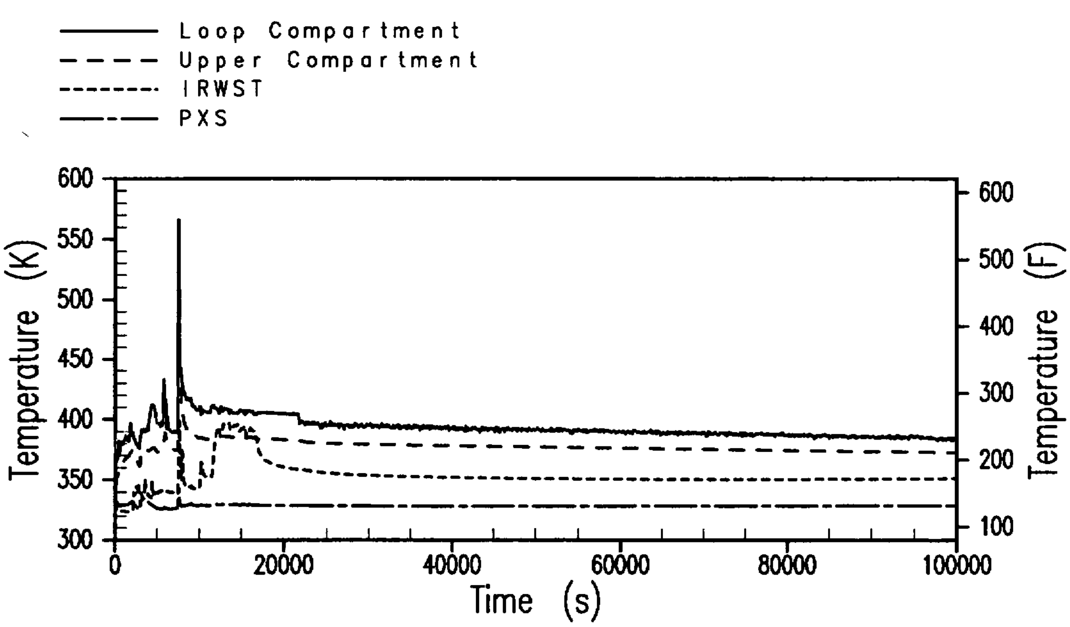


Figure 34-78

Case 3BE-6: Containment Gas Temperature SBLOCA with Failed Gravity Injection

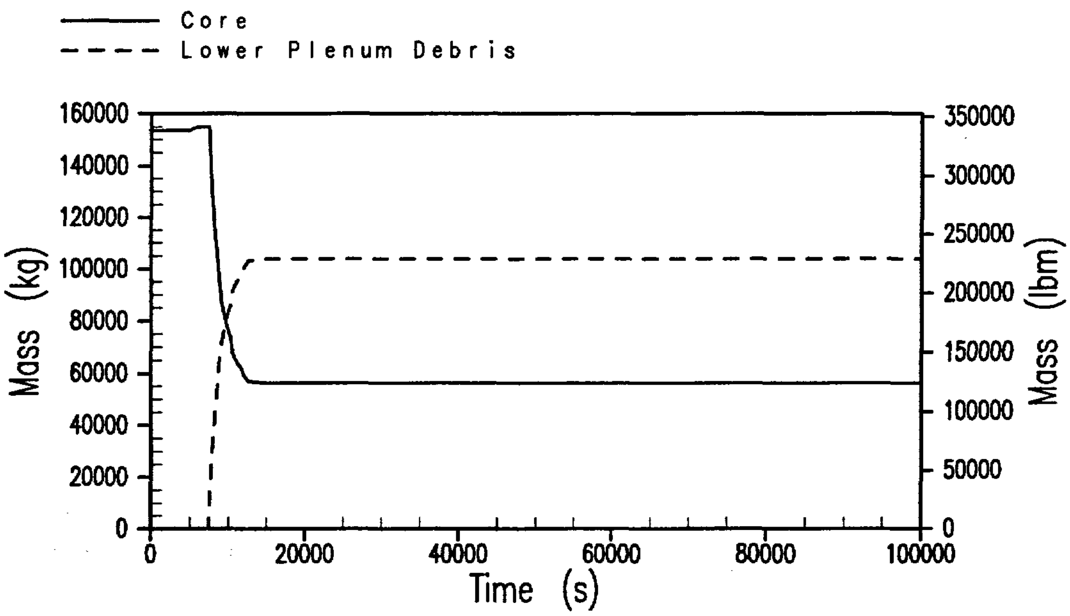


Figure 34-79

Case 3BE-6: Core Mass
SBLOCA with Failed Gravity Injection

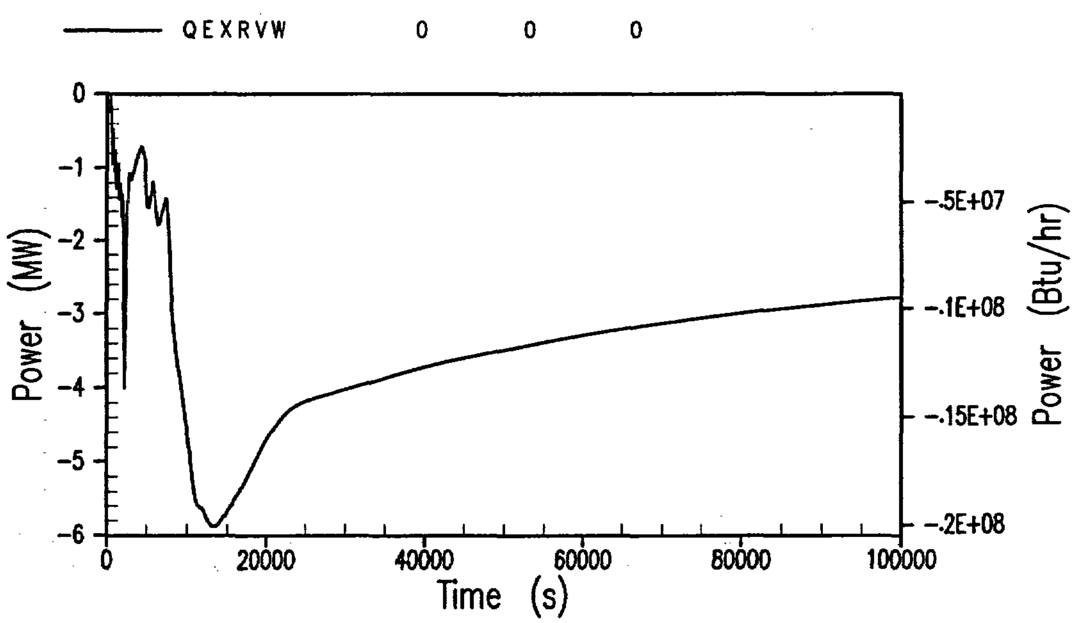


Figure 34-80

Case 3BE-6: Reactor Pressure Vessel to Cavity Water Heat Transfer
SBLOCA with Failed Gravity Injection

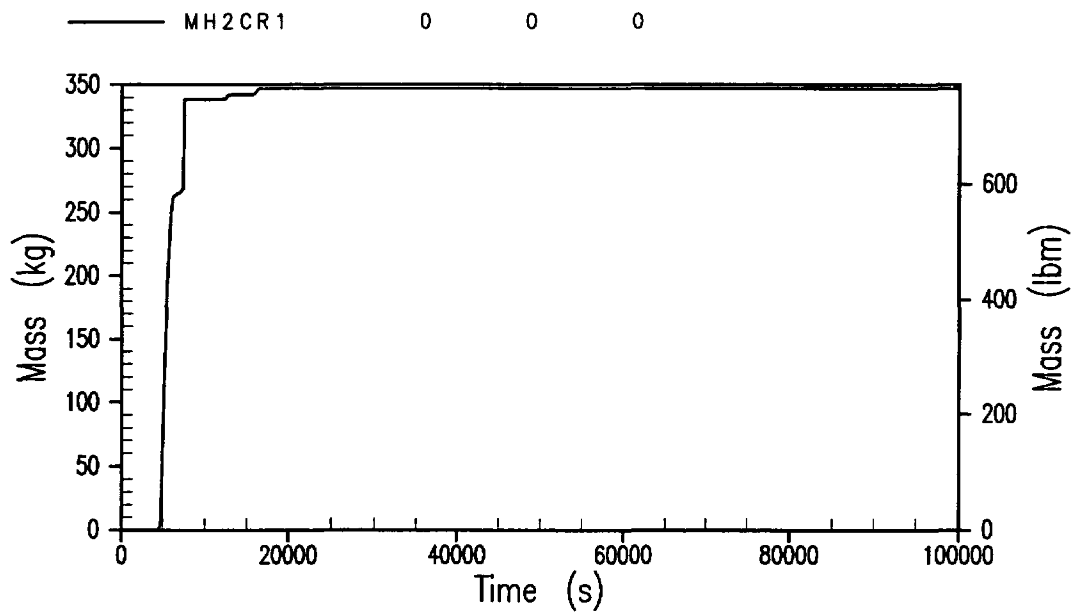


Figure 34-81

Case 3BE-6: In-Vessel Hydrogen Generation SBLOCA with Failed Gravity Injection

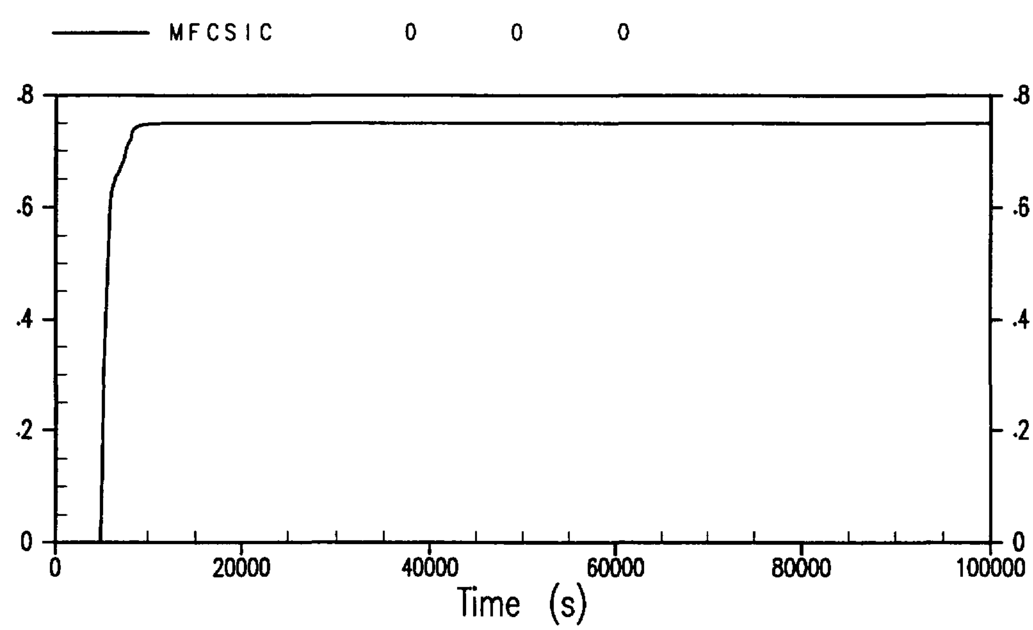


Figure 34-82

Case 3BE-6: Mass Fraction of CsI Released to Containment SBLOCA with Failed Gravity Injection

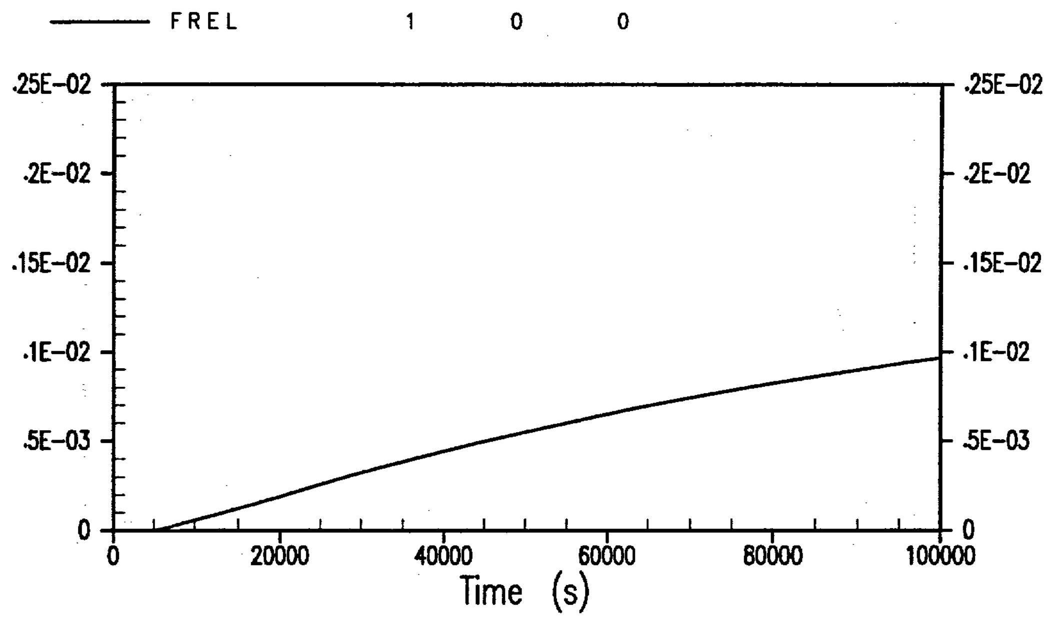


Figure 34-83

Case 3BE-6: Mass Fraction of Noble Gases Released to Environment SBLOCA with Failed Gravity Injection

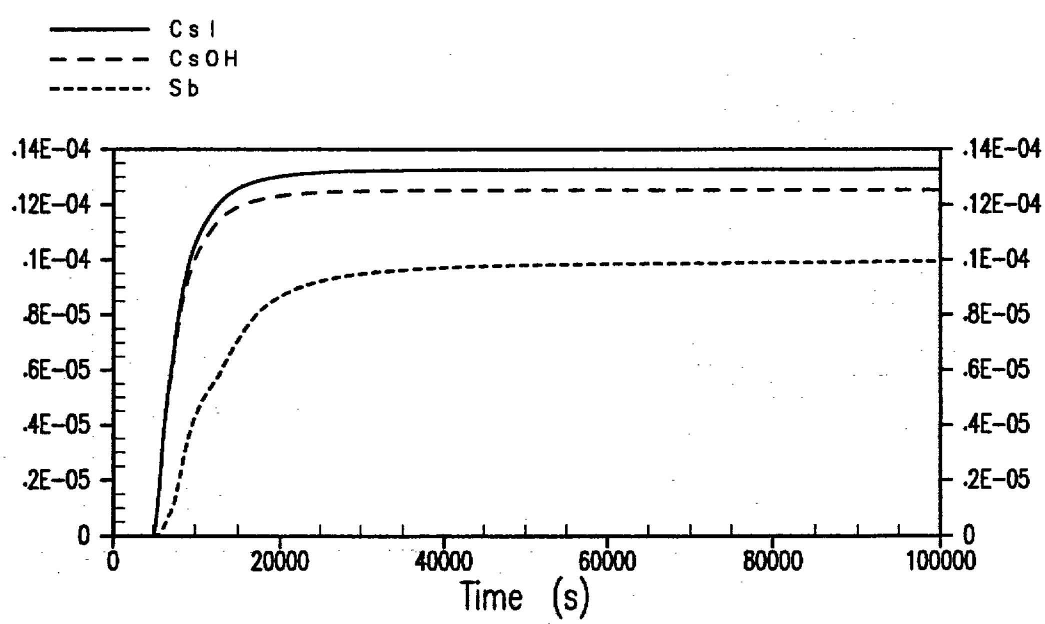


Figure 34-84

Case 3BE-6: Mass Fraction of Fission Products Released to Environment SBLOCA with Failed Gravity Injection

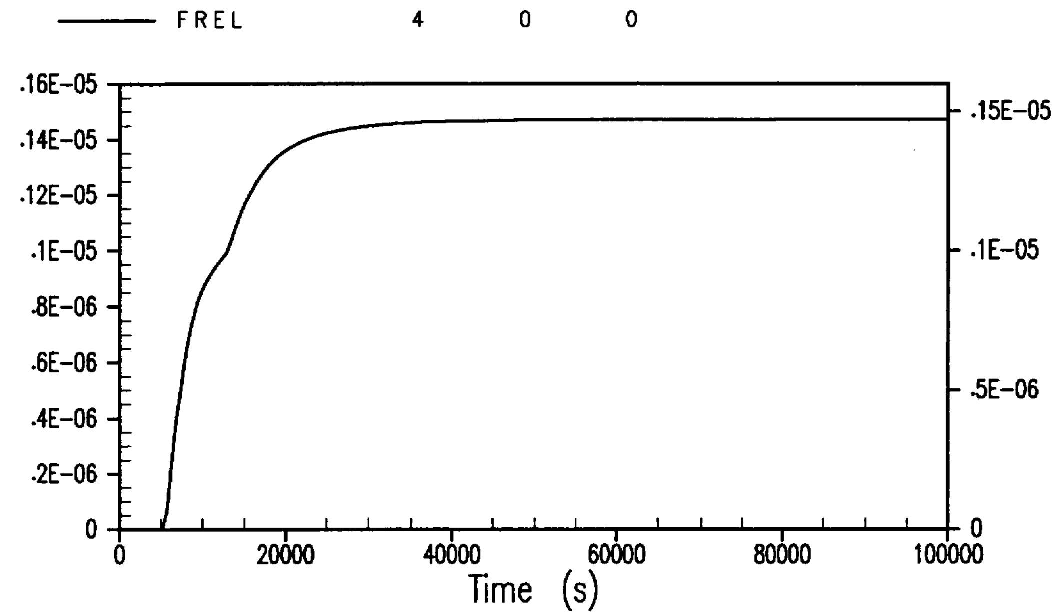


Figure 34-85

Case 3BE-6: Mass Fraction of SrO Released to Environment SBLOCA with Failed Gravity Injection

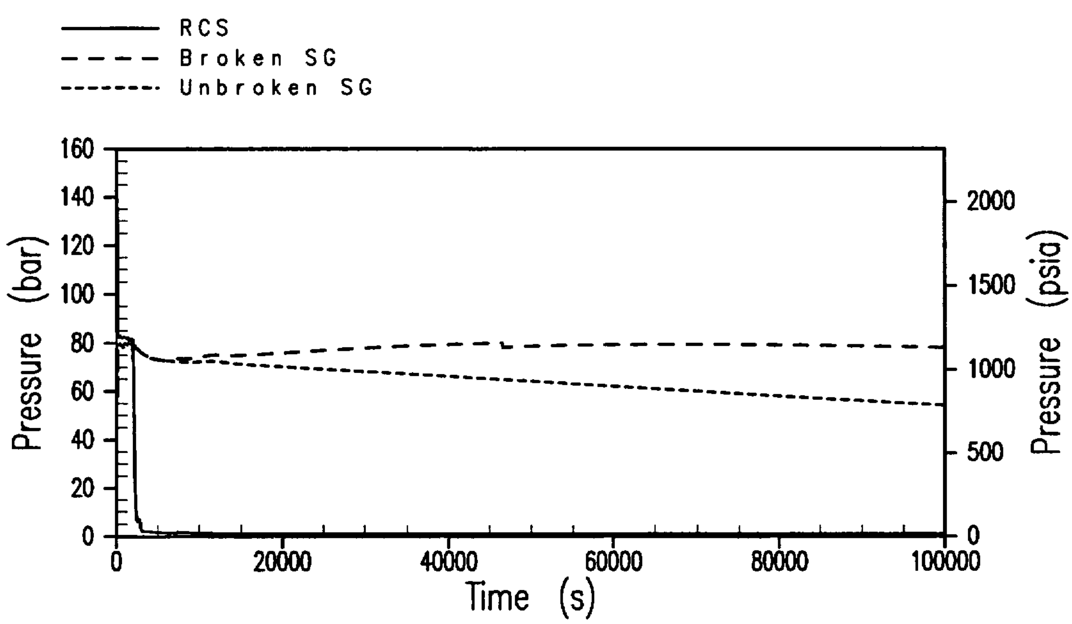


Figure 34-86

Case 3BE-7: Reactor Coolant System and Steam Generator Pressure SBLOCA with Failed Gravity Injection

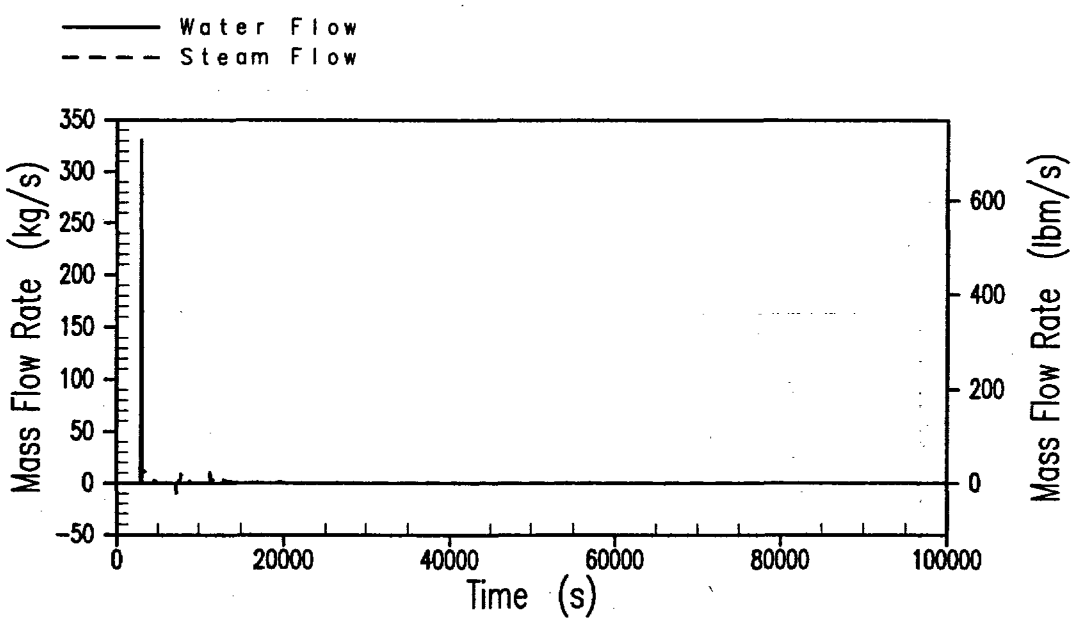


Figure 34-87

Case 3BE-7: ADS Stage 4 Flow Rates SBLOCA with Failed Gravity Injection

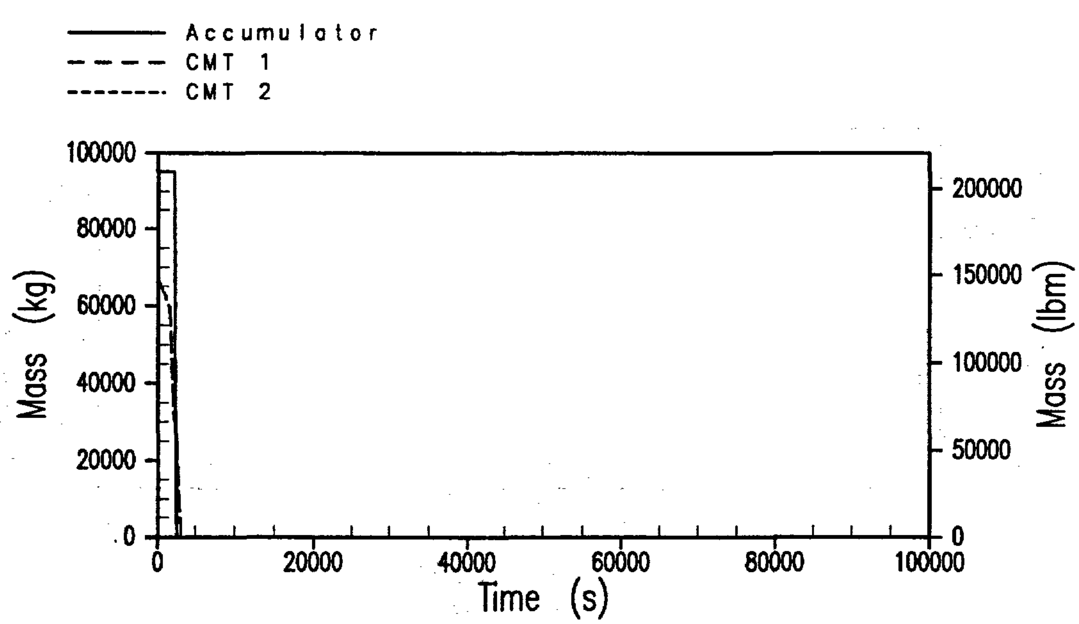


Figure 34-88

Case 3BE-7: Accumulator/CMT Water Mass SBLOCA with Failed Gravity Injection

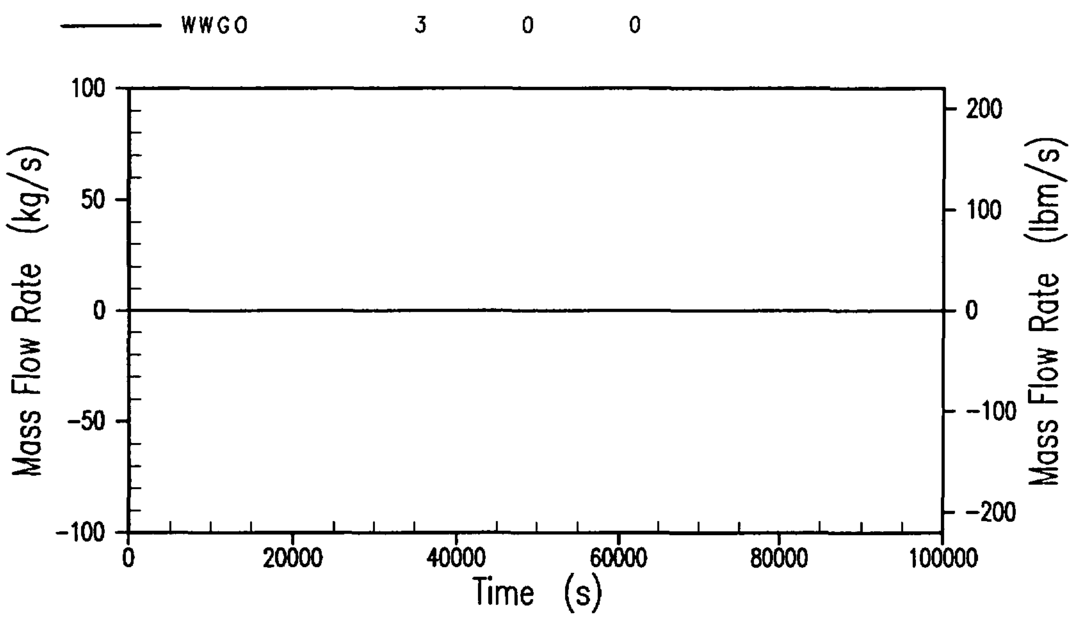


Figure 34-89

Case 3BE-7: IRWST Injection Flow Rate SBLOCA with Failed Gravity Injection

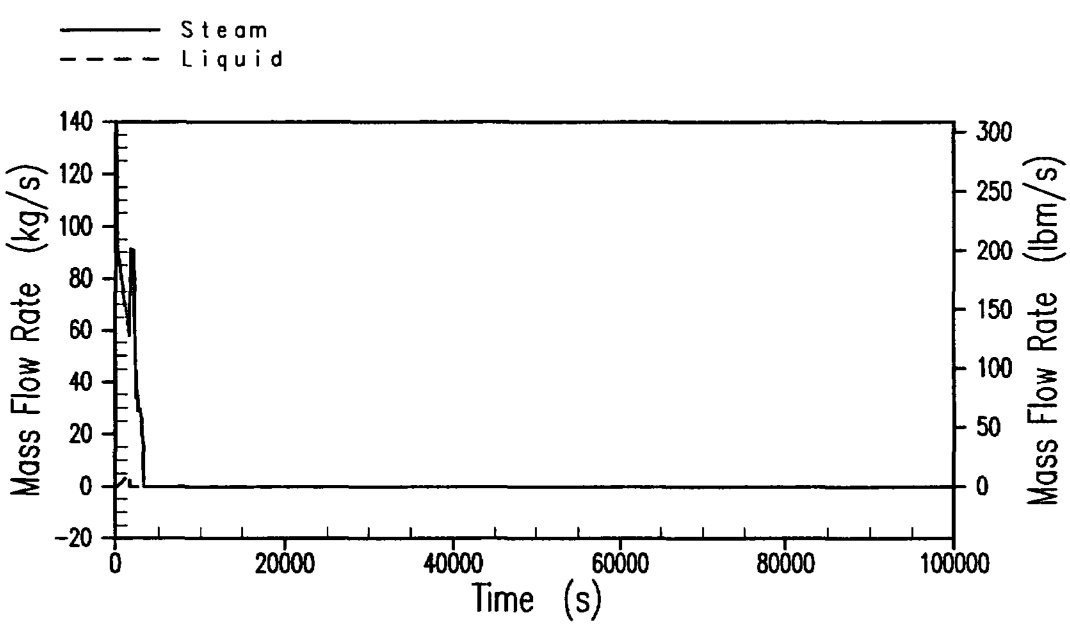


Figure 34-90

Case 3BE-7: Break Flow Rate SBLOCA with Failed Gravity Injection

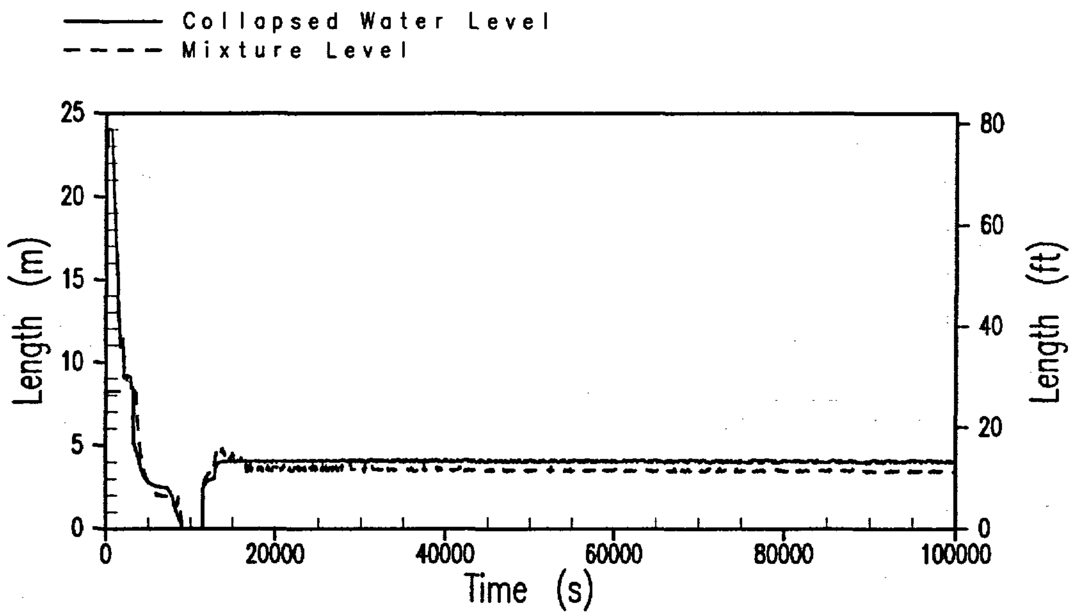


Figure 34-91

Case 3BE-7: Reactor Vessel Water Level SBLOCA with Failed Gravity Injection

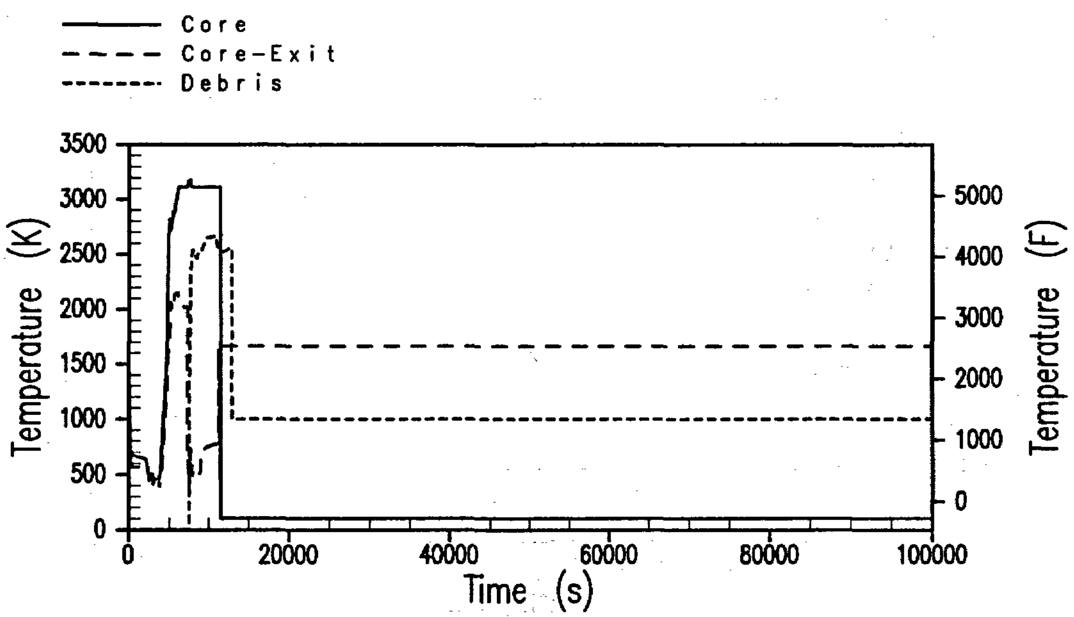


Figure 34-92

Case 3BE-7: Core Temperatures SBLOCA with Failed Gravity Injection

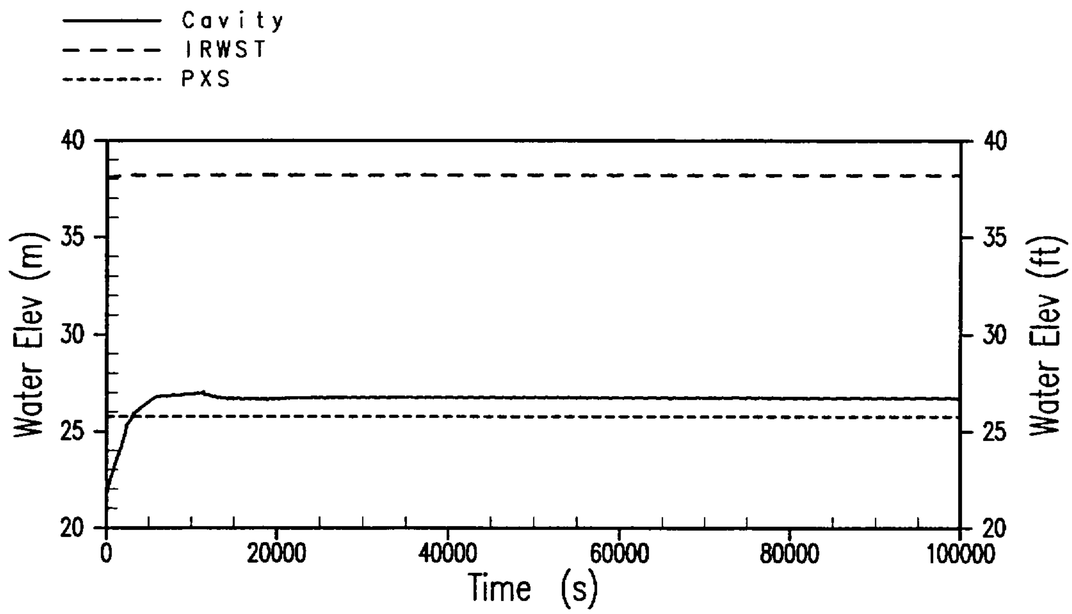


Figure 34-93

Case 3BE-7: Containment Water Pool Elevations SBLOCA with Failed Gravity Injection

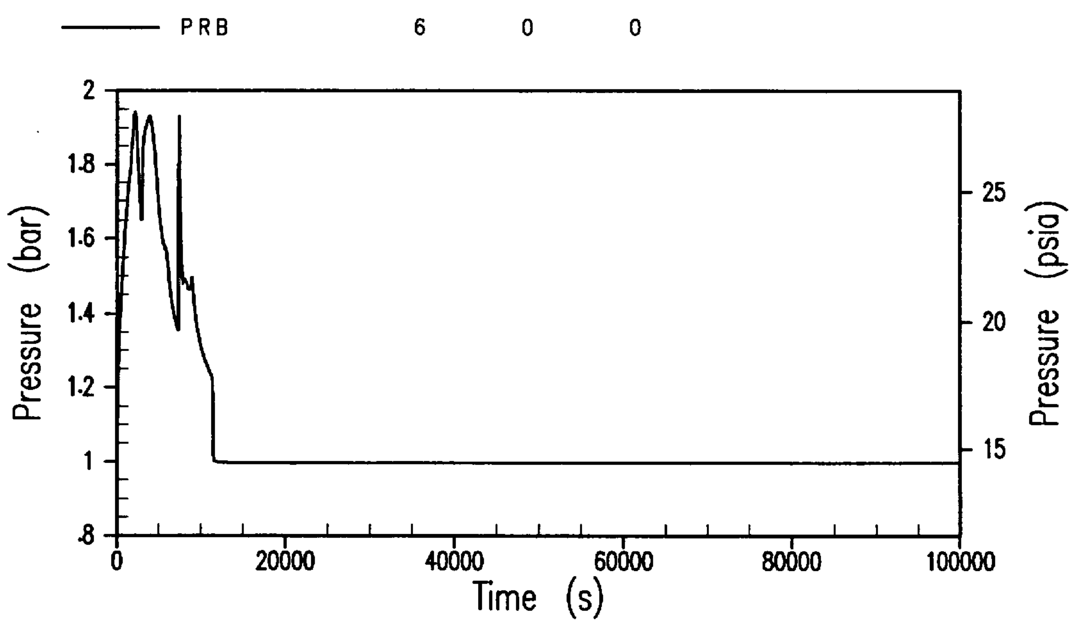


Figure 34-94

Case 3BE-7: Containment Pressure SBLOCA with Failed Gravity Injection

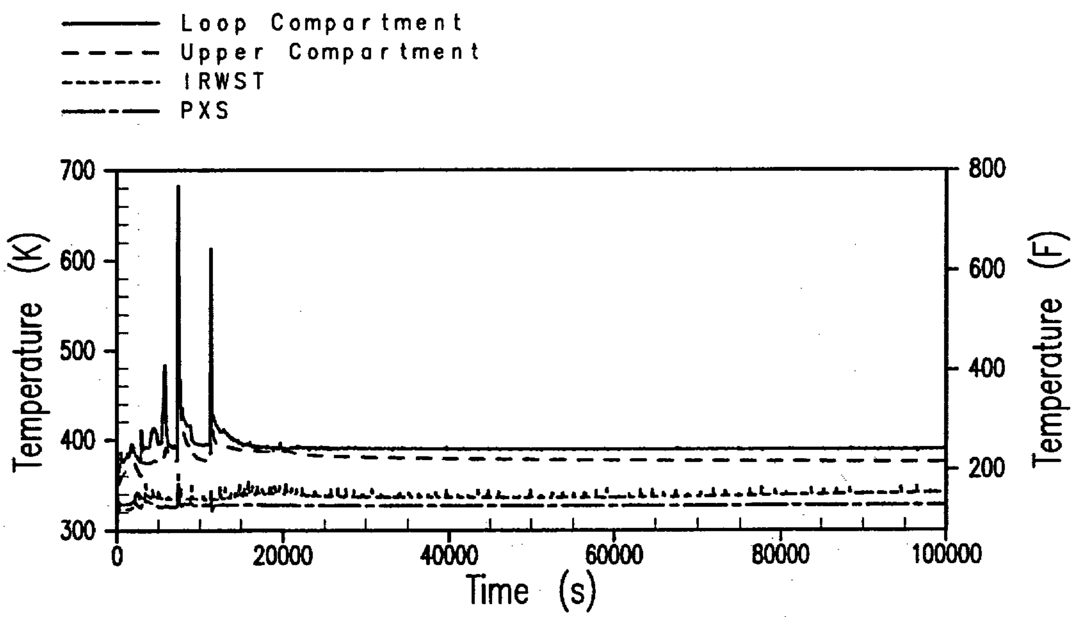


Figure 34-95

Case 3BE-7: Containment Gas Temperature SBLOCA with Failed Gravity Injection

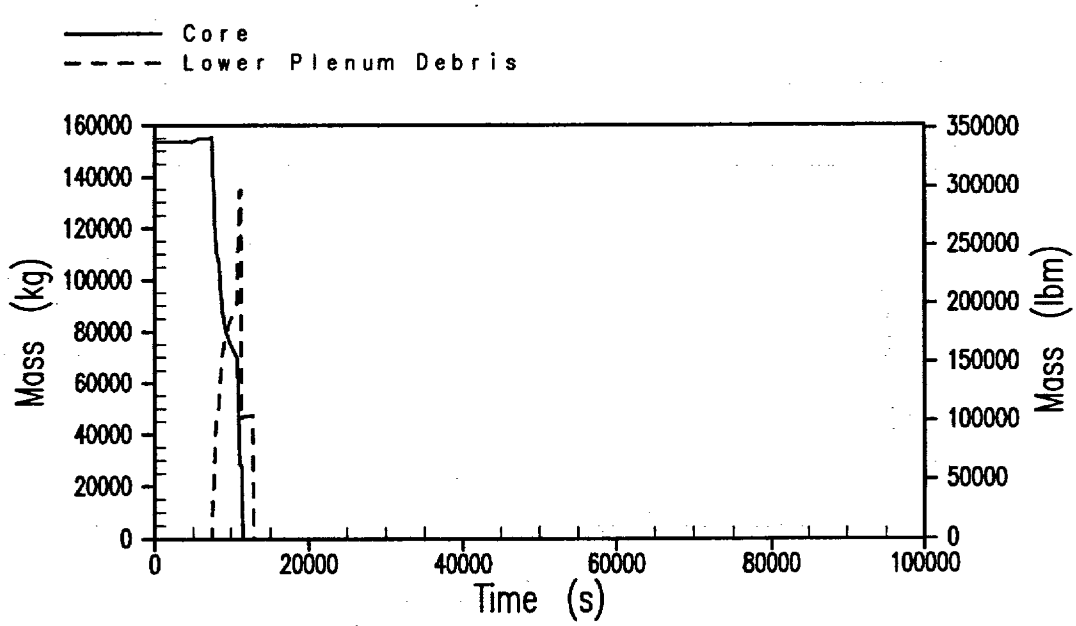


Figure 34-96

Case 3BE-7: Core Mass SBLOCA with Failed Gravity Injection

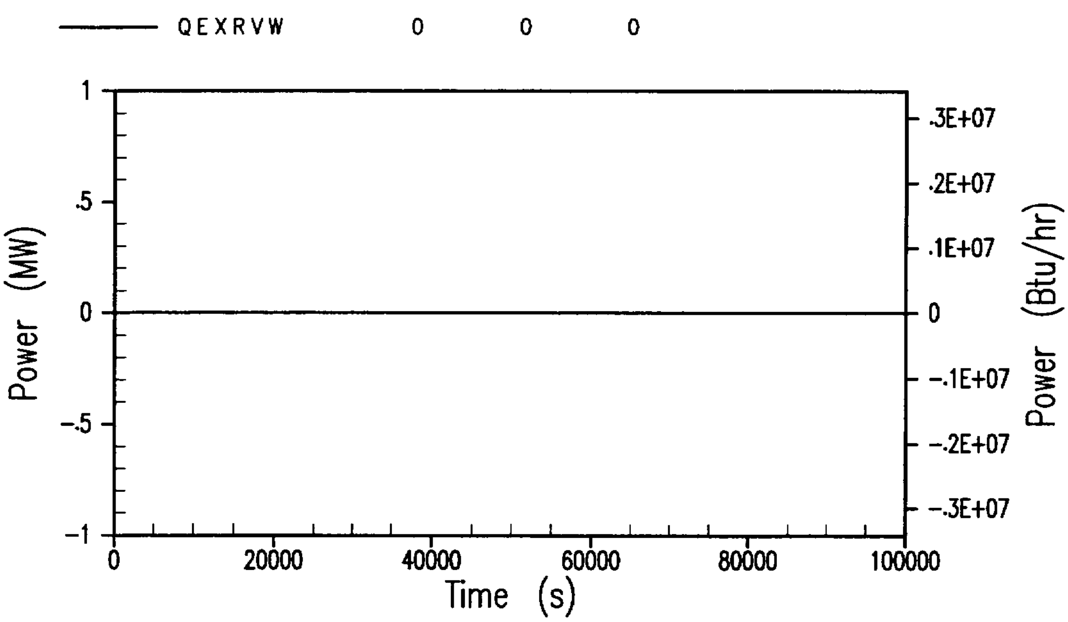


Figure 34-97

Case 3BE-7: Reactor Pressure Vessel to Cavity Water Heat Transfer SBLOCA with Failed Gravity Injection

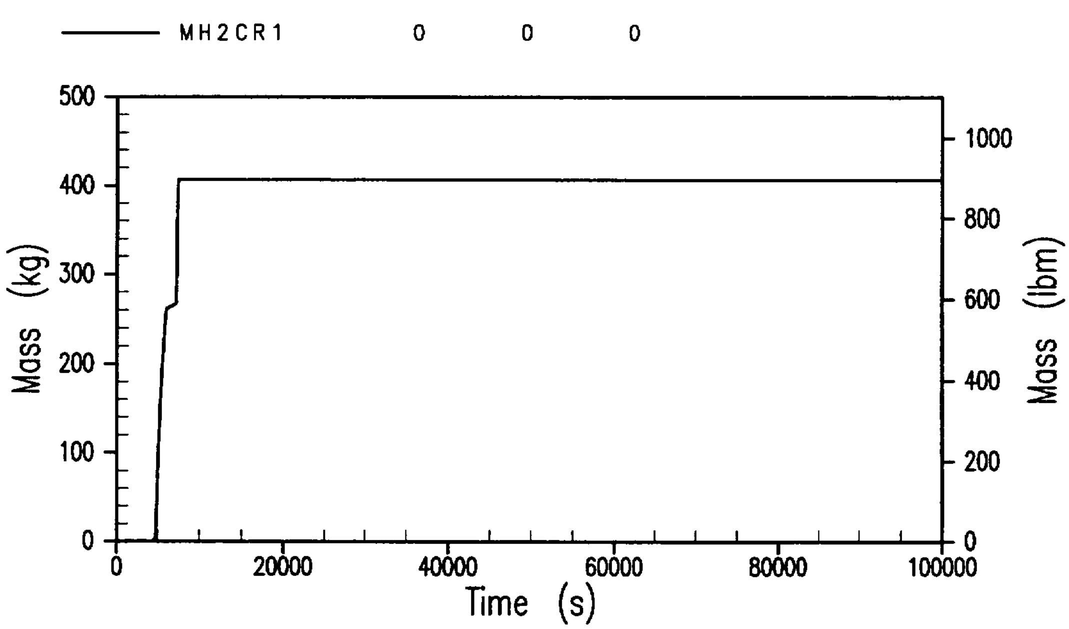


Figure 34-98

Case 3BE-7: In-Vessel Hydrogen Generation SBLOCA with Failed Gravity Injection

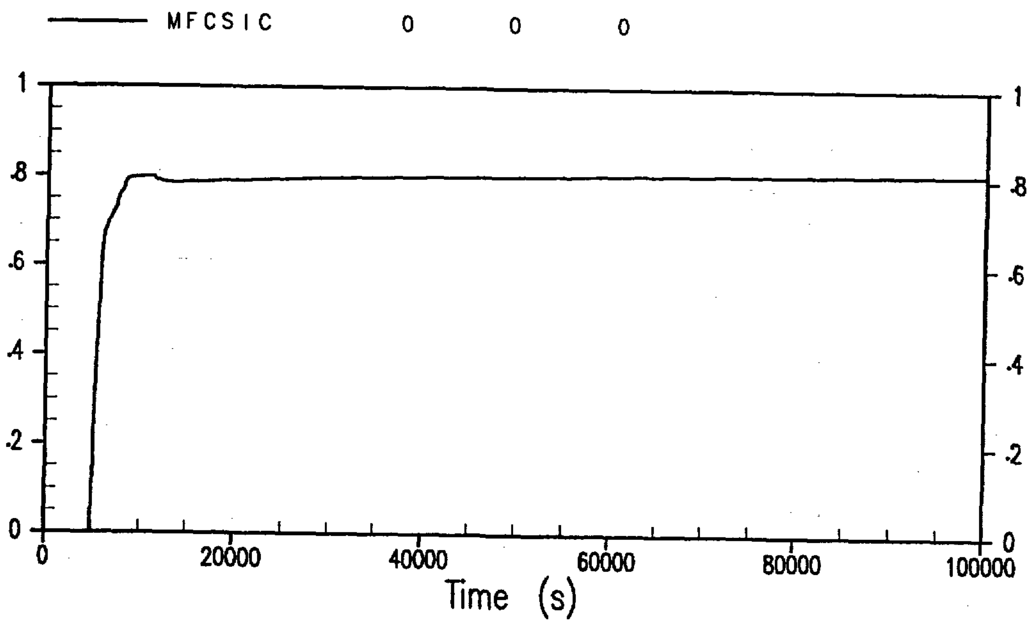


Figure 34-99

Case 3BE-7: Mass Fraction of CsI Released to Containment SBLOCA with Failed Gravity Injection

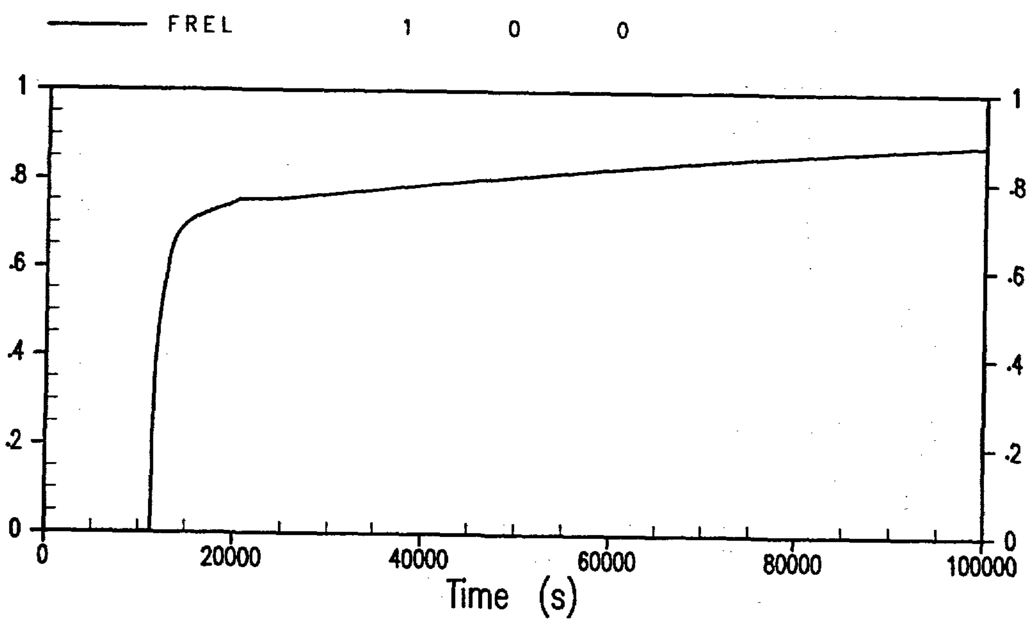


Figure 34-100

Case 3BE-7: Mass Fraction of Noble Gases Released to Environment SBLOCA with Failed Gravity Injection

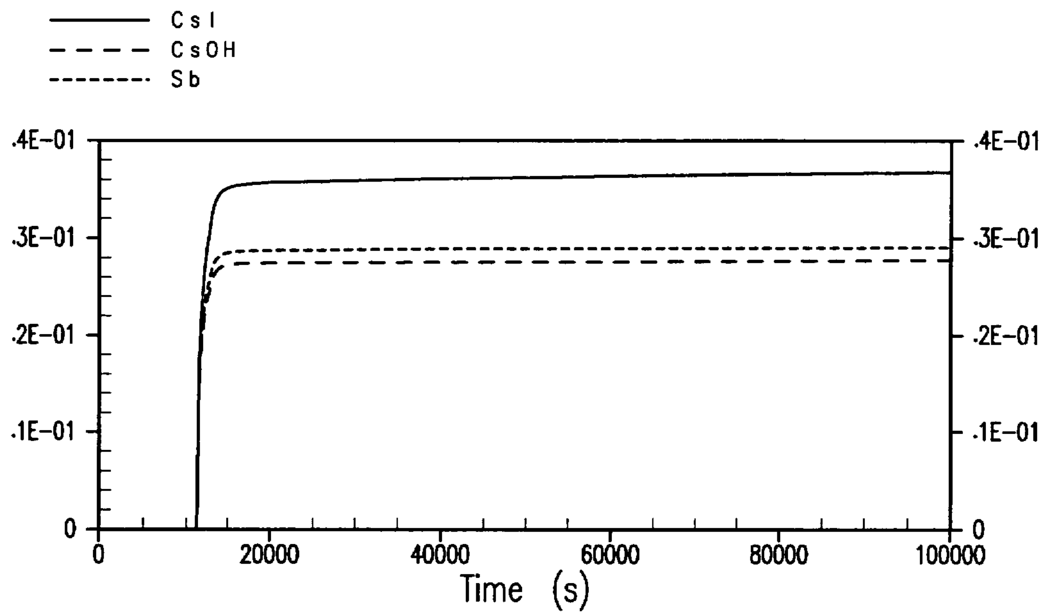


Figure 34-101

Case 3BE-7: Mass Fraction of Fission Products Released to Environment SBLOCA with Failed Gravity Injection

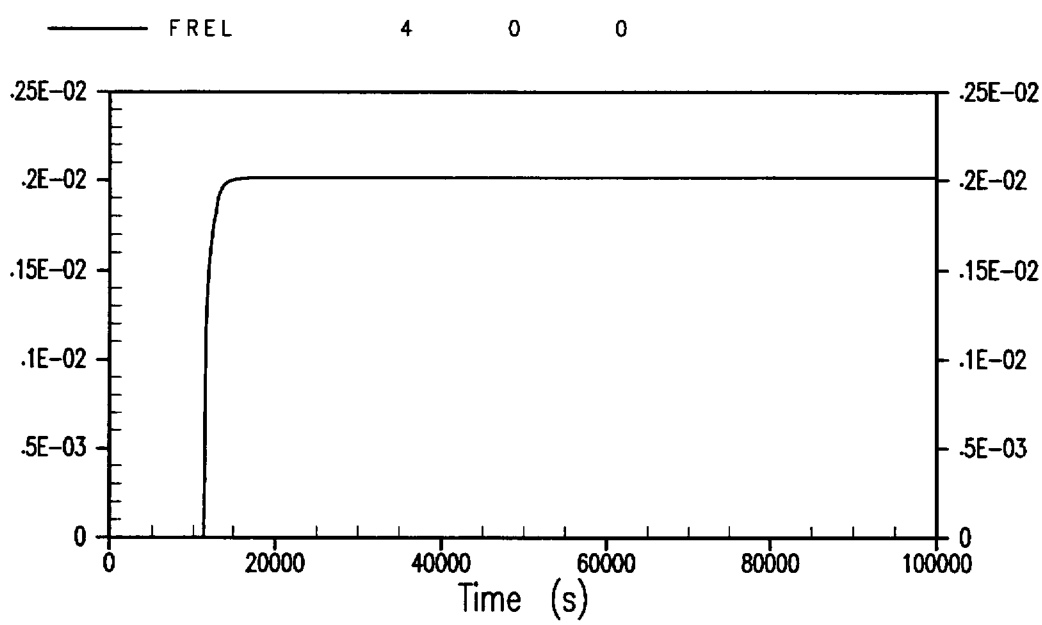


Figure 34-102

Case 3BE-7: Mass Fraction of SrO Released to Environment SBLOCA with Failed Gravity Injection

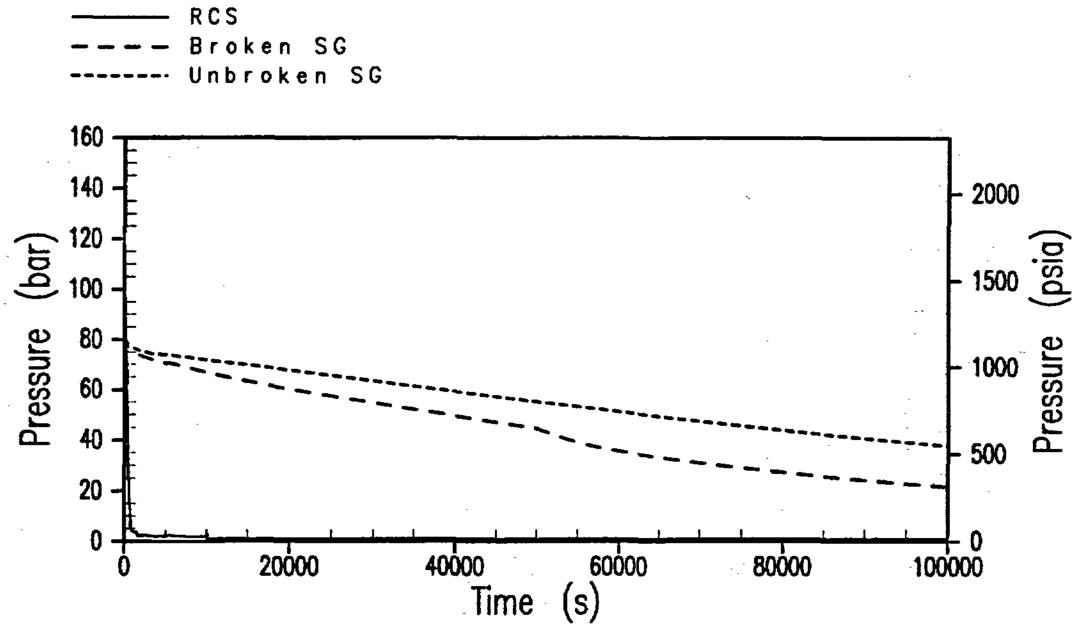


Figure 34-103

Case 3BE-3: Reactor Coolant System and Steam Generator Pressure DVI Line Break, Failed Gravity Injection, No PXS Flooding

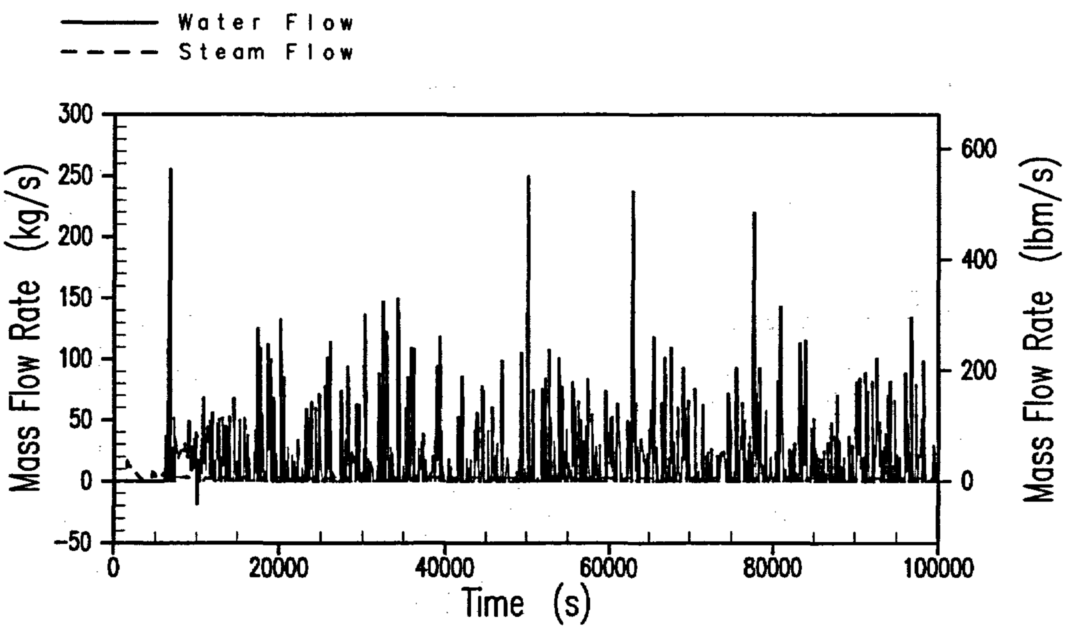


Figure 34-104

Case 3BE-3: ADS Stage 4 Flow Rate DVI Line Break, Failed Gravity Injection, No PXS Flooding

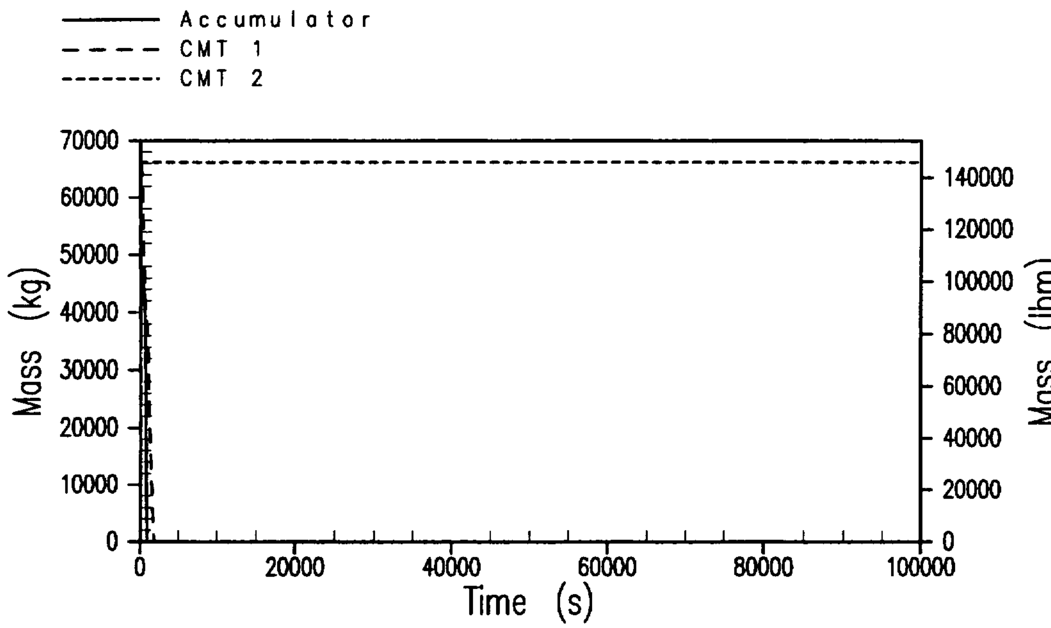


Figure 34-105

Case 3BE-3: Accumulator/CMT Water Mass
DVI Line Break, Failed Gravity Injection, No PXS Flooding

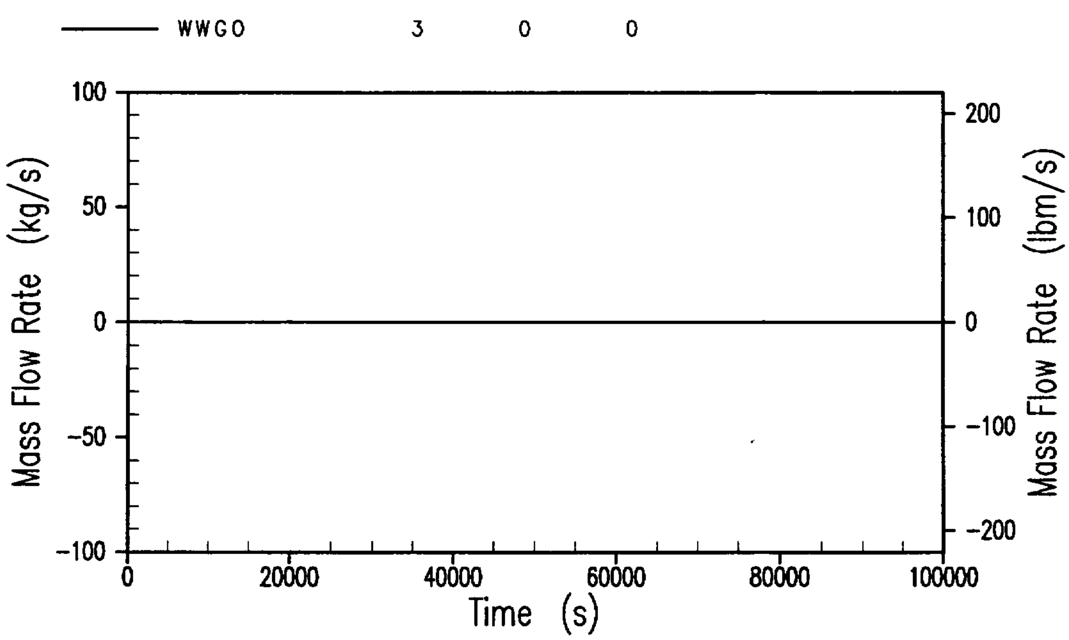


Figure 34-106

Case 3BE-3: IRWST Injection Flow Rate
DVI Line Break, Failed Gravity Injection, No PXS Flooding

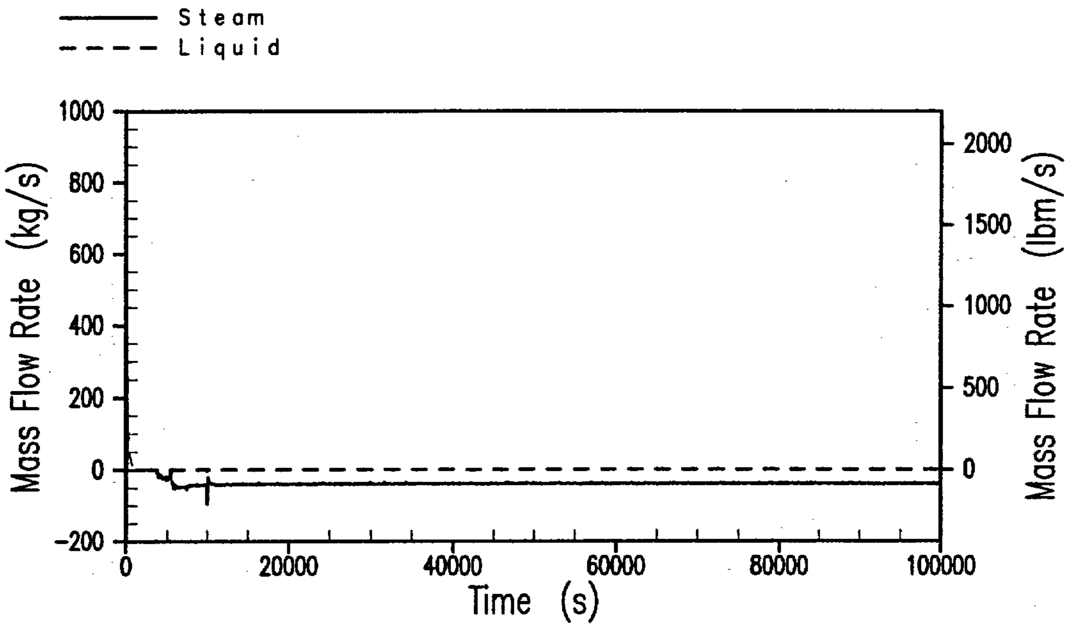


Figure 34-107

Case 3BE-3: Break Flow Rate
DVI Line Break, Failed Gravity Injection, No PXS Flooding

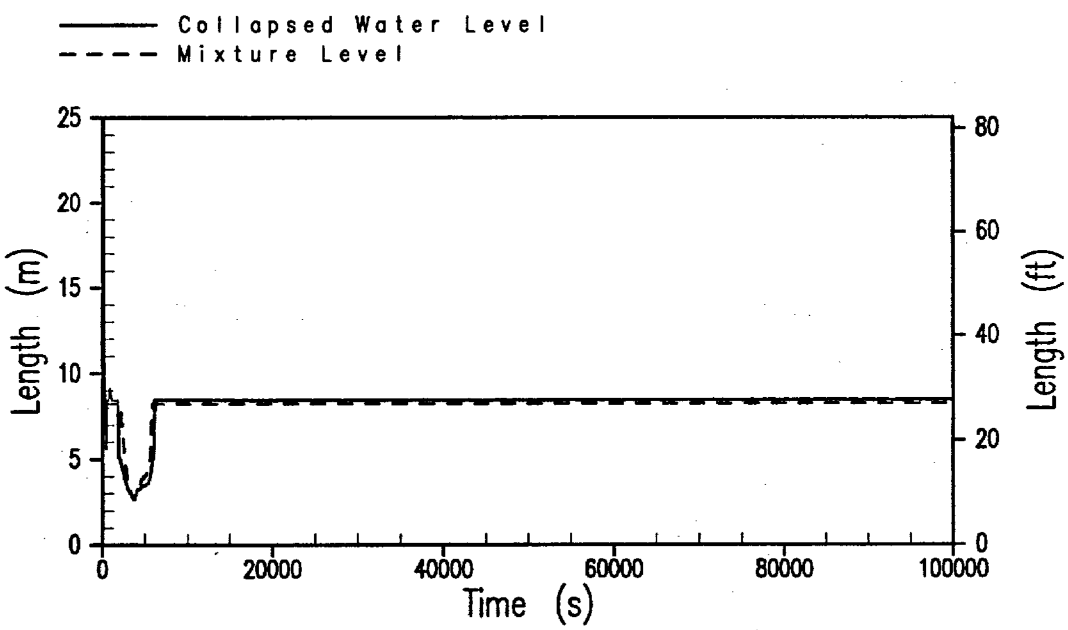


Figure 34-108

Case 3BE-3: Reactor Vessel Water Level
DVI Line Break, Failed Gravity Injection, No PXS Flooding

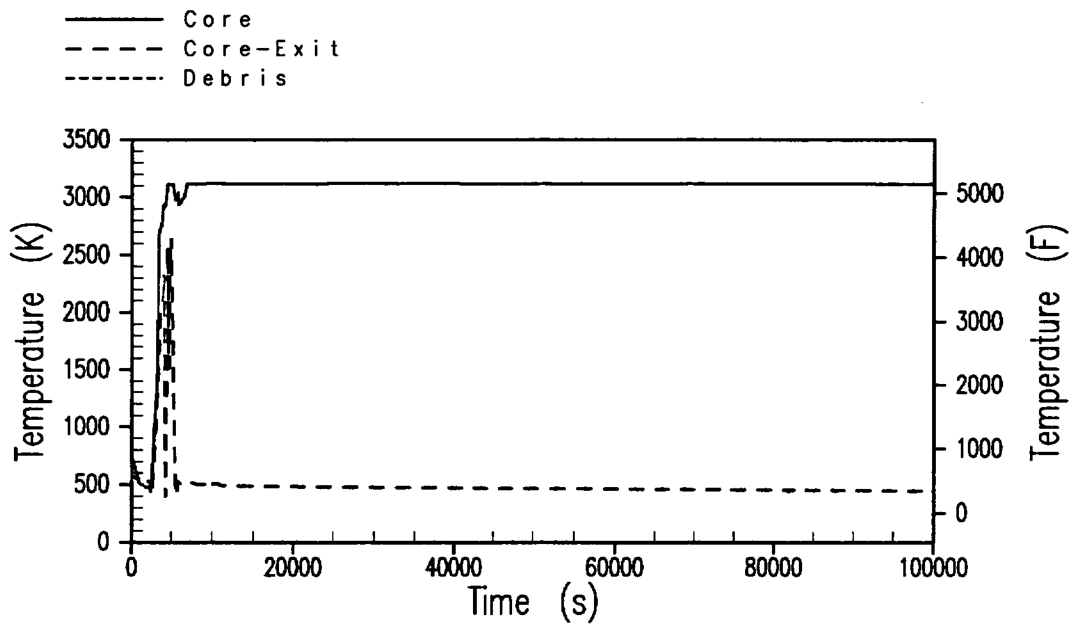


Figure 34-109

Case 3BE-3: Core Temperatures
DVI Line Break, Failed Gravity Injection, No PXS Flooding

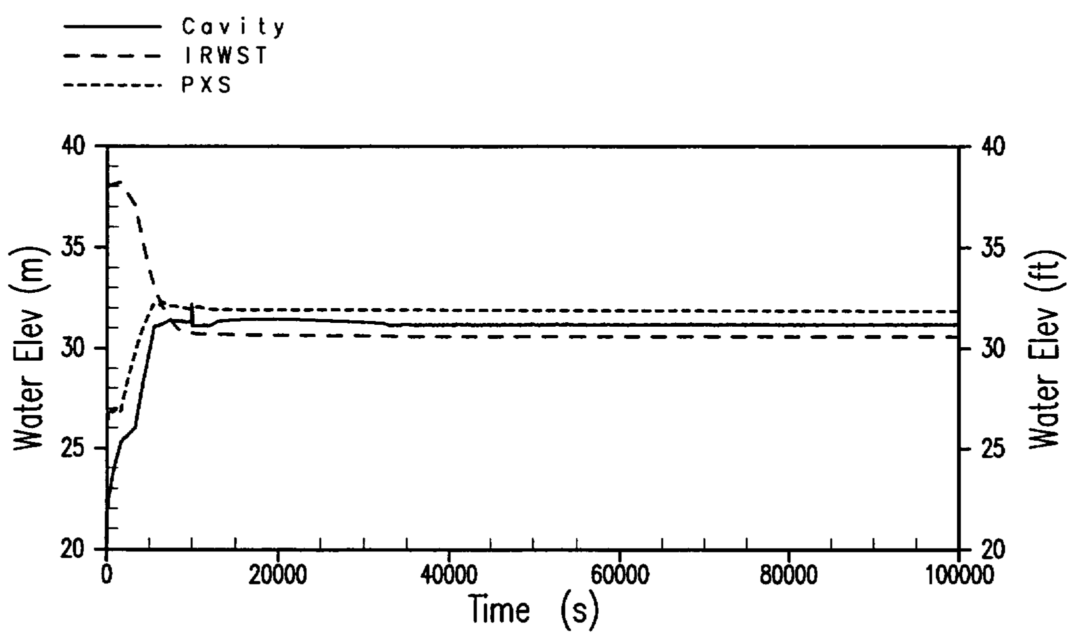


Figure 34-110

Case 3BE-3: Containment Water Pool Elevations
DVI Line Break, Failed Gravity Injection, No PXS Flooding

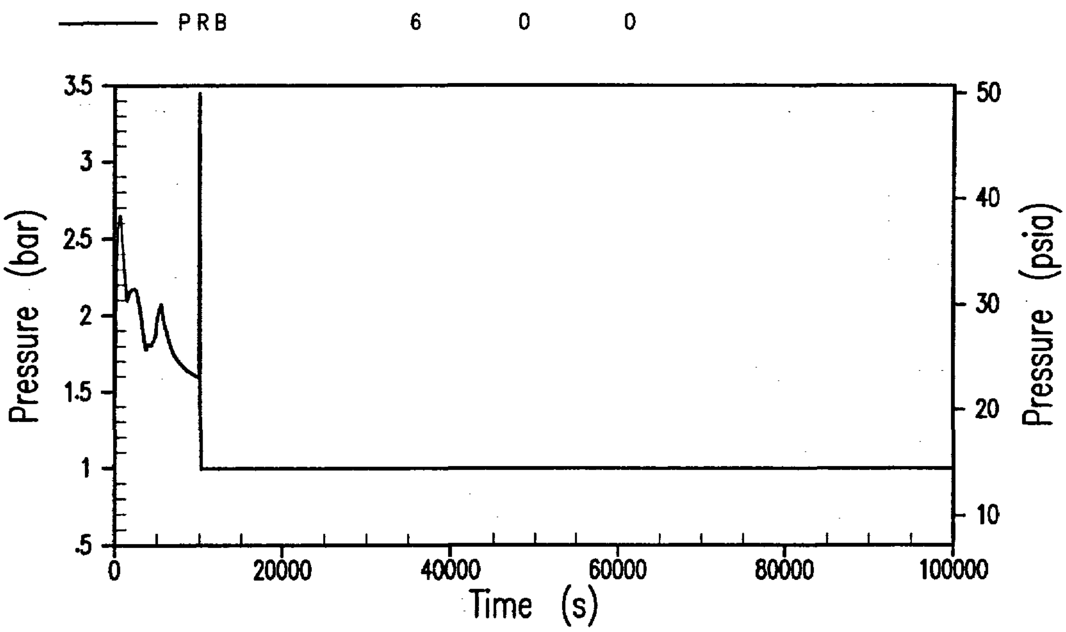


Figure 34-111

Case 3BE-3: Containment Pressure
DVI Line Break, Failed Gravity Injection, No PXS Flooding

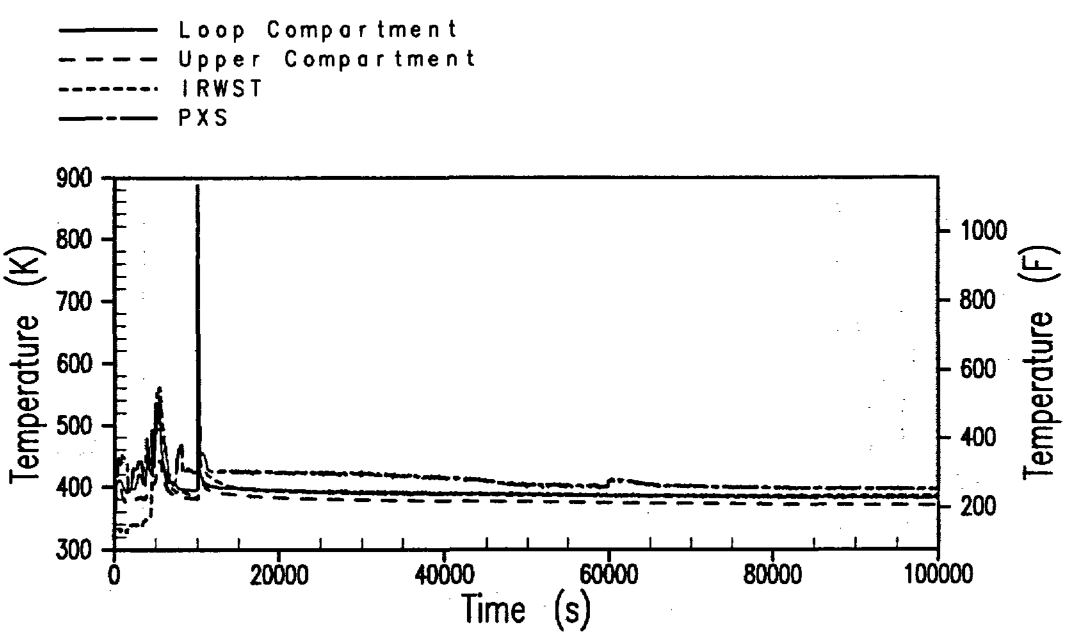


Figure 34-112

Case 3BE-3: Containment Gas Temperature
DVI Line Break, Failed Gravity Injection, No PXS Flooding

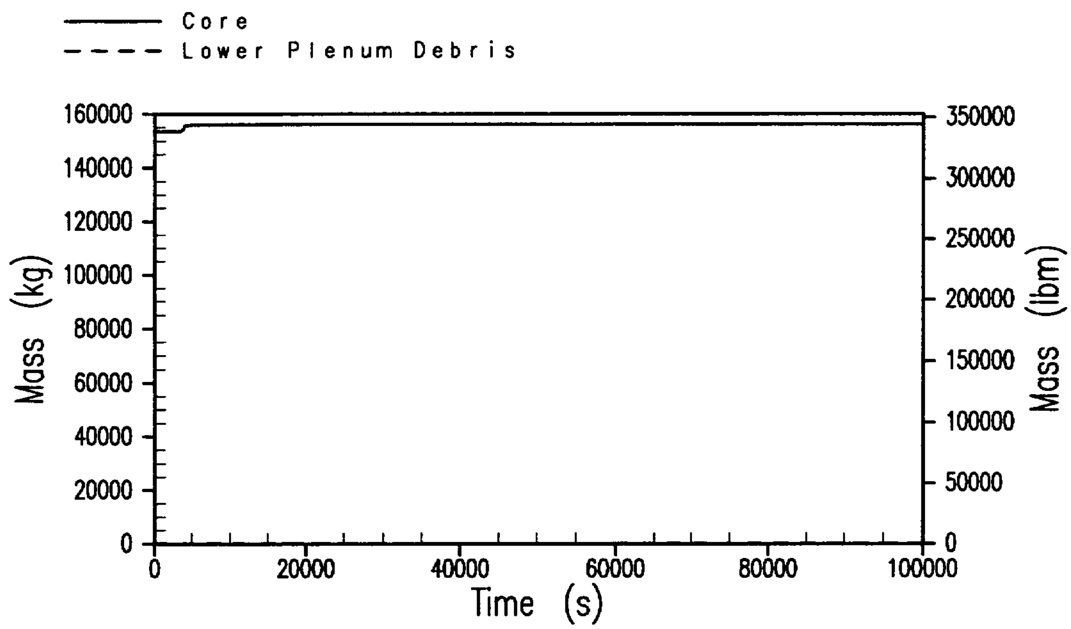


Figure 34-113

Case 3BE-3: Core Mass
DVI Line Break, Failed Gravity Injection, No PXS Flooding

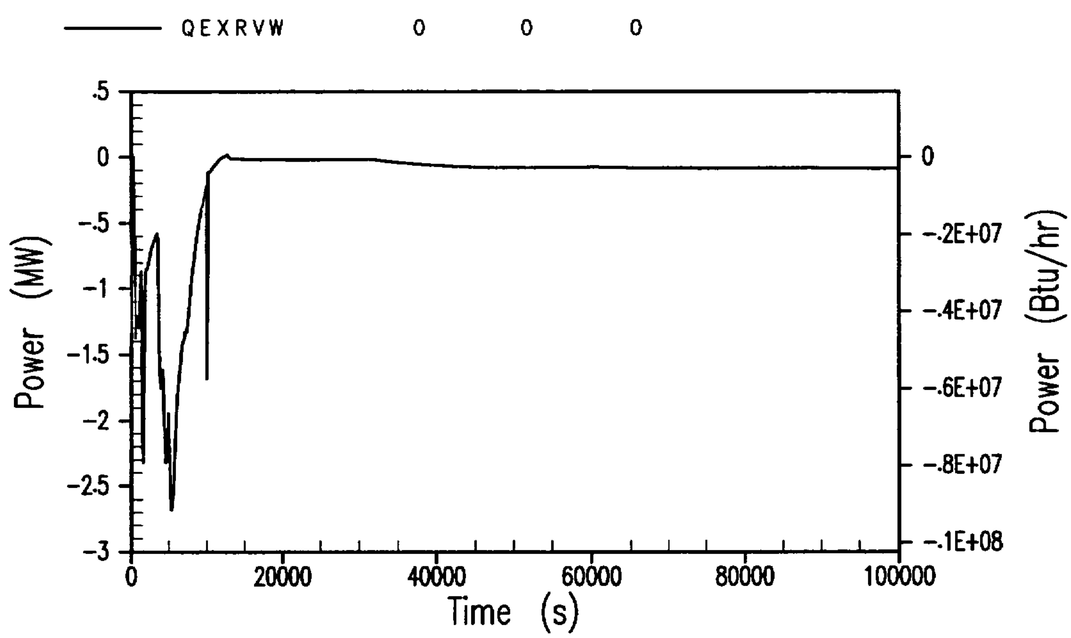


Figure 34-114

Case 3BE-3: Reactor Pressure Vessel to Cavity Water Heat Transfer
DVI Line Break, Failed Gravity Injection, No PXS Flooding

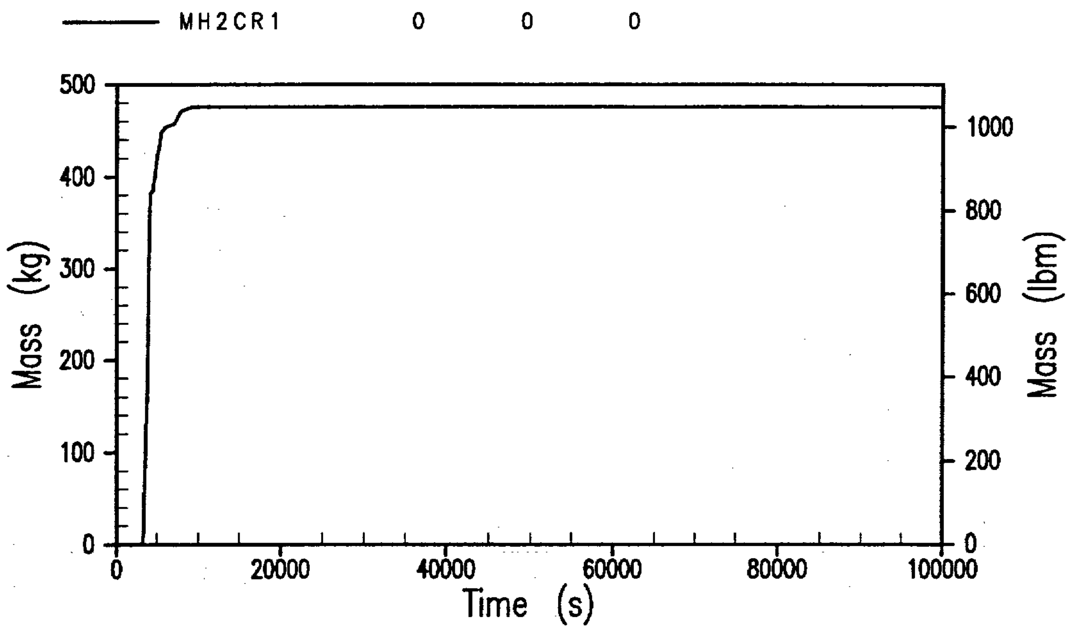


Figure 34-115

Case 3BE-3: In-Vessel Hydrogen Generation
DVI Line Break, Failed Gravity Injection, No PXS Flooding

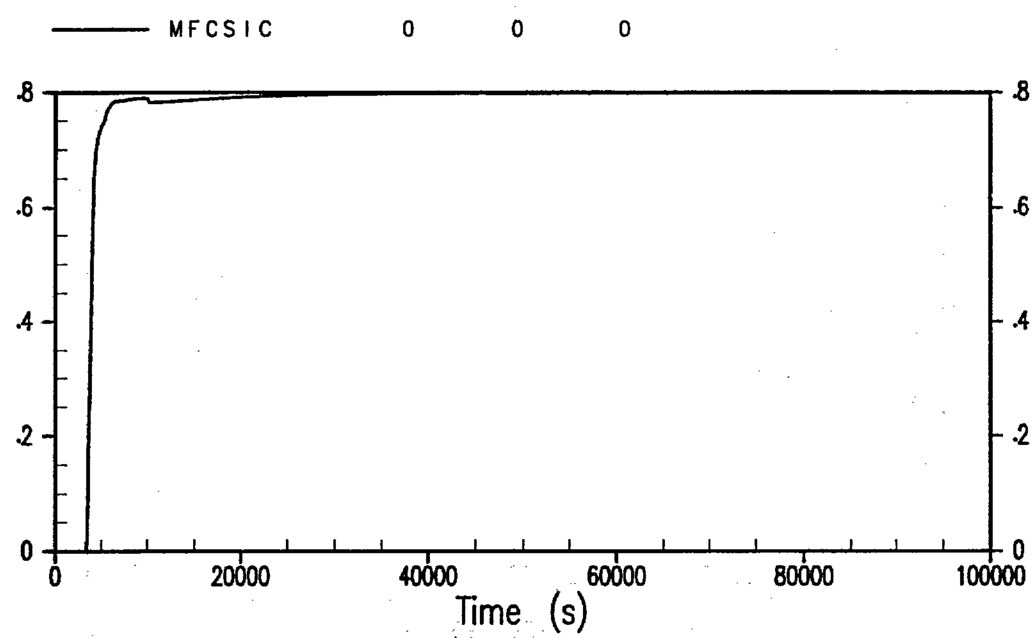


Figure 34-116

Case 3BE-3: Mass Fraction of CsI Released to Containment
DVI Line Break, Failed Gravity Injection, No PXS Flooding

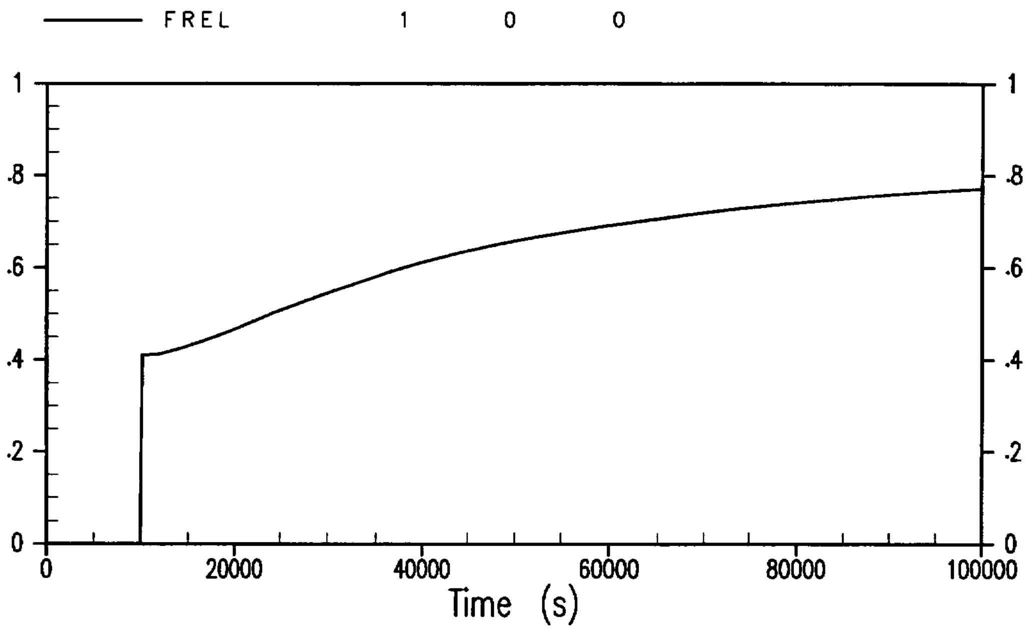


Figure 34-117

Case 3BE-3: Mass Fraction of Noble Gases Released to Environment DVI Line Break, Failed Gravity Injection, No PXS Flooding

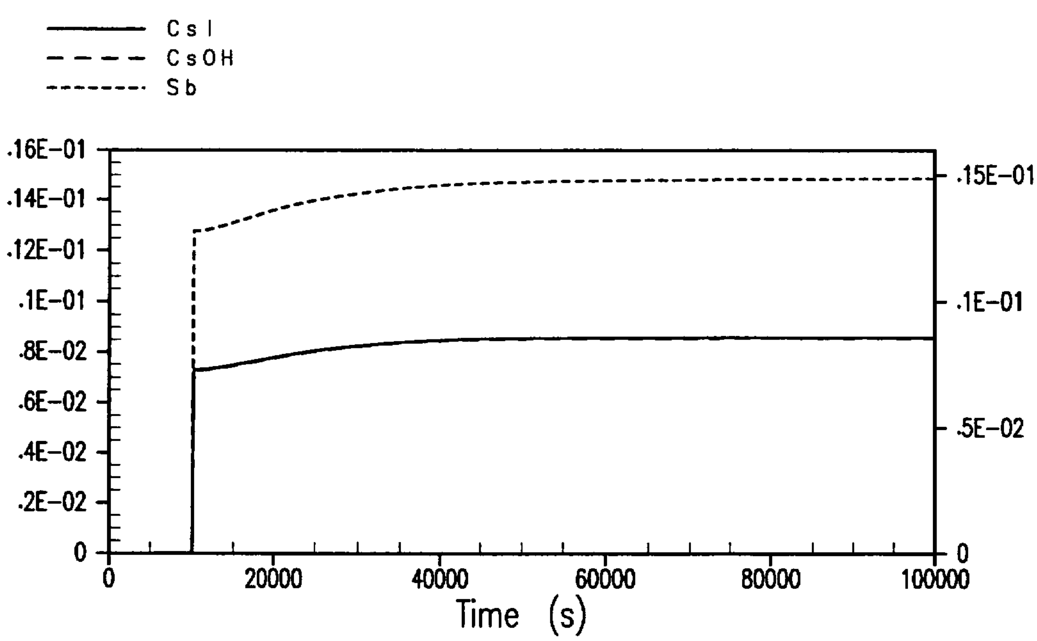


Figure 34-118

Case 3BE-3: Mass Fraction of Fission Products Released to Environment DVI Line Break, Failed Gravity Injection, No PXS Flooding

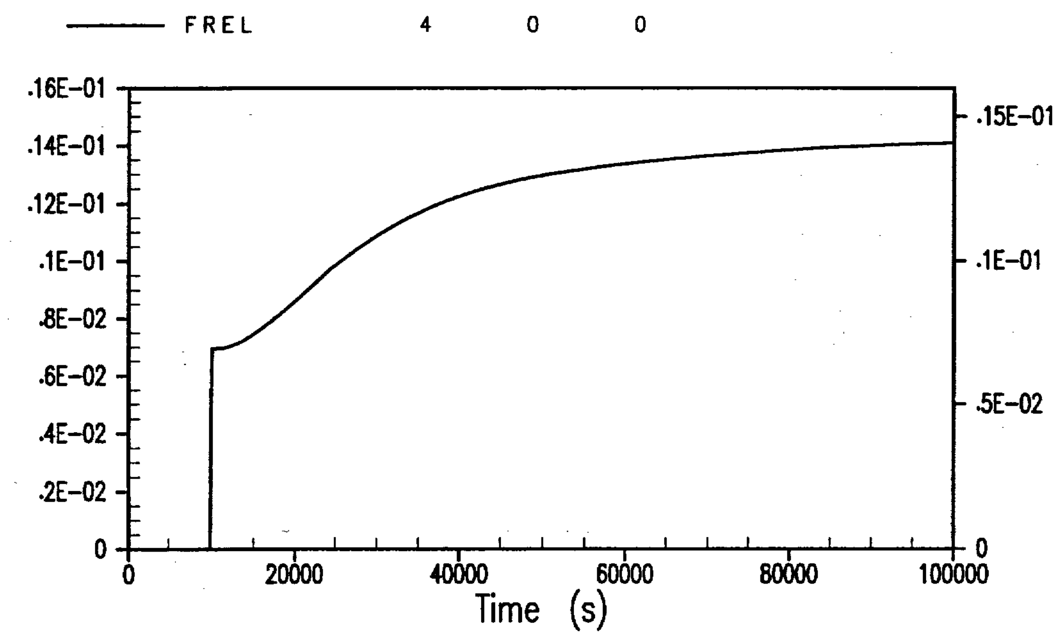


Figure 34-119

Case 3BE-3: Mass Fraction of SrO Released to Environment DVI Line Break, Failed Gravity Injection, No PXS Flooding

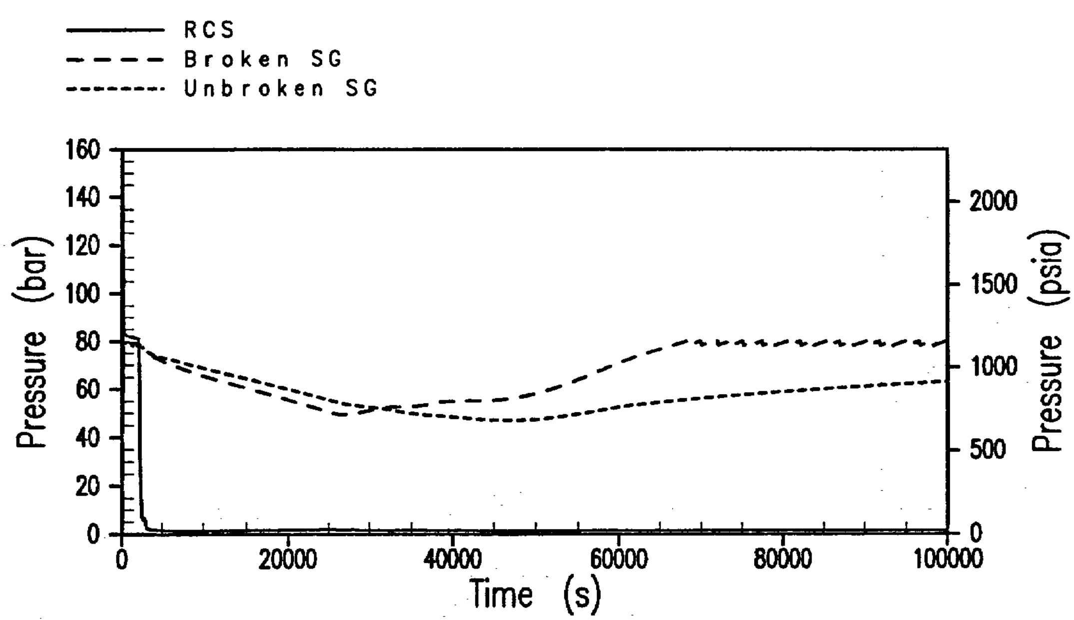


Figure 34-120

Case 3BL-1: Reactor Coolant System and Steam Generator Pressure SBLOCA with Failed Gravity Injection

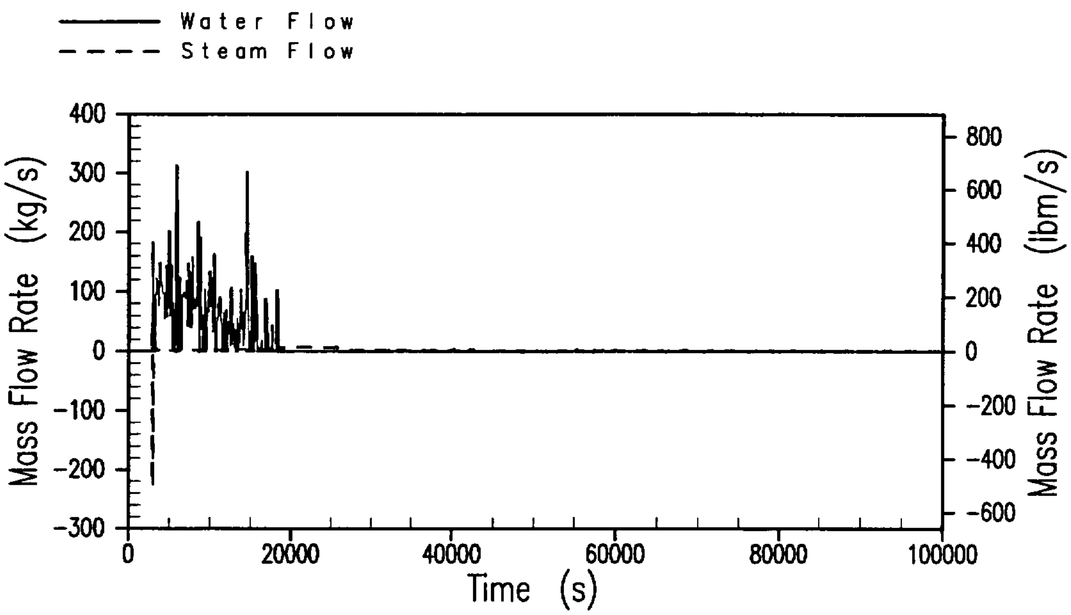


Figure 34-121

Case 3BL-1: ADS Stage 4 Flow Rates SBLOCA with Failed Gravity Injection

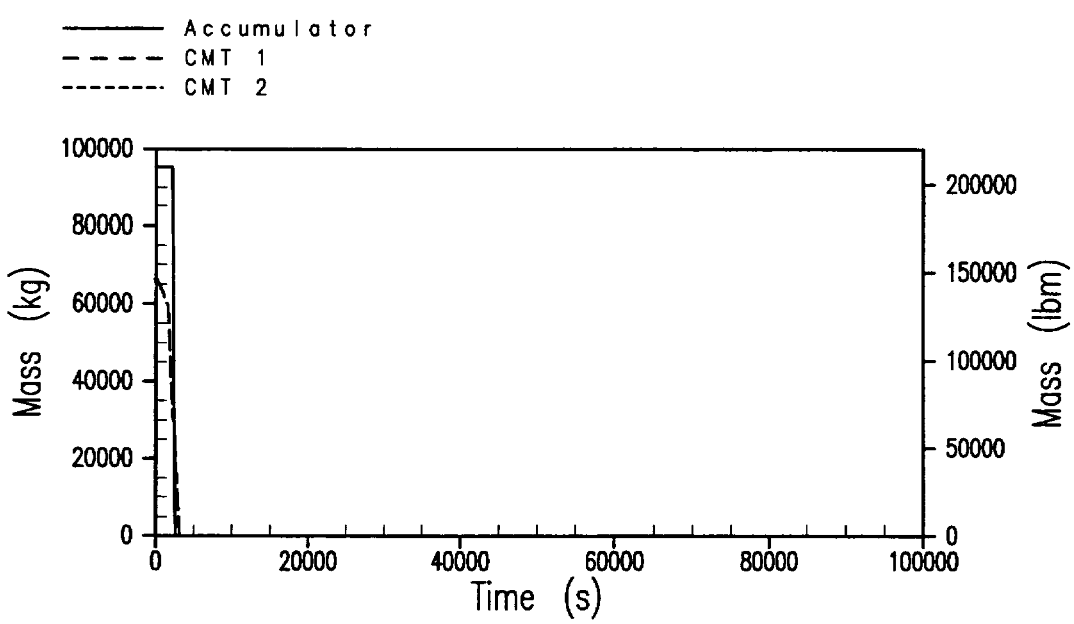


Figure 34-122

Case 3BL-1: Accumulator/CMT Water Mass SBLOCA with Failed Gravity Injection

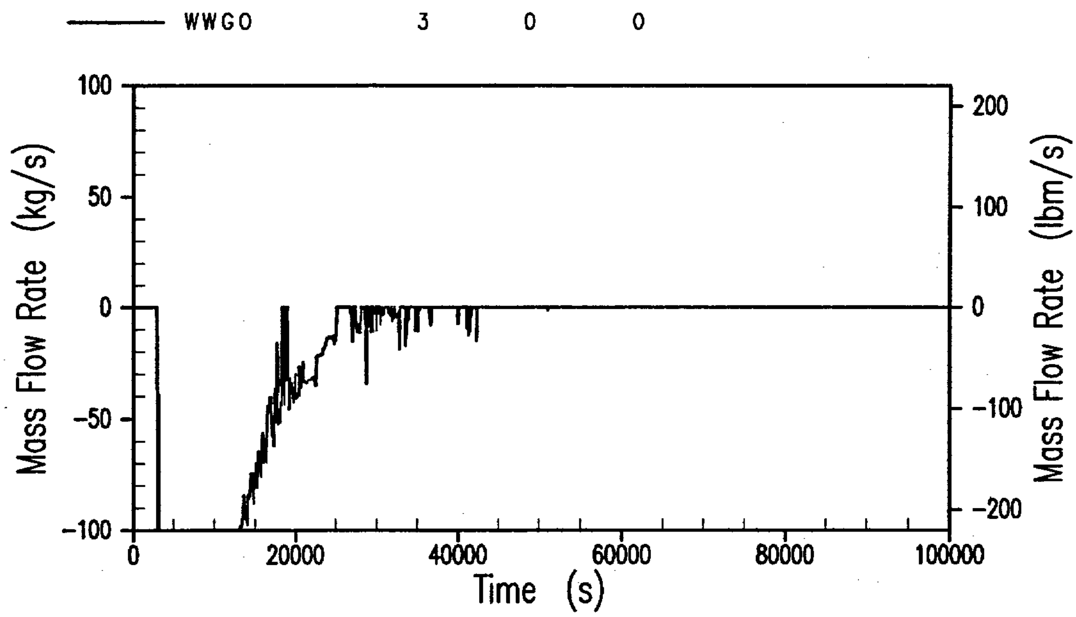


Figure 34-123

Case 3BL-1: IRWST Injection Flow Rate SBLOCA with Failed Gravity Injection

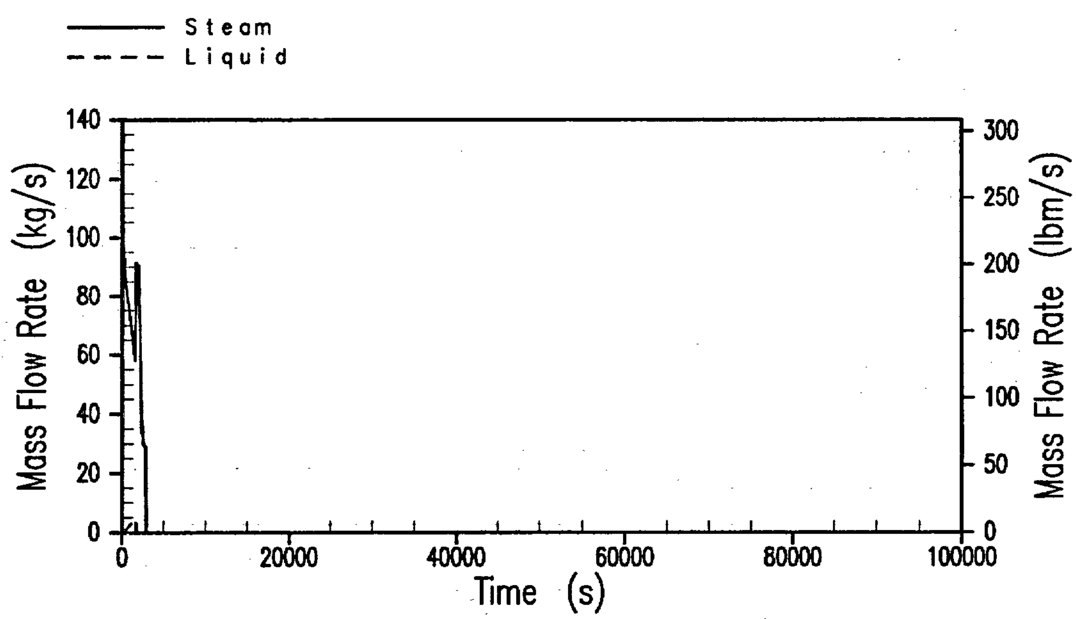


Figure 34-124

Case 3BL-1: Break Flow Rate SBLOCA with Failed Gravity Injection

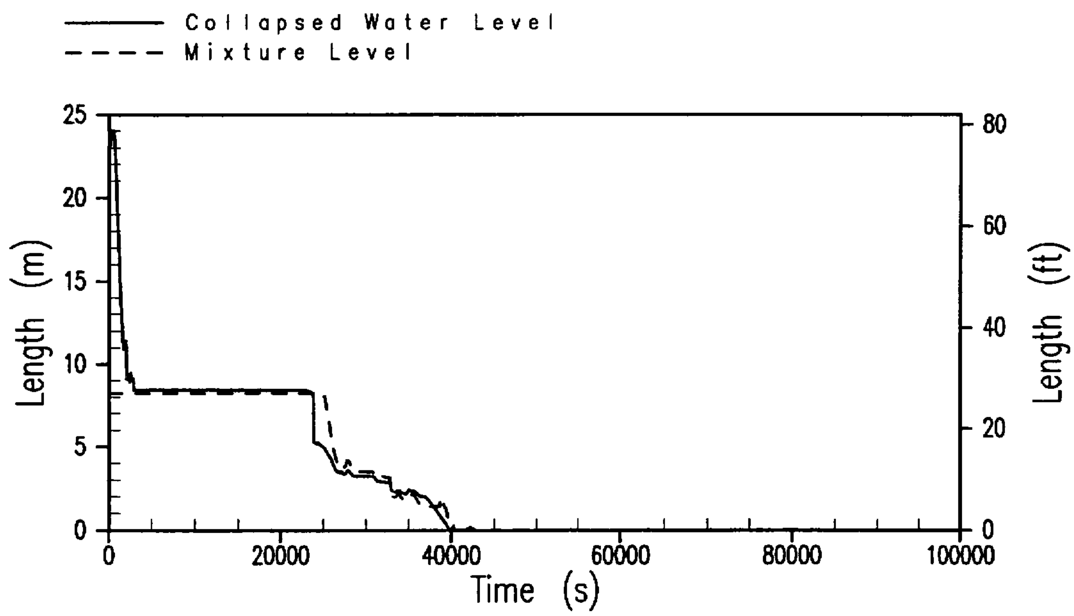


Figure 34-125

Case 3BL-1: Reactor Vessel Water Level
SBLOCA with Failed Gravity Injection

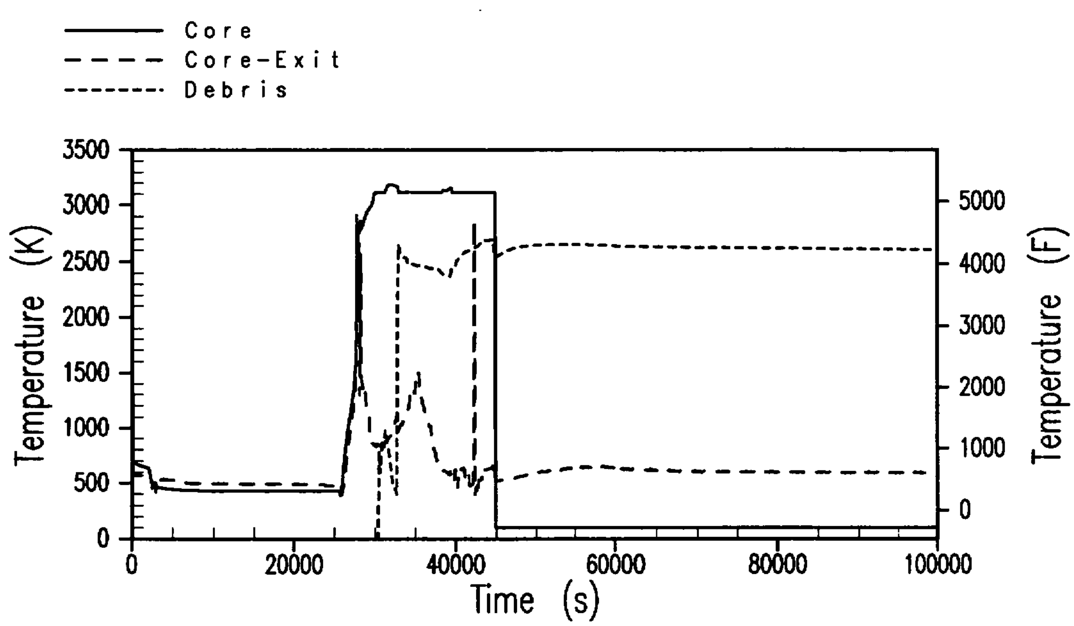


Figure 34-126

Case 3BL-1: Core Temperatures
SBLOCA with Failed Gravity Injection

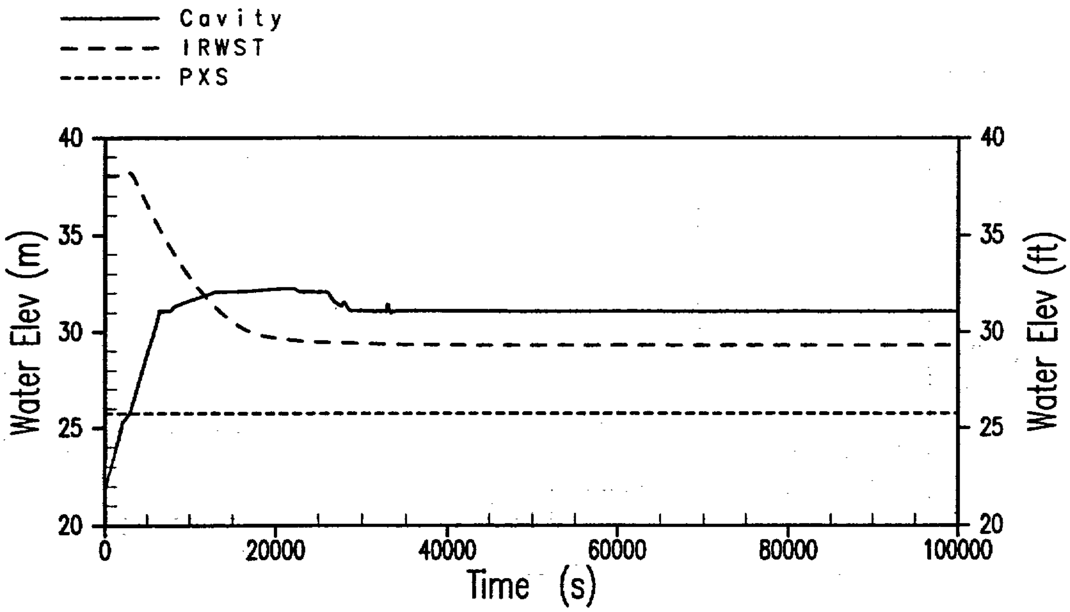


Figure 34-127

Case 3BL-1: Containment Water Pool Elevations SBLOCA with Failed Gravity Injection

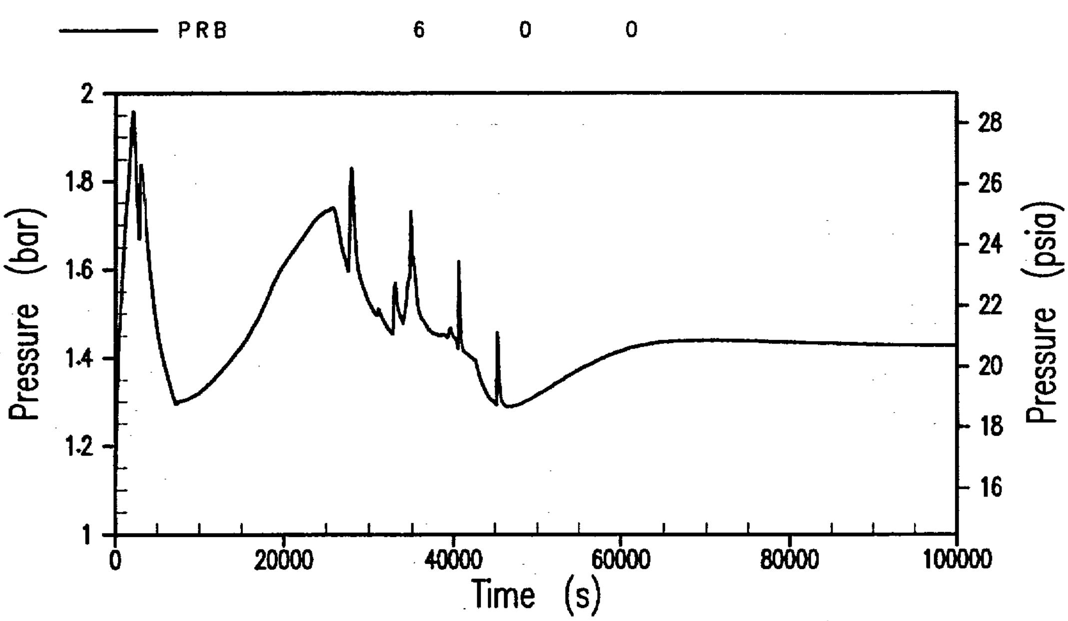


Figure 34-128

Case 3BL-1: Containment Pressure SBLOCA with Failed Gravity Injection

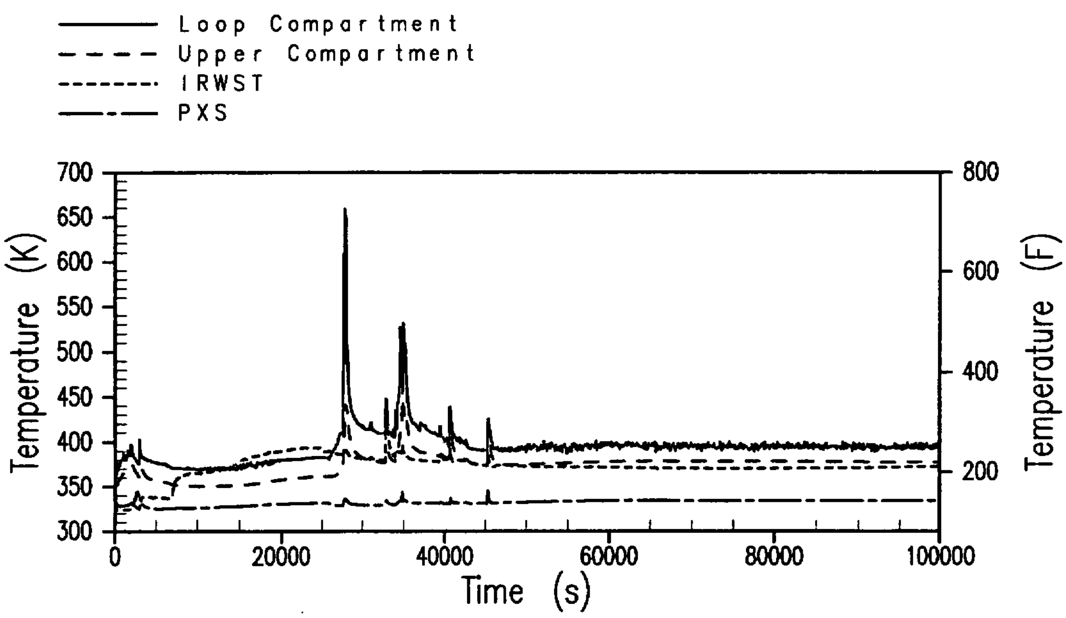


Figure 34-129

Case 3BL-1: Containment Gas Temperature
SBLOCA with Failed Gravity Injection

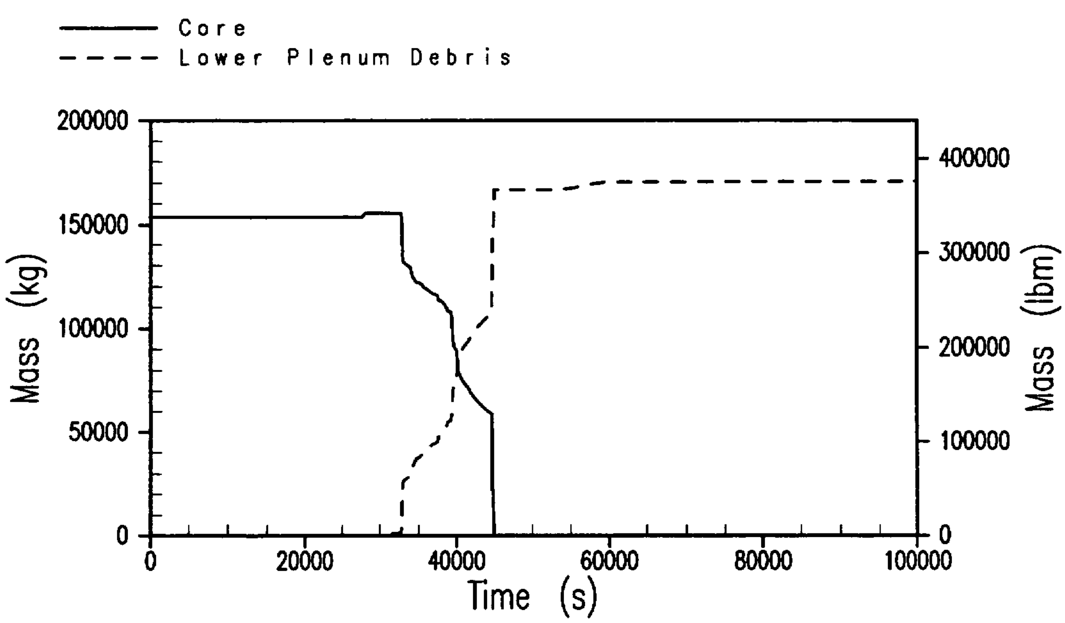


Figure 34-130

Case 3BL-1: Core Mass
SBLOCA with Failed Gravity Injection

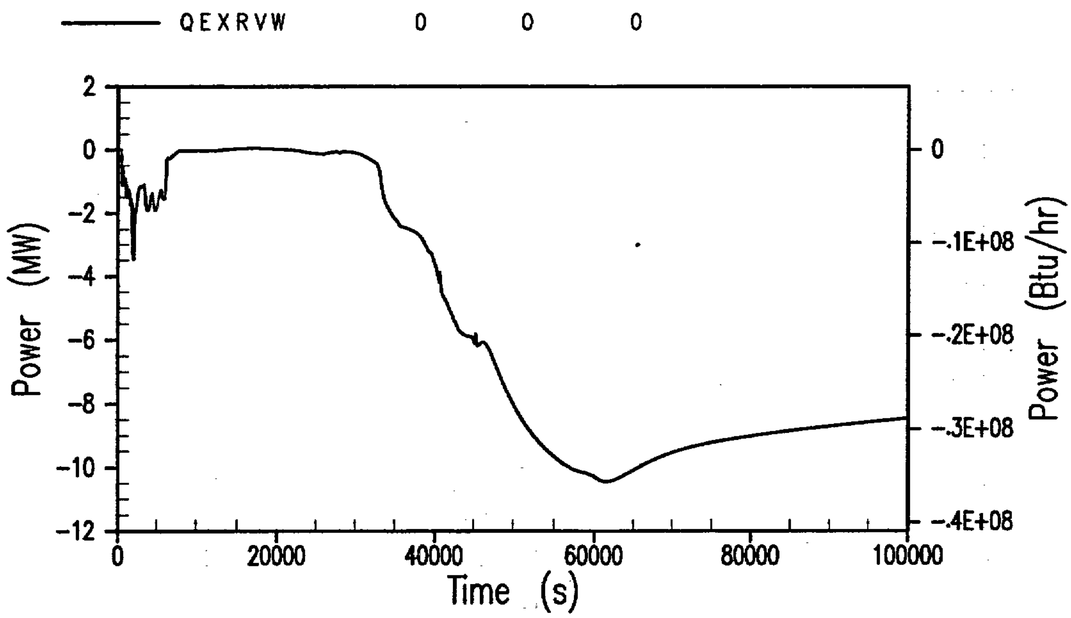


Figure 34-131

Case 3BL-1: Reactor Pressure Vessel to Cavity Water Heat Transfer SBLOCA with Failed Gravity Injection

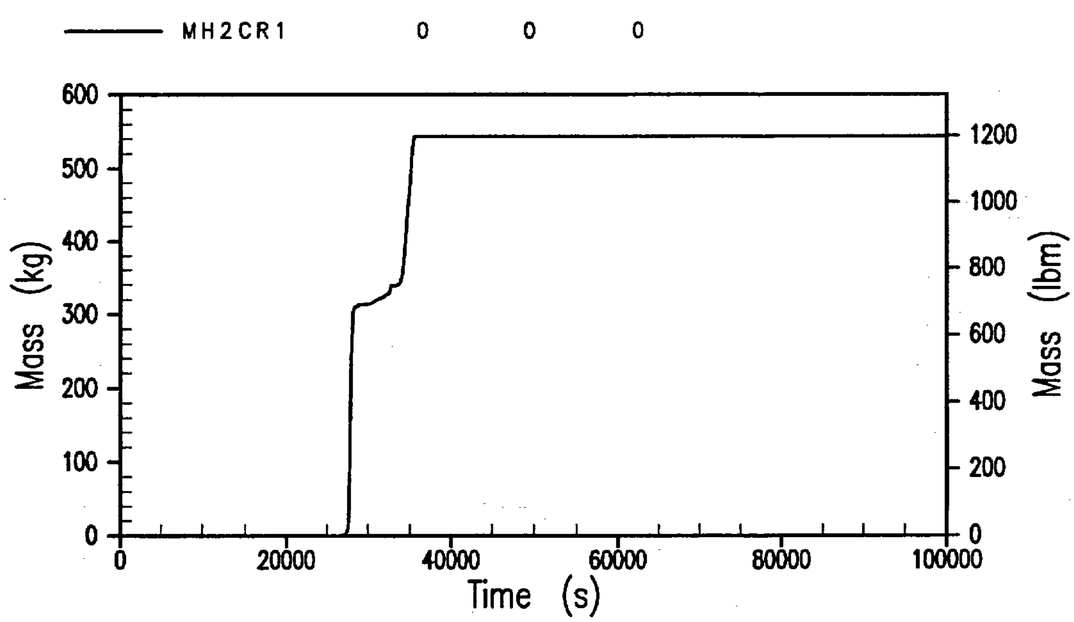


Figure 34-132

Case 3BL-1: In-Vessel Hydrogen Generation SBLOCA with Failed Gravity Injection

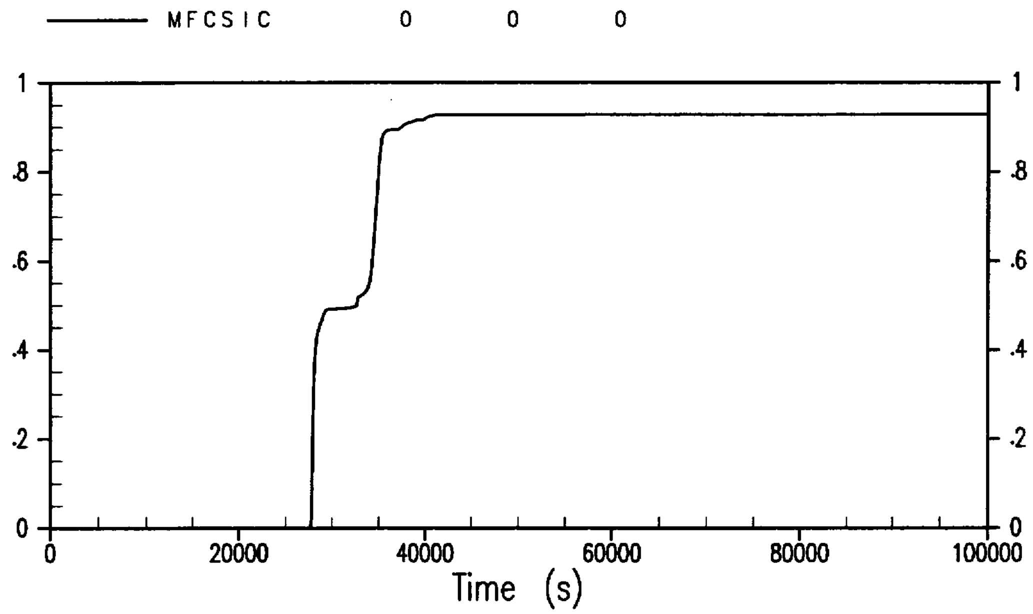


Figure 34-133

Case 3BL-1: Mass Fraction of CsI Released to Containment SBLOCA with Failed Gravity Injection

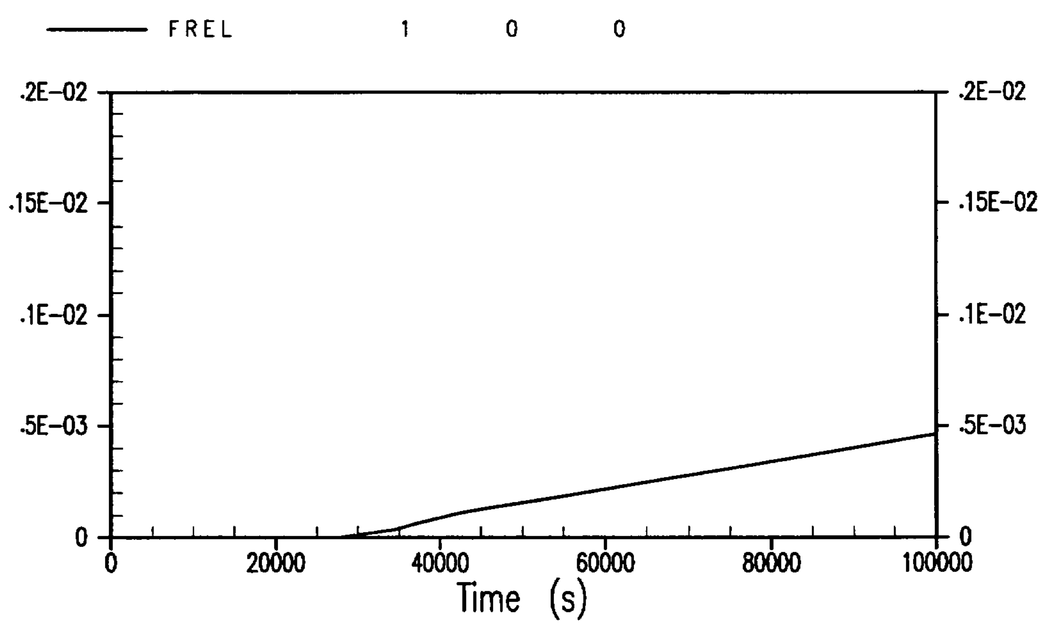


Figure 34-134

Case 3BL-1: Mass Fraction of Noble Gases Released to Environment SBLOCA with Failed Gravity Injection

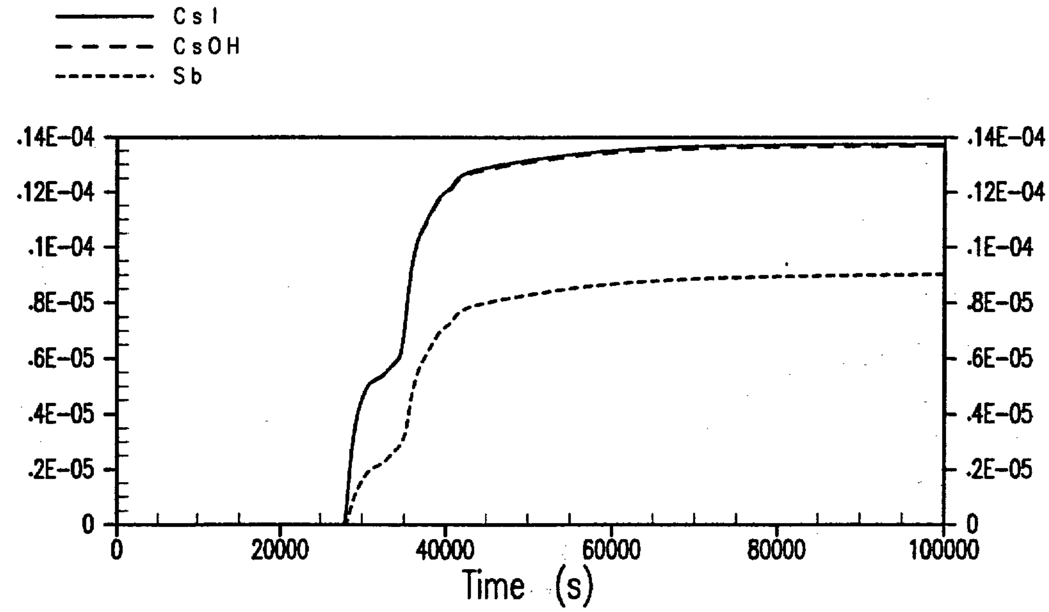


Figure 34-135

Case 3BL-1: Mass Fraction of Fission Products Released to Environment SBLOCA with Failed Gravity Injection

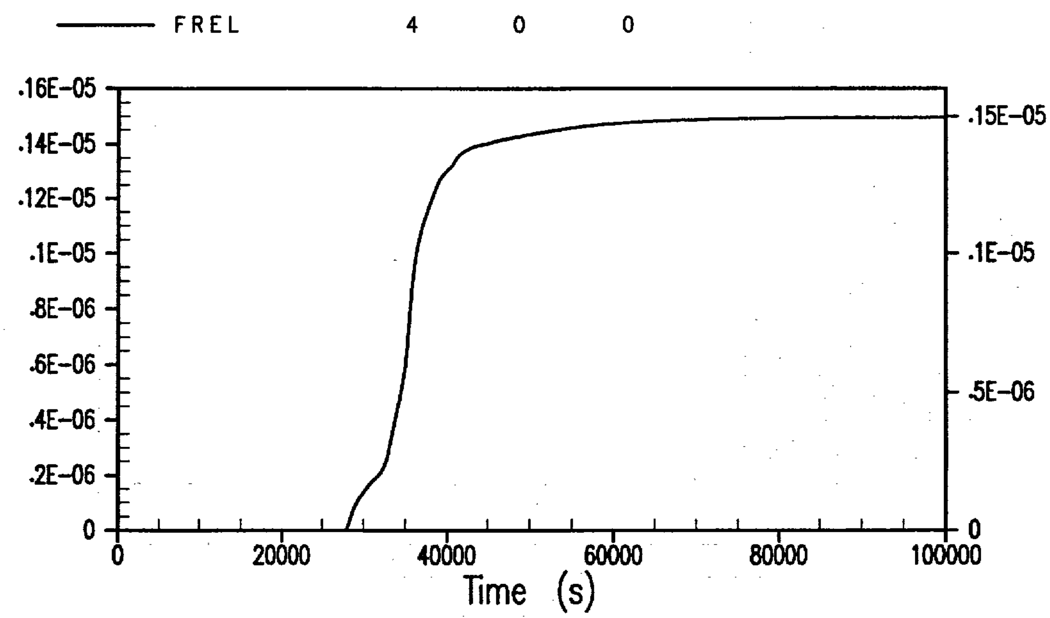


Figure 34-136

Case 3BL-1: Mass Fraction of SrO Released to Environment SBLOCA with Failed Gravity Injection

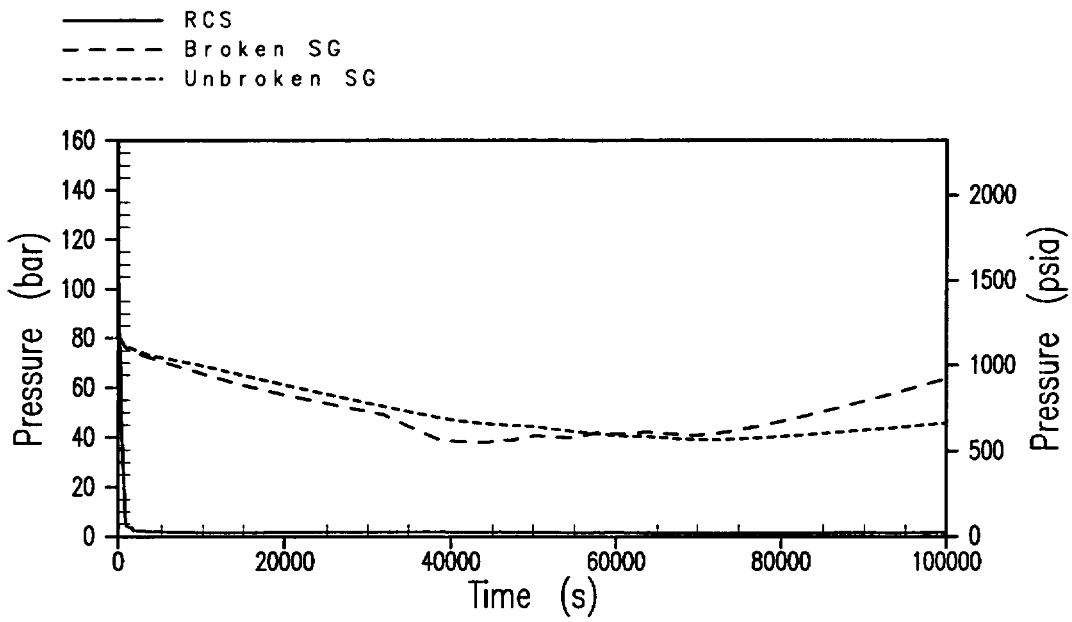


Figure 34-137

Case 3BL-2: Reactor Coolant System and Steam Generator Pressure DVI Line Break with Failed Gravity Injection

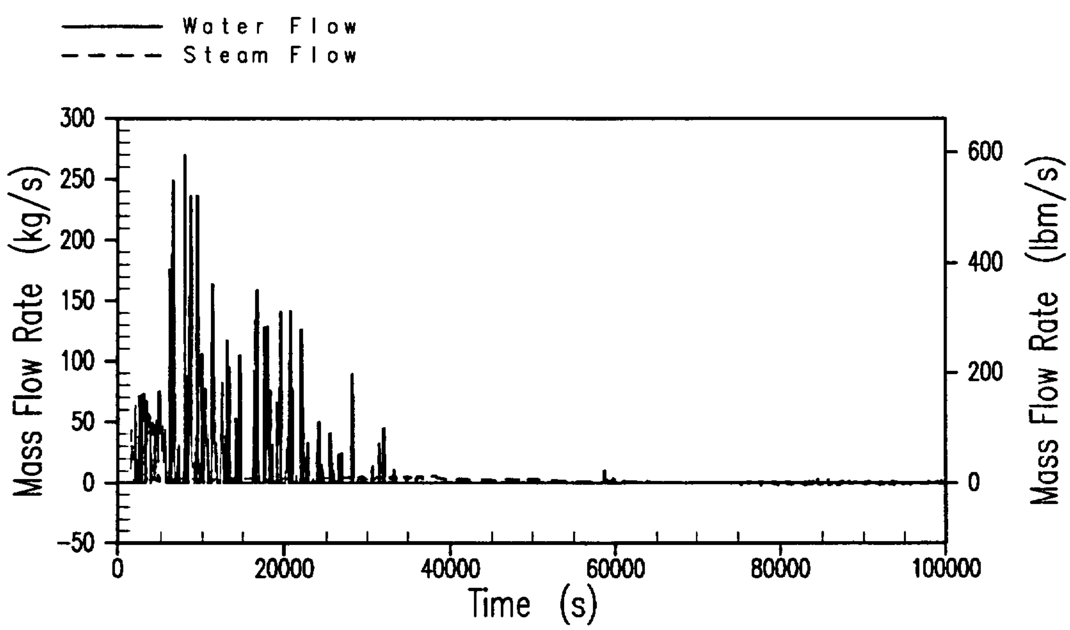


Figure 34-138

Case 3BL-2: ADS Stage 4 Flow Rates DVI Line Break with Failed Gravity Injection

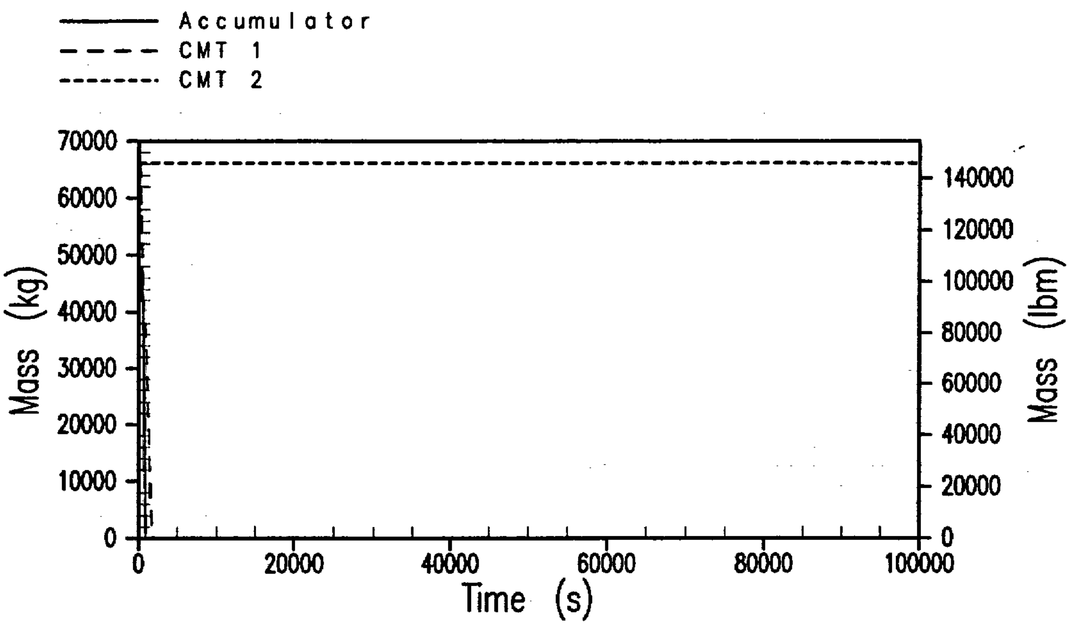


Figure 34-139

Case 3BL-2: Accumulator/CMT Water Mass
DVI Line Break with Failed Gravity Injection

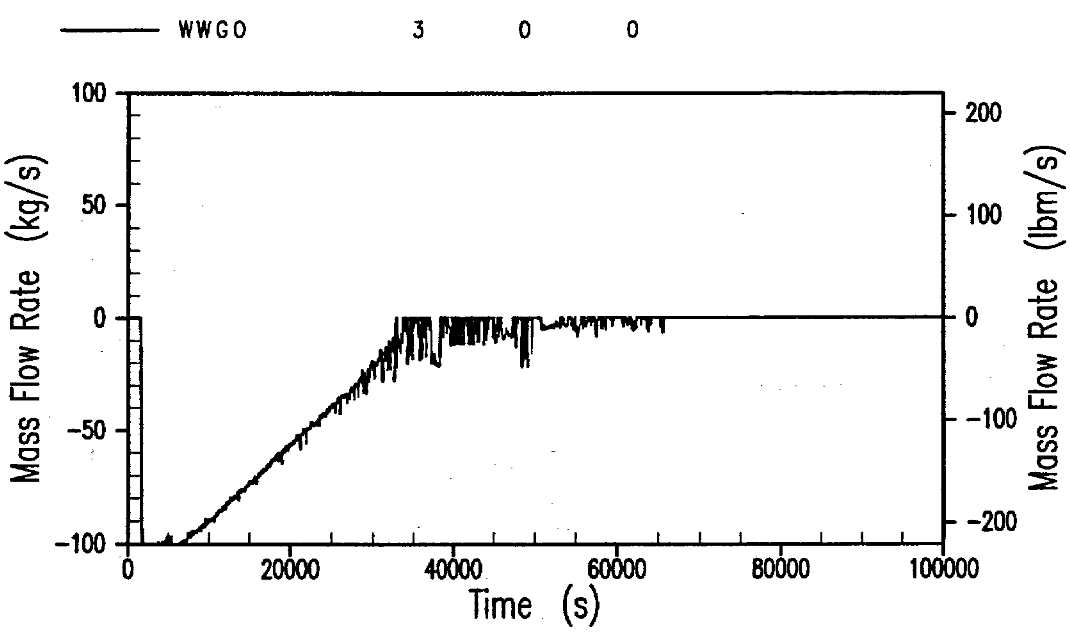


Figure 34-140

Case 3BL-2: IRWST Injection Flow Rate
DVI Line Break with Failed Gravity Injection

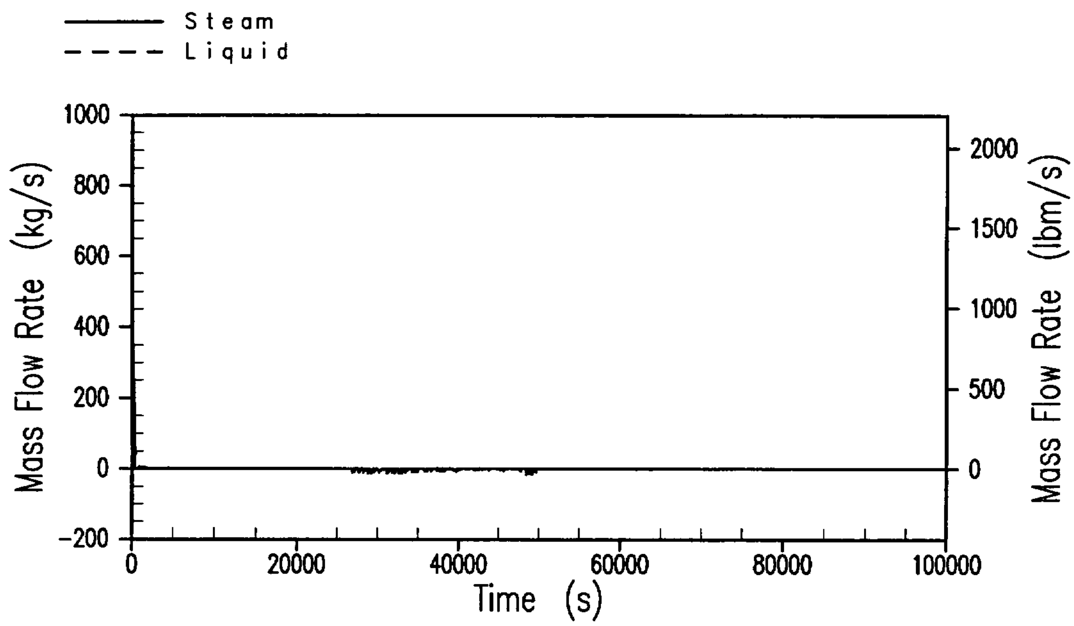


Figure 34-141

Case 3BL-2: Break Flow Rate
DVI Line Break with Failed Gravity Injection

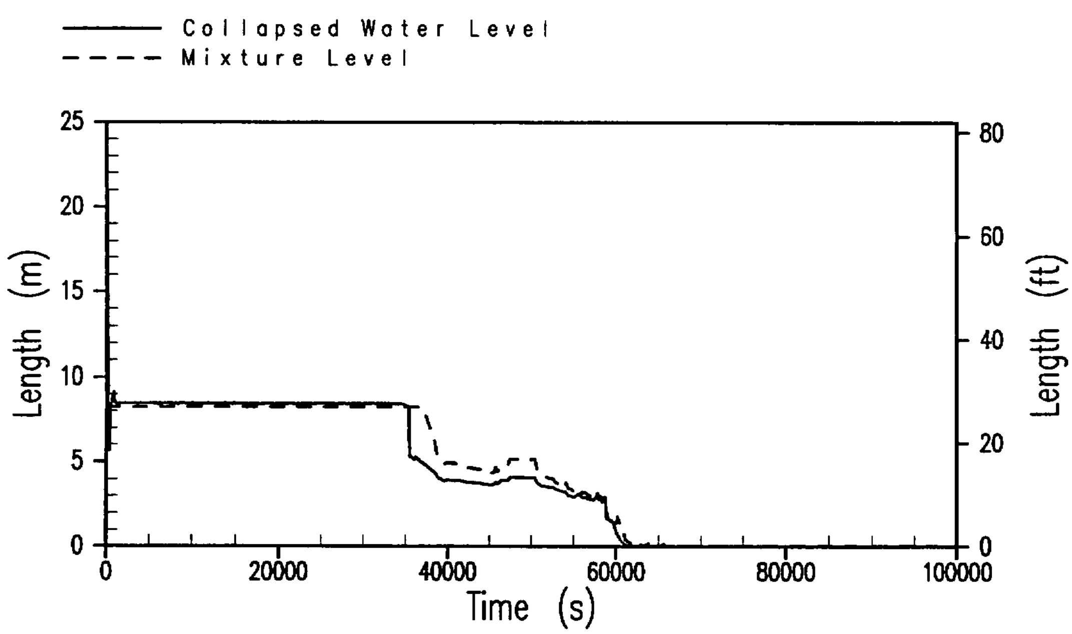


Figure 34-142

Case 3BL-2: Reactor Vessel Water Level
DVI Line Break with Failed Gravity Injection

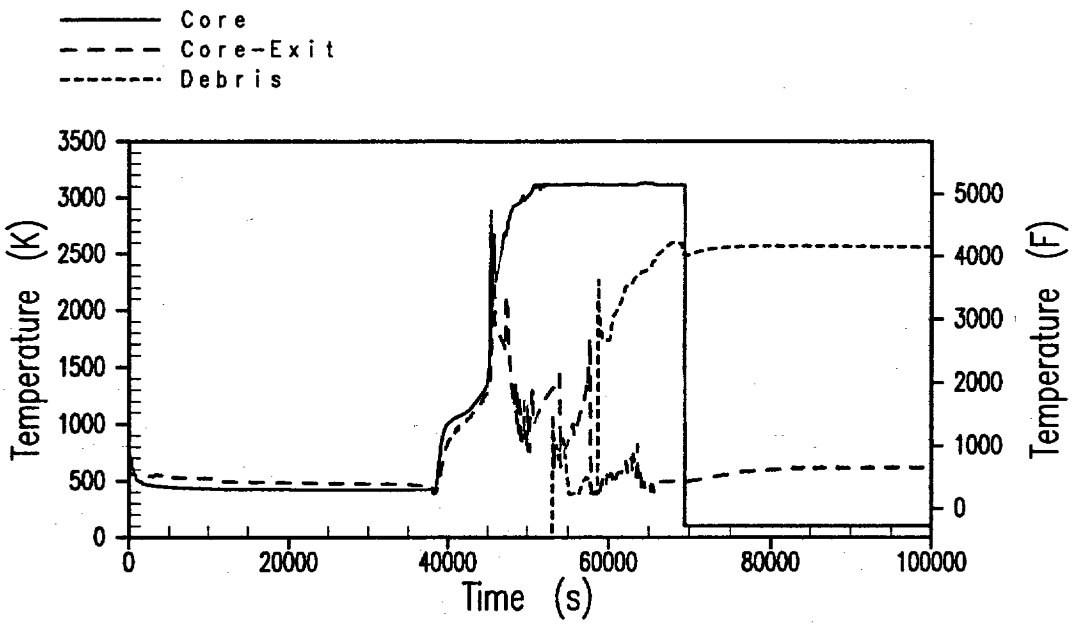


Figure 34-143

Case 3BL-2: Core Temperatures
DVI Line Break with Failed Gravity Injection

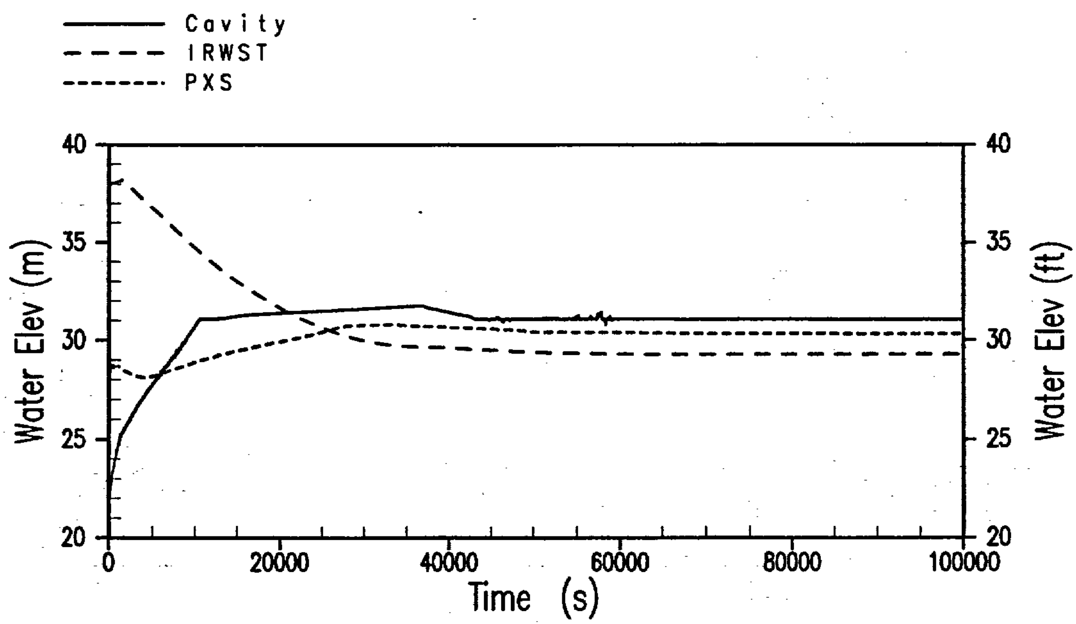


Figure 34-144

Case 3BL-2: Containment Water Pool Elevations
DVI Line Break with Failed Gravity Injection

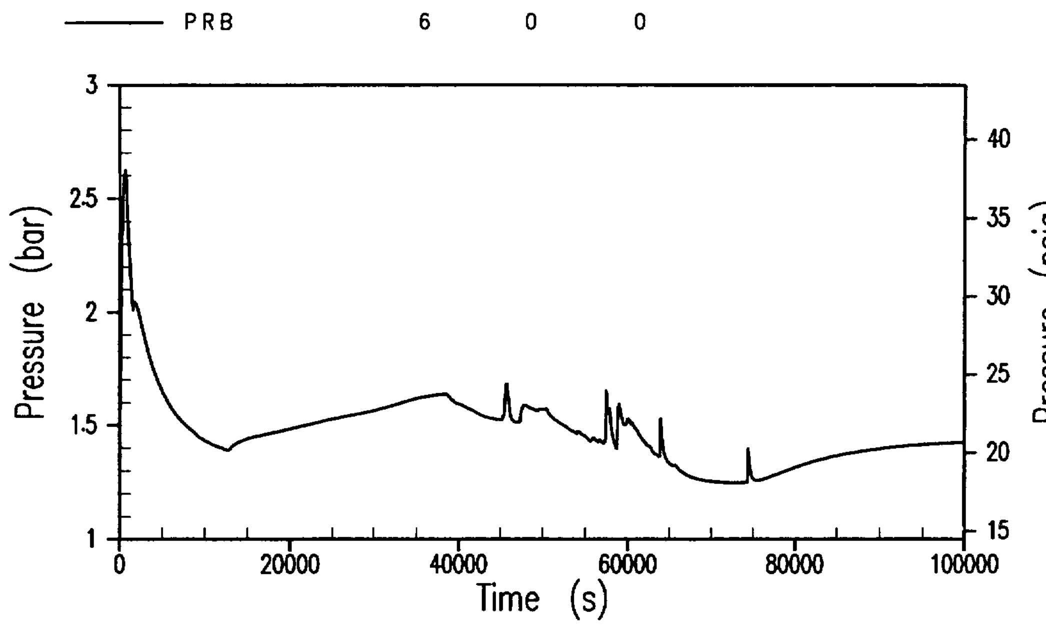


Figure 34-145

Case 3BL-2: Containment Pressure
DVI Line Break with Failed Gravity Injection

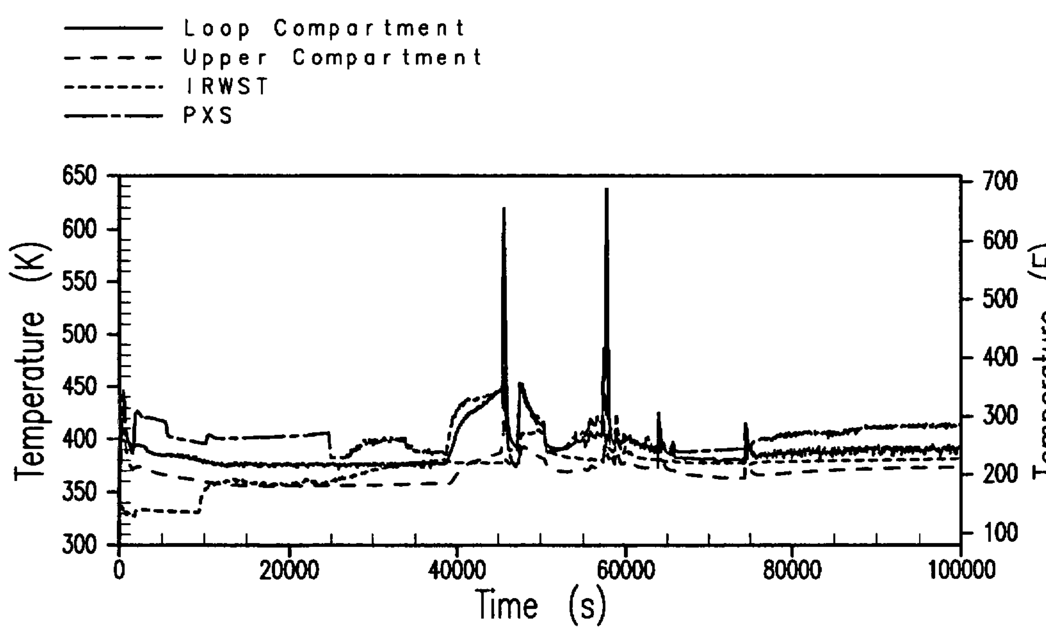


Figure 34-146

Case 3BL-2: Containment Gas Temperature
DVI Line Break with Failed Gravity Injection

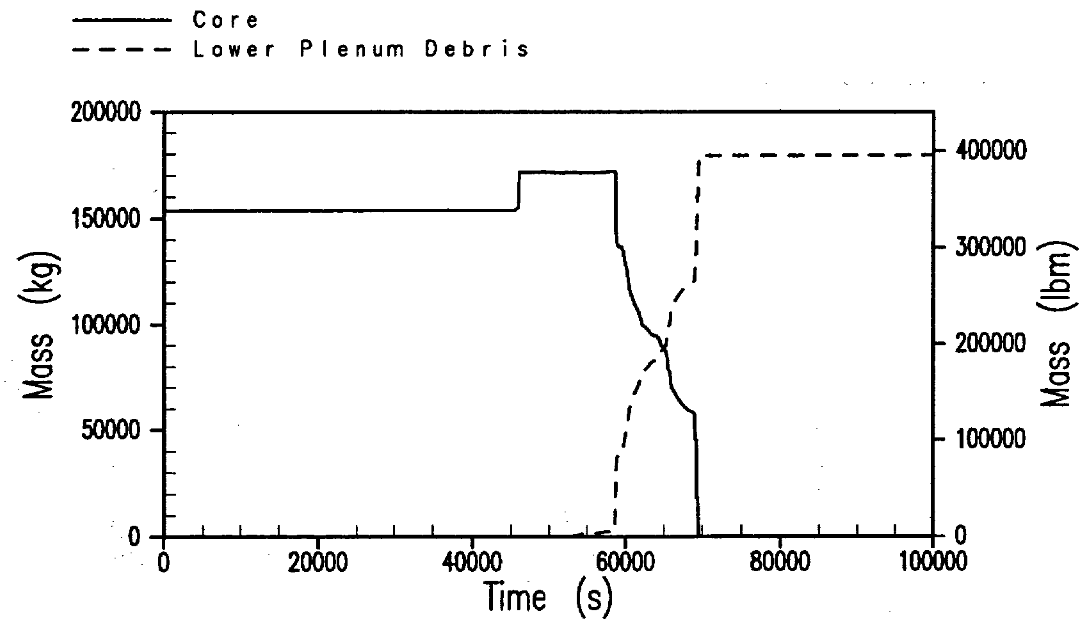


Figure 34-147

Case 3BL-2: Core Mass
DVI Line Break with Failed Gravity Injection

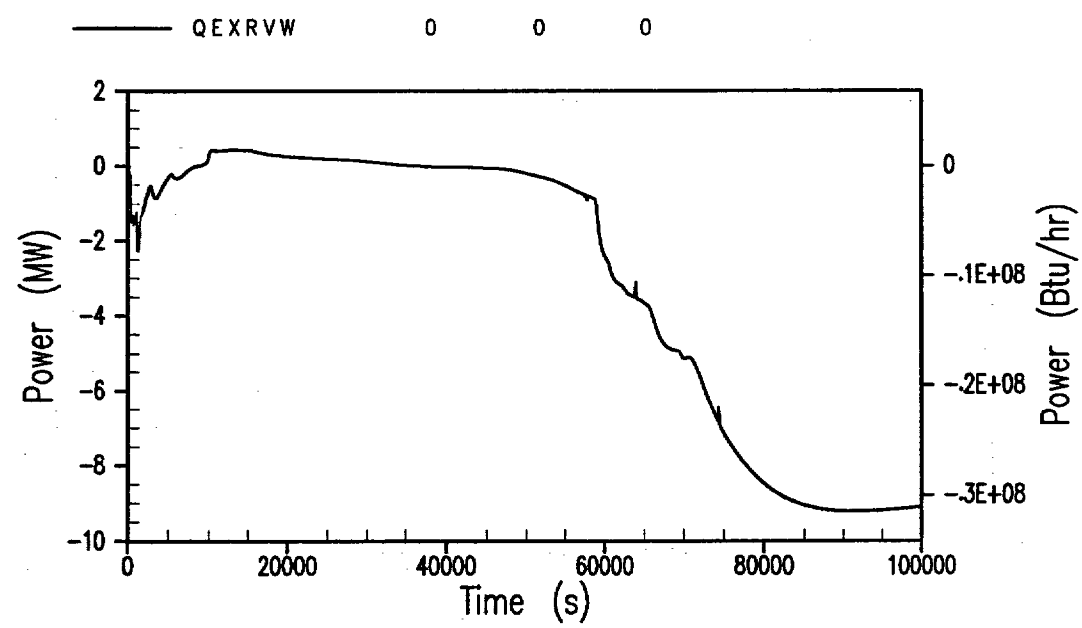


Figure 34-148

Case 3BL-2: Reactor Pressure Vessel to Cavity Water Heat Transfer
DVI Line Break with Failed Gravity Injection

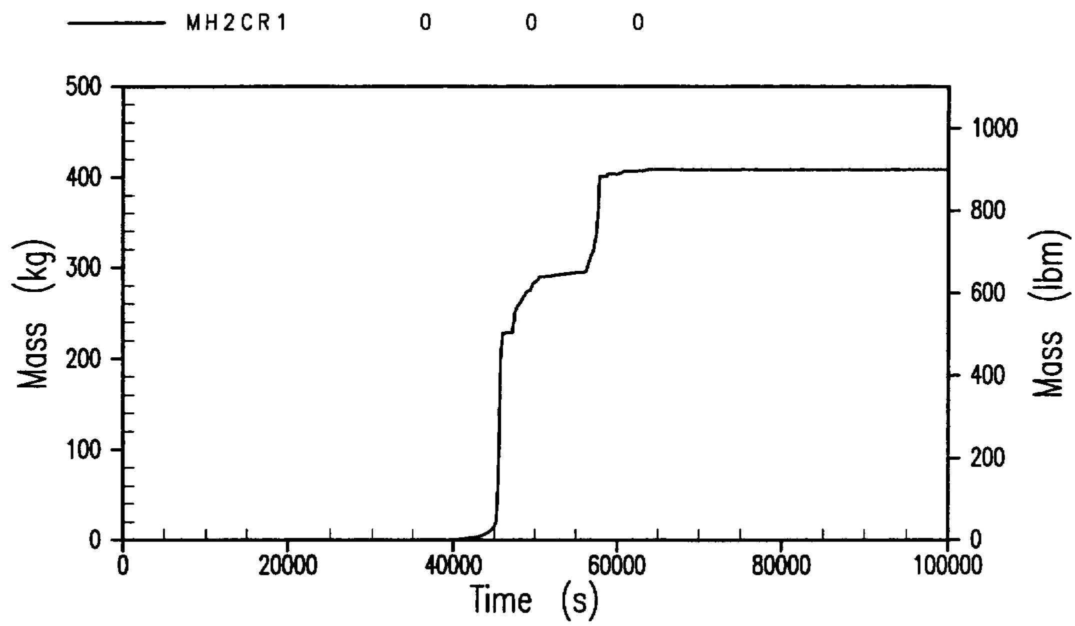


Figure 34-149

Case 3BL-2: In-Vessel Hydrogen Generation DVI Line Break with Failed Gravity Injection

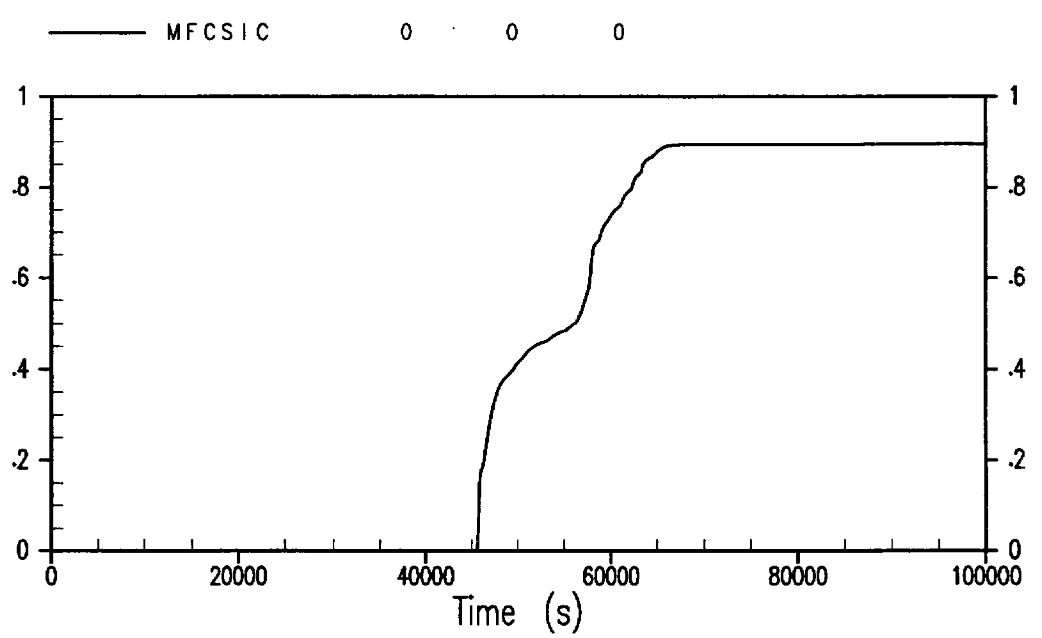


Figure 34-150

Case 3BL-2: Mass Fraction of CsI Released to Containment DVI Line Break with Failed Gravity Injection

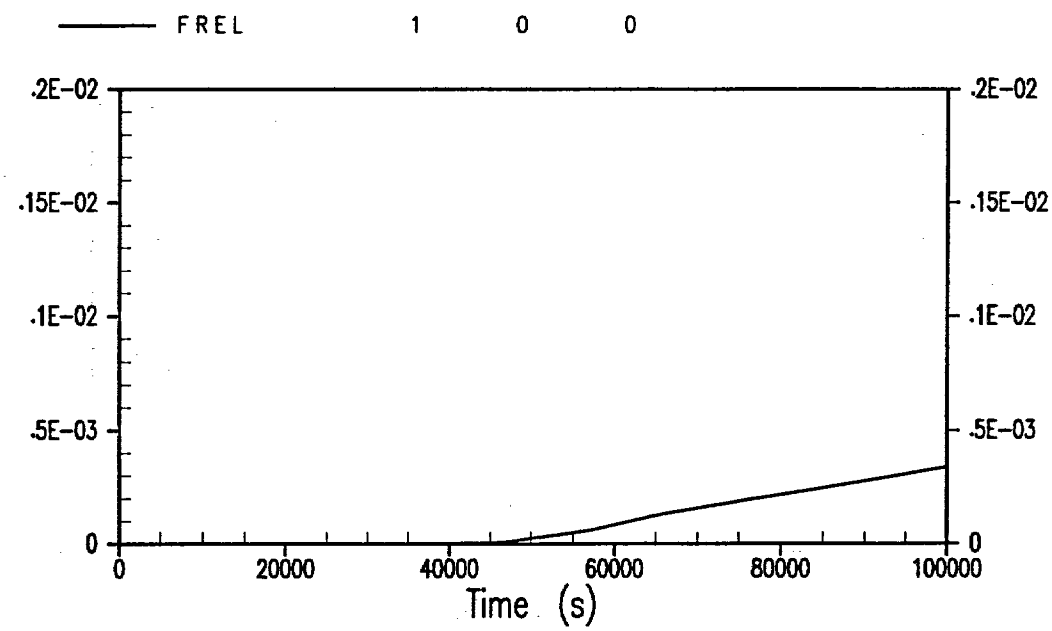


Figure 34-151

Case 3BL-2: Mass Fraction of Noble Gases Released to Environment DVI Line Break with Failed Gravity Injection

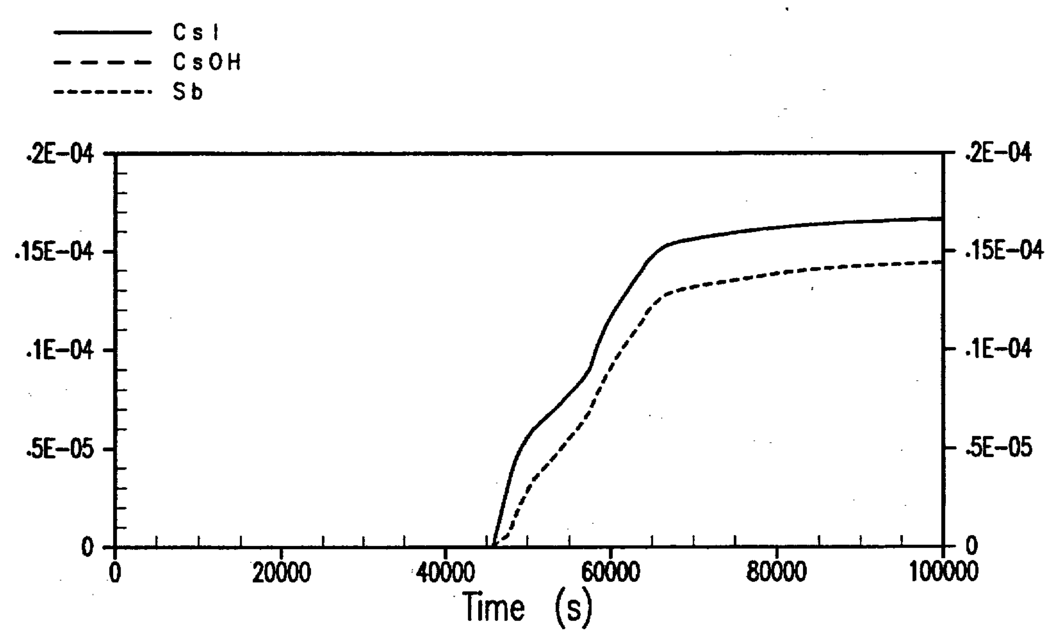


Figure 34-152

Case 3BL-2: Mass Fraction of Fission Products Released to Environment DVI Line Break with Failed Gravity Injection

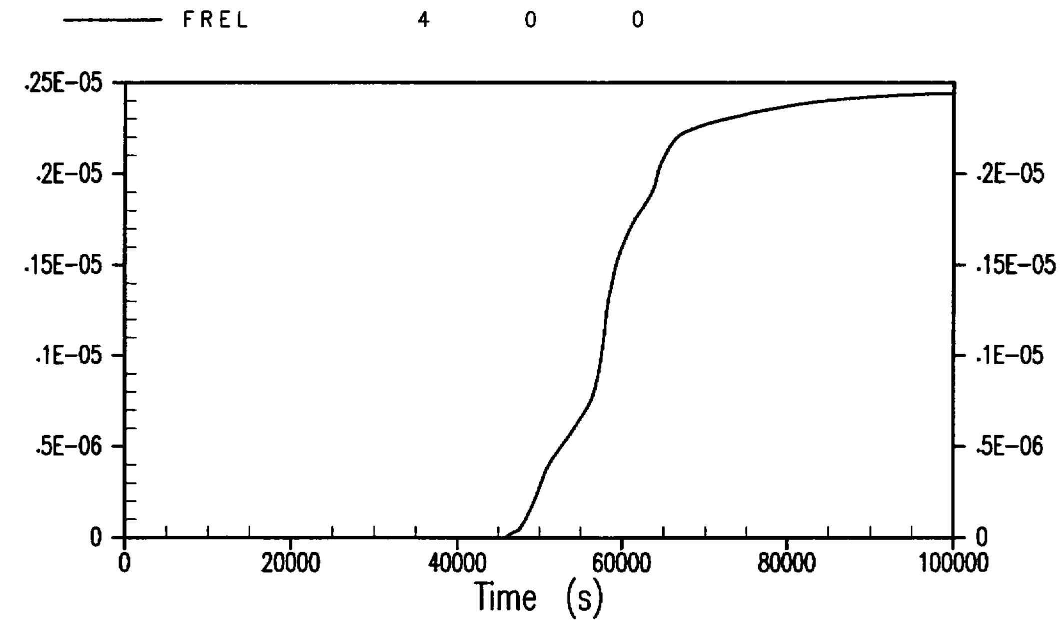


Figure 34-153

Case 3BL-2: Mass Fraction of SrO Released to Environment DVI Line Break with Failed Gravity Injection

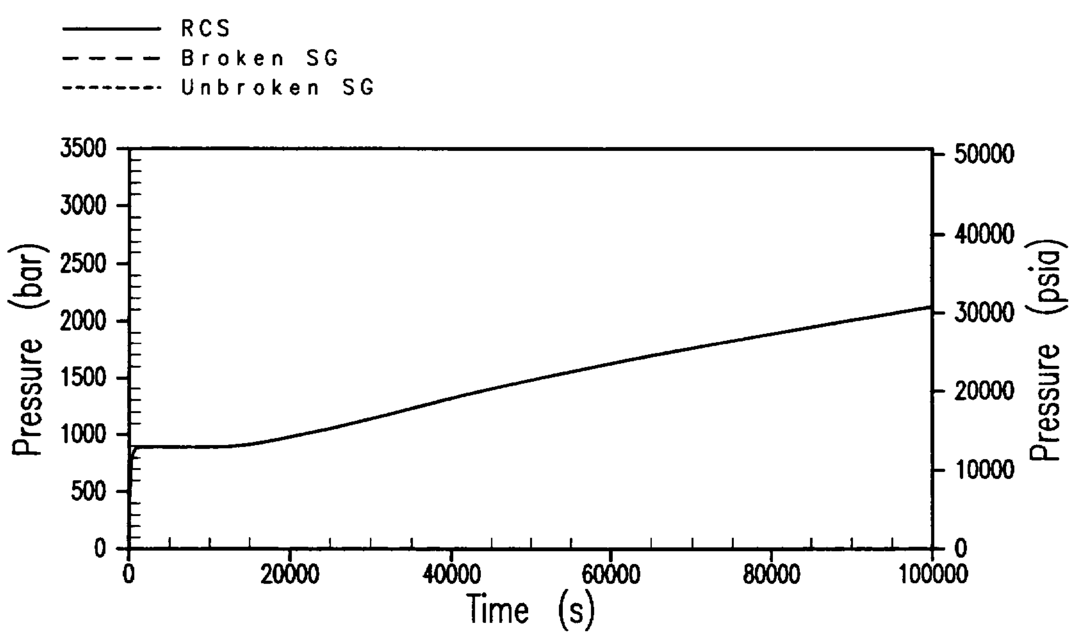


Figure 34-154

Case 3BR-1: Reactor Coolant System and Steam Generator Pressure CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

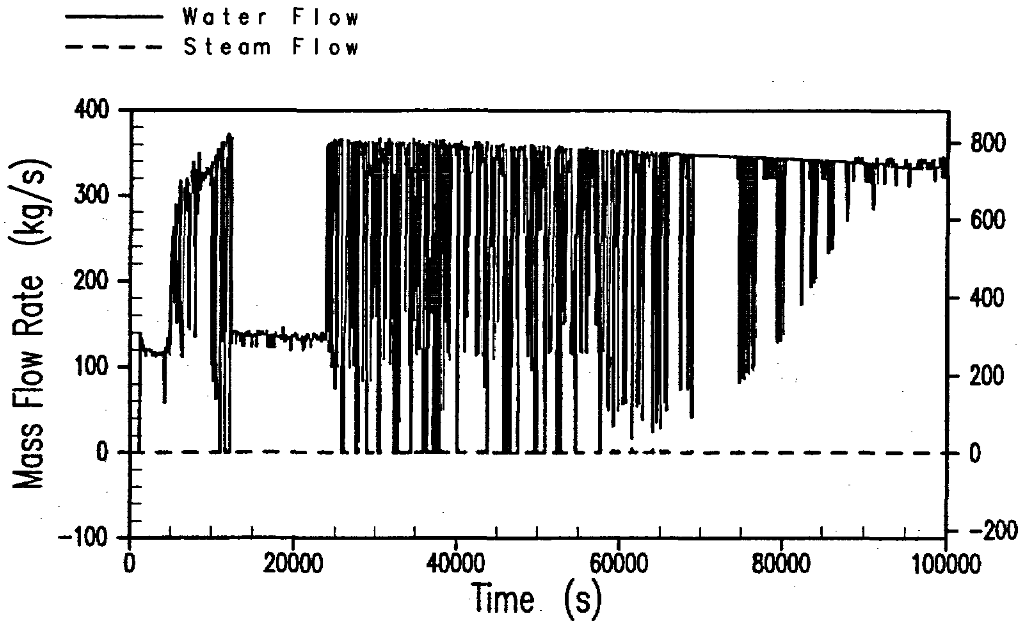


Figure 34-155

Case 3BR-1: ADS Stage 4 Flow Rates
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

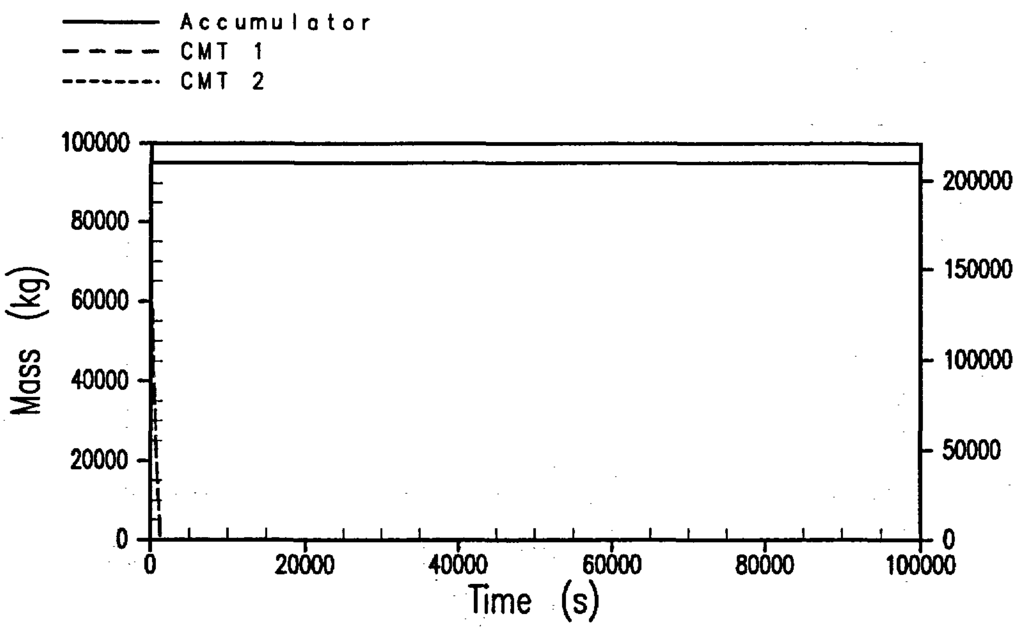


Figure 34-156

Case 3BR-1: Accumulator/CMT Water Mass
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

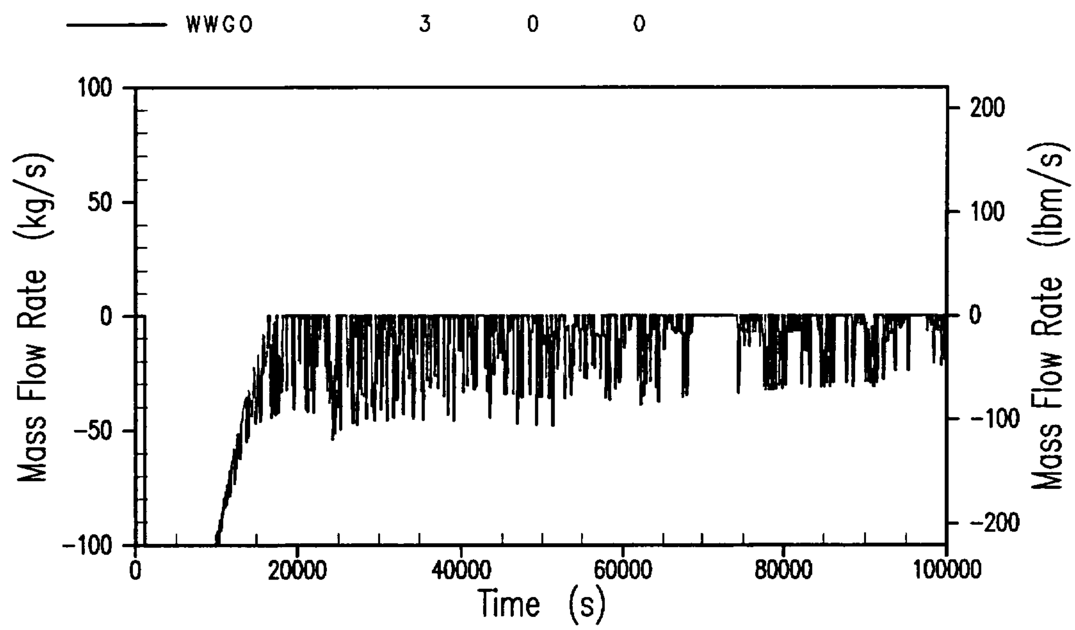


Figure 34-157

Case 3BR-1: IRWST Injection Flow Rate
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

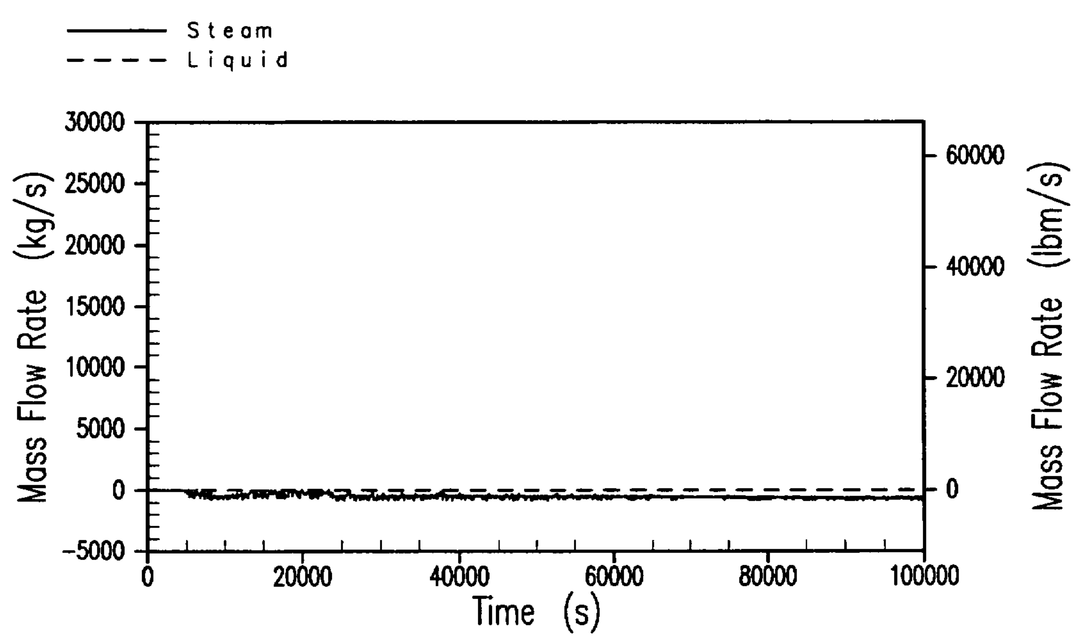


Figure 34-158

Case 3BR-1: Break Flow Rate
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

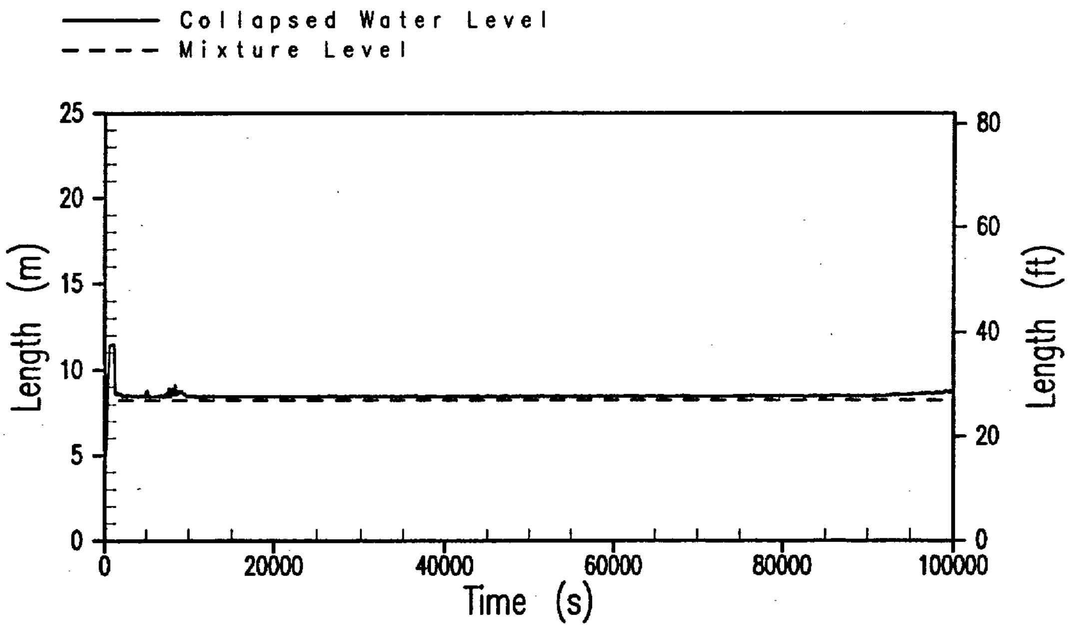


Figure 34-159

Case 3BR-1: Reactor Vessel Water Level
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

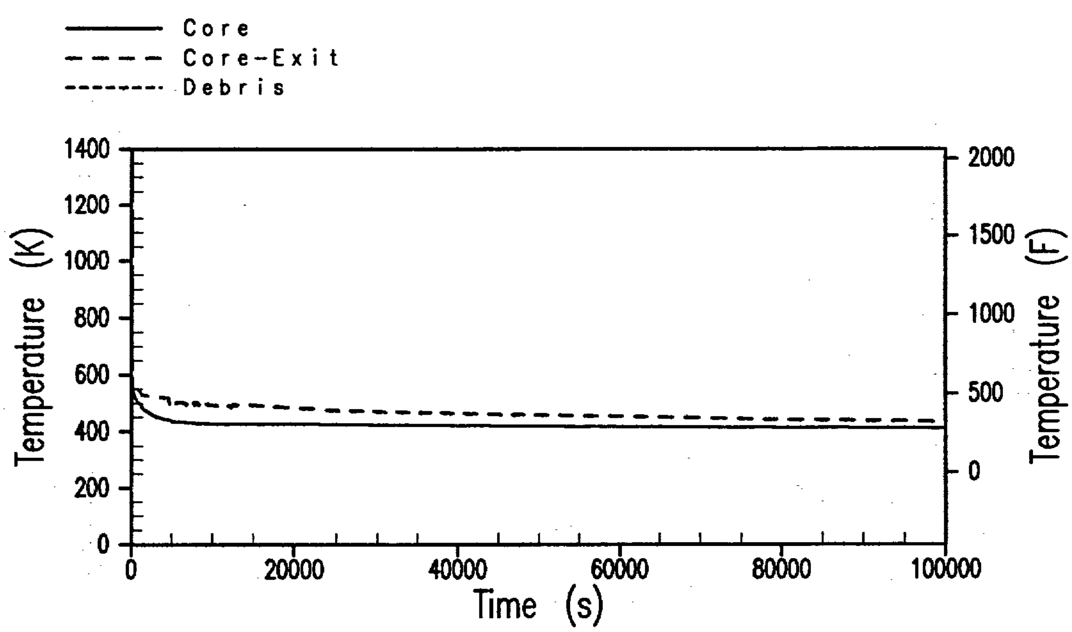


Figure 34-160

Case 3BR-1: Core Temperatures
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

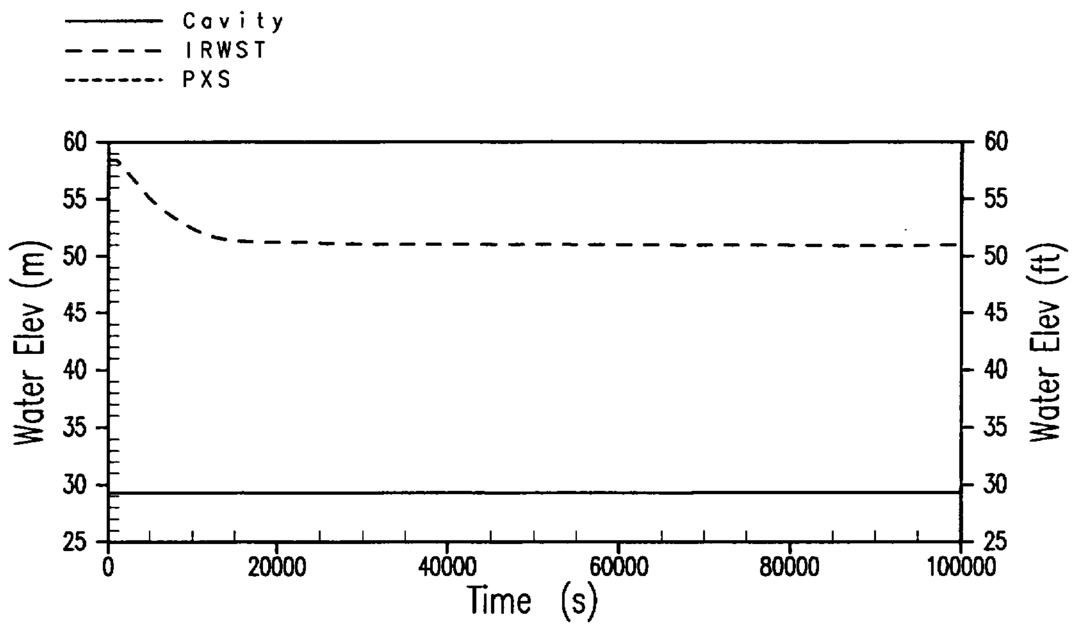


Figure 34-161

Case 3BR-1: Containment Water Pool Elevations
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

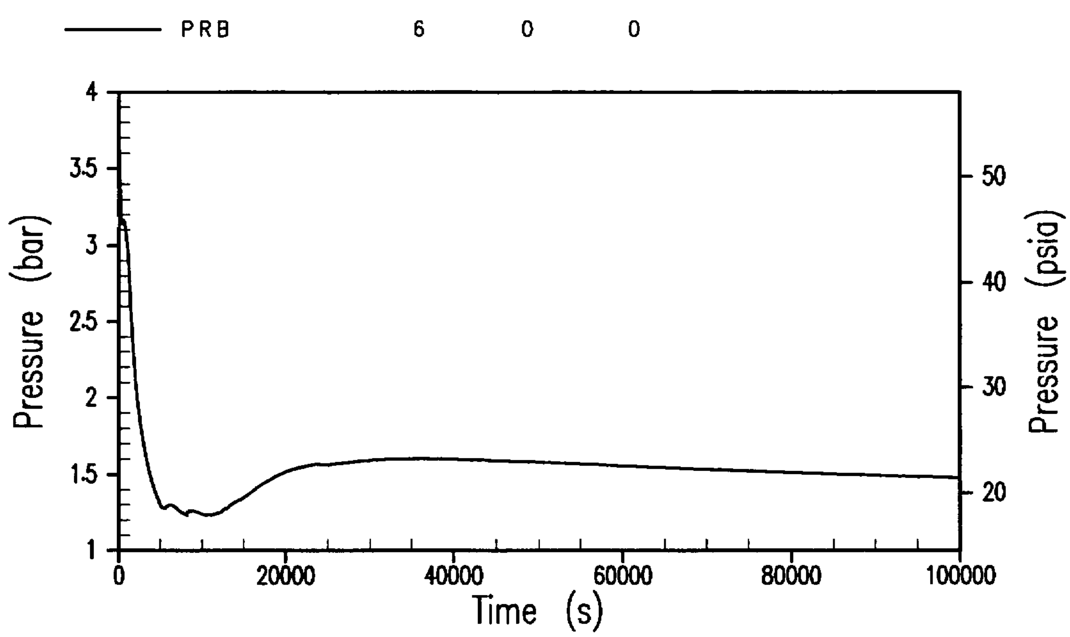


Figure 34-162

Case 3BR-1: Containment Pressure
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

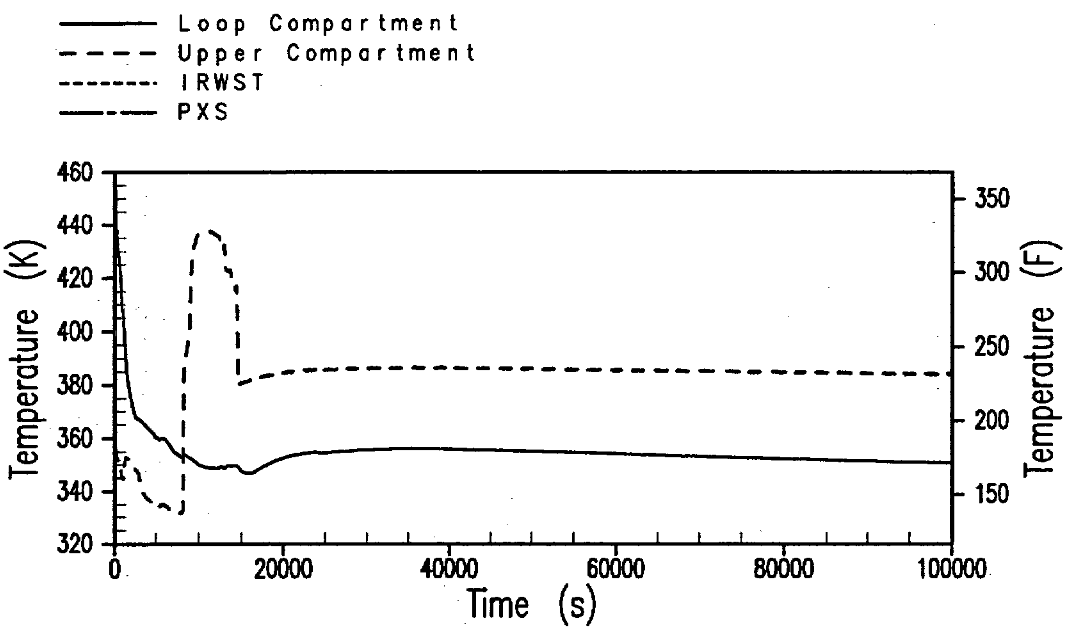


Figure 34-163

Case 3BR-1: Containment Gas Temperature
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

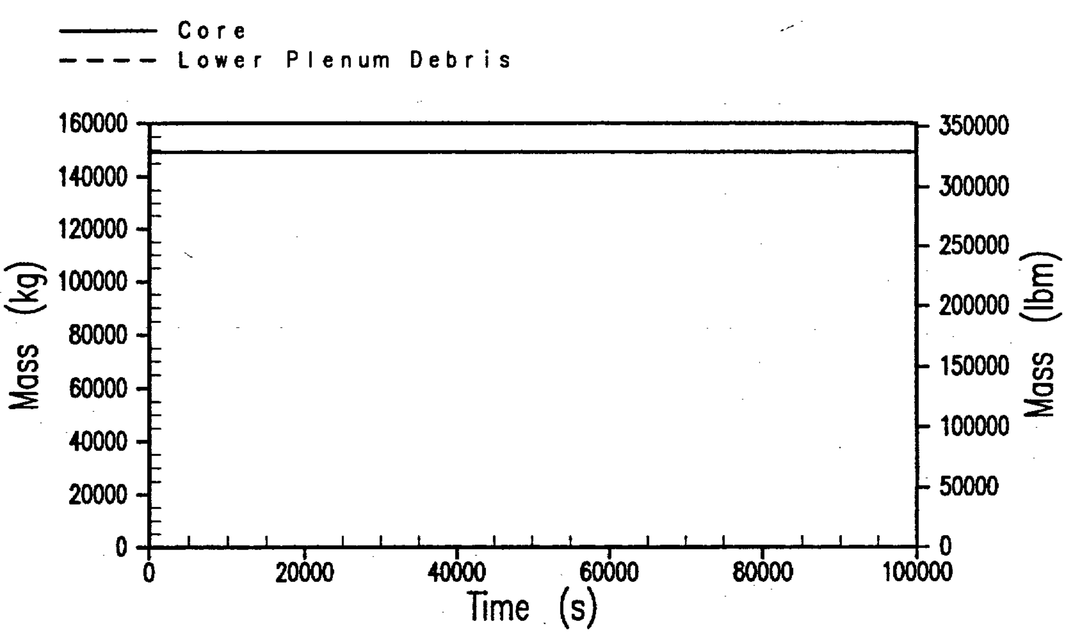


Figure 34-164

Case 3BR-1: Core Mass
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

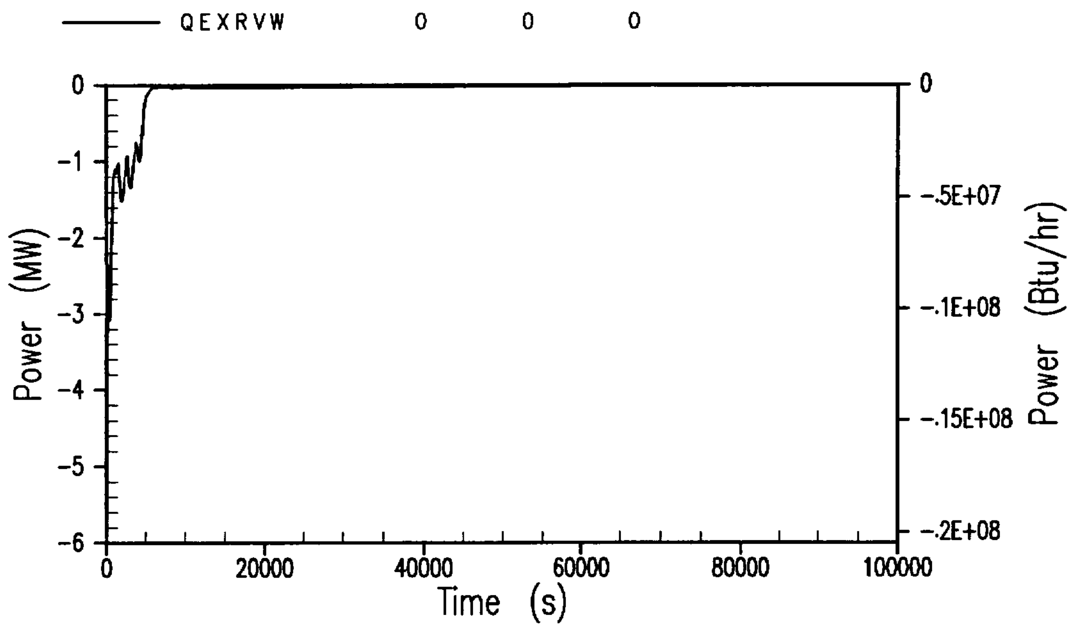


Figure 34-165

Case 3BR-1: Reactor Pressure Vessel to Cavity Water Heat Transfer
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

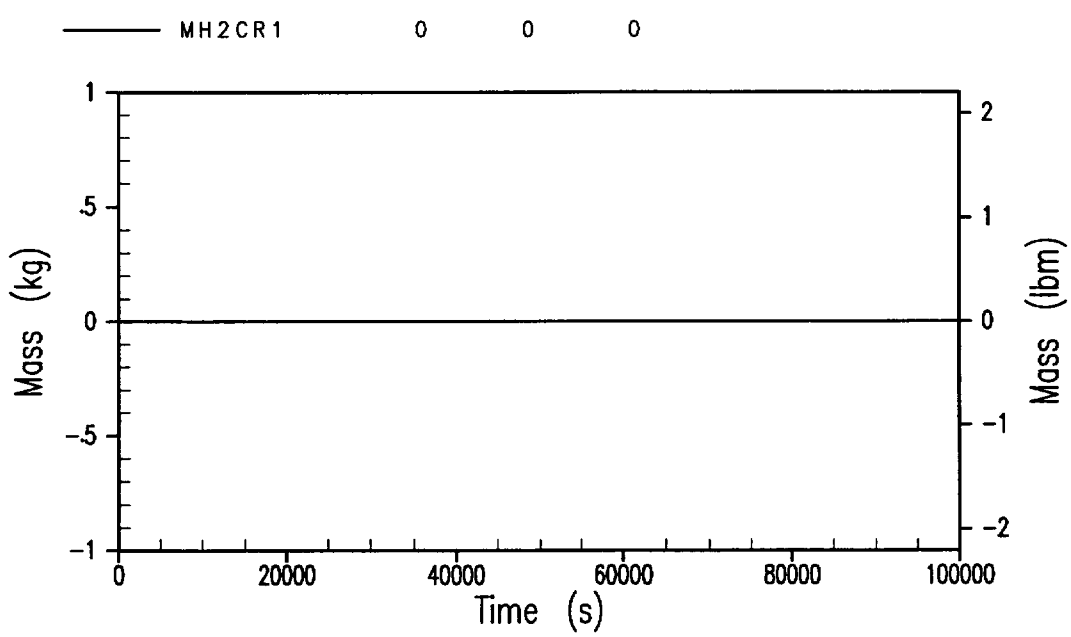


Figure 34-166

Case 3BR-1: In-Vessel Hydrogen Generation
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

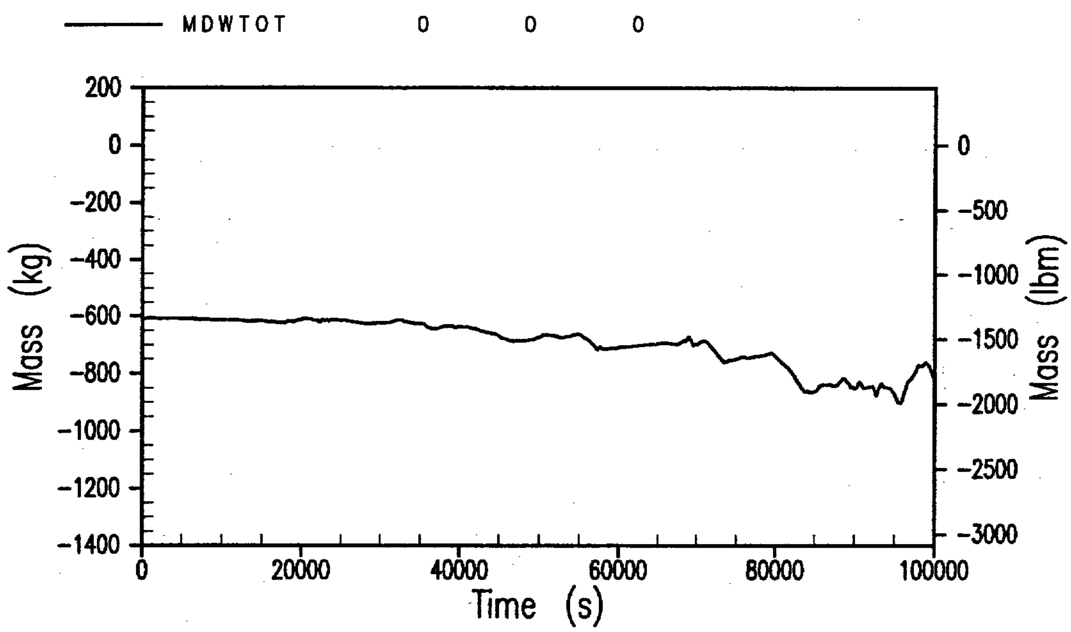


Figure 34-167

Case 3BR-1: Mass Fraction of CsI Released to Containment
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

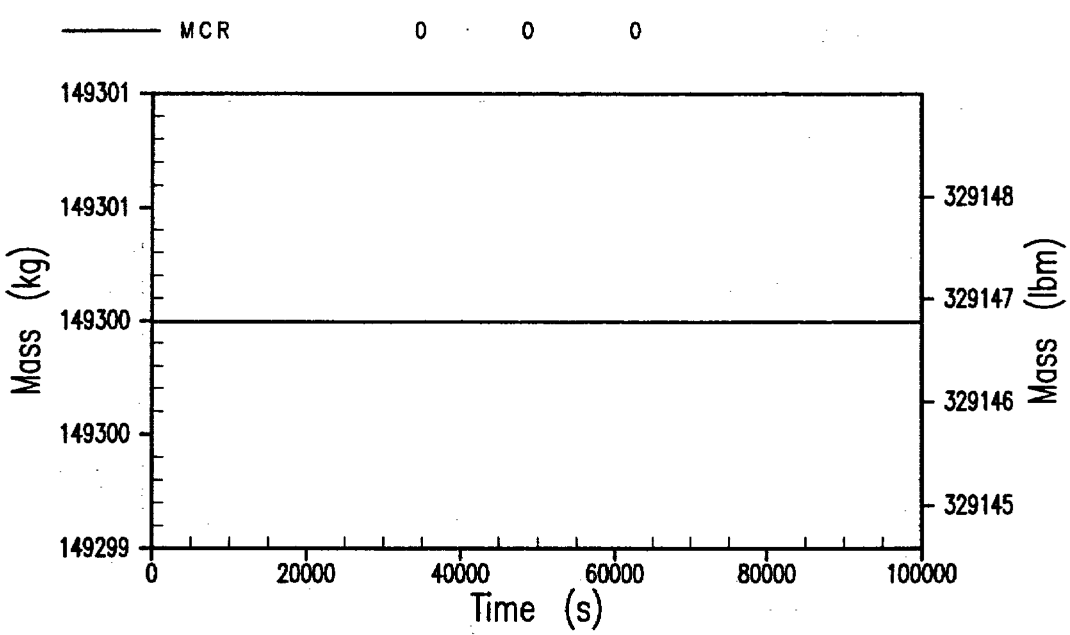


Figure 34-168

Case 3BR-1: Mass Fraction of Noble Gases Released to Environment
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

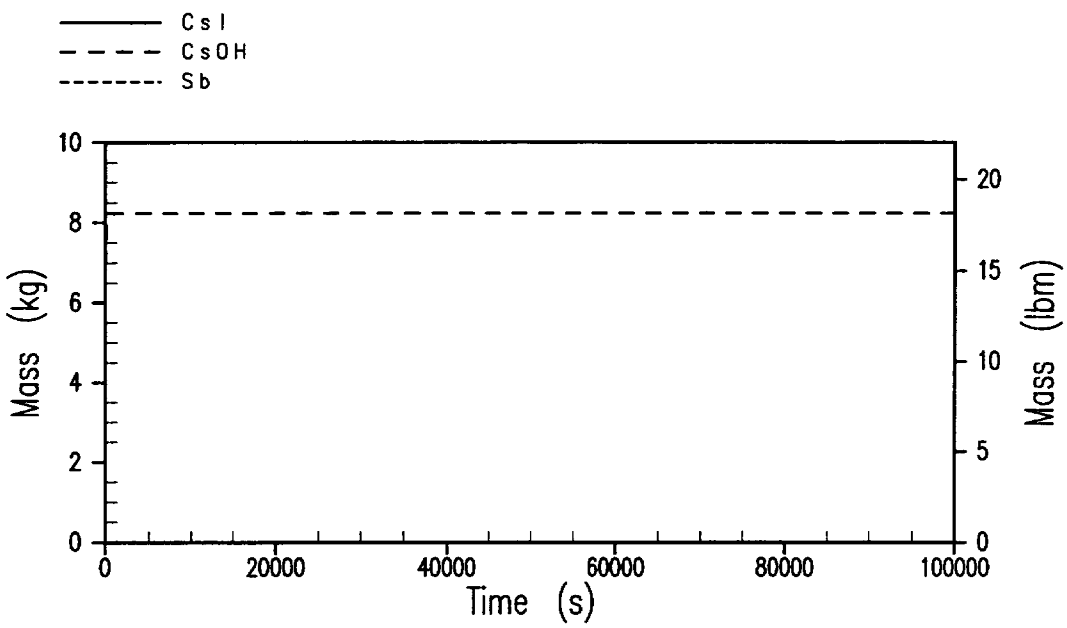


Figure 34-169

Case 3BR-1: Mass Fraction of Fission Products Released to Environment
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

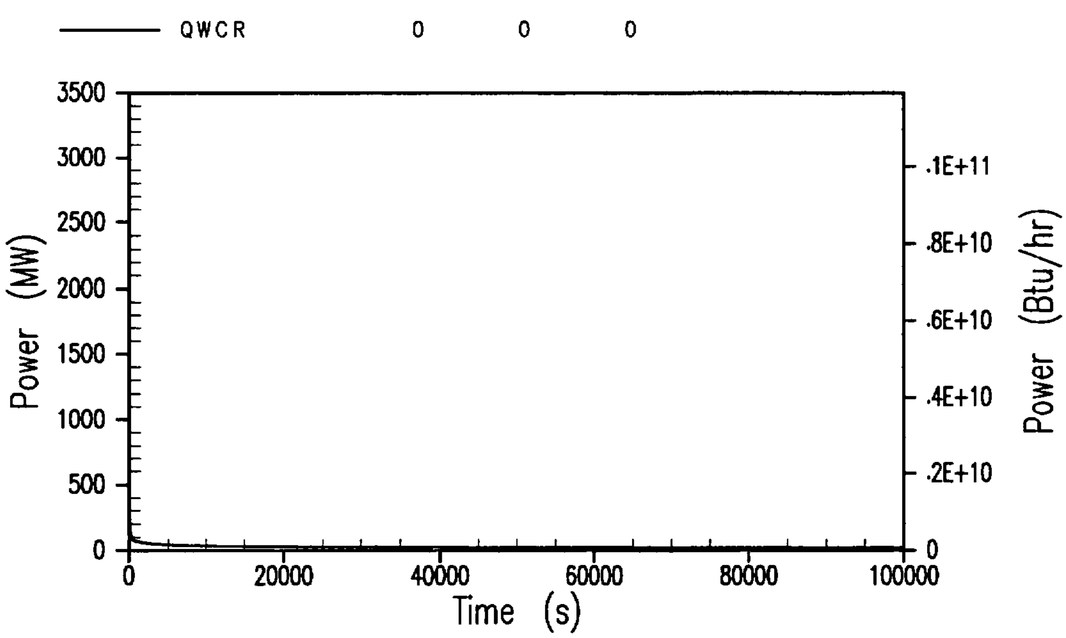


Figure 34-170

Case 3BR-1: Mass Fraction of SrO Released to Environment
CL LBLOCA to Loop Compartment 2/2 Gravity Injection/Recirculation Lines

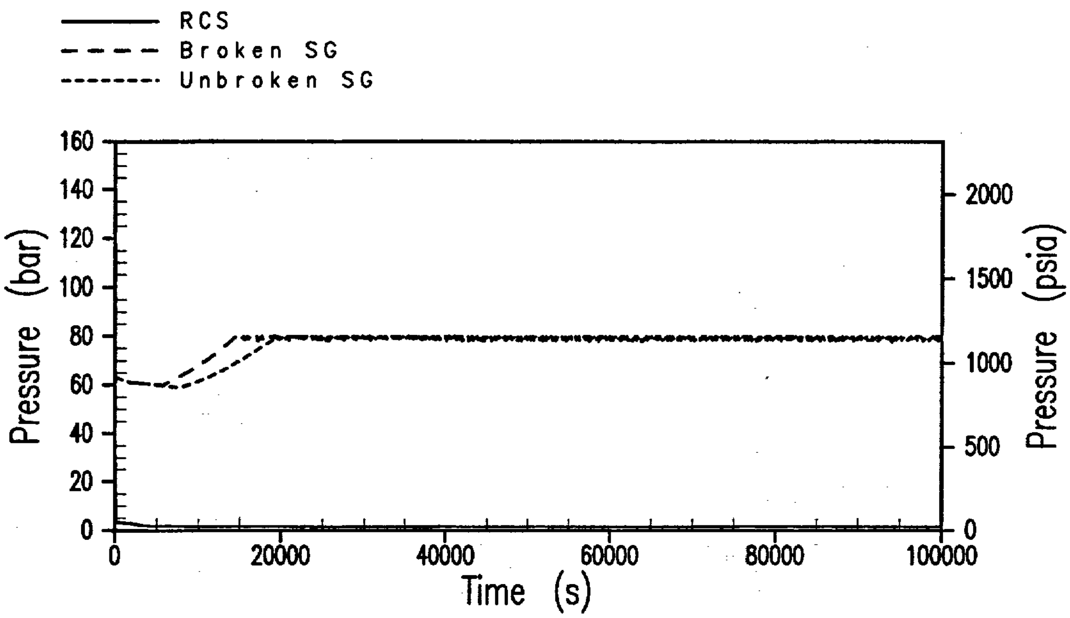


Figure 34-171

Case 3BR-1a: Reactor Coolant System and Steam Generator Pressure
CL LBLOCA with Failed Accumulators

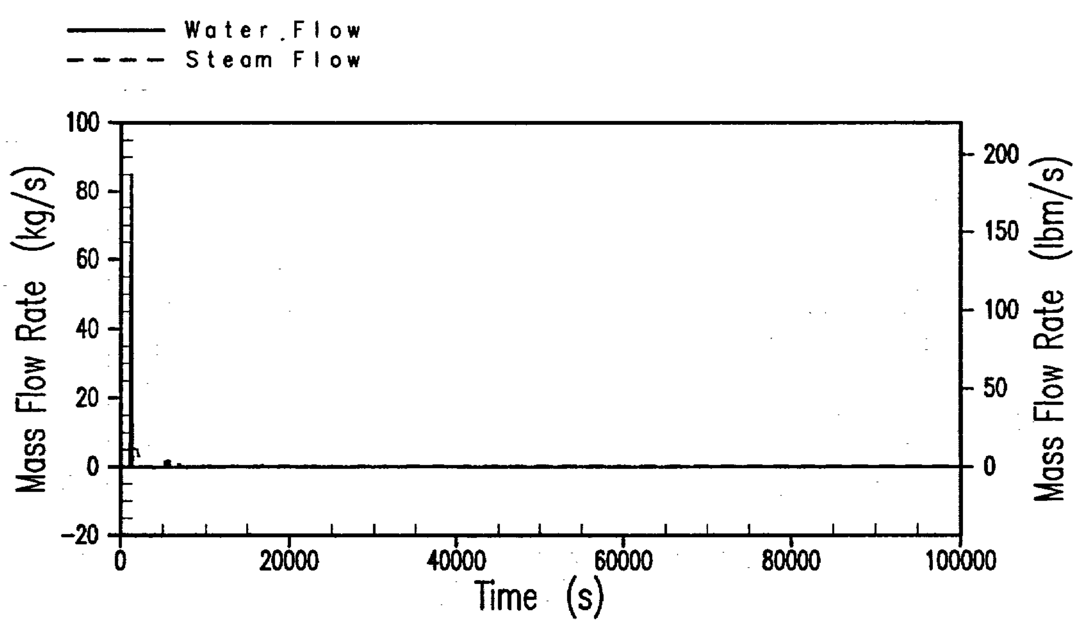


Figure 34-172

Case 3BR-1a: ADS Stage 4 Flow Rates
CL LBLOCA with Failed Accumulators

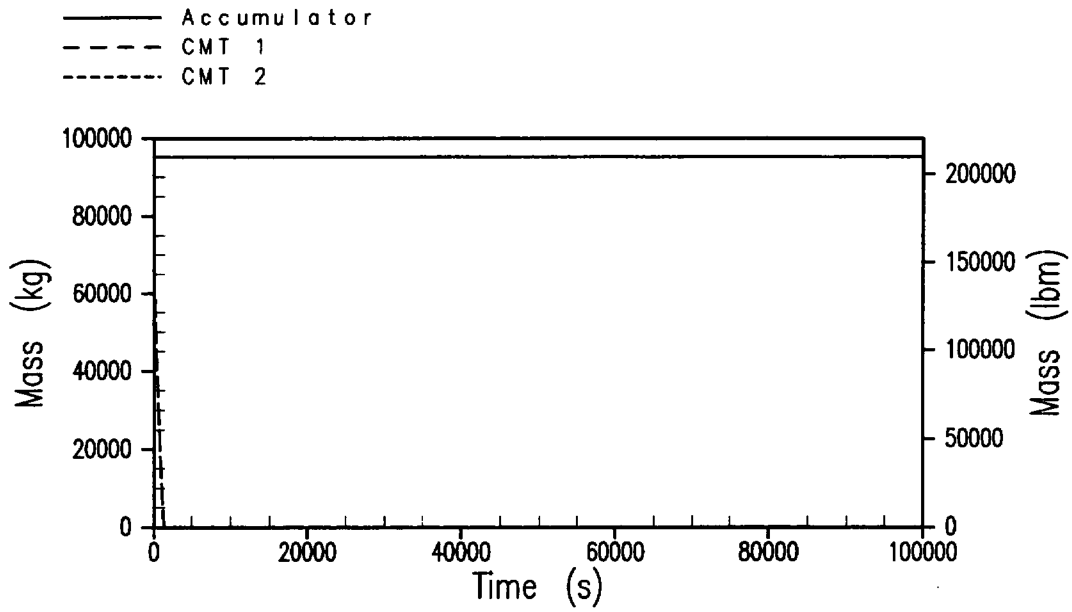


Figure 34-173

Case 3BR-1a: Accumulator/CMT Water Mass
CL LBLOCA with Failed Accumulators

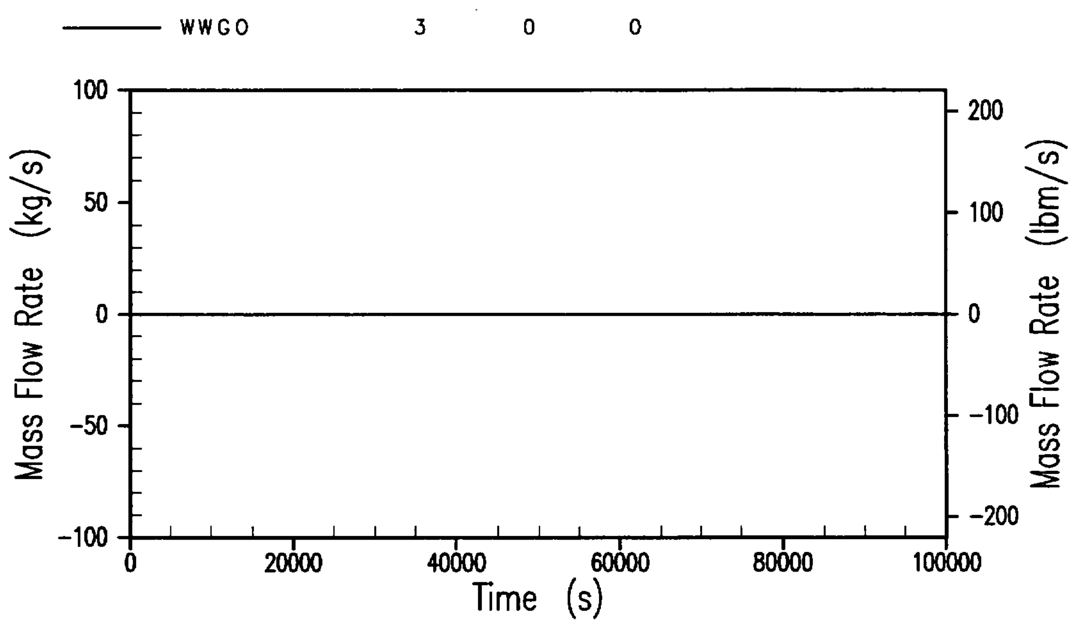


Figure 34-174

Case 3BR-1a: IRWST Injection Flow Rate
CL LBLOCA with Failed Accumulators

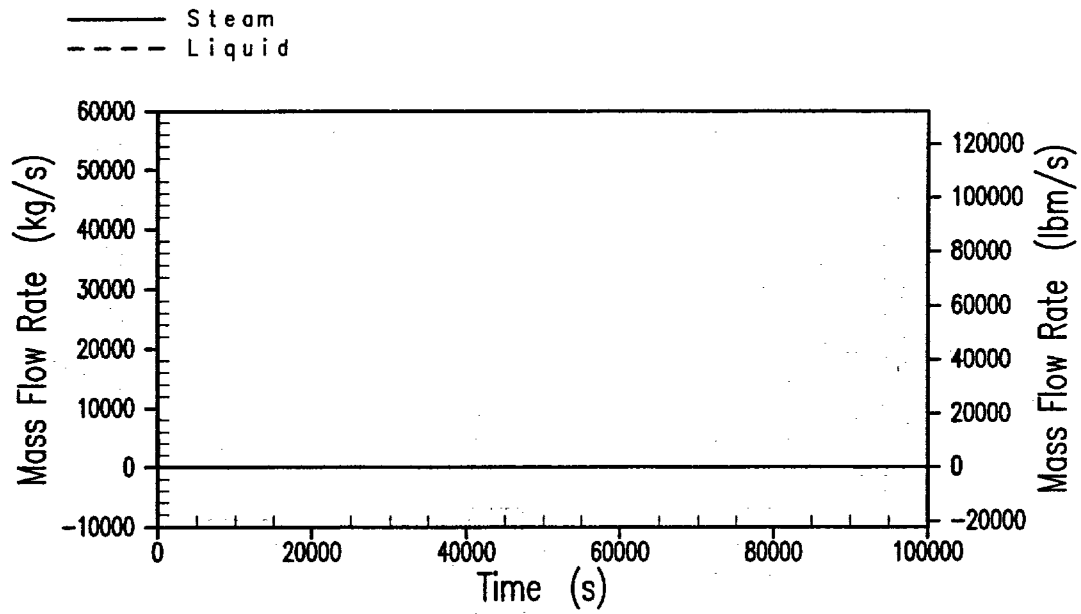


Figure 34-175

Case 3BR-1a: Break Flow Rate
CL LBLOCA with Failed Accumulators

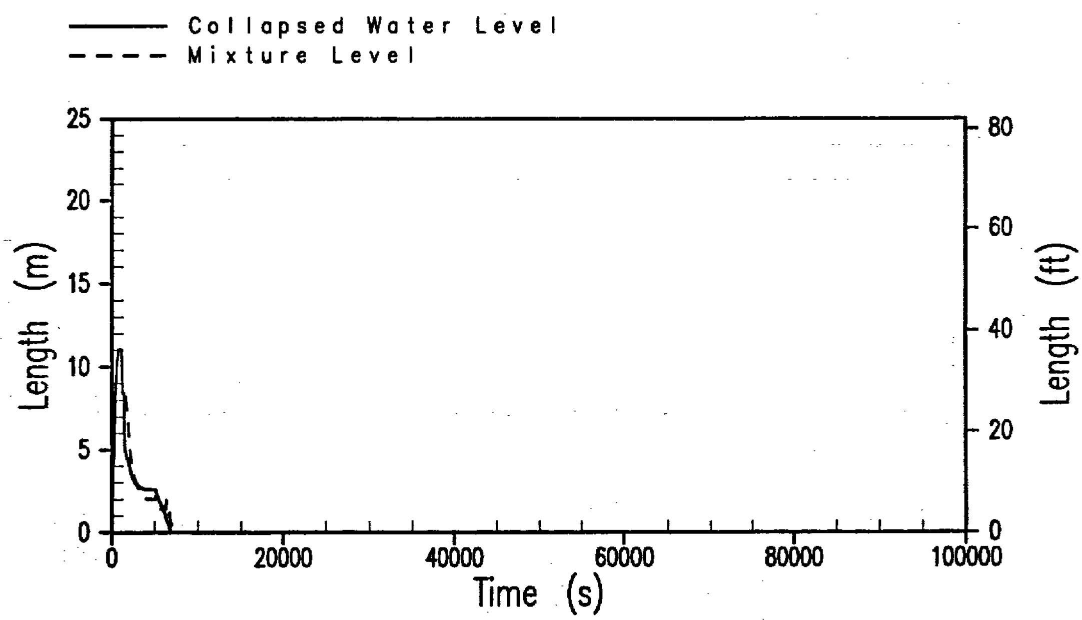


Figure 34-176

Case 3BR-1a: Reactor Vessel Water Level
CL LBLOCA with Failed Accumulators

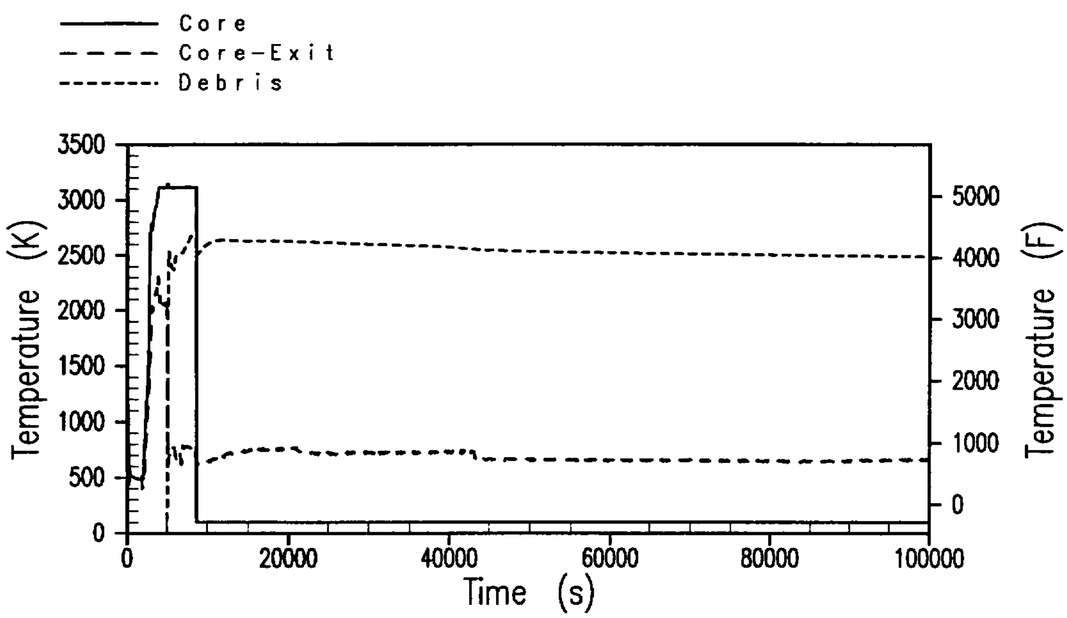


Figure 34-177

Case 3BR-1a: Core Temperatures CL LBLOCA with Failed Accumulators

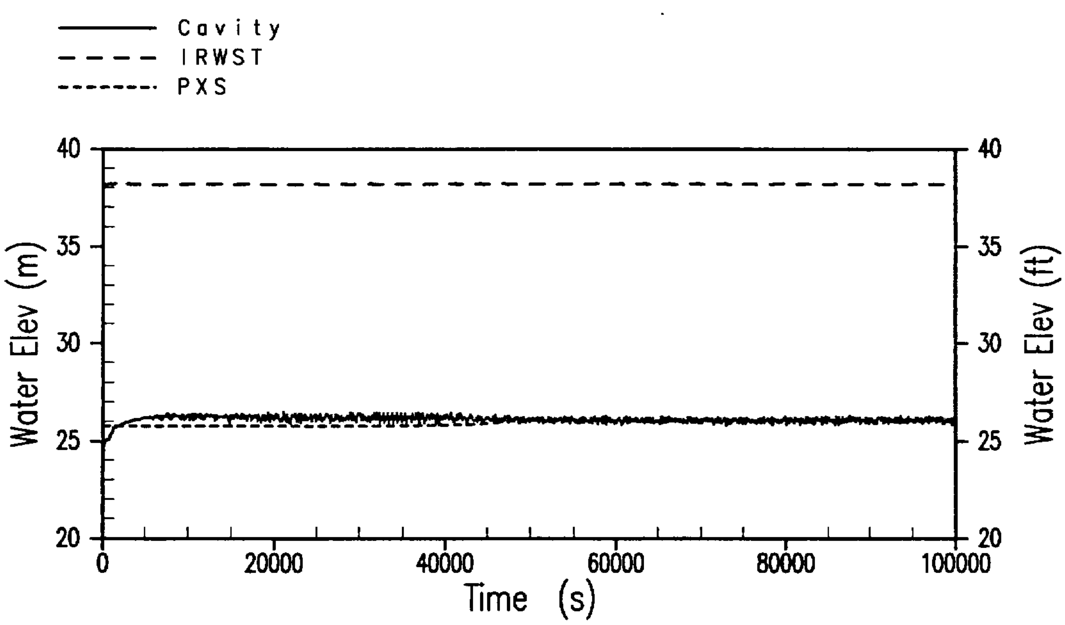


Figure 34-178

Case 3BR-1a: Containment Water Pool Elevations CL LBLOCA with Failed Accumulators

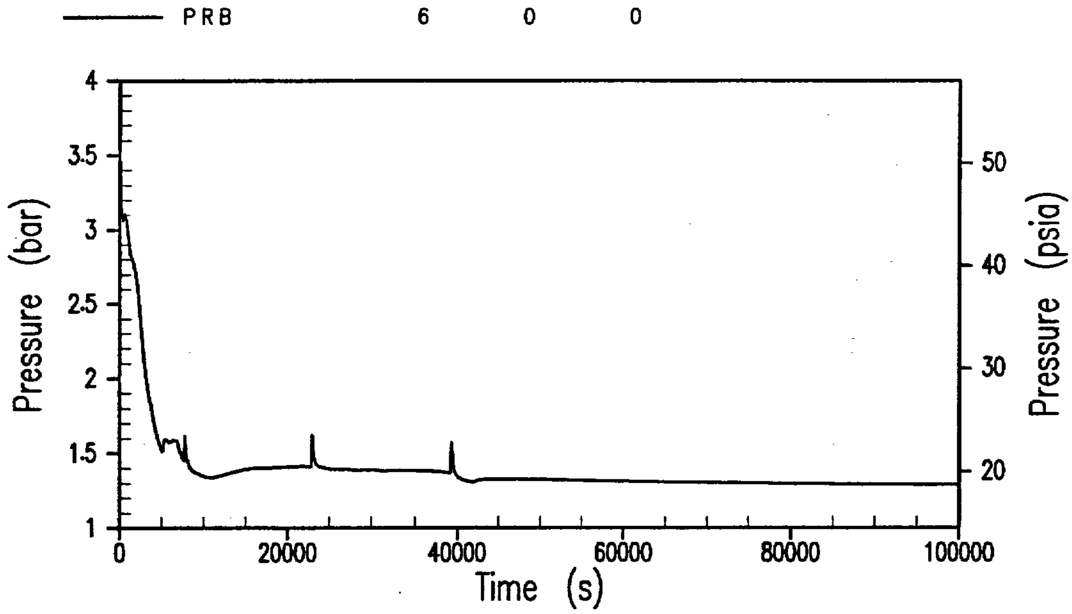


Figure 34-179

Case 3BR-1a: Containment Pressure CL LBLOCA with Failed Accumulators

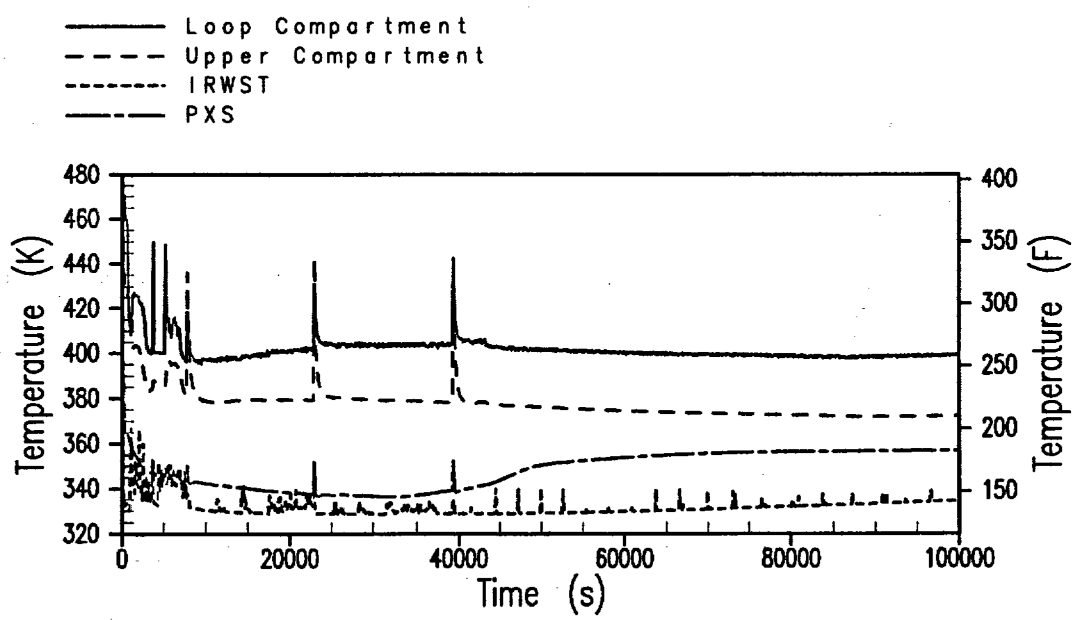


Figure 34-180

Case 3BR-1a: Containment Gas Temperature CL LBLOCA with Failed Accumulators

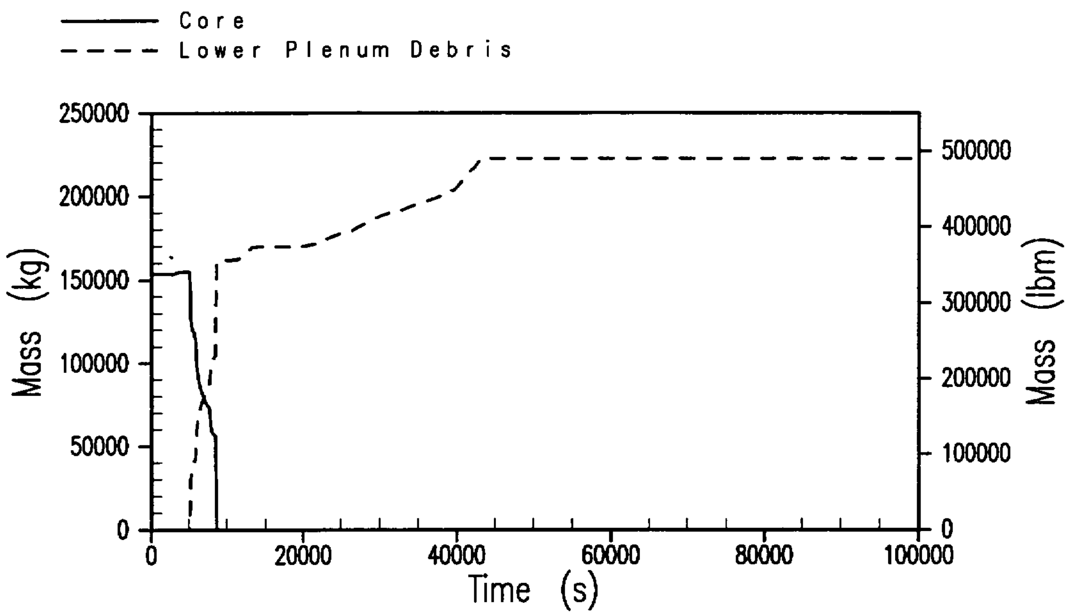


Figure 34-181

Case 3BR-1a: Core Mass
CL LBLOCA with Failed Accumulators

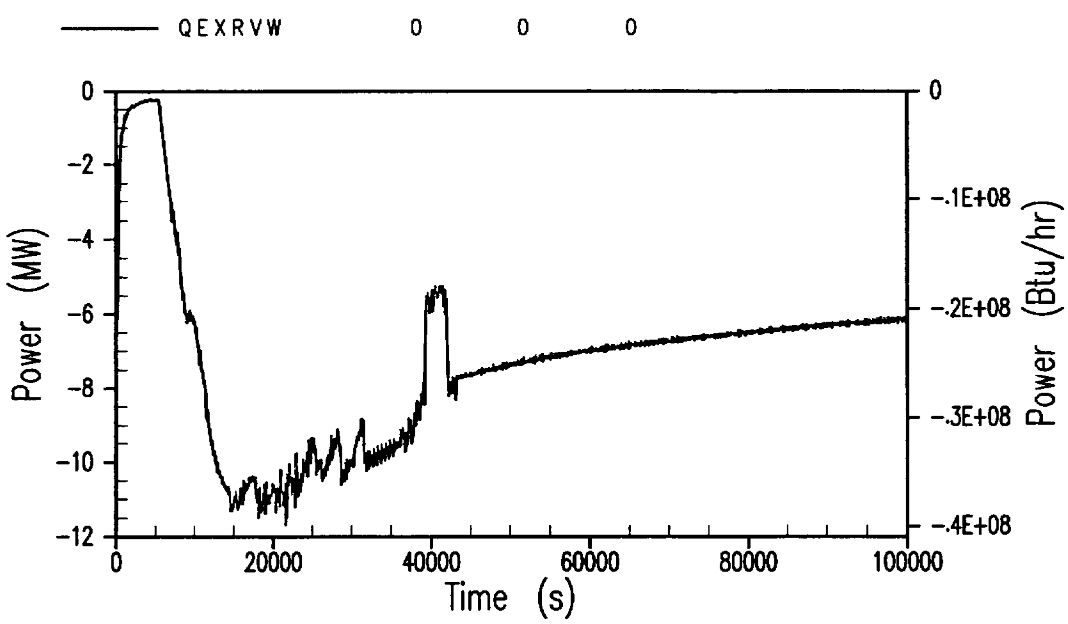


Figure 34-182

Case 3BR-1a: Reactor Pressure Vessel to Cavity Water Heat Transfer
CL LBLOCA with Failed Accumulators

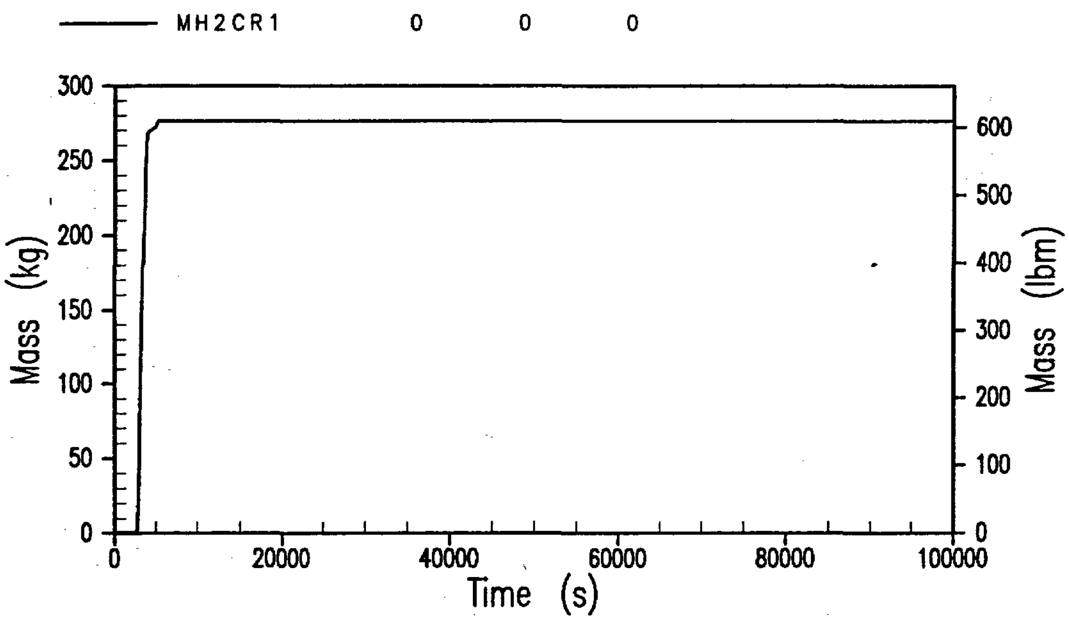


Figure 34-183

Case 3BR-1a: In-Vessel Hydrogen Generation CL LBLOCA with Failed Accumulators

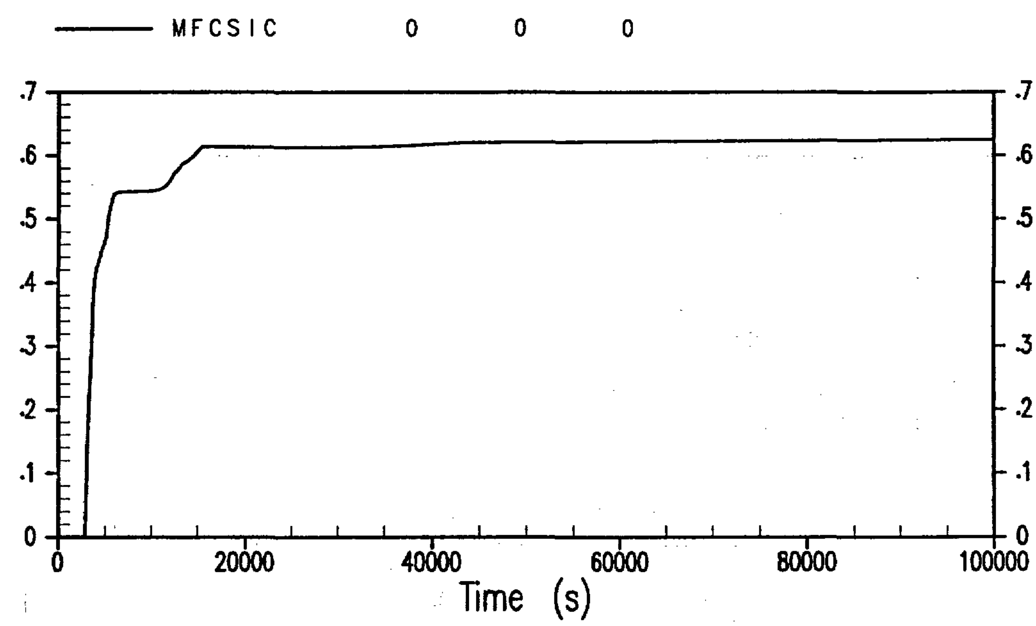


Figure 34-184

Case 3BR-1a: Mass Fraction of CsI Released to Containment CL LBLOCA with Failed Accumulators

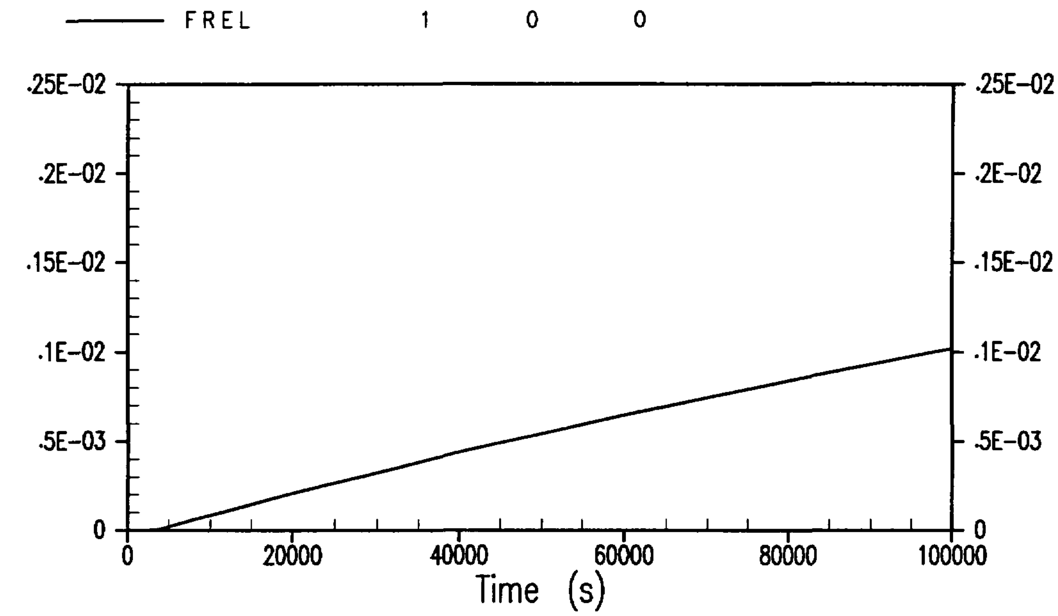


Figure 34-185

Case 3BR-1a: Mass Fraction of Noble Gases Released to Environment CL LBLOCA with Failed Accumulators

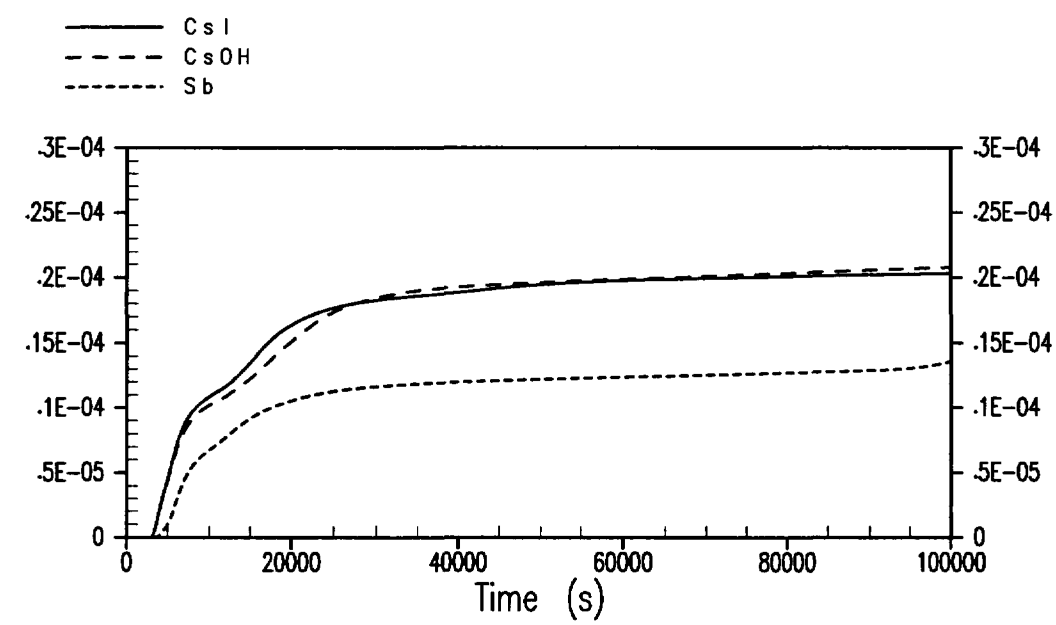


Figure 34-186

Case 3BR-1a: Mass Fraction of Fission Products Released to Environment CL LBLOCA with Failed Accumulators

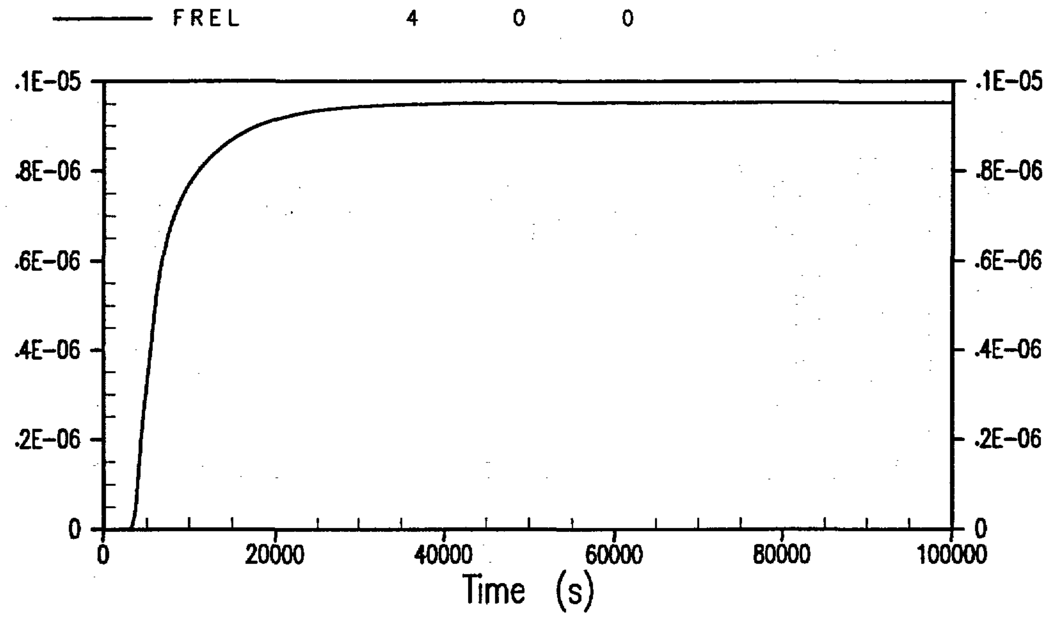


Figure 34-187

Case 3BR-1a: Mass Fraction of SrO Released to Environment CL LBLOCA with Failed Accumulators

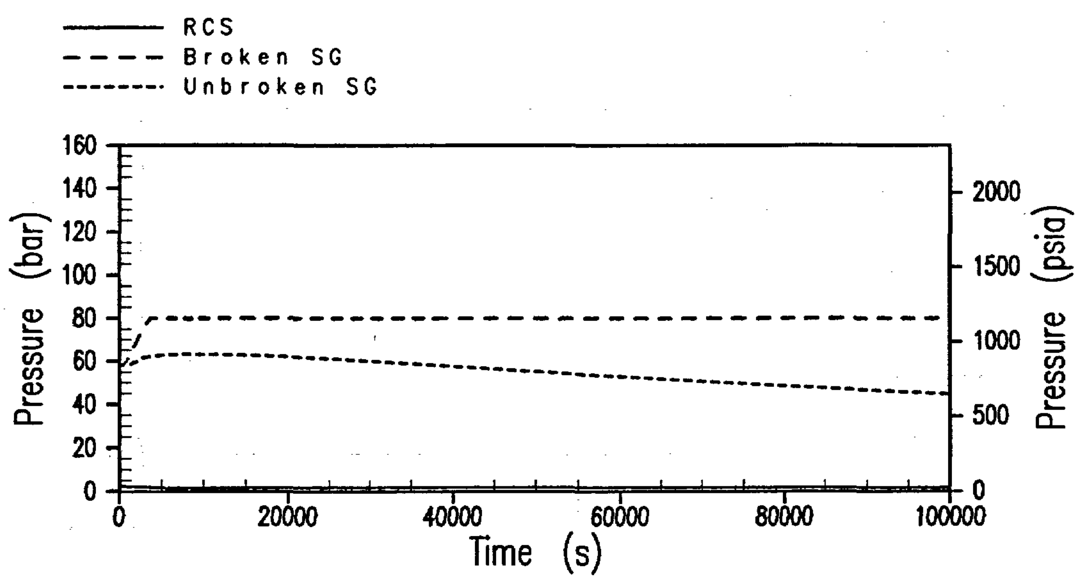


Figure 34-188

Case 3C-1: Reactor Coolant System and Steam Generator Pressure Vessel Rupture

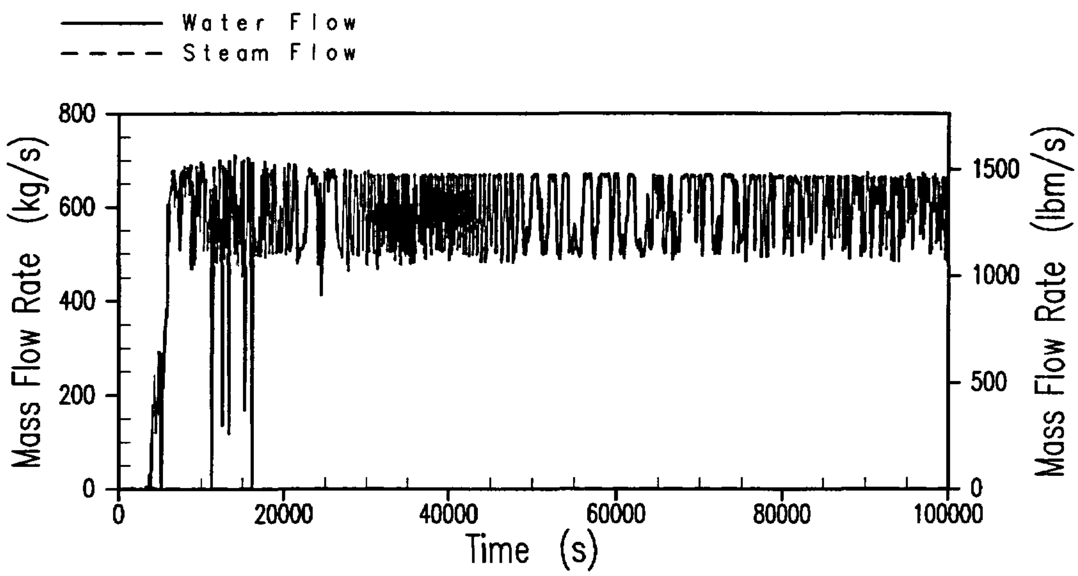


Figure 34-189

Case 3C-1: ADS Stage 4 Flow Rates Vessel Rupture

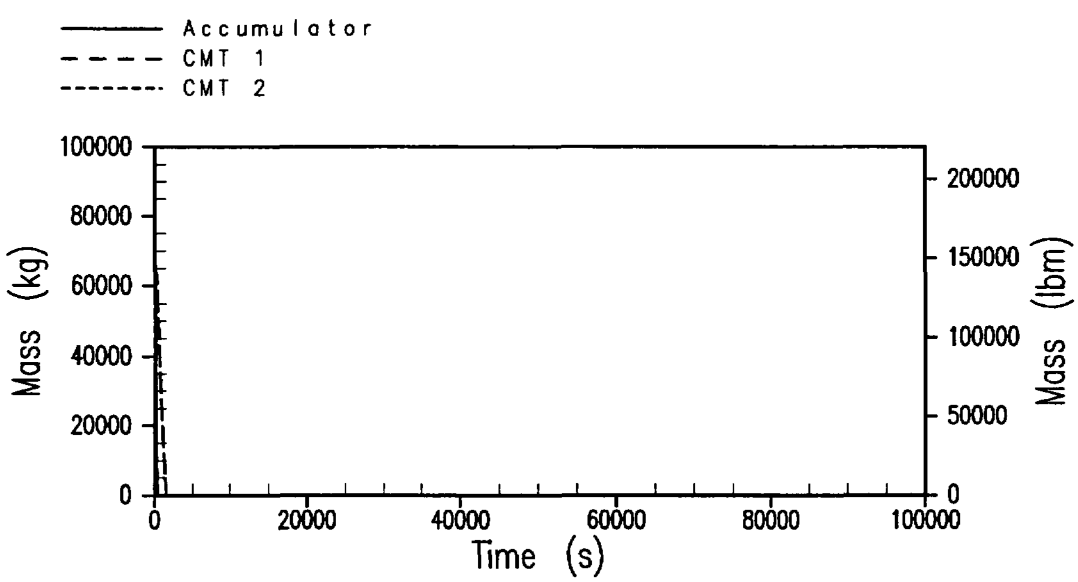


Figure 34-190

Case 3C-1: Accumulator/CMT Water Mass Vessel Rupture

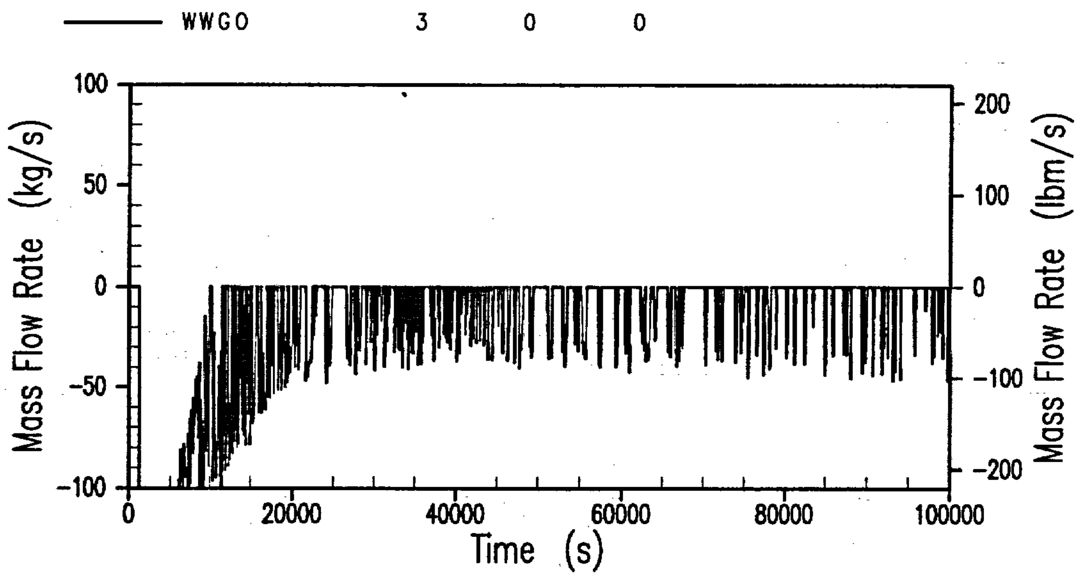


Figure 34-191

Case 3C-1: IRWST Injection Flow Rate Vessel Rupture

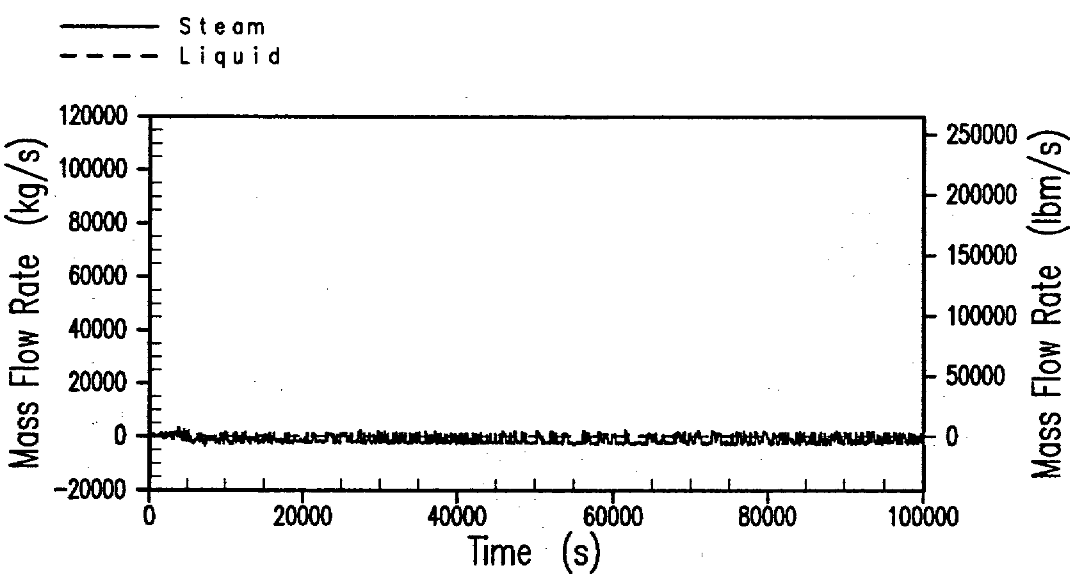


Figure 34-192

Case 3C-1: Break Flow Rate Vessel Rupture

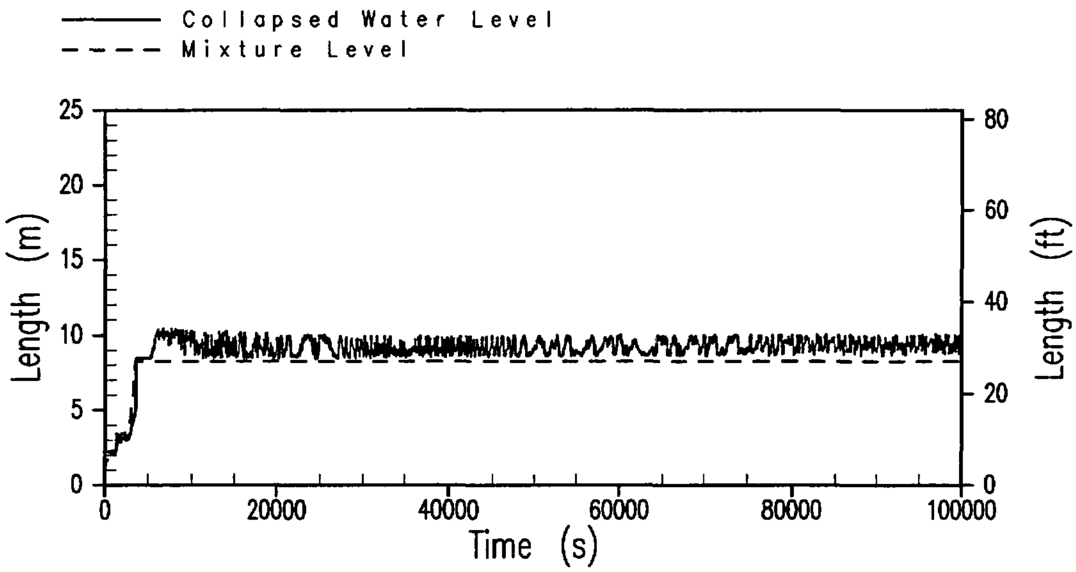


Figure 34-193

Case 3C-1: Reactor Vessel Water Level
Vessel Rupture

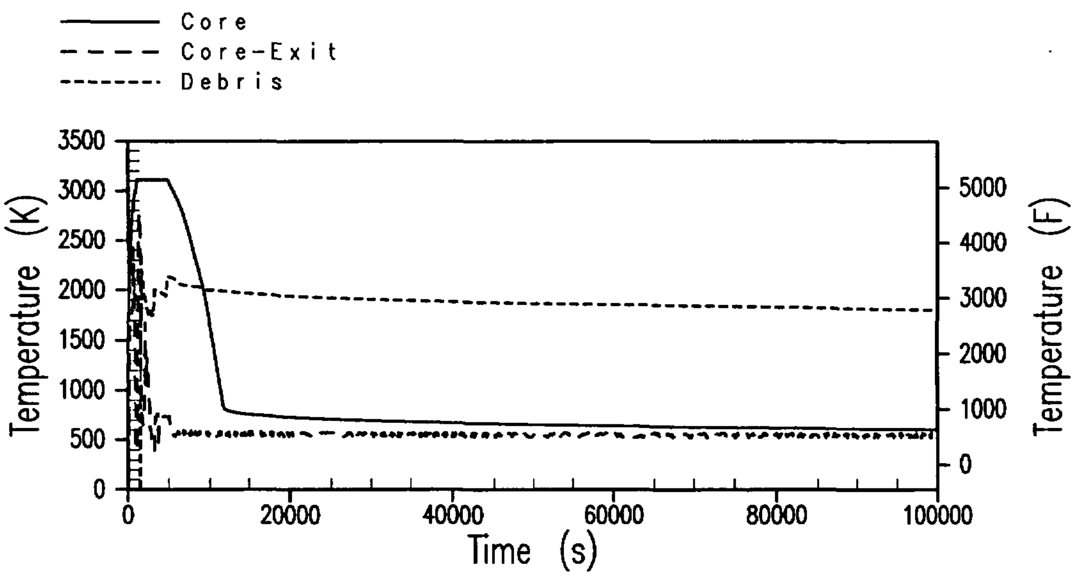


Figure 34-194

Case 3C-1: Core Temperatures
Vessel Rupture

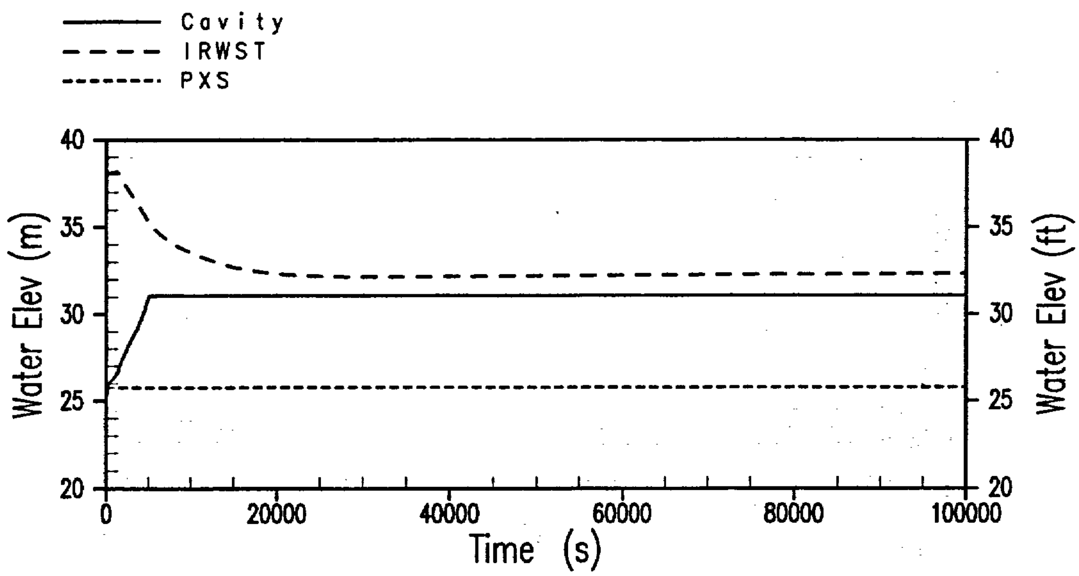


Figure 34-195

Case 3C-1: Containment Water Pool Elevations
Vessel Rupture

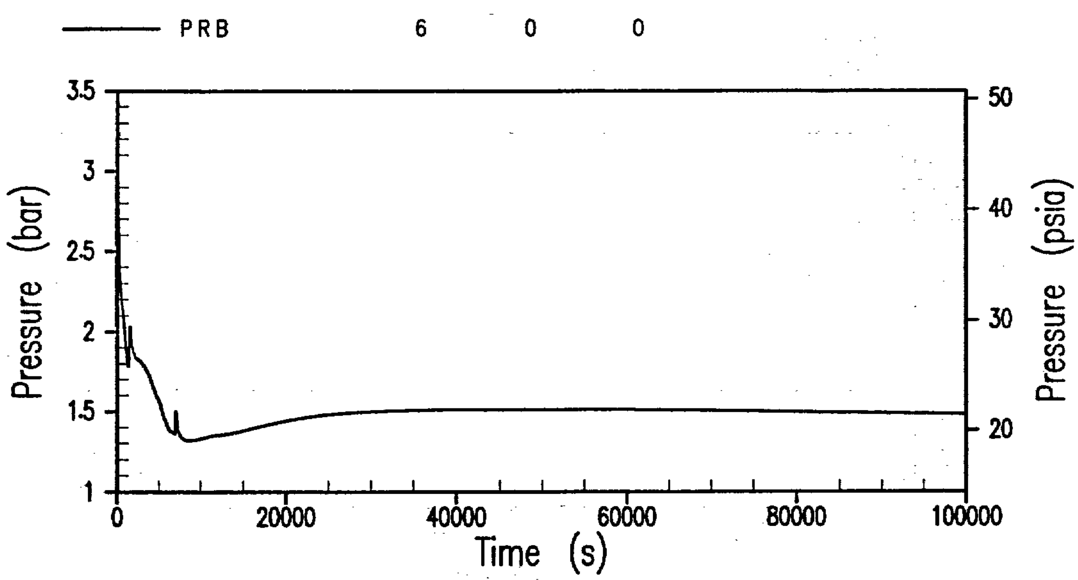


Figure 34-196

Case 3C-1: Containment Pressure
Vessel Rupture

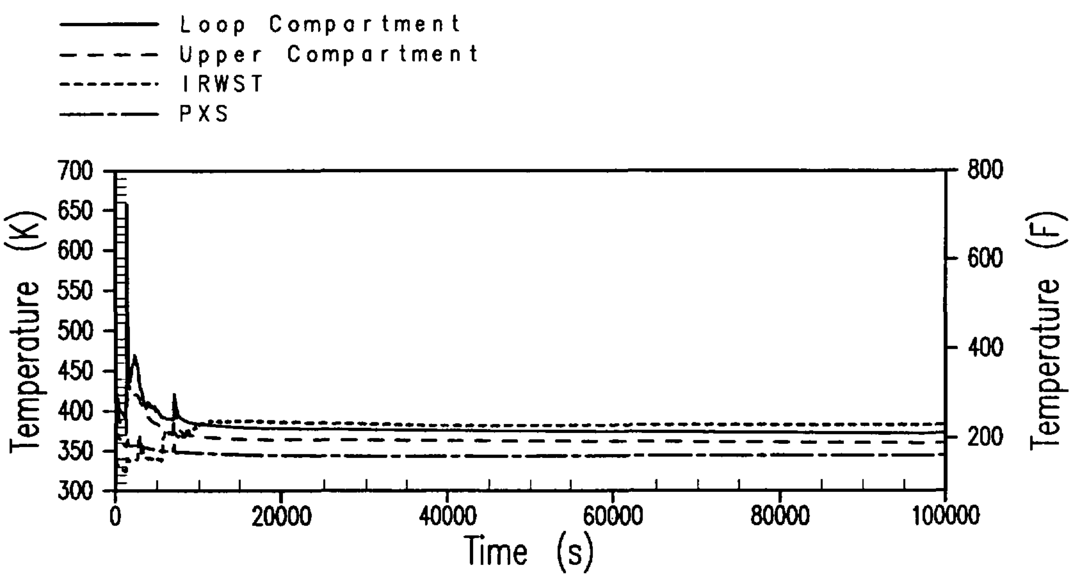


Figure 34-197

Case 3C-1: Containment Gas Temperature Vessel Rupture

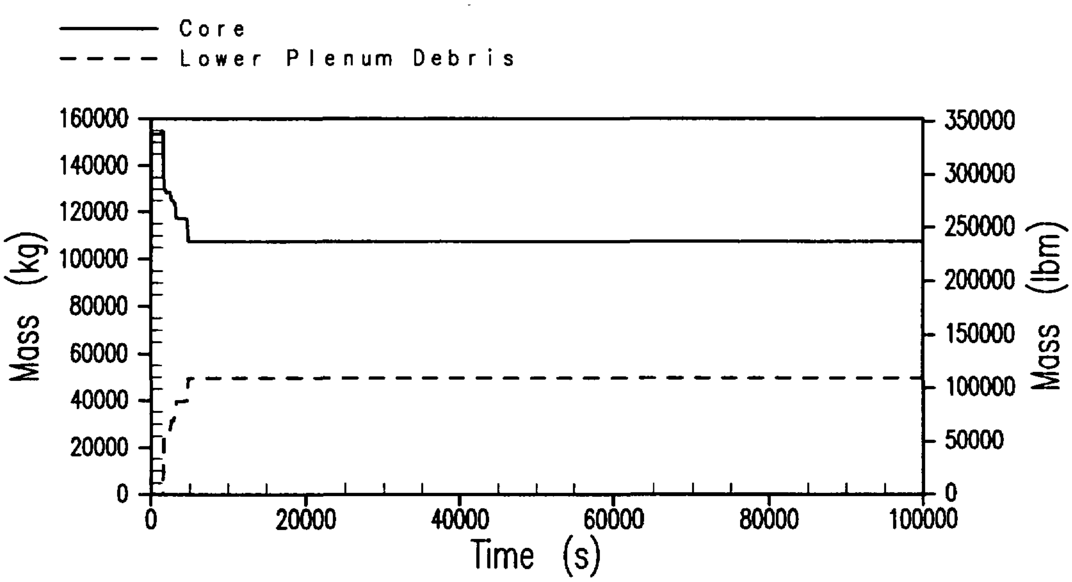


Figure 34-198

Case 3C-1: Core Mass Vessel Rupture

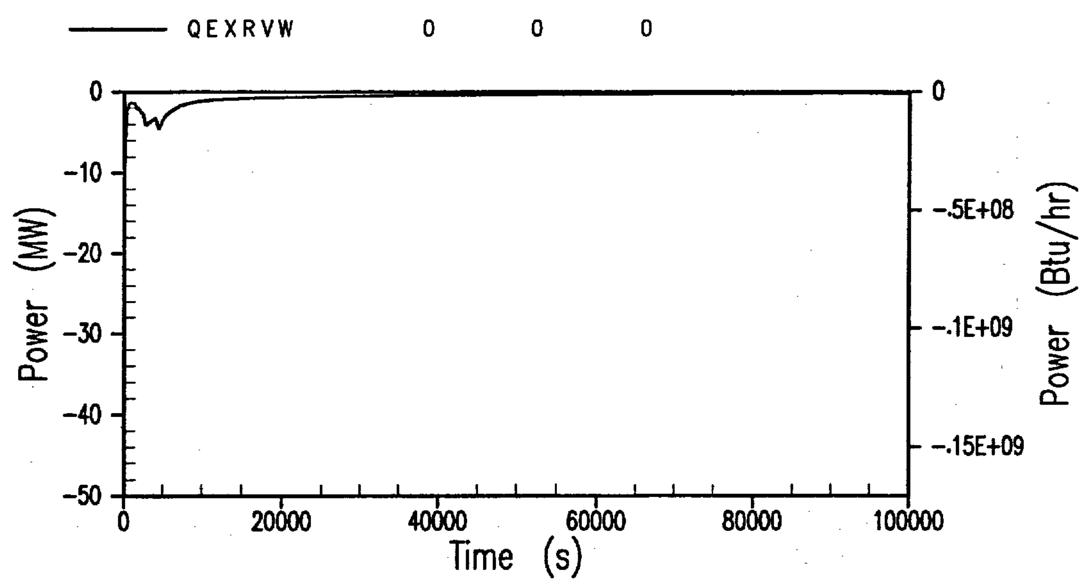


Figure 34-199

Case 3C-1: Reactor Pressure Vessel to Cavity Water Heat Transfer Vessel Rupture

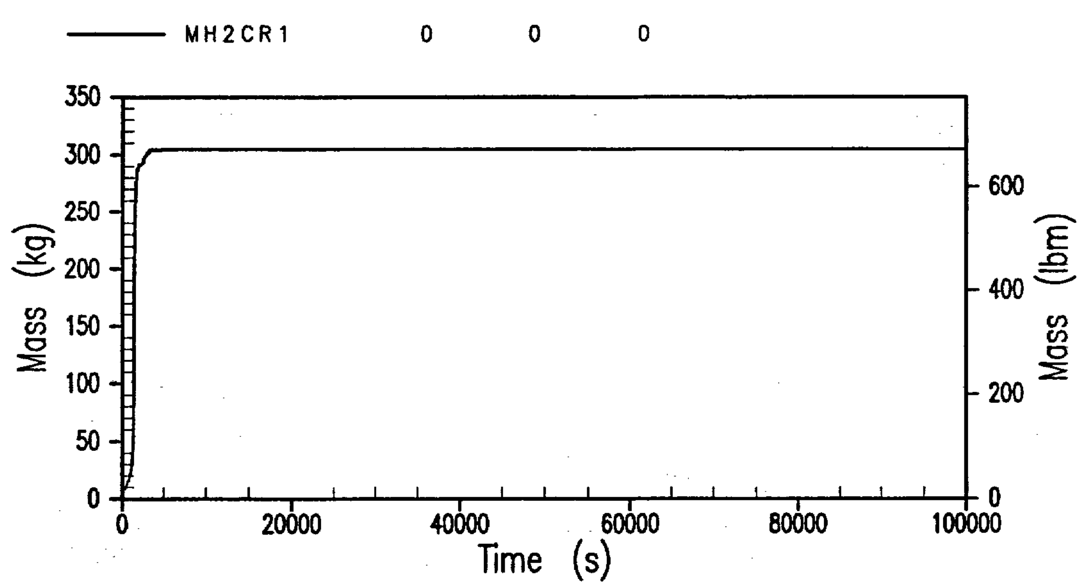


Figure 34-200

Case 3C-1: In-Vessel Hydrogen Generation Vessel Rupture

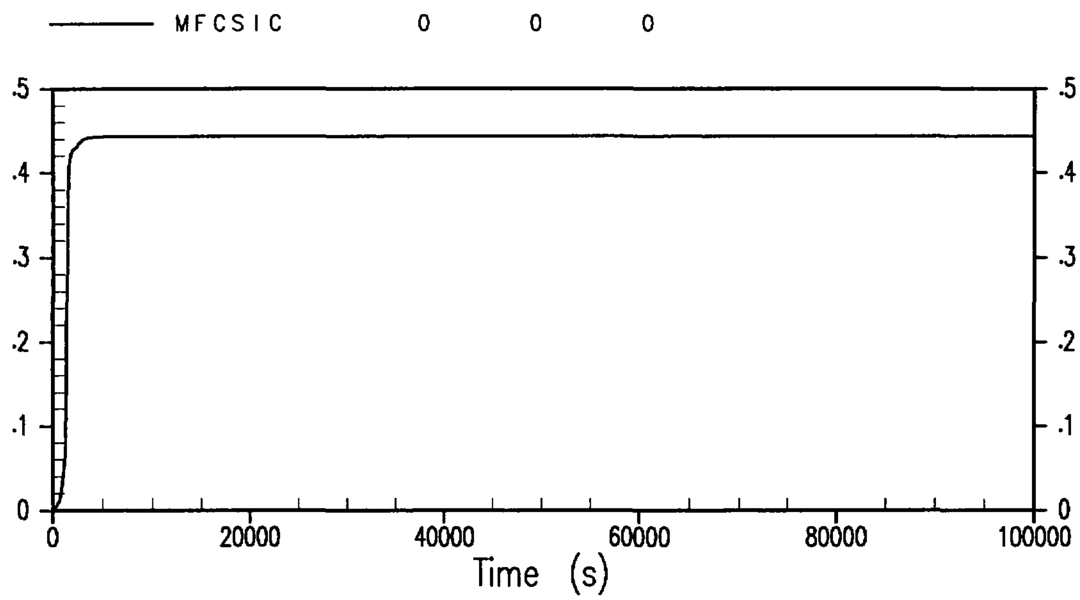


Figure 34-201

Case 3C-1: Mass Fraction of CsI Released to Containment
Vessel Rupture

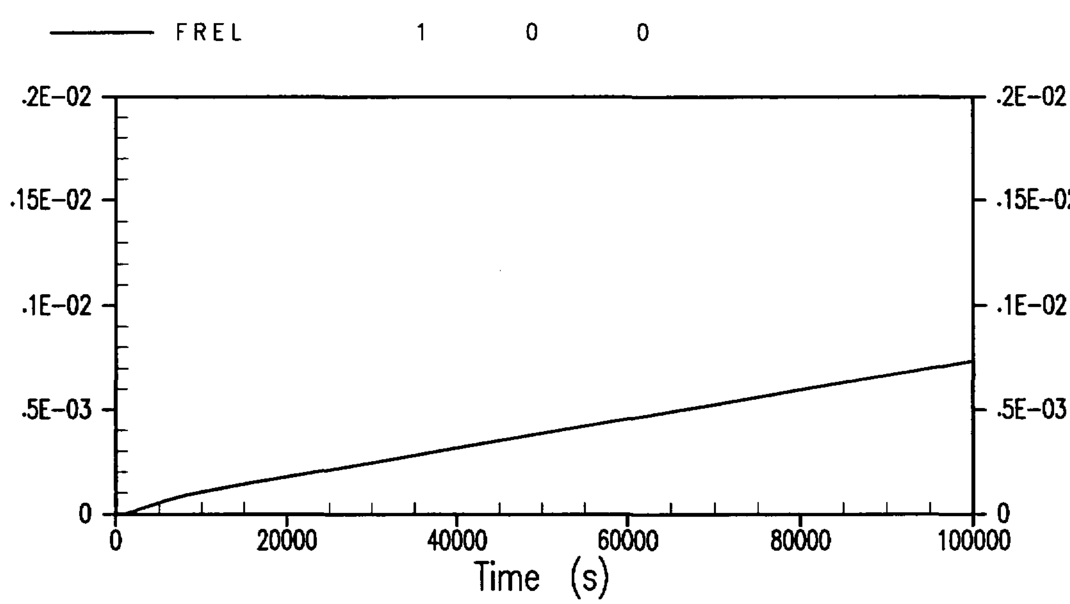


Figure 34-202

Case 3C-1: Mass Fraction of Noble Gas Released to Environment
Vessel Rupture

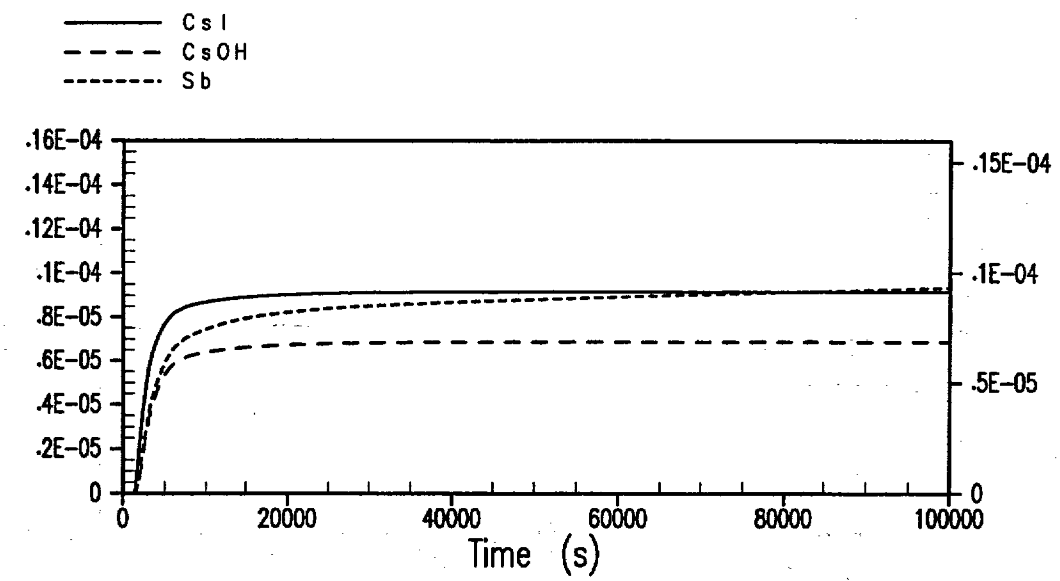


Figure 34-203

Case 3C-1: Mass Fraction of Fission Products Released to Environment Vessel Rupture

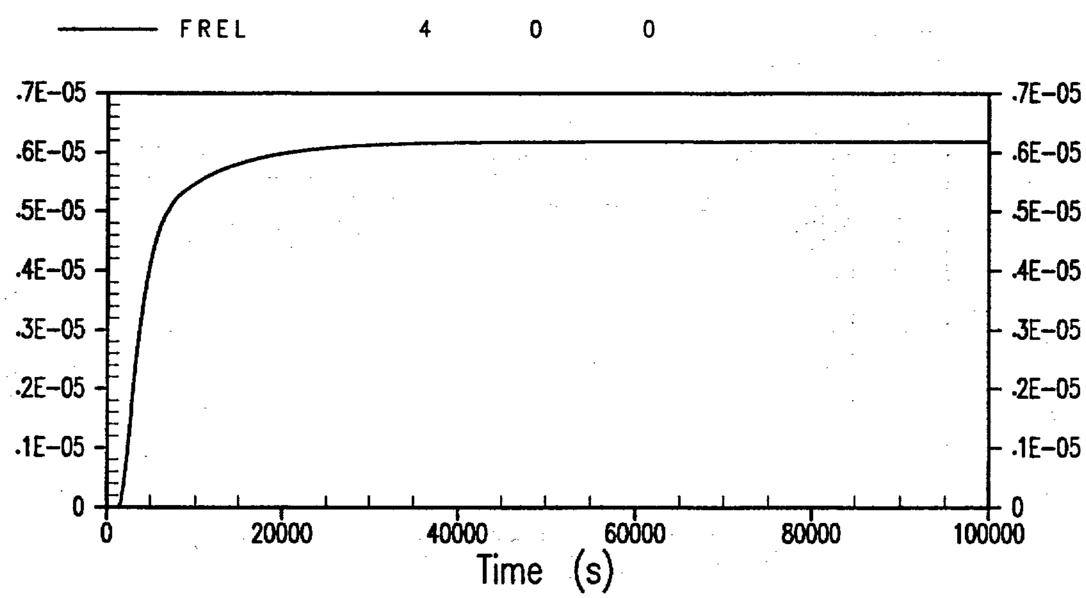


Figure 34-204

Case 3C-1: Mass Fraction of SrO Released to Environment Vessel Rupture

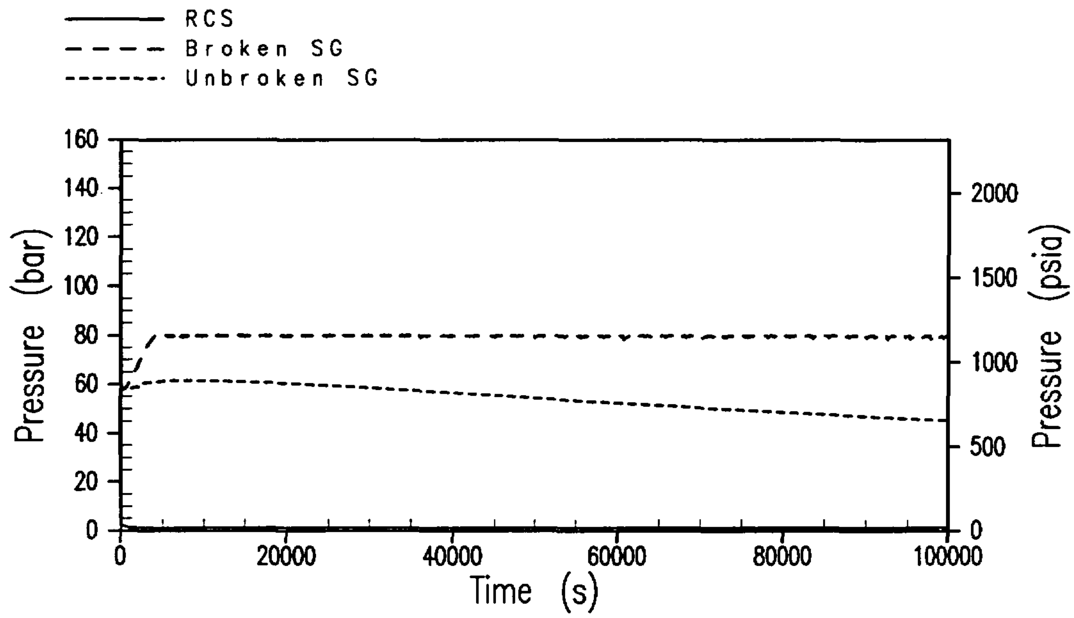


Figure 34-205

Case 3C-2: Reactor Coolant System and Steam Generator Pressure Vessel Rupture with Containment Failure

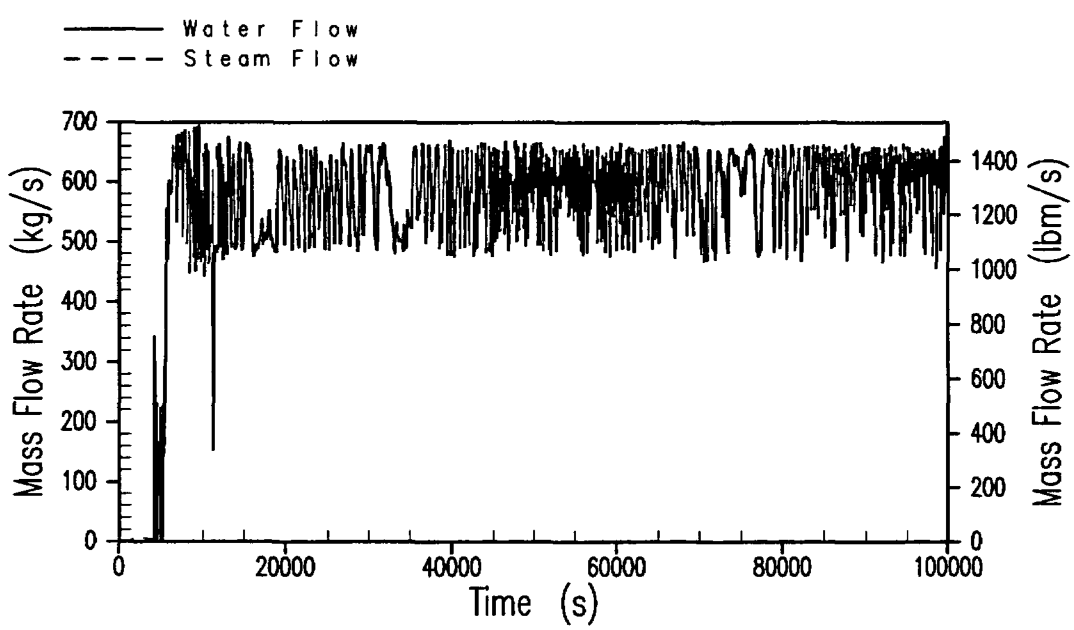


Figure 34-206

Case 3C-2: ADS Stage 4 Flow Rates Vessel Rupture with Containment Failure

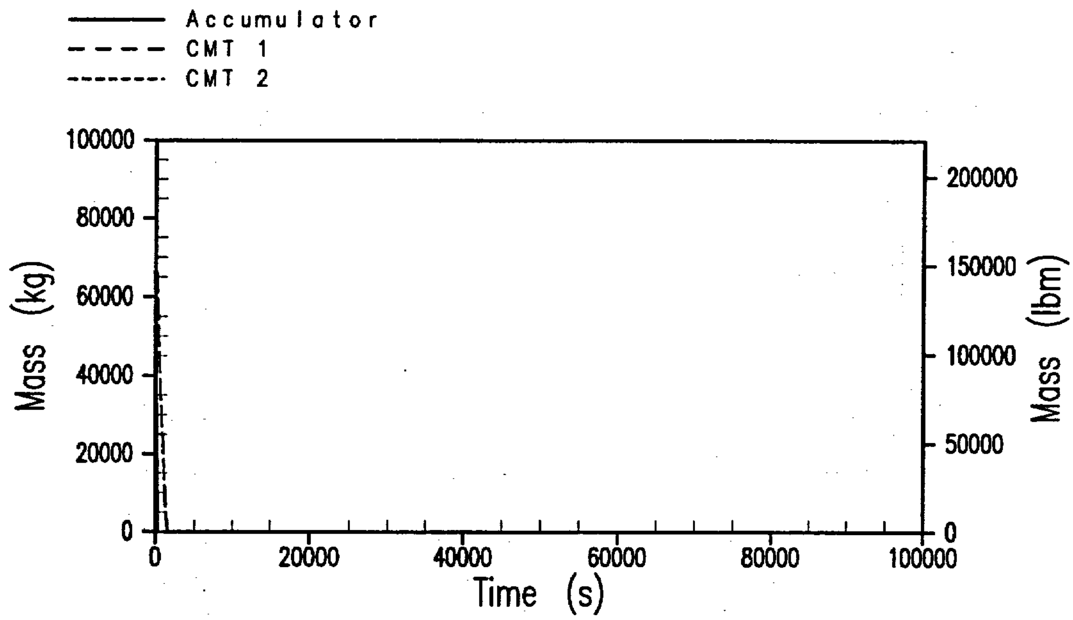


Figure 34-207

**Case 3C-2: Accumulator/CMT Water Mass
Vessel Rupture with Containment Failure**

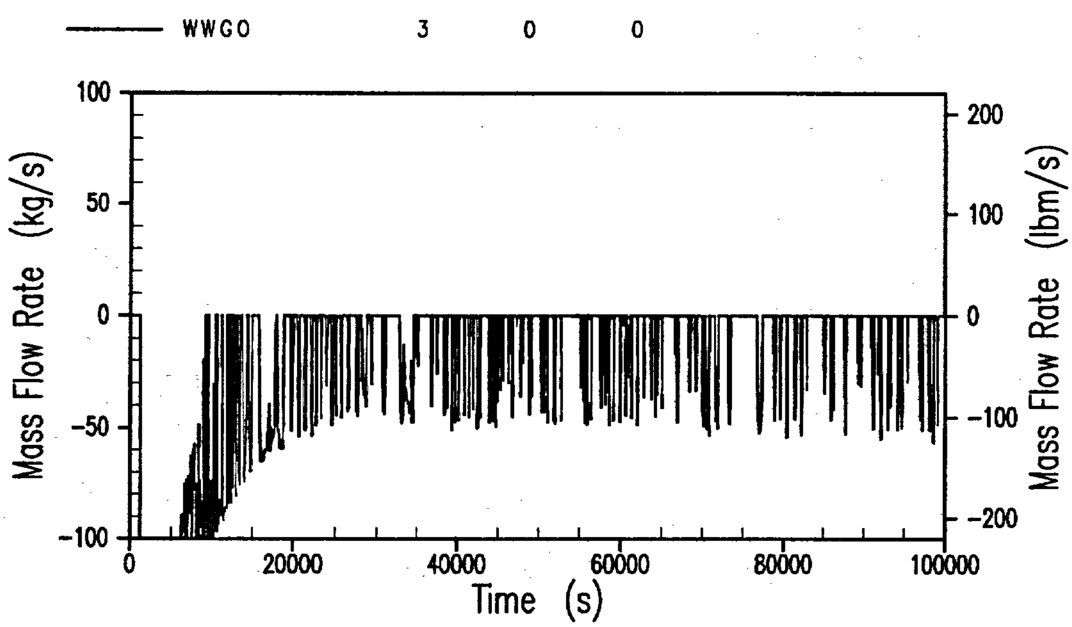


Figure 34-208

**Case 3C-2: IRWST Injection Flow Rate
Vessel Rupture with Containment Failure**

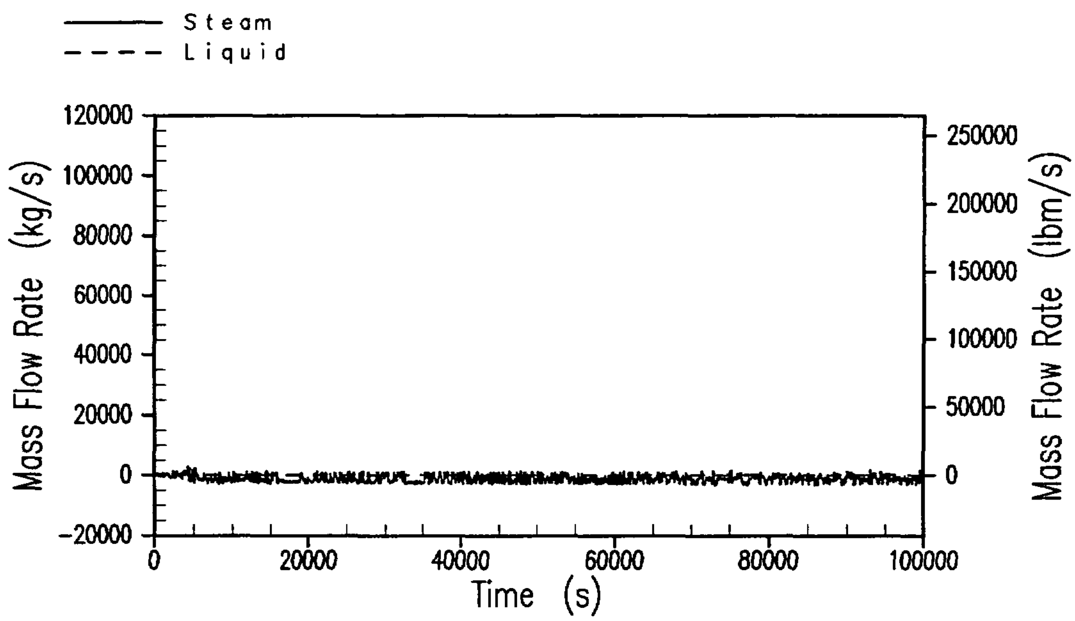


Figure 34-209

Case 3C-2: Break Flow Rate
Vessel Rupture with Containment Failure

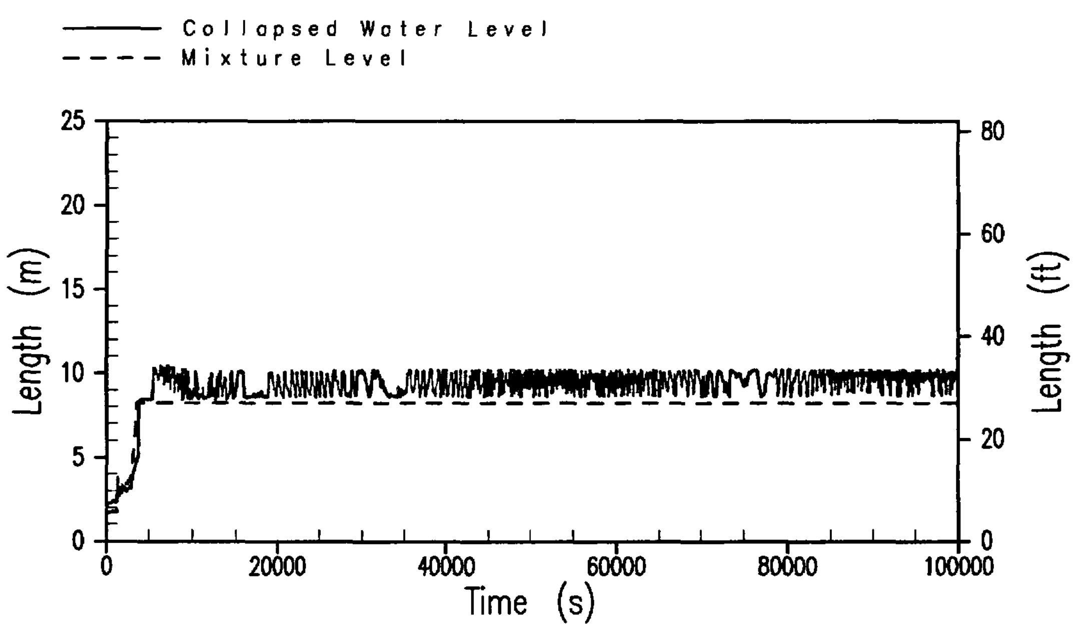


Figure 34-210

Case 3C-2: Reactor Vessel Water Level
Vessel Rupture with Containment Failure

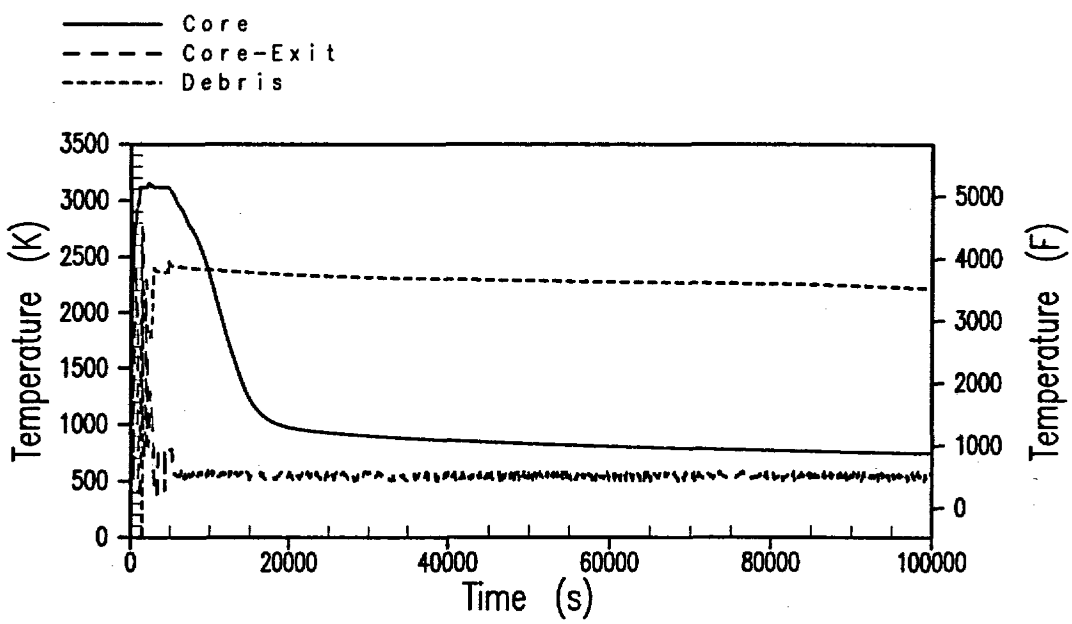


Figure 34-211

Case 3C-2: Core Temperatures
Vessel Rupture with Containment Failure

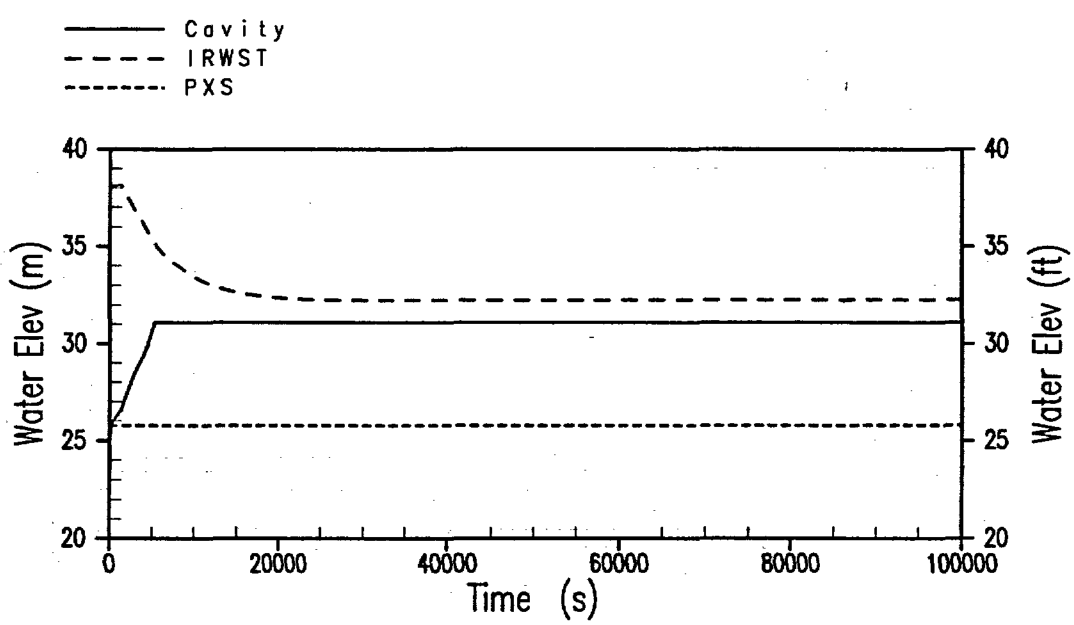


Figure 34-212

Case 3C-2: Containment Water Pool Elevations
Vessel Rupture with Containment Failure

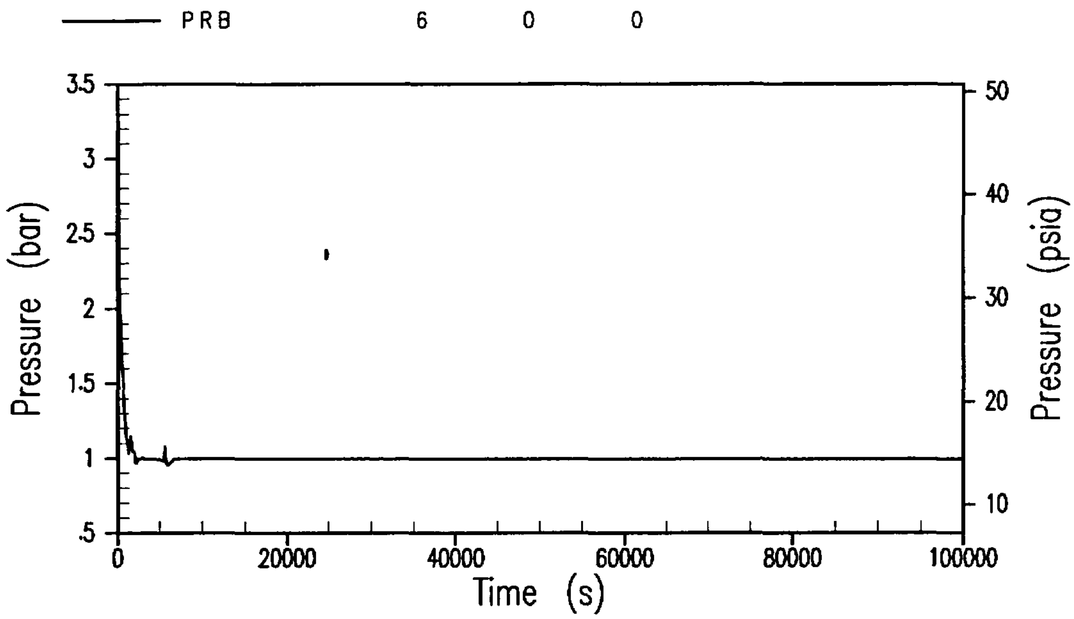


Figure 34-213

Case 3C-2: Containment Pressure Vessel Rupture with Containment Failure

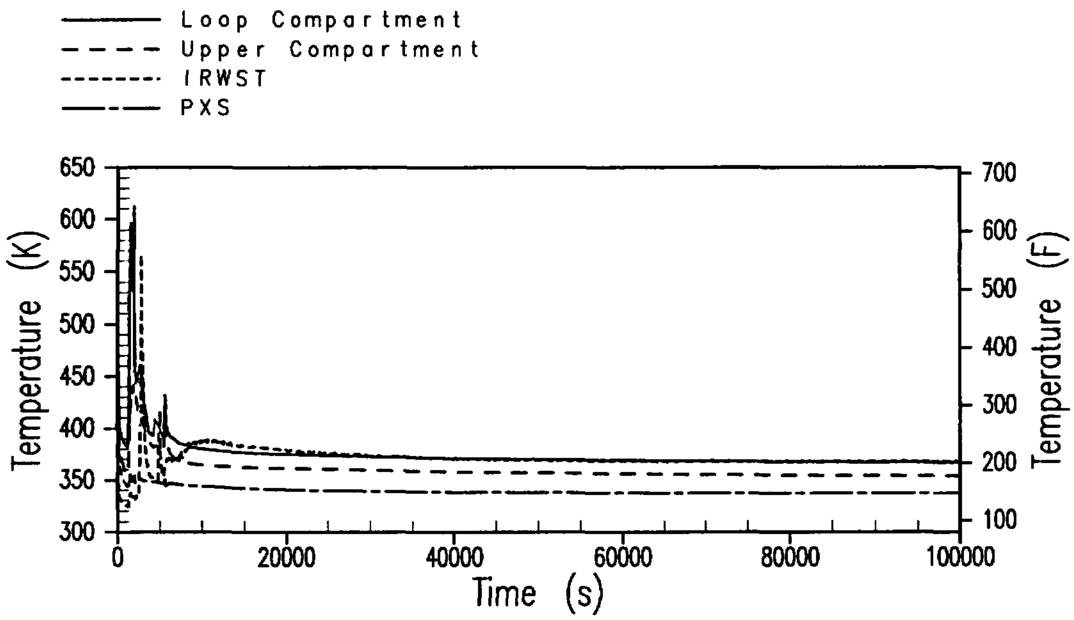


Figure 34-214

Case 3C-2: Containment Gas Temperature Vessel Rupture with Containment Failure

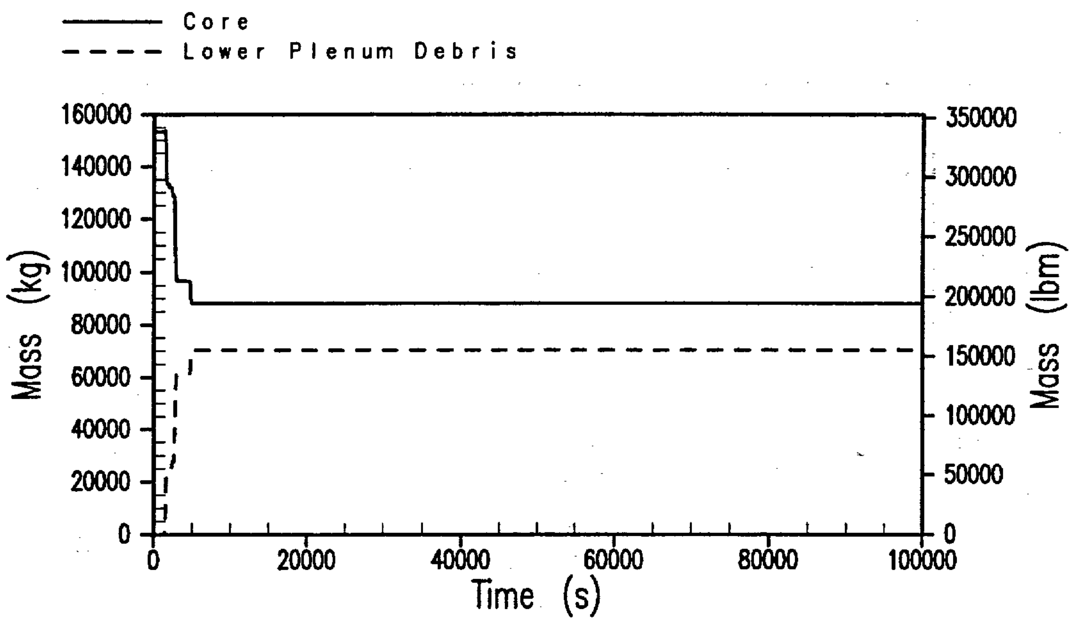


Figure 34-215

Case 3C-2: Core Mass
Vessel Rupture with Containment Failure

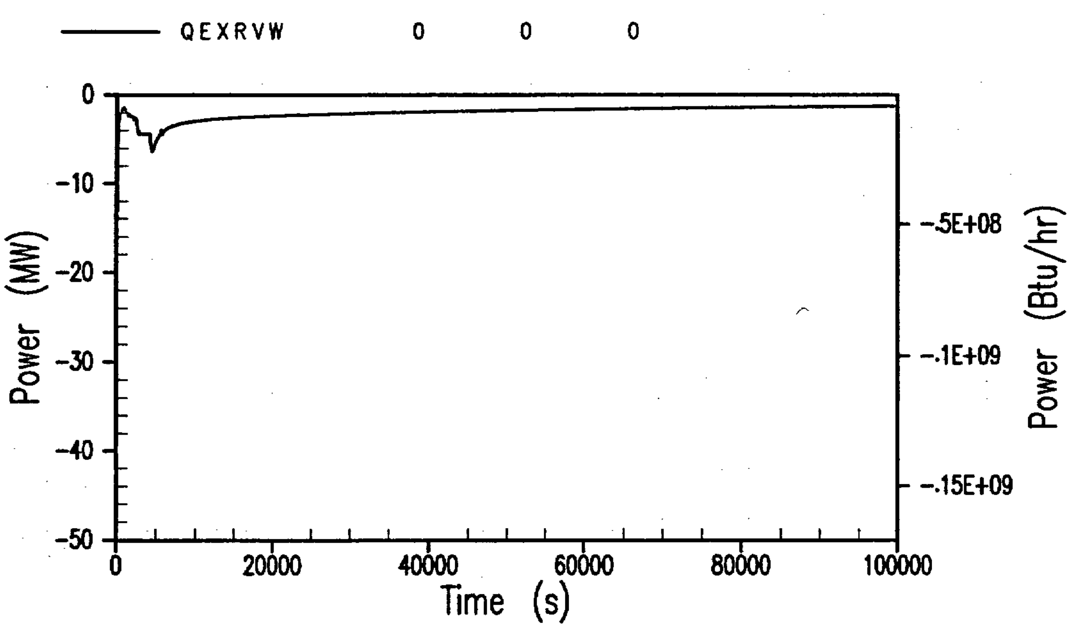


Figure 34-216

Case 3C-2: Reactor Pressure Vessel to Cavity Water Heat Transfer
Vessel Rupture with Containment Failure

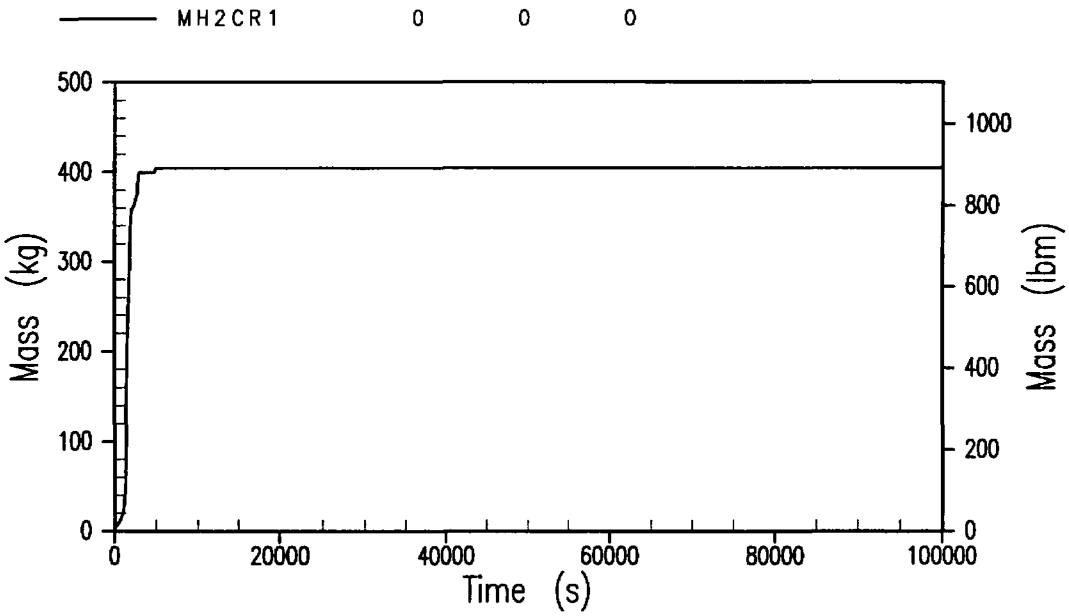


Figure 34-217

Case 3C-2: In-Vessel Hydrogen Generation
Vessel Rupture with Containment Failure

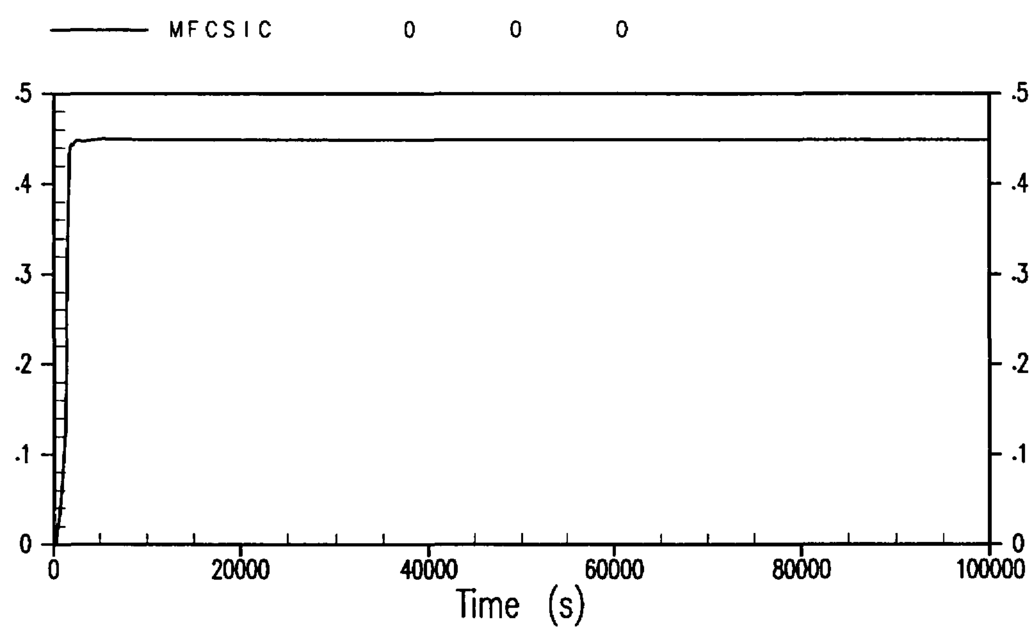


Figure 34-218

Case 3C-2: Mass Fraction of CsI Released to Containment
Vessel Rupture with Containment Failure

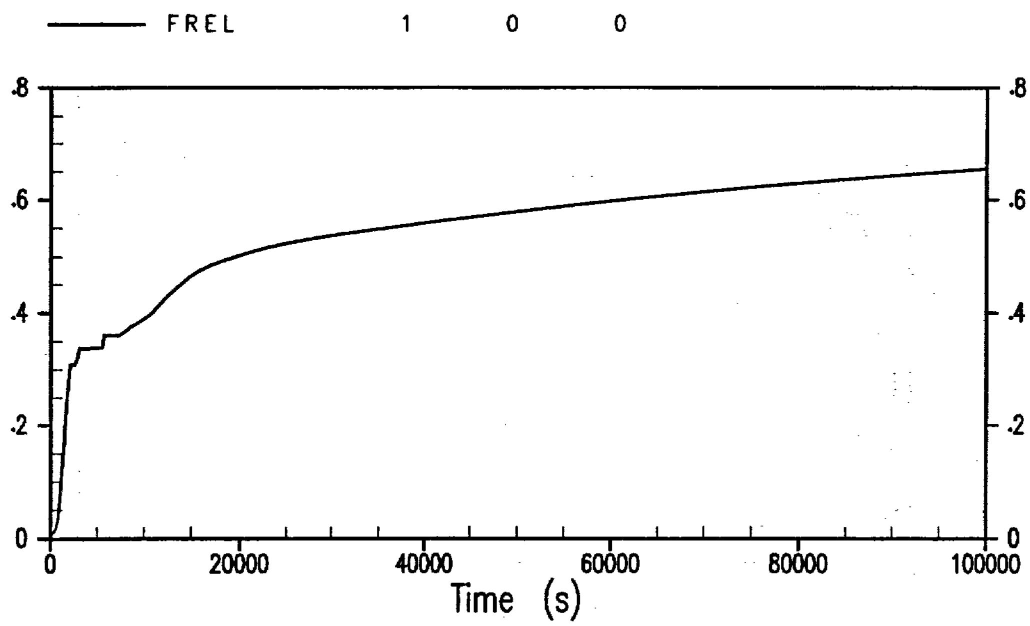


Figure 34-219

Case 3C-2: Mass Fraction of Noble Gases Released to Environment Vessel Rupture with Containment Failure

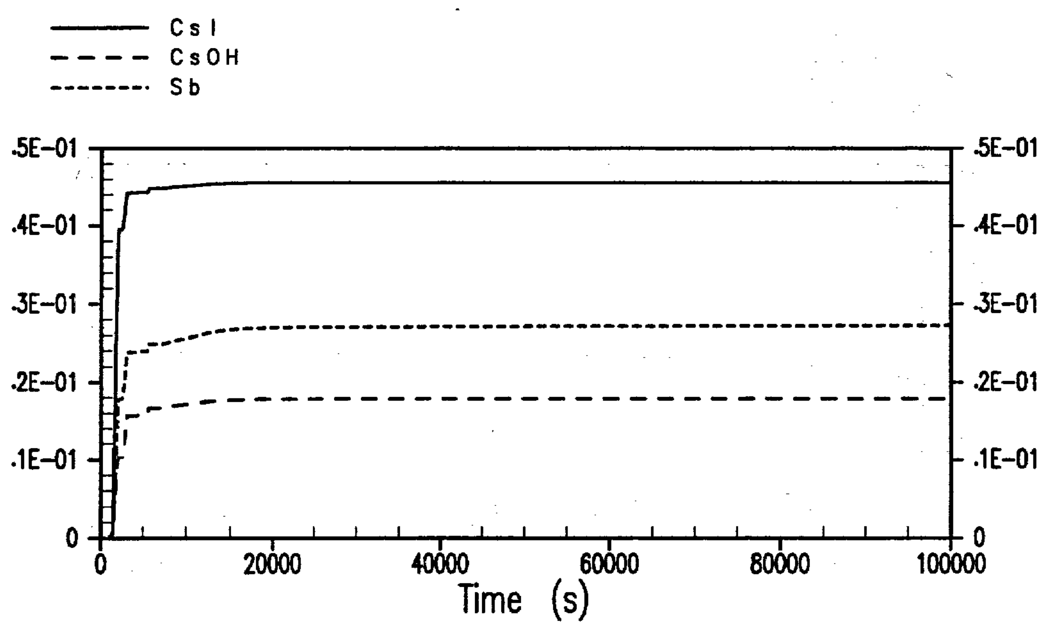


Figure 34-220

Case 3C-2: Mass Fraction of Fission Products Released to Environment Vessel Rupture with Containment Failure

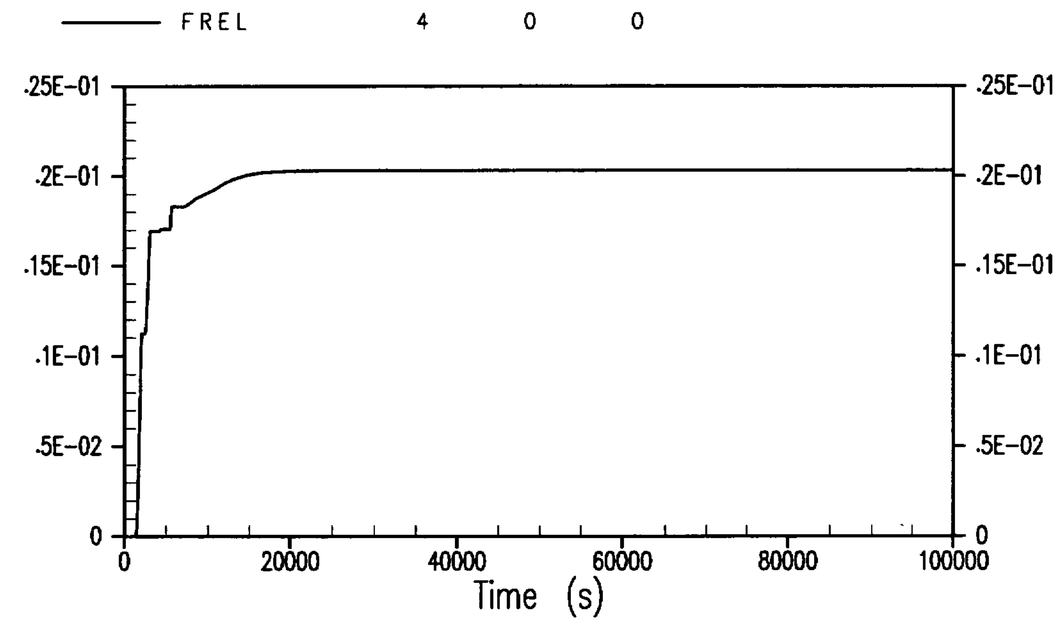


Figure 34-221

Case 3C-2: Mass Fraction of SrO Released to Environment
Vessel Rupture with Containment Failure

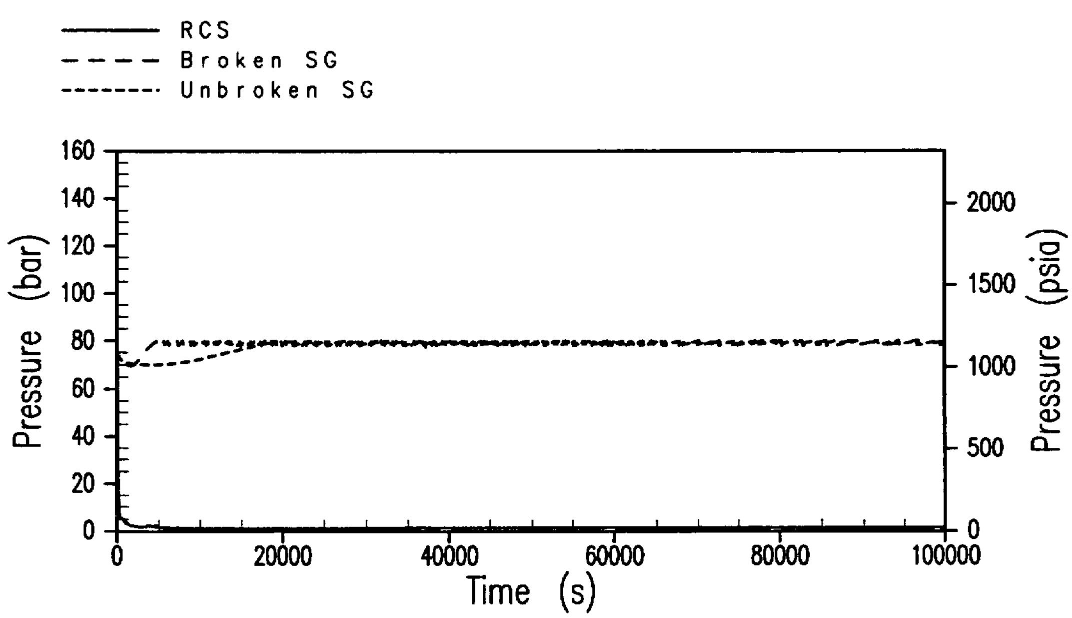


Figure 34-222

Case 3D-1: Reactor Coolant System and Steam Generator Pressure
Spurious ADS-4 with Failed CMTs

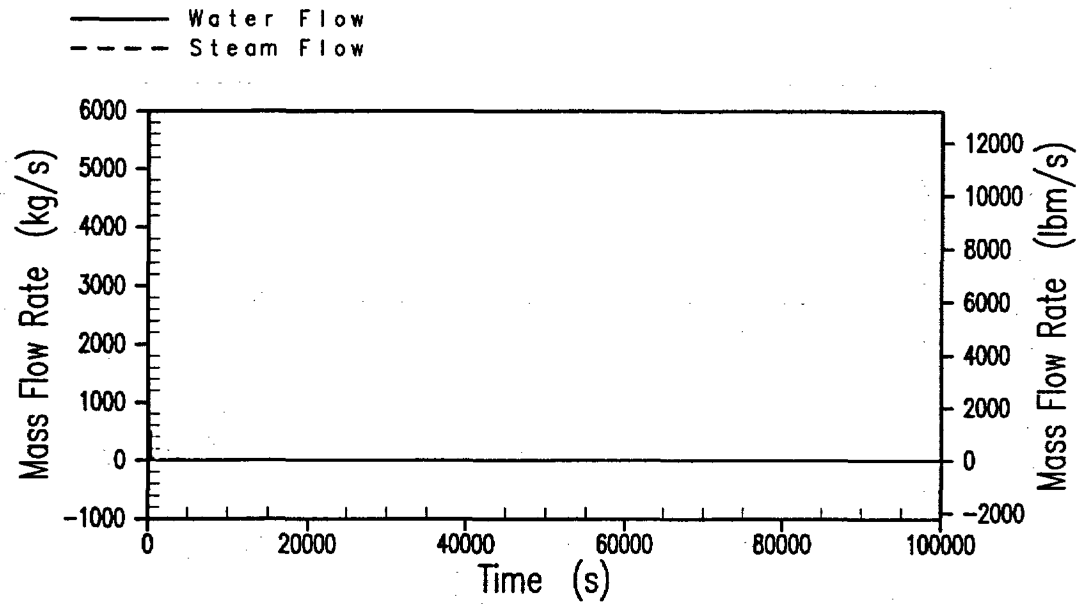


Figure 34-223

Case 3D-1: ADS Stage 4 Flow Rates
Spurious ADS-4 with Failed CMTs

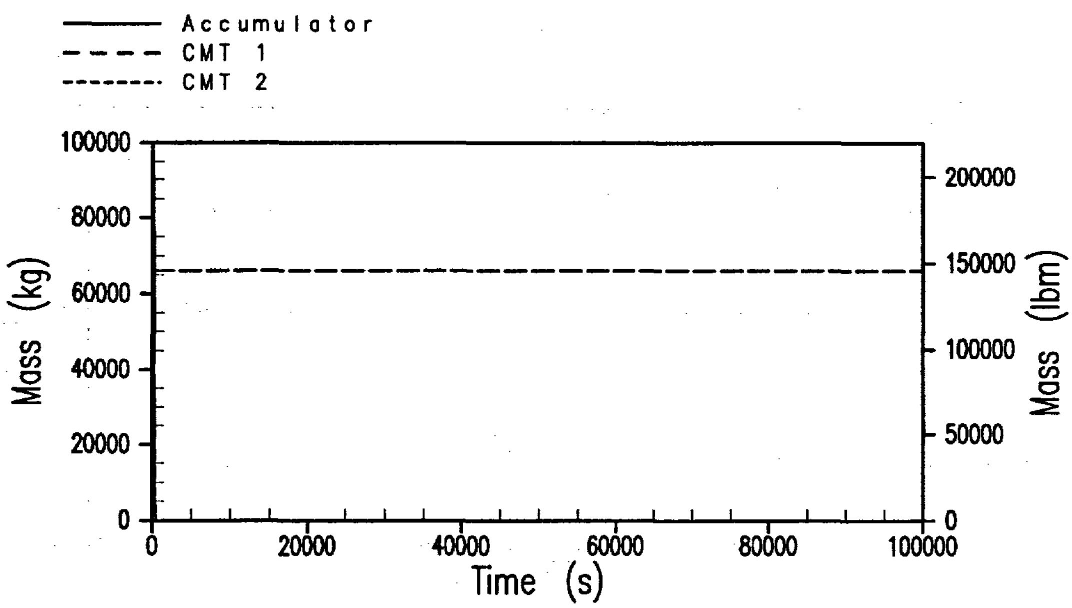


Figure 34-224

Case 3D-1: Accumulator/CMT Water Mass
Spurious ADS-4 with Failed CMTs

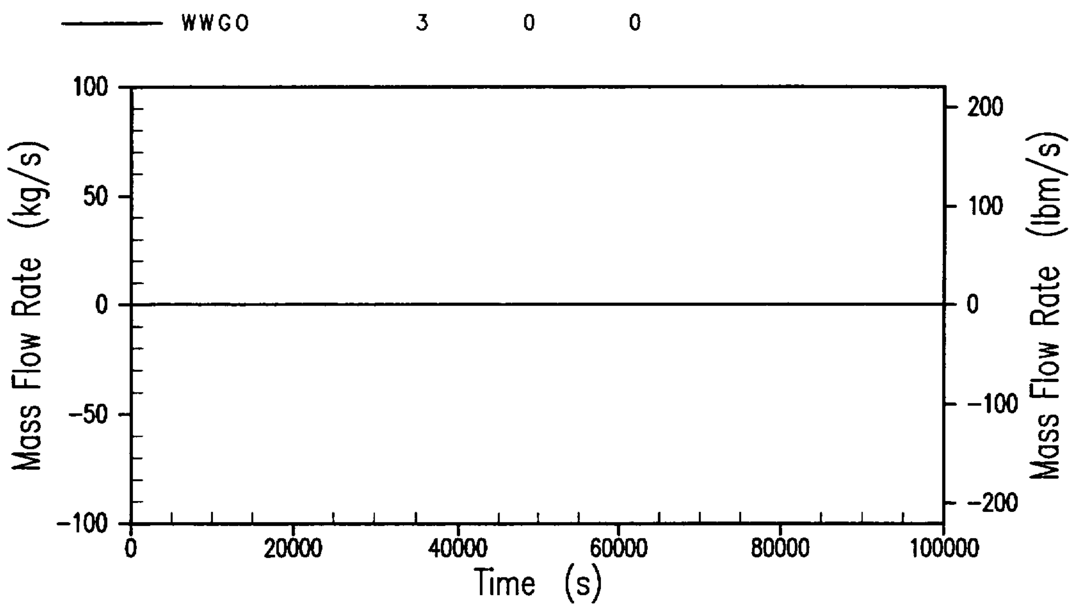


Figure 34-225

Case 3D-1: IRWST Injection Flow Rate
Spurious ADS-4 with Failed CMTs

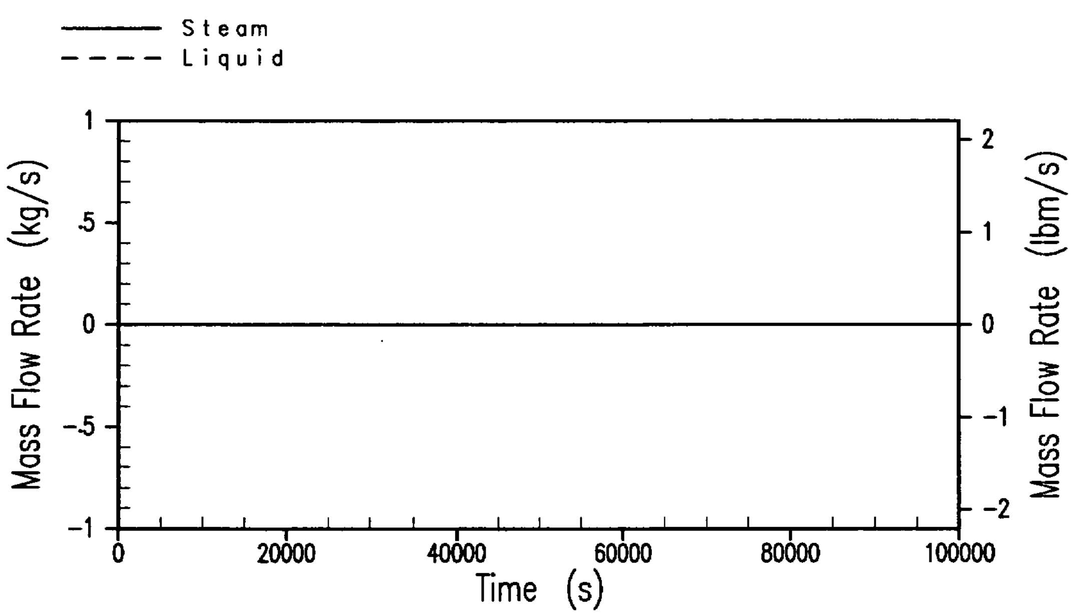


Figure 34-226

Case 3D-1: Break Flow Rate
Spurious ADS-4 with Failed CMTs

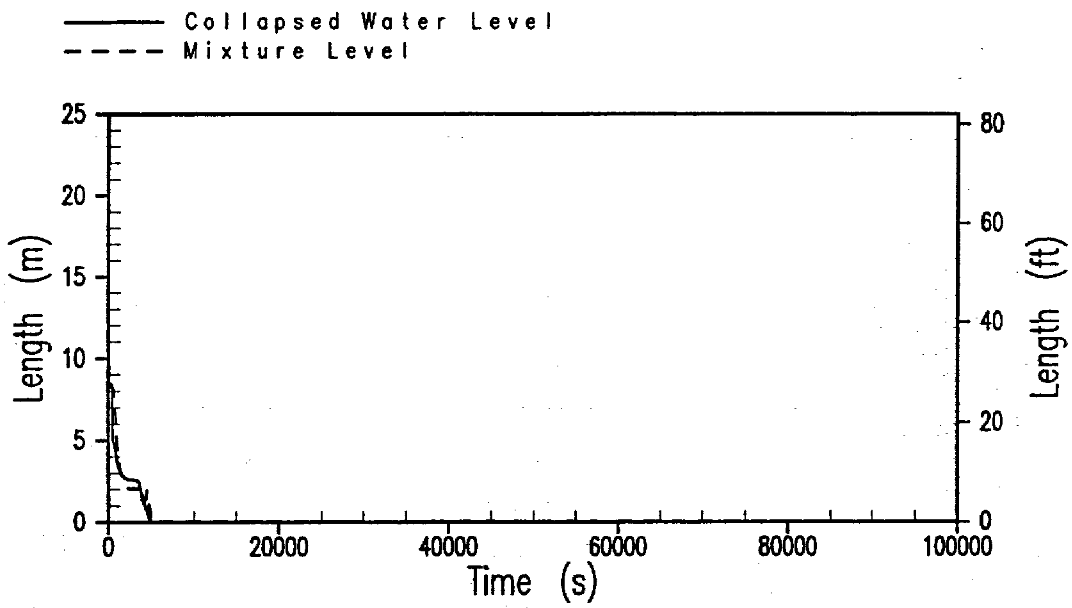


Figure 34-227

Case 3D-1: Reactor Vessel Water Level Spurious ADS-4 with Failed CMTs

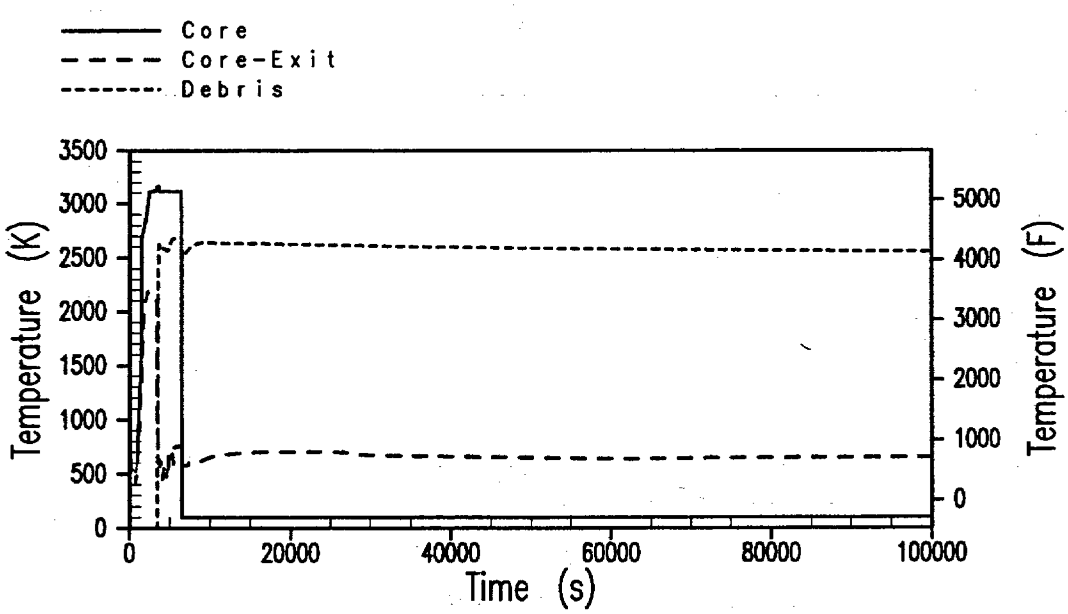


Figure 34-228

Case 3D-1: Core Temperatures Spurious ADS-4 with Failed CMTs

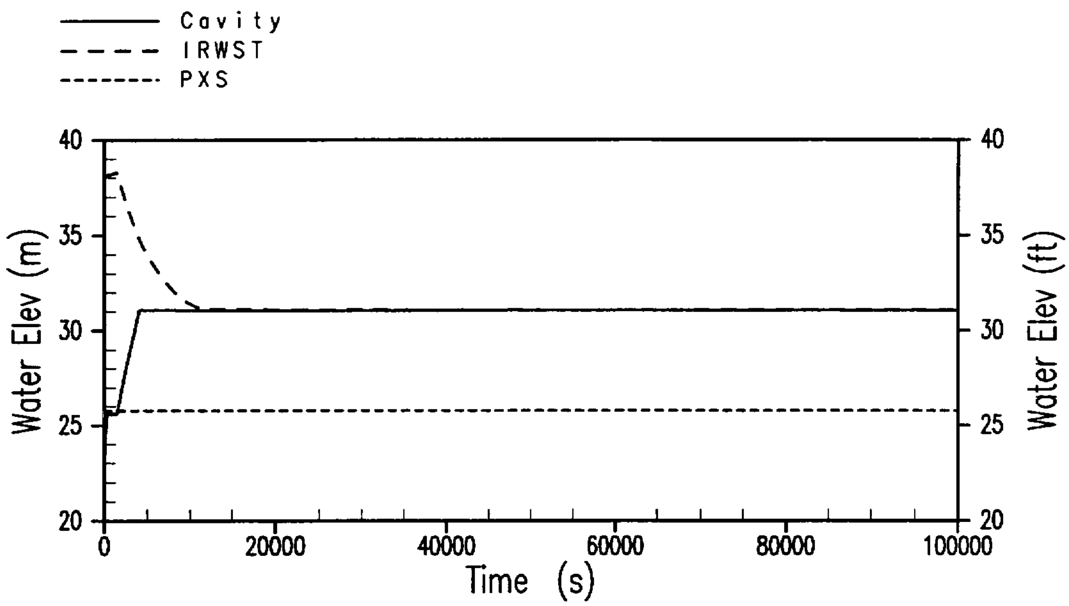


Figure 34-229

Case 3D-1: Containment Water Pool Elevations
Spurious ADS-4 with Failed CMTs

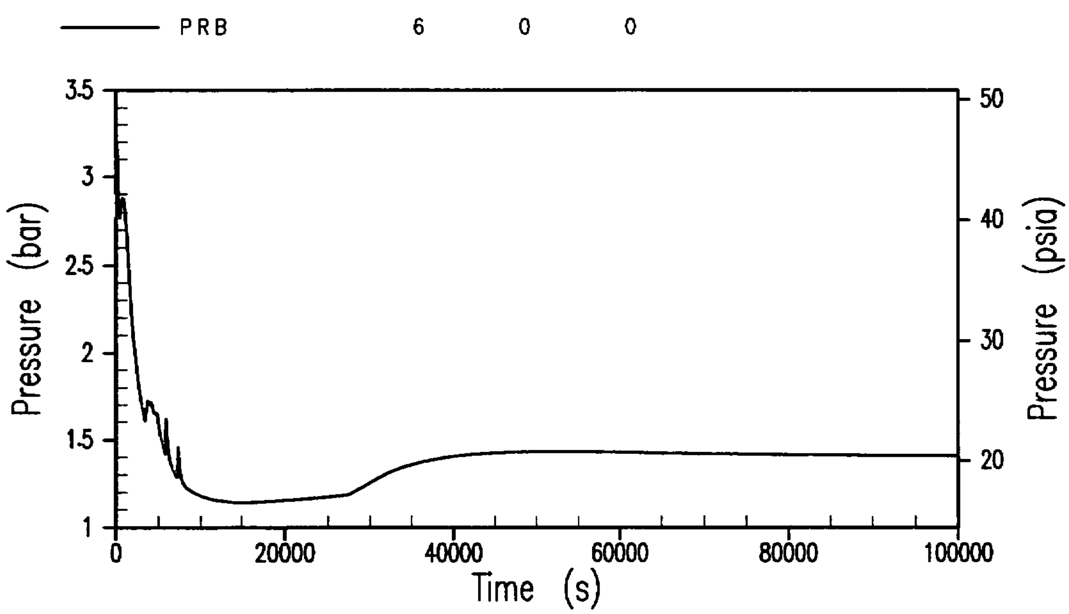


Figure 34-230

Case 3D-1: Containment Pressure
Spurious ADS-4 with Failed CMTs

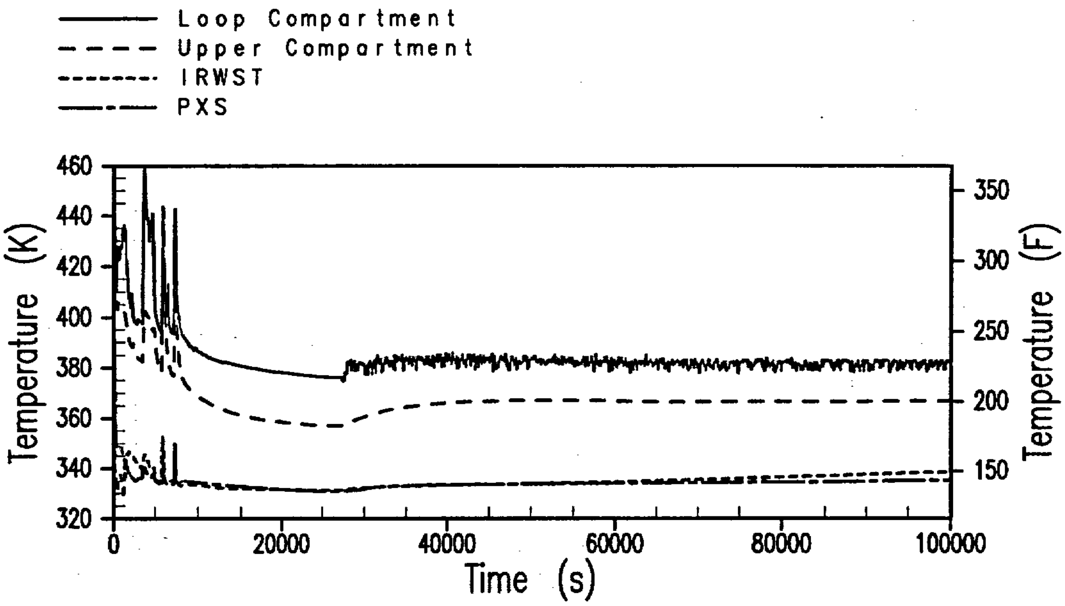


Figure 34-231

Case 3D-1: Containment Gas Temperature Spurious ADS-4 with Failed CMTs

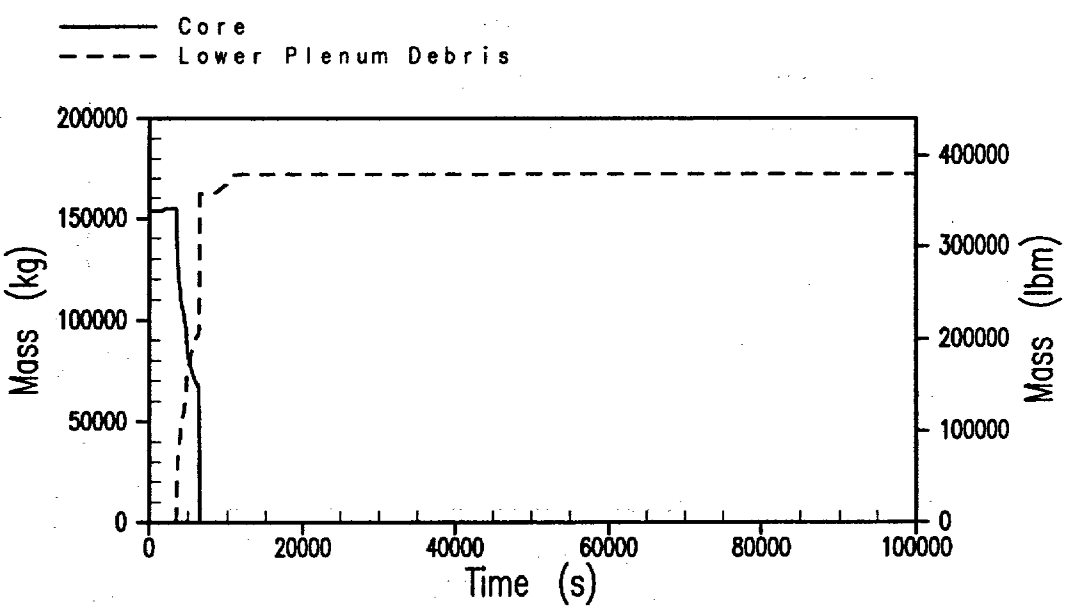


Figure 34-232

Case 3D-1: Core Mass Spurious ADS-4 with Failed CMTs

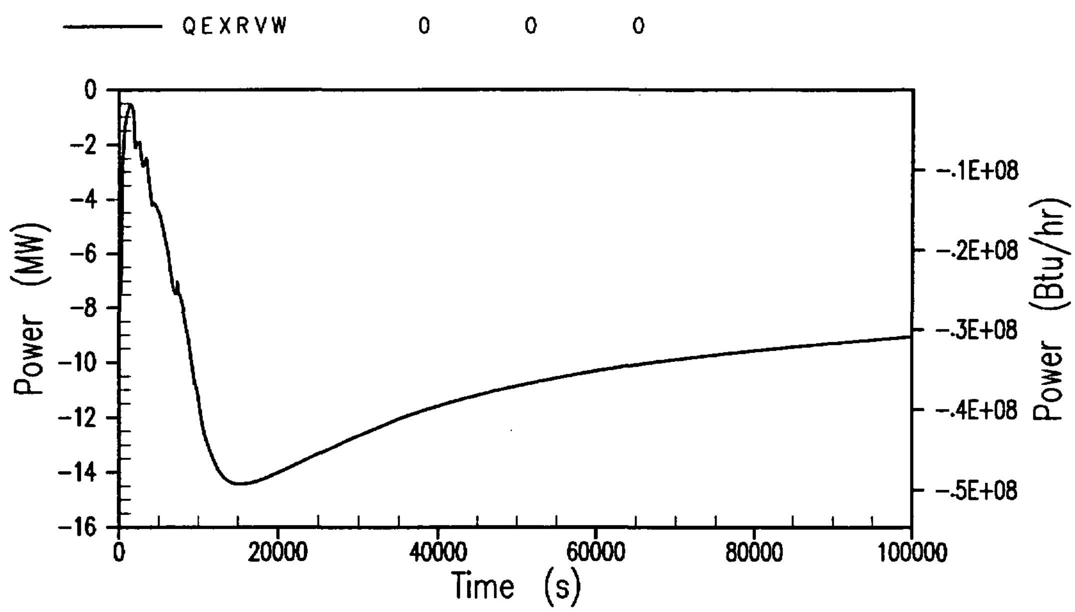


Figure 34-233

Case 3D-1: Reactor Pressure Vessel to Cavity Water Heat Transfer Spurious ADS-4 with Failed CMTs

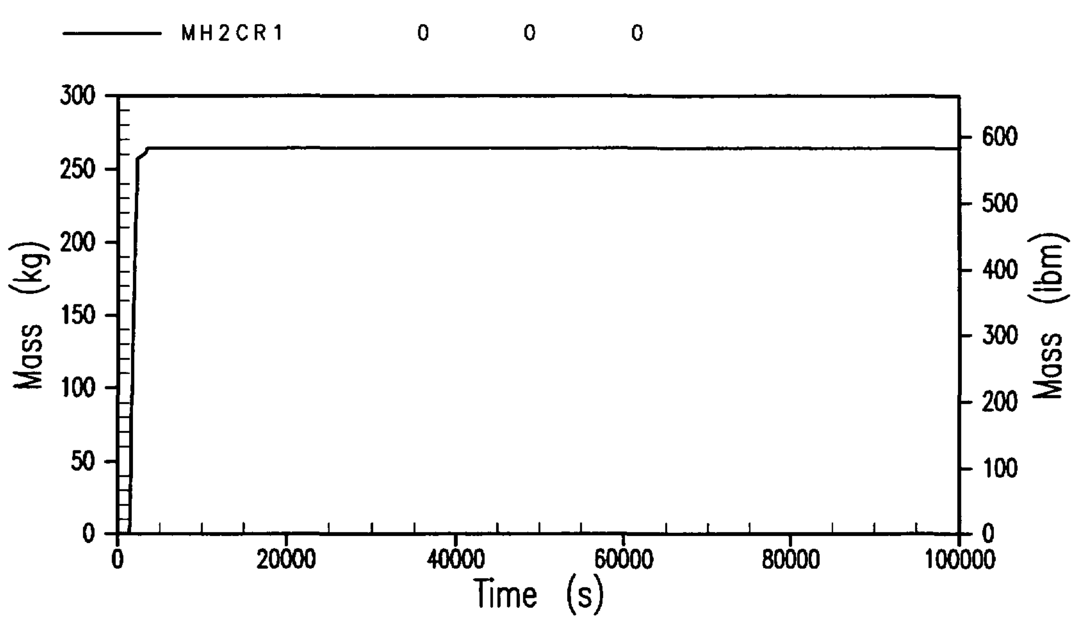


Figure 34-234

Case 3D-1: In-Vessel Hydrogen Generation Spurious ADS-4 with Failed CMTs

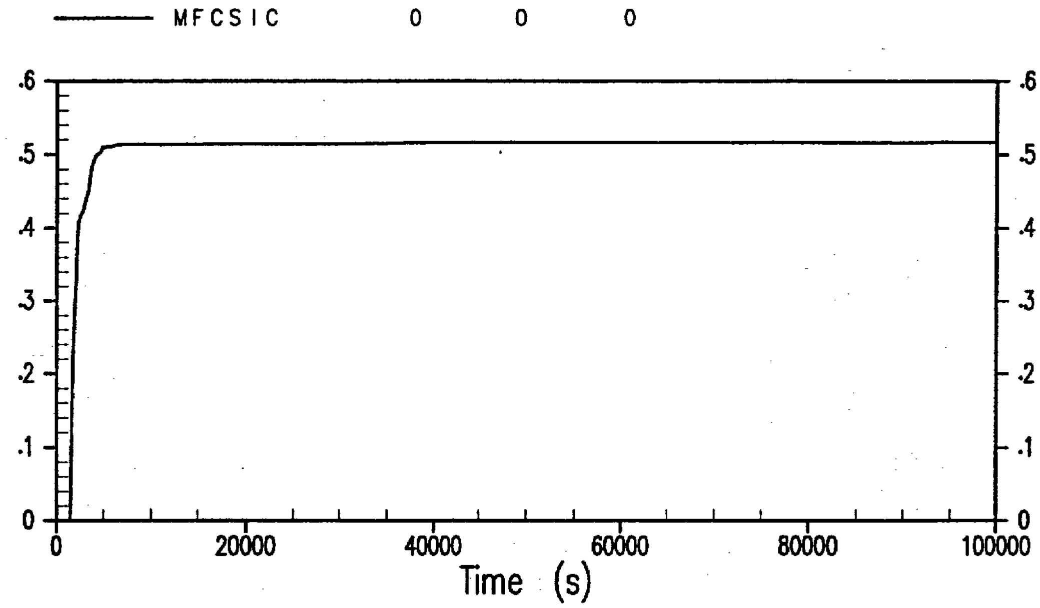


Figure 34-235

Case 3D-1: Mass Fraction of CsI Released to Containment Spurious ADS-4 with Failed CMTs

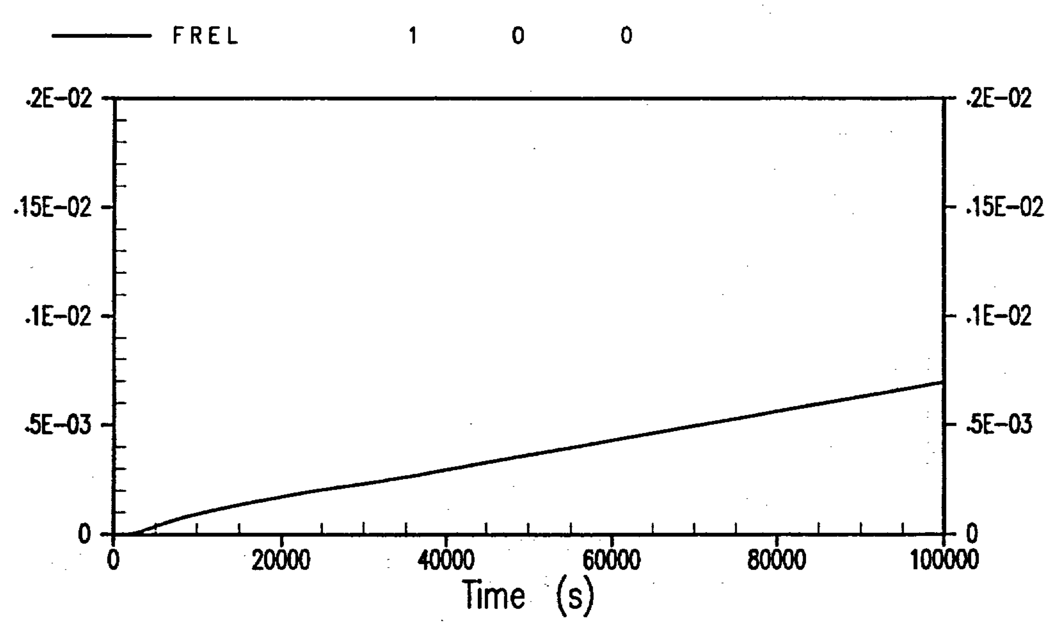


Figure 34-236

Case 3D-1: Mass Fraction of Noble Gases Released to Environment Spurious ADS-4 with Failed CMTs

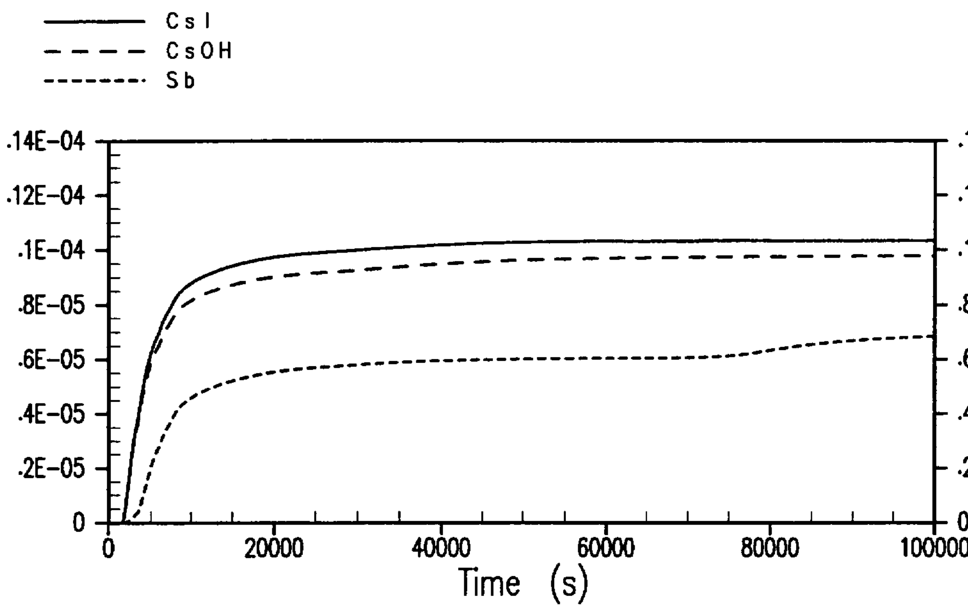


Figure 34-237

Case 3D-1: Mass Fraction of Fission Products Released to Environment Spurious ADS-4 with Failed CMTs

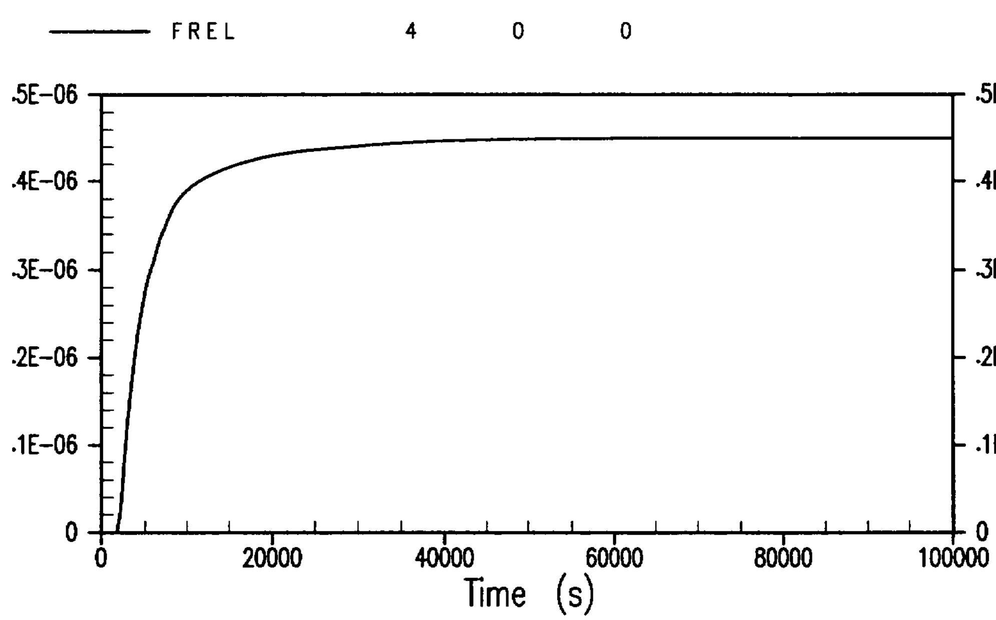


Figure 34-238

Case 3D-1: Mass Fraction of SrO Released to Environment Spurious ADS-4 with Failed CMTs

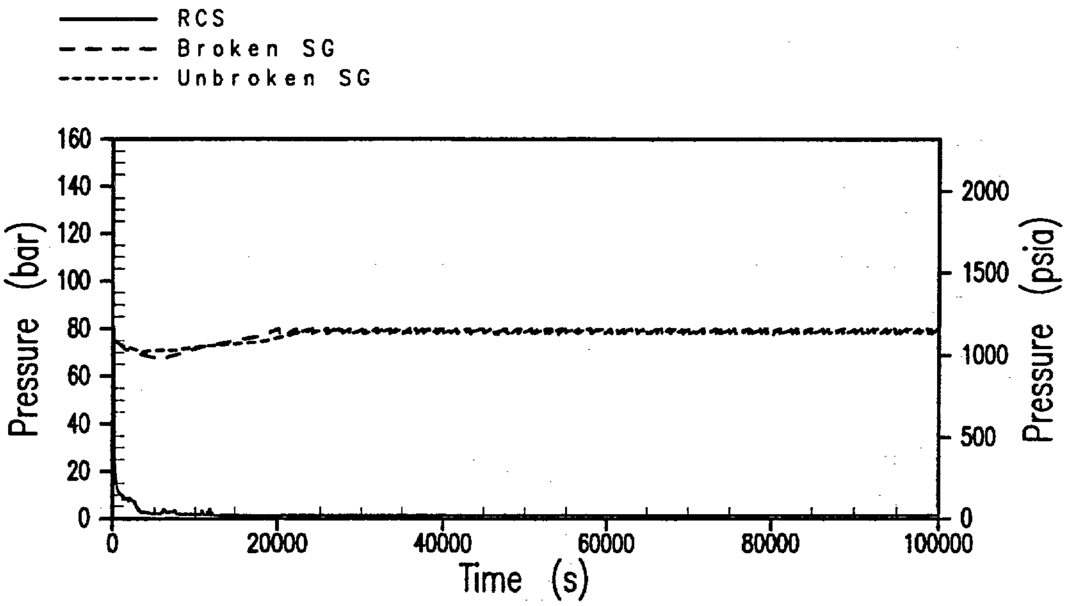


Figure 34-239

Case 3D-2: Reactor Coolant System and Steam Generator Pressure Spurious ADS-2 with Failed CMTs

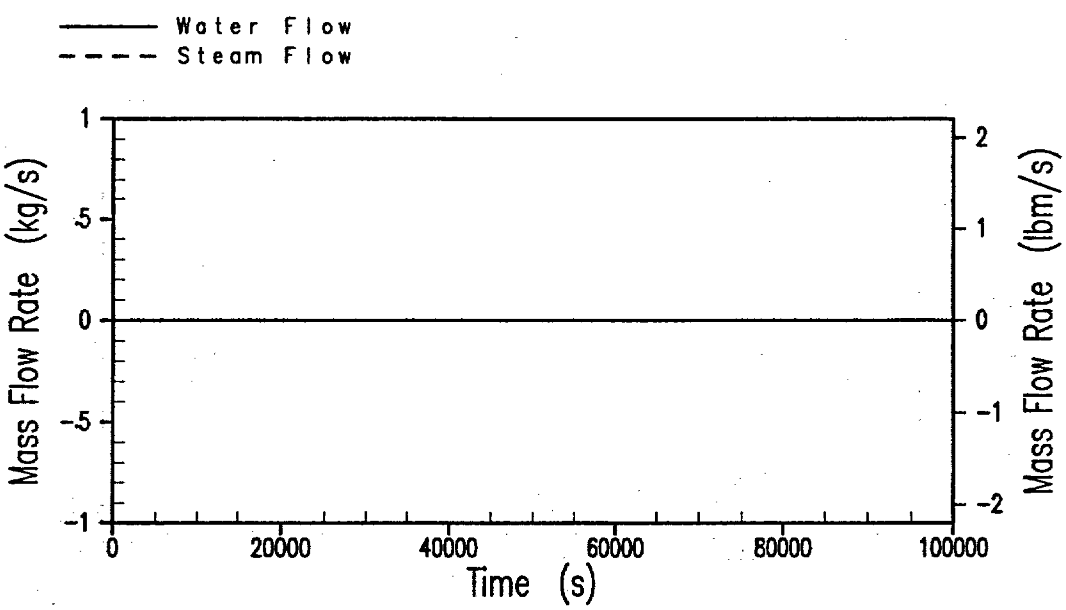


Figure 34-240

Case 3D-2: ADS Stage 4 Flow Rates Spurious ADS-2 with Failed CMTs

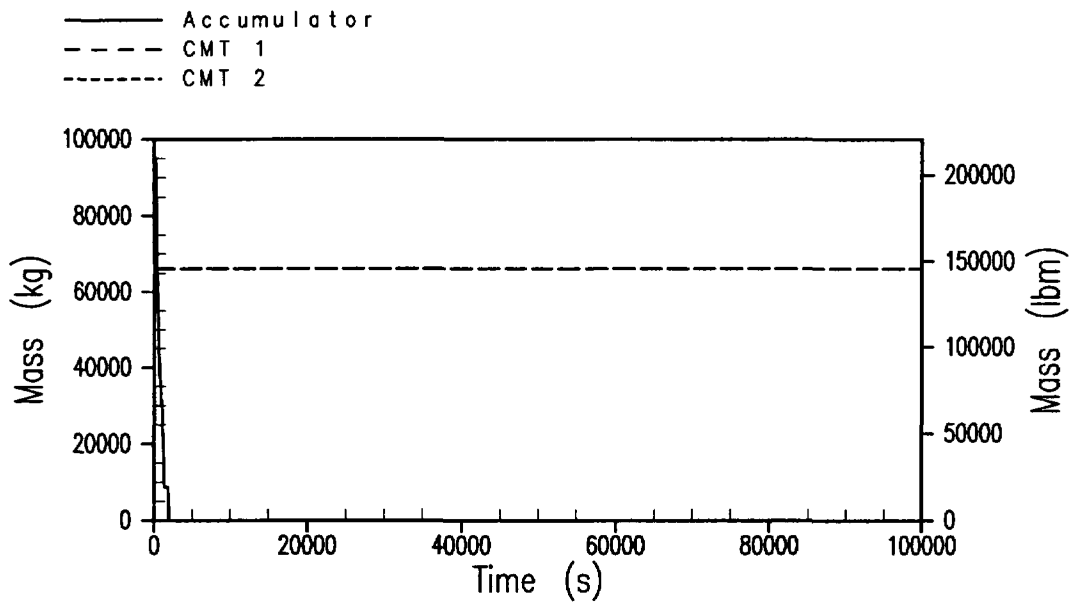


Figure 34-241

Case 3D-2: Accumulator/CMT Water Mass
Spurious ADS-2 with Failed CMTs

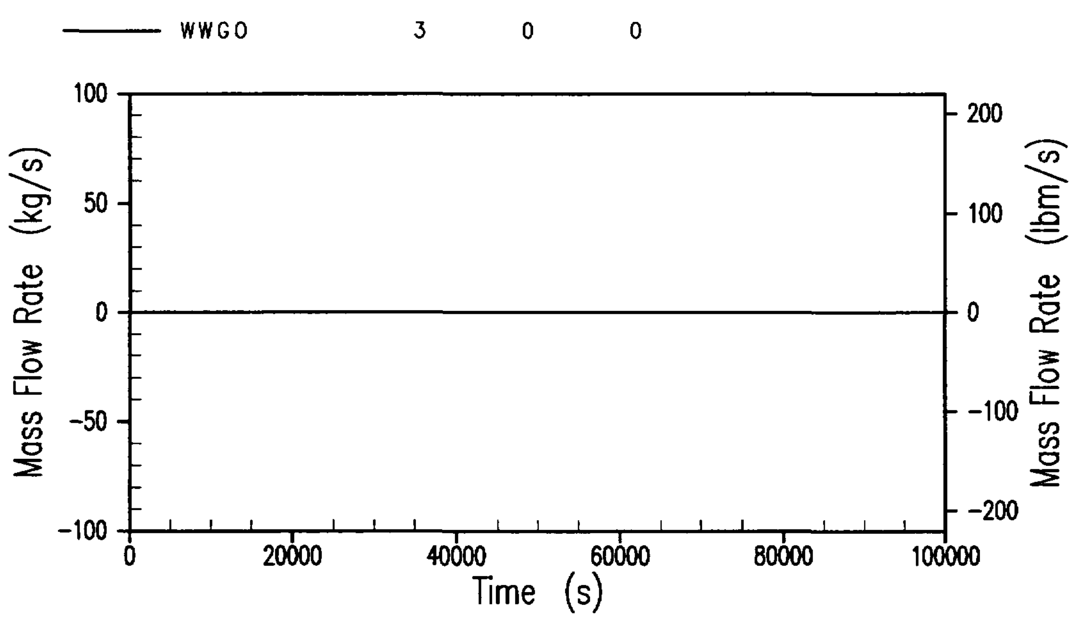


Figure 34-242

Case 3D-2: IRWST Injection Flow Rate
Spurious ADS-2 with Failed CMTs

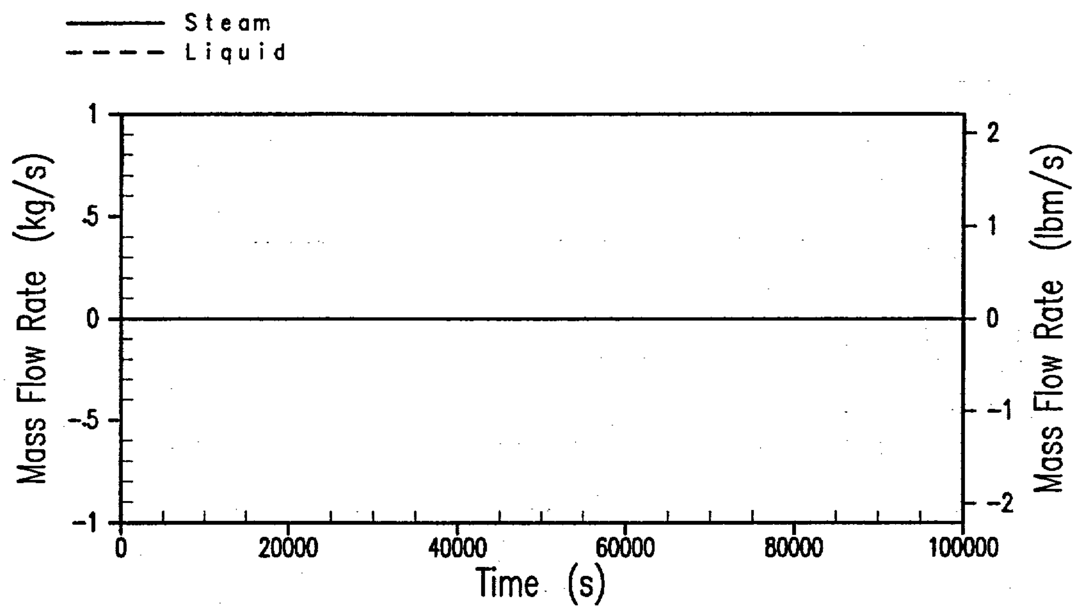


Figure 34-243

Case 3D-2: Break Flow Rate
Spurious ADS-2 with Failed CMTs

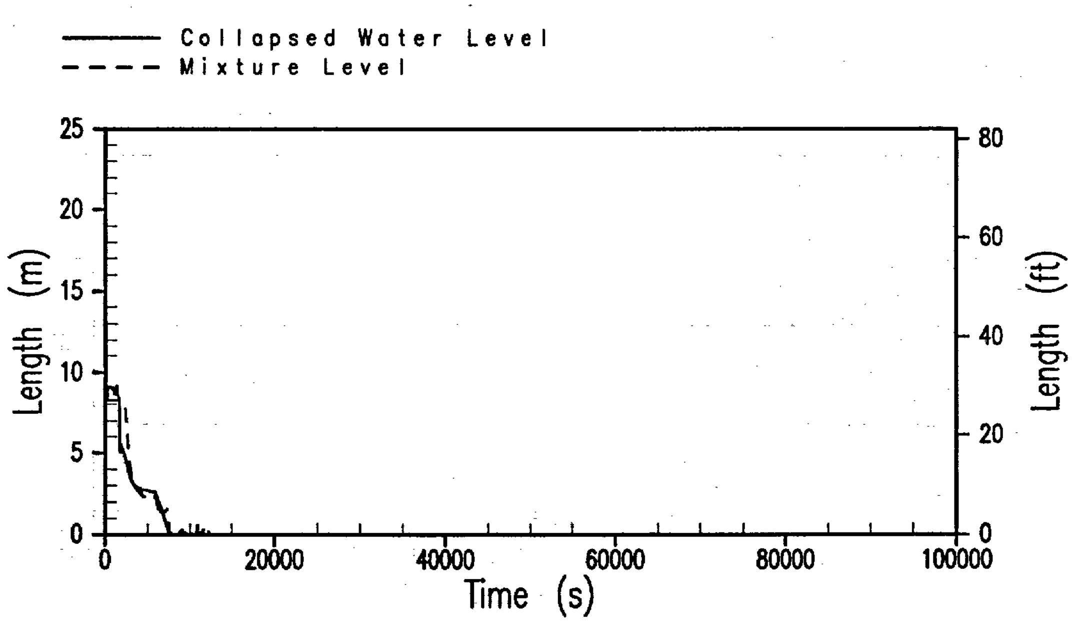


Figure 34-244

Case 3D-2: Reactor Vessel Water Level
Spurious ADS-2 with Failed CMTs

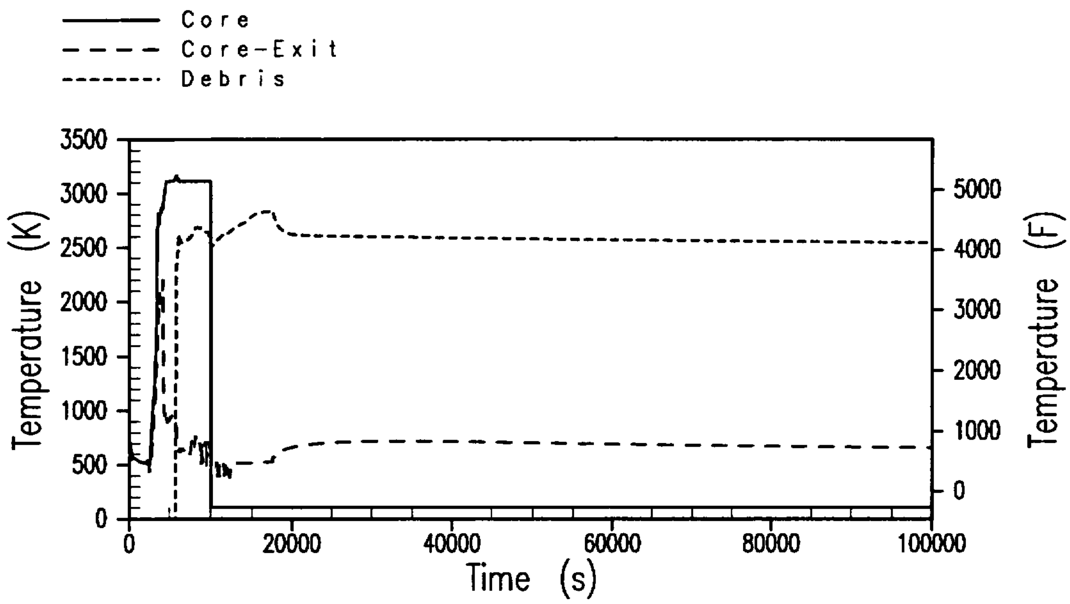


Figure 34-245

Case 3D-2: Core Temperatures Spurious ADS-2 with Failed CMTs

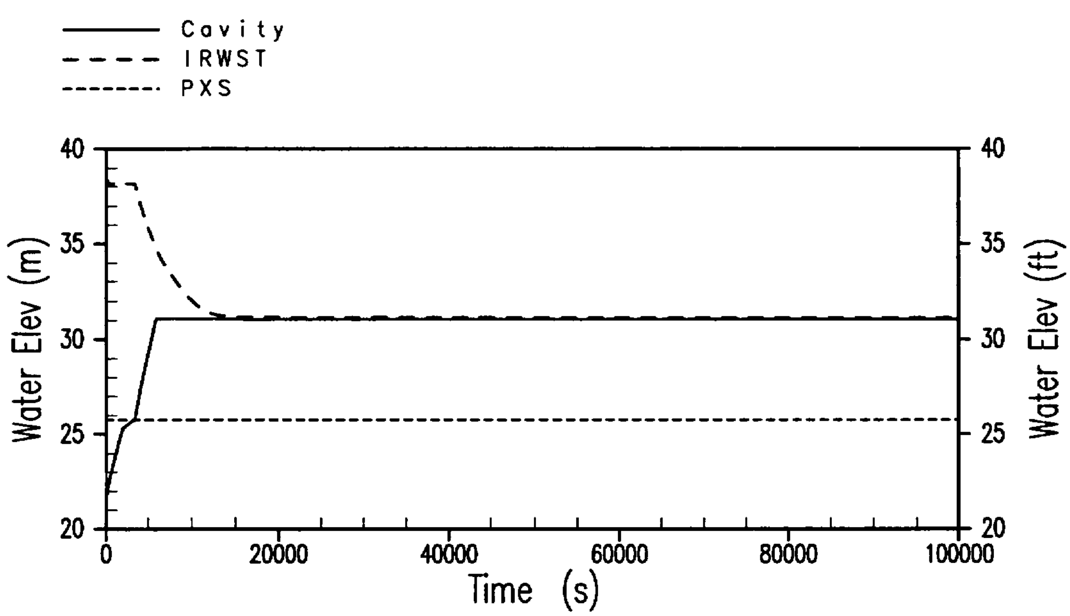


Figure 34-246

Case 3D-2: Containment Pool Water Elevations Spurious ADS-2 with Failed CMTs

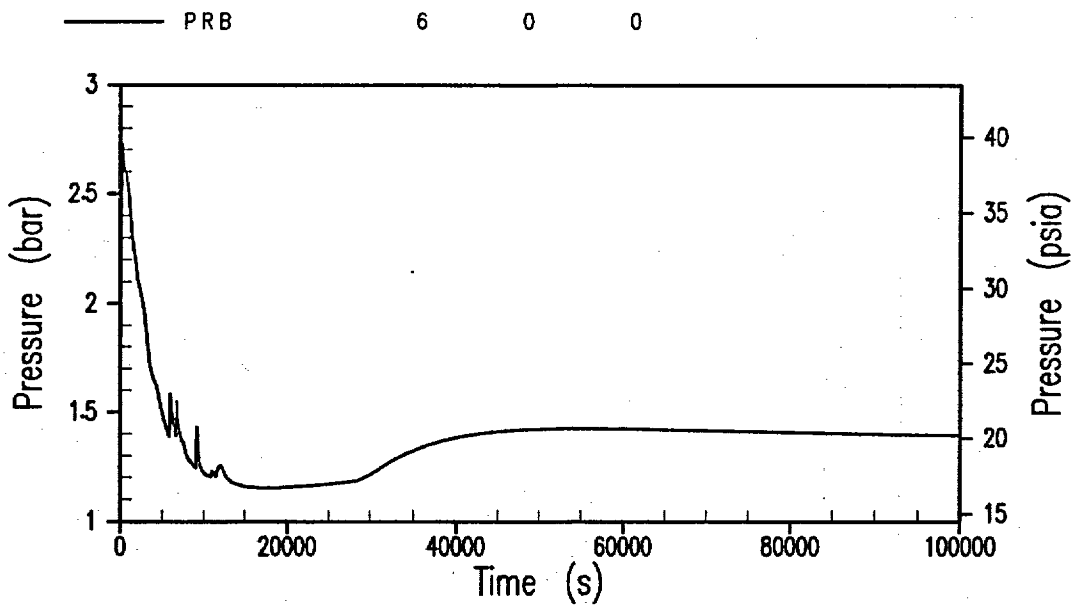


Figure 34-247

Case 3D-2: Containment Pressure Spurious ADS-2 with Failed CMTs

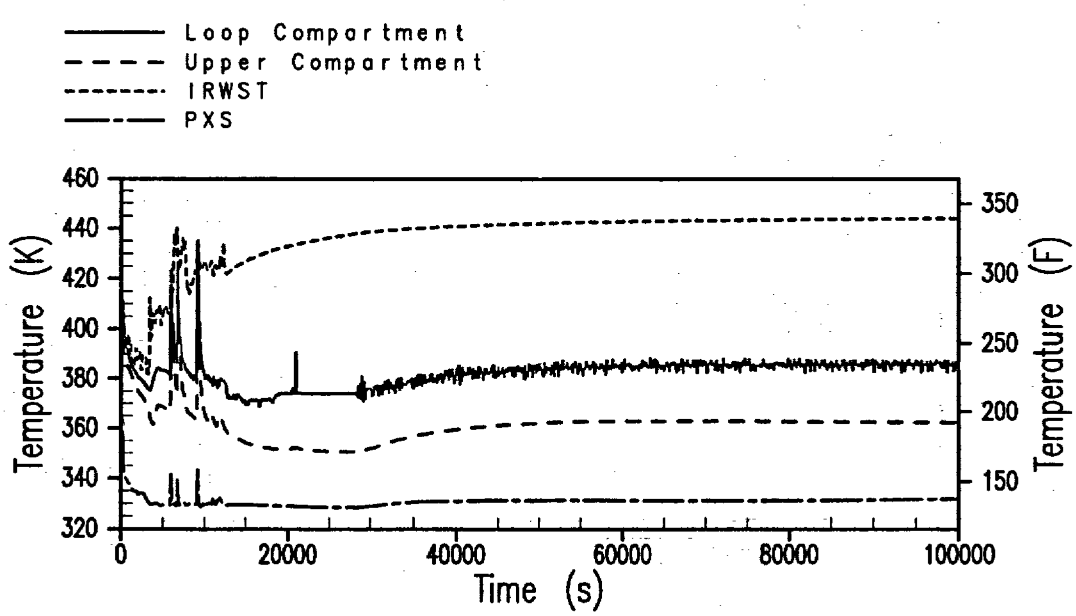


Figure 34-248

Case 3D-2: Containment Gas Temperature Spurious ADS-2 with Failed CMTs

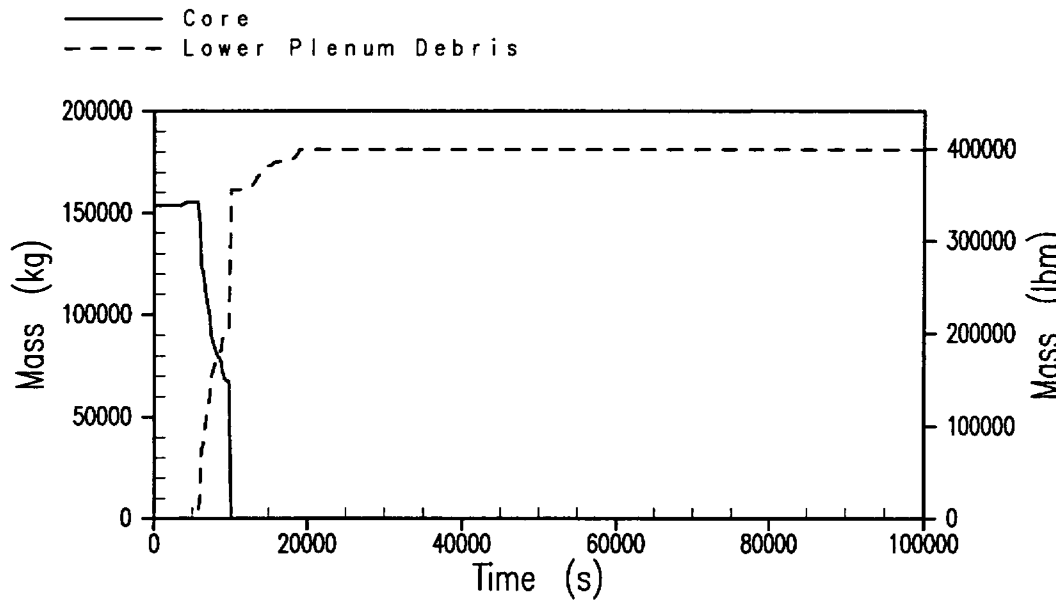


Figure 34-249

Case 3D-2: Core Mass
Spurious ADS-2 with Failed CMTs

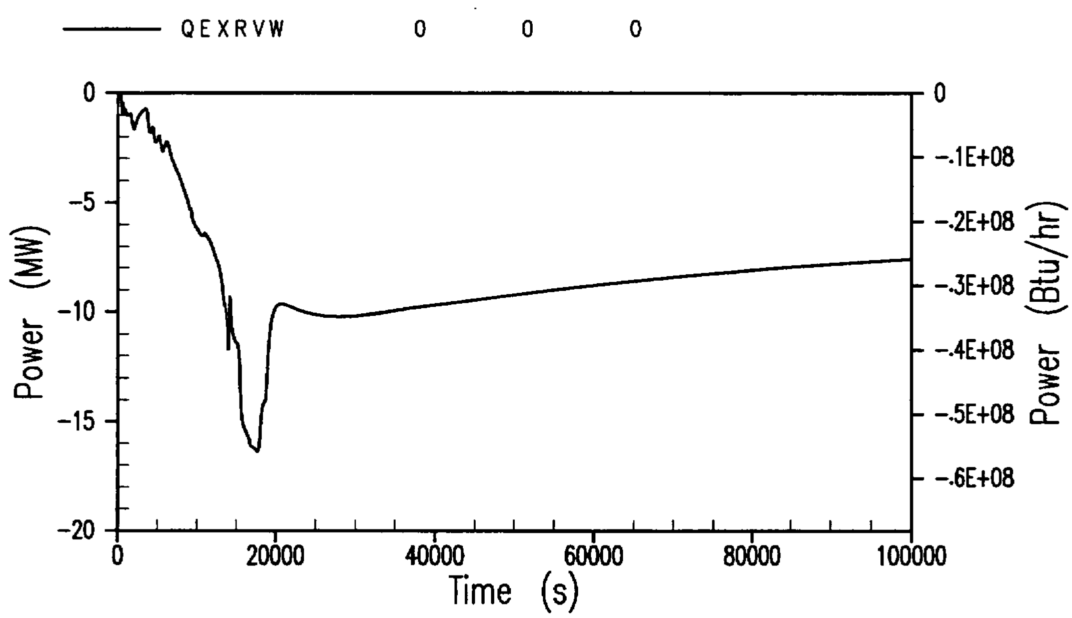


Figure 34-250

Case 3D-2: Reactor Pressure Vessel to Cavity Water Heat Transfer
Spurious ADS-2 with Failed CMTs

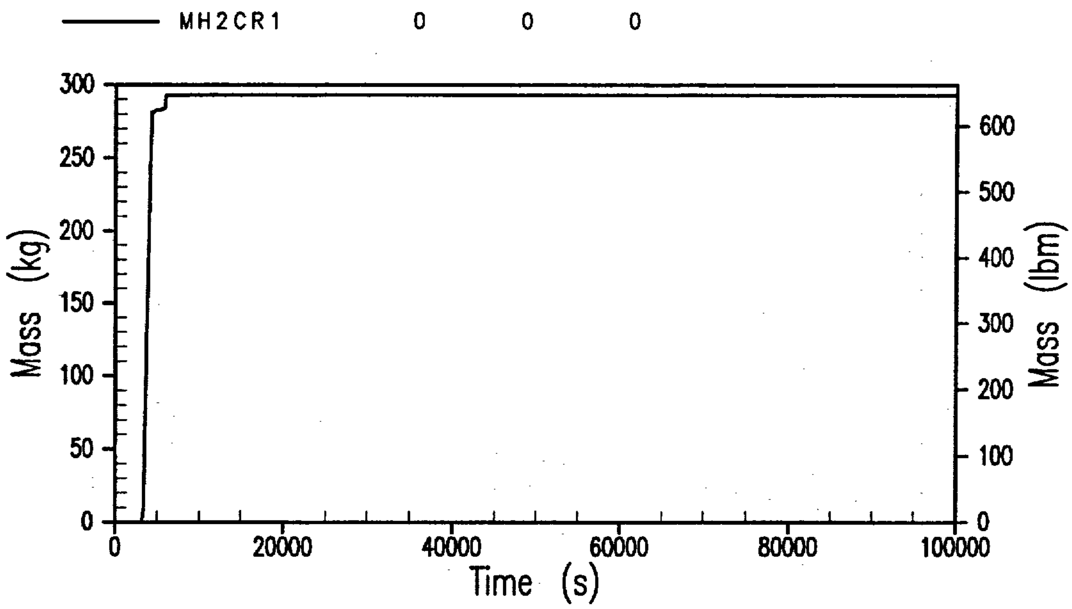


Figure 34-251

Case 3D-2: In-Vessel Hydrogen Generation
Spurious ADS-2 with Failed CMTs

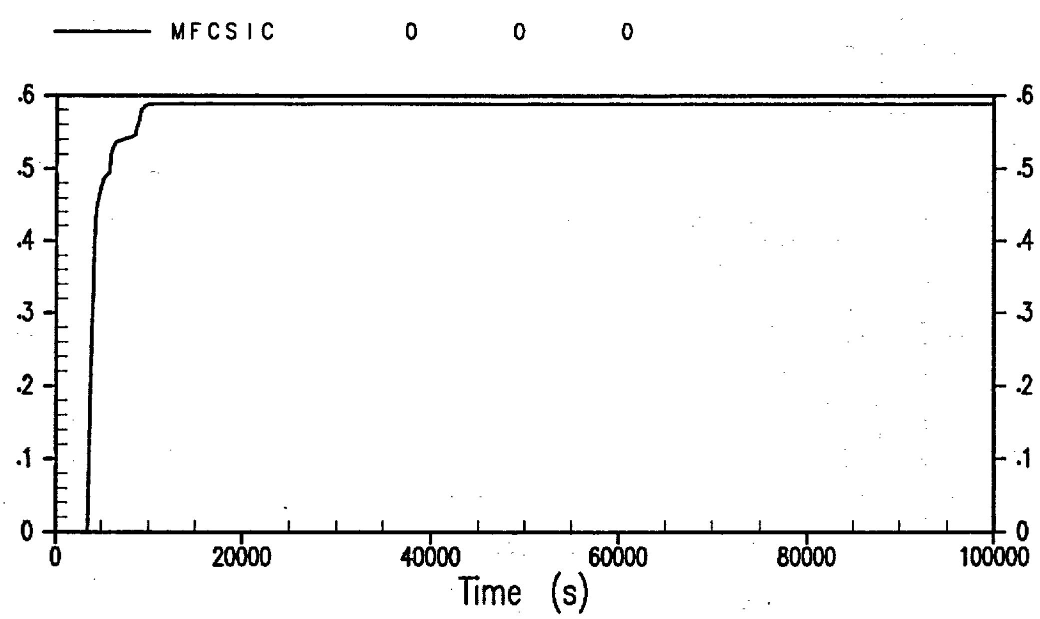


Figure 34-252

Case 3D-2: Mass Fraction of CsI Released to Containment
Spurious ADS-2 with Failed CMTs

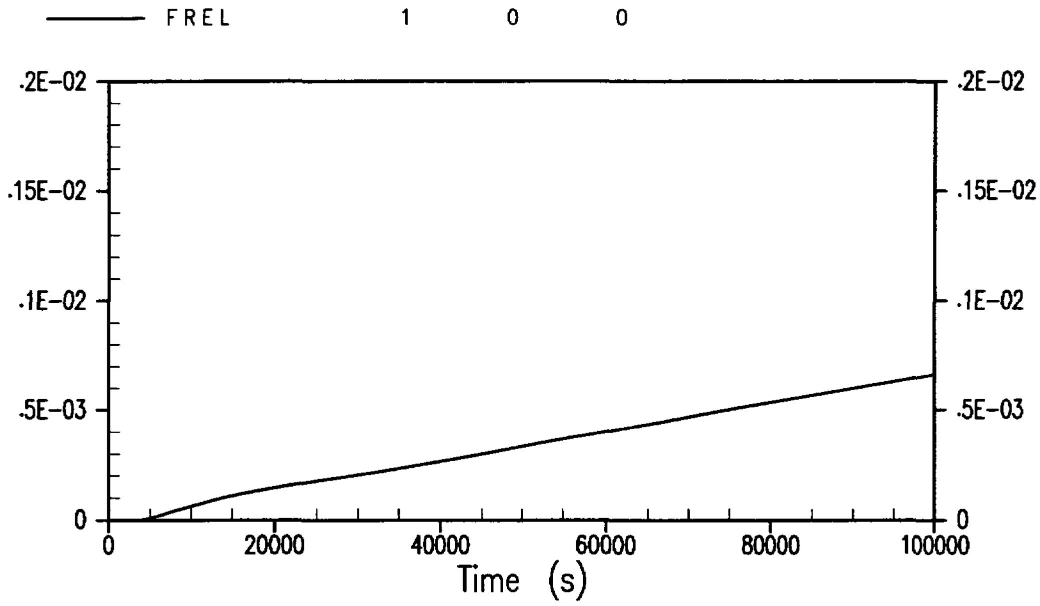


Figure 34-253

Case 3D-2: Mass Fraction of Noble Gas Released to Environment Spurious ADS-2 with Failed CMTs

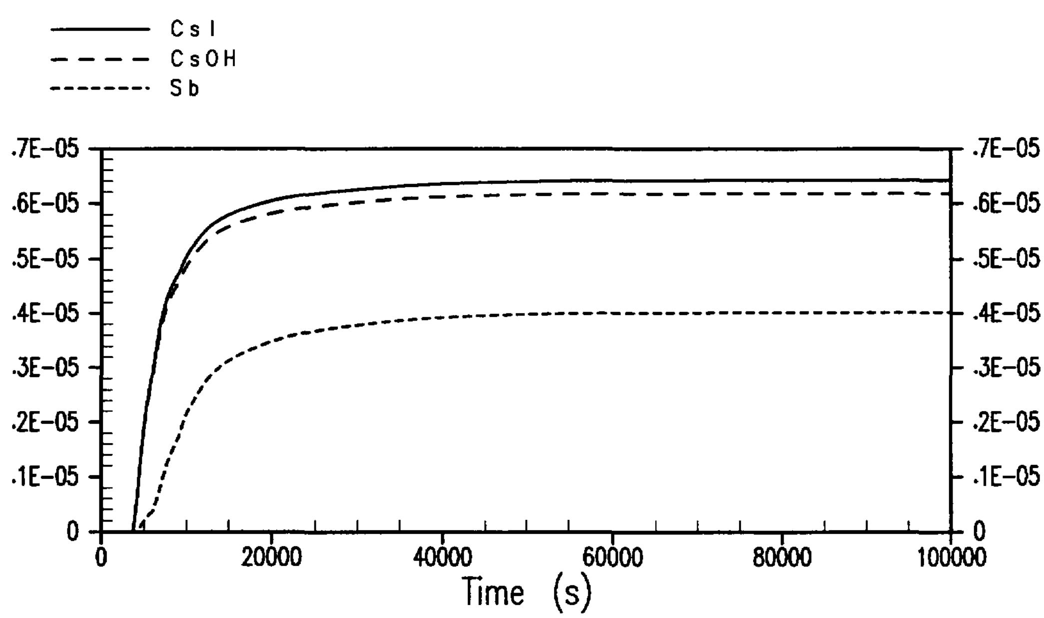


Figure 34-254

Case 3D-2: Mass Fraction of Fission Products Released to Environment Spurious ADS-2 with Failed CMTs

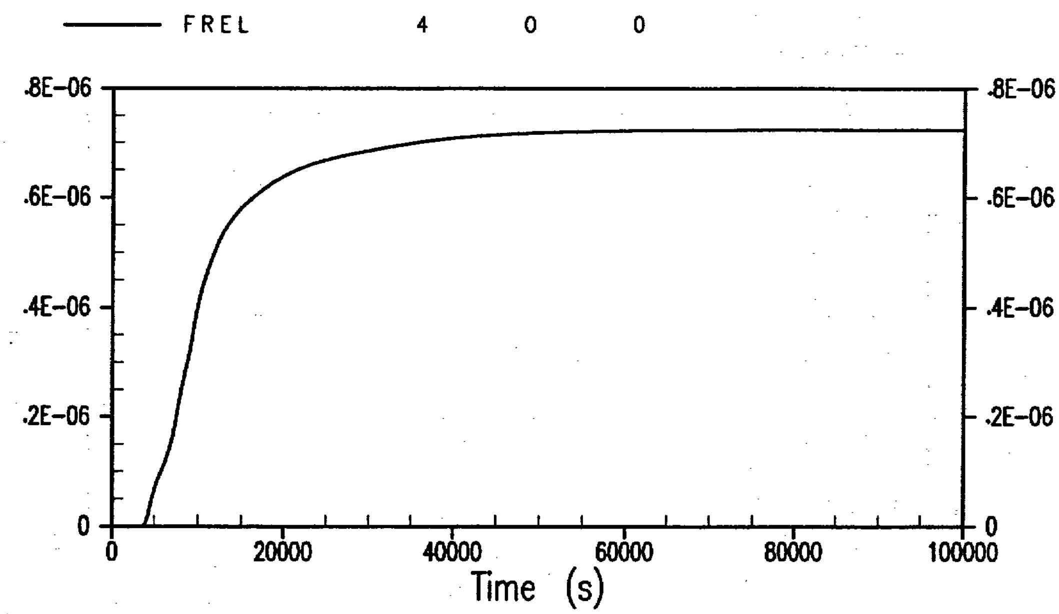


Figure 34-255

Case 3D-2: Mass Fraction of SrO Released to Environment Spurious ADS-2 with Failed CMTs

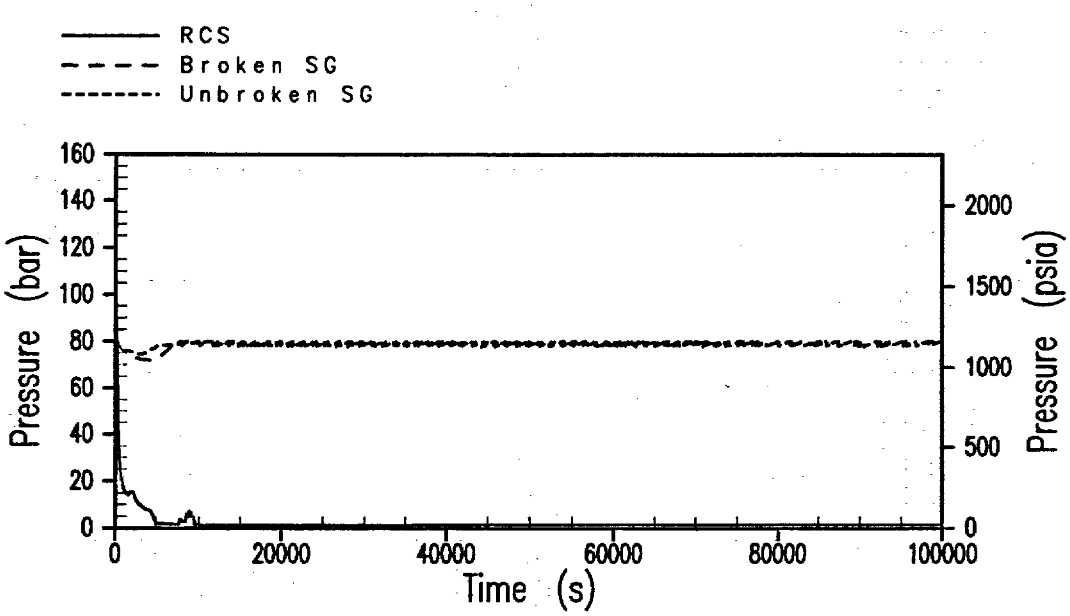


Figure 34-256

Case 3D-3: Reactor Coolant System and Steam Generator Pressure DVI Line Break with Failed ADS

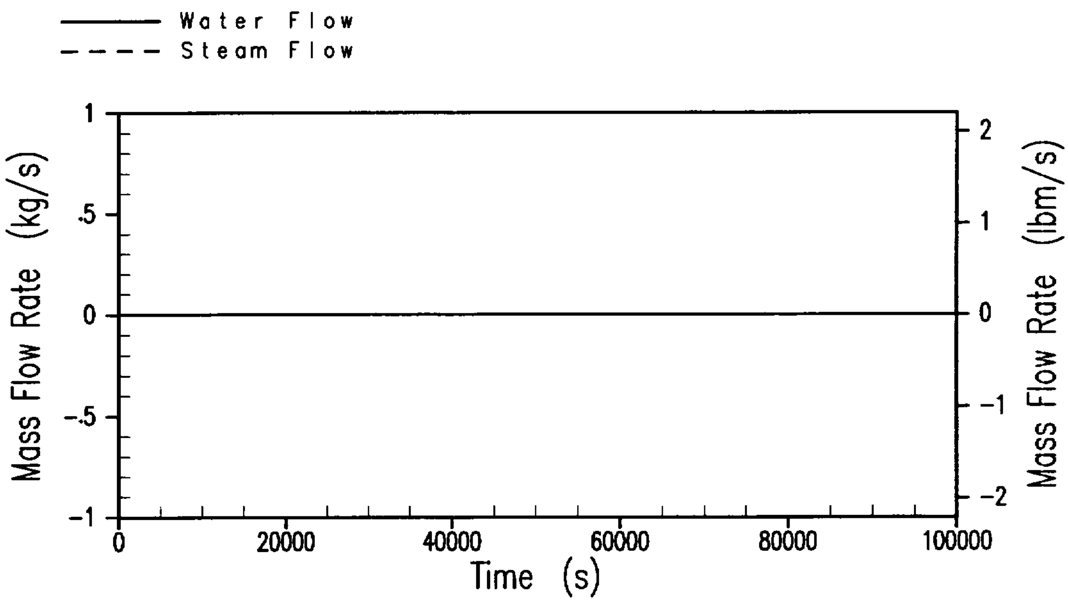


Figure 34-257

Case 3D-3: ADS Stage 4 Flow Rates DVI Line Break with Failed ADS

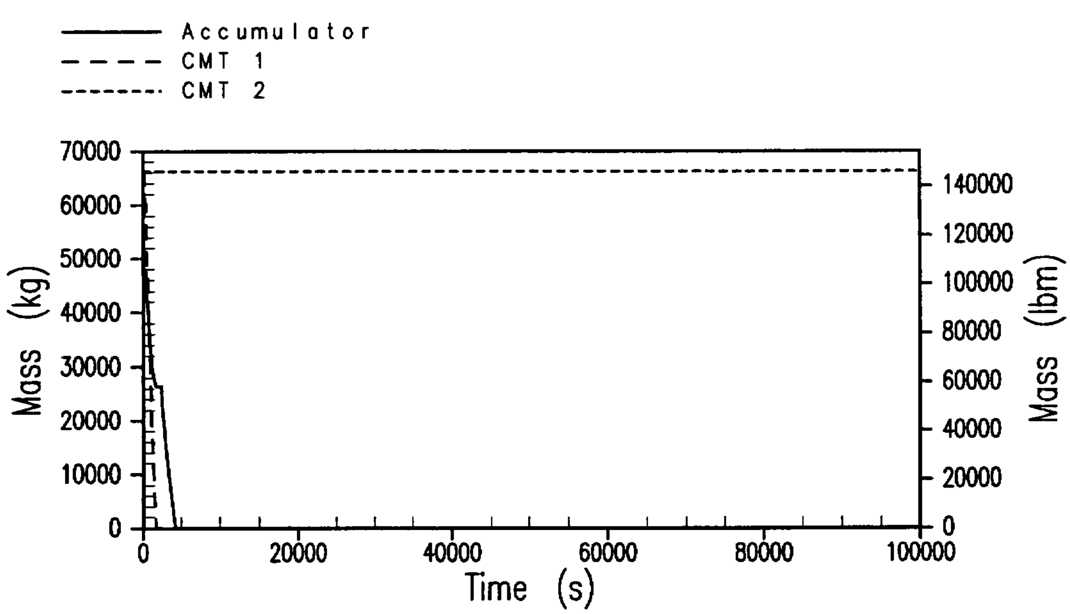


Figure 34-258

Case 3D-3: Accumulator/CMT Water Mass DVI Line Break with Failed ADS

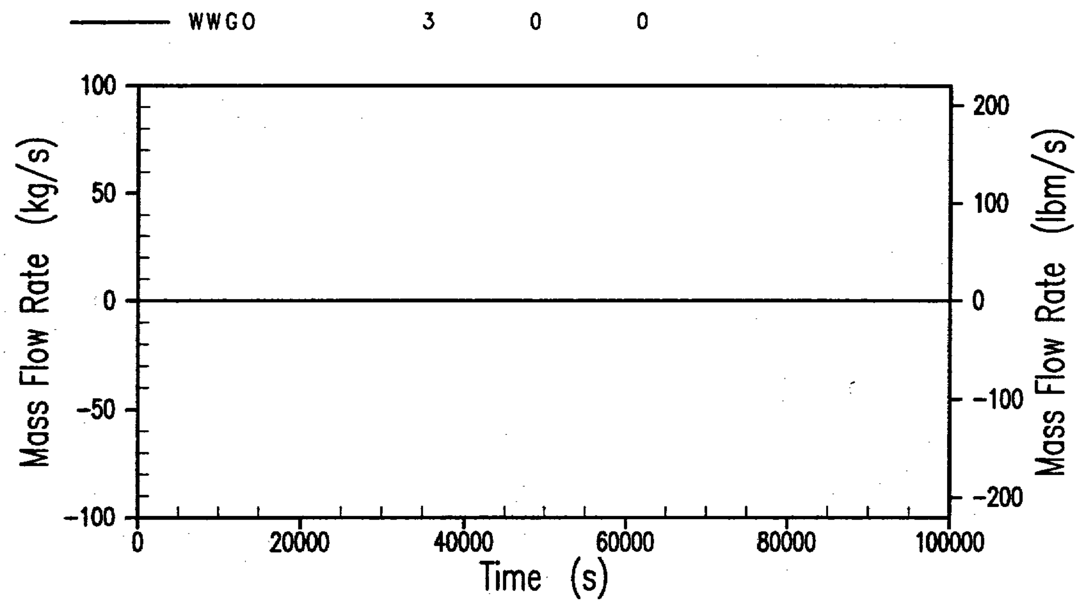


Figure 34-259

Case 3D-3: IRWST Injection Flow Rate
DVI Line Break with Failed ADS

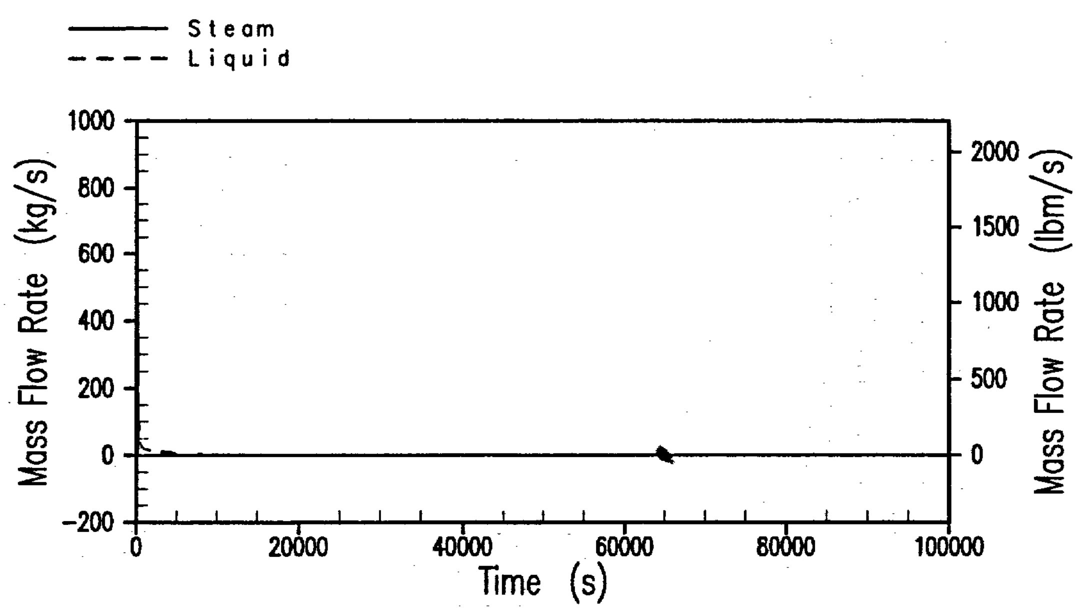


Figure 34-260

Case 3D-3: Break Flow Rate
DVI Line Break with Failed ADS

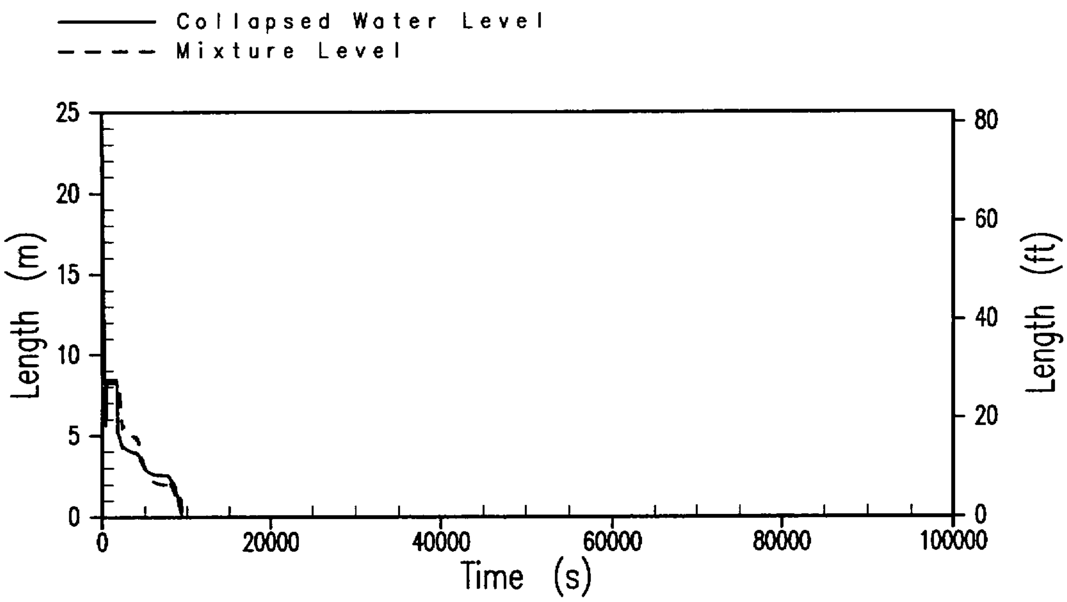


Figure 34-261

Case 3D-3: Reactor Vessel Water Level
DVI Line Break with Failed ADS

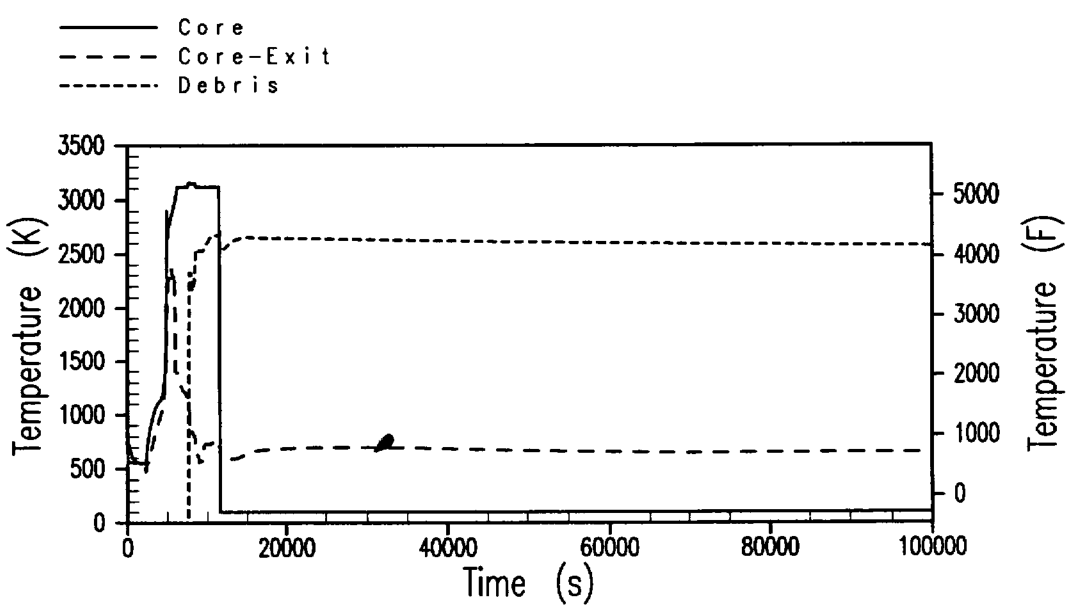


Figure 34-262

Case 3D-3: Core Temperatures
DVI Line Break with Failed ADS

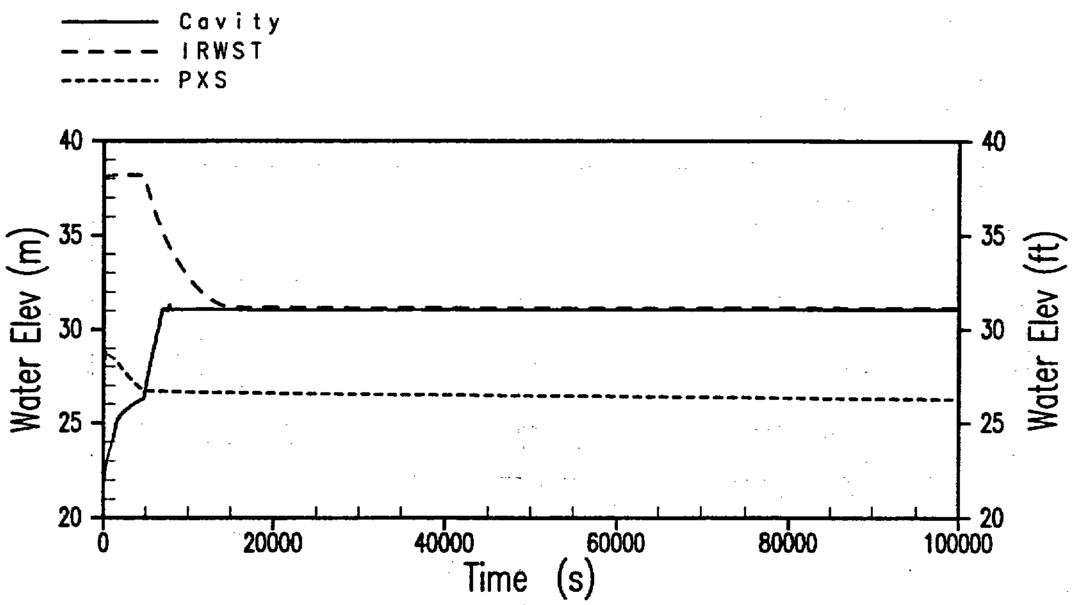


Figure 34-263

Case 3D-3: Containment Water Pool Elevations DVI Line Break with Failed ADS

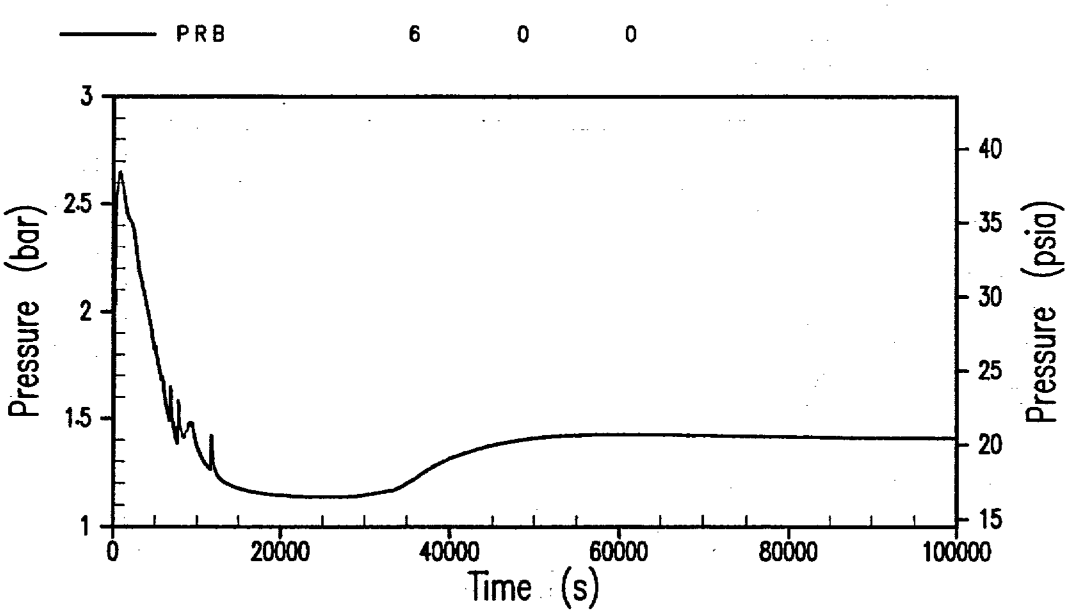


Figure 34-264

Case 3D-3: Containment Pressure DVI Line Break with Failed ADS

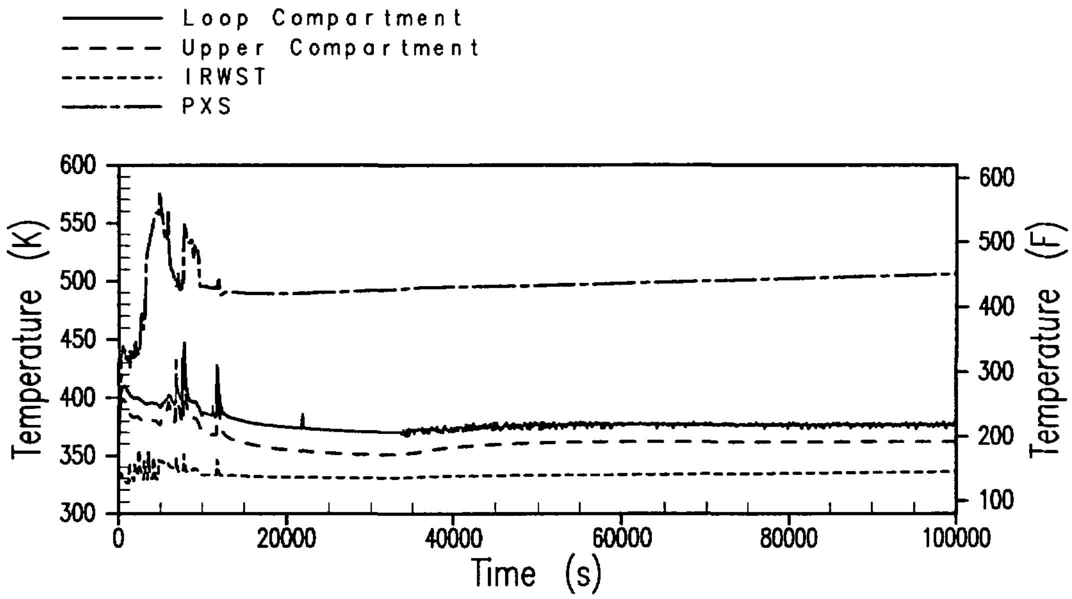


Figure 34-265

Case 3D-3: Containment Gas Temperature
DVI Line Break with Failed ADS

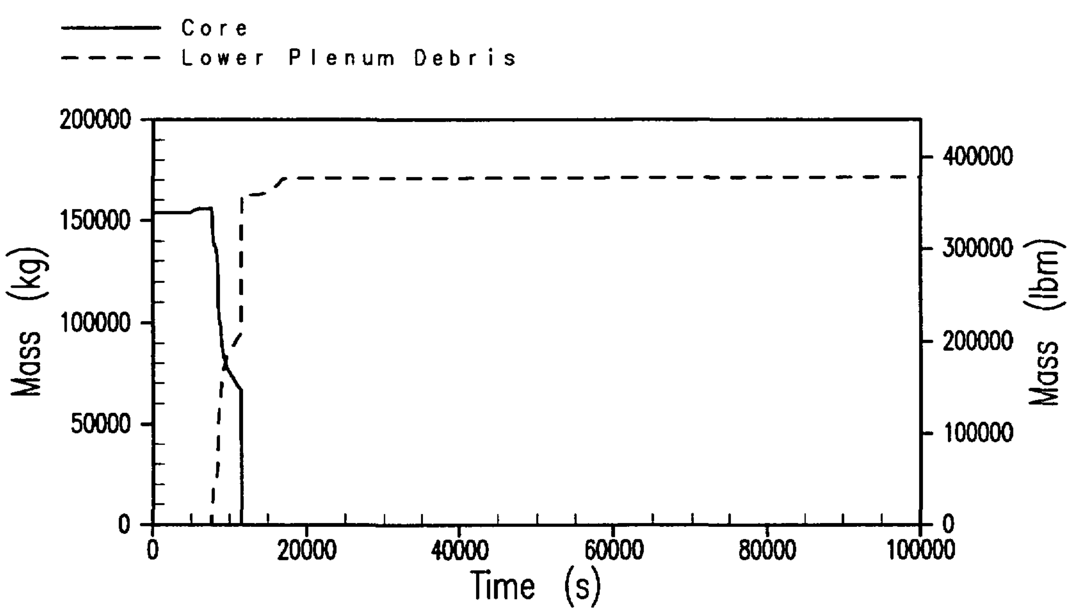


Figure 34-266

Case 3D-3: Core Mass
DVI Line Break with Failed ADS

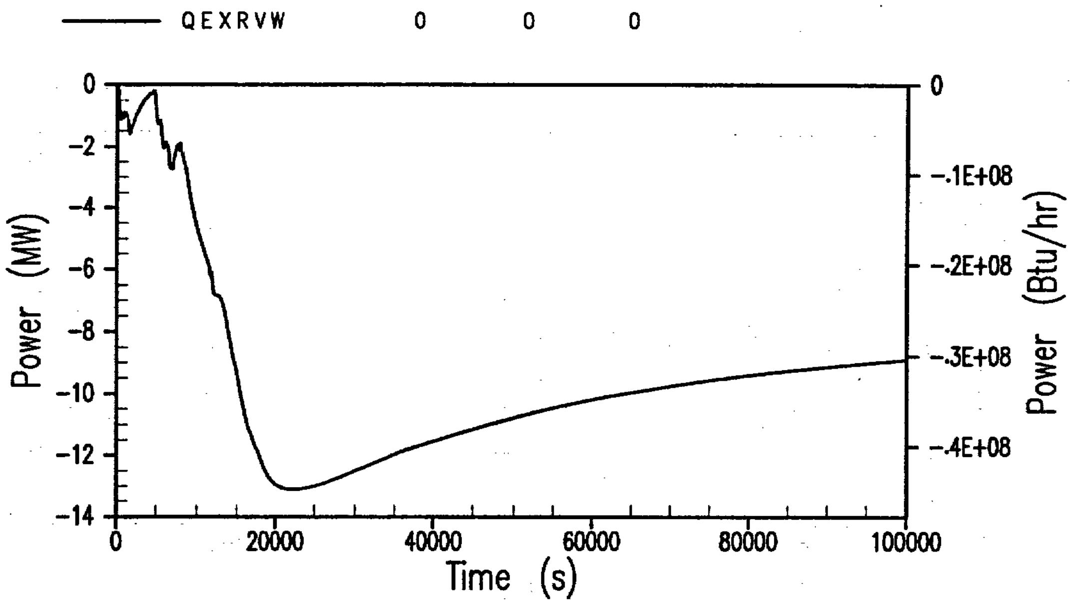


Figure 34-267

Case 3D-3: Reactor Pressure Vessel to Cavity Water Heat Transfer DVI Line Break with Failed ADS

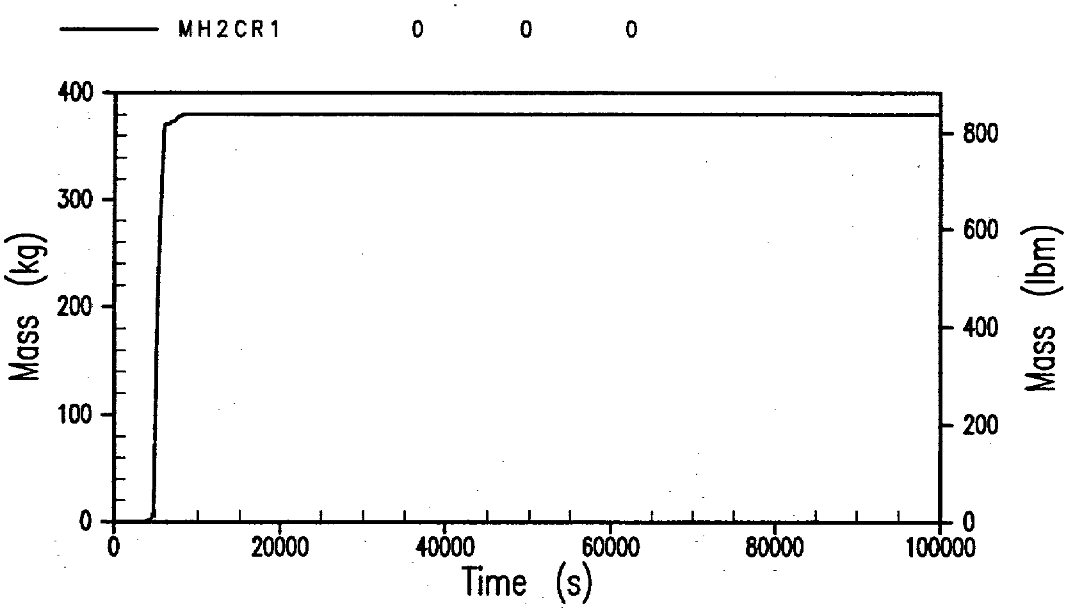


Figure 34-268

Case 3D-3: In-Vessel Hydrogen Generation DVI Line Break with Failed ADS

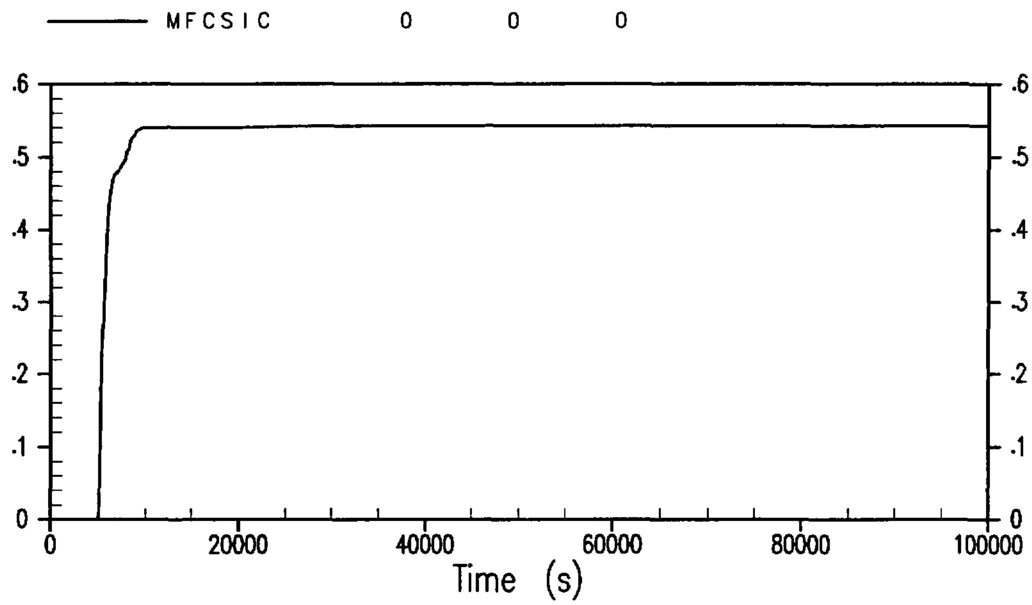


Figure 34-269

Case 3D-3: Mass Fraction of CsI Released to Containment
DVI Line Break with Failed ADS

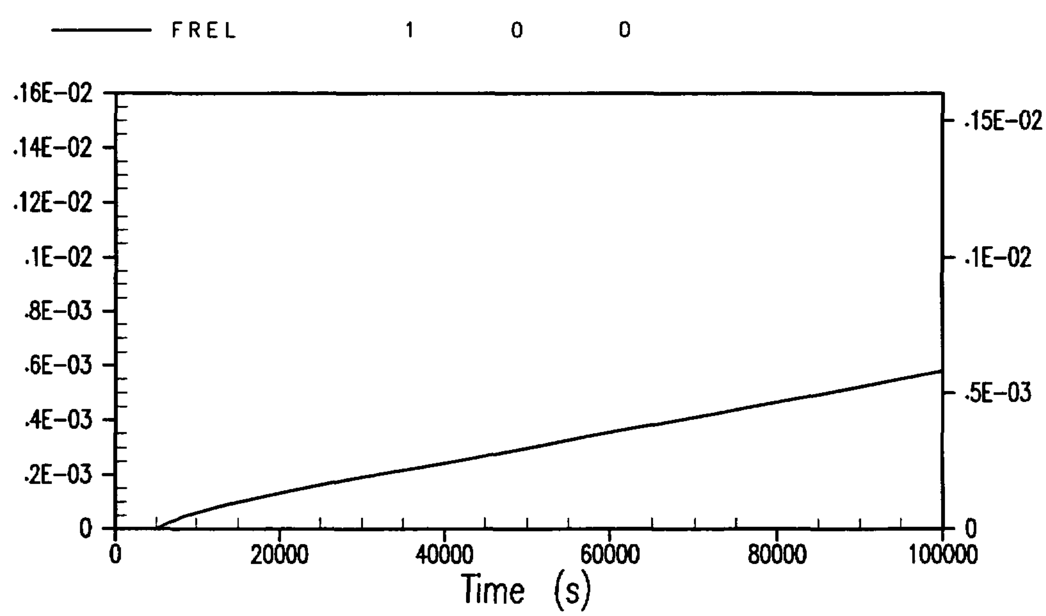


Figure 34-270

Case 3D-3: Mass Fraction of Noble Gases Released to Environment
DVI Line Break with Failed ADS

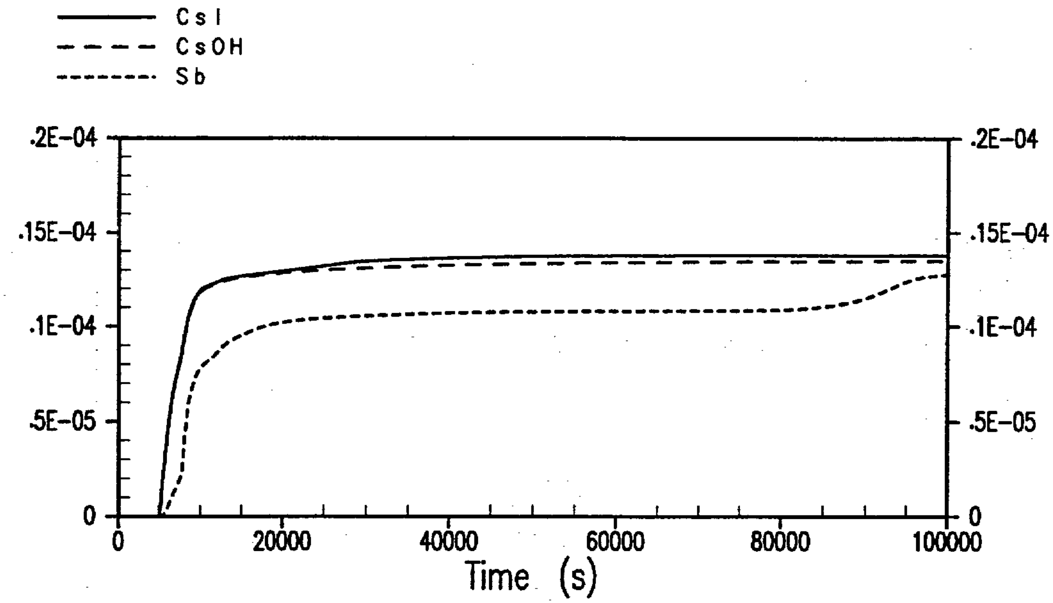


Figure 34-271

Case 3D-3: Mass Fraction of Fission Products Released to Environment DVI Line Break with Failed ADS

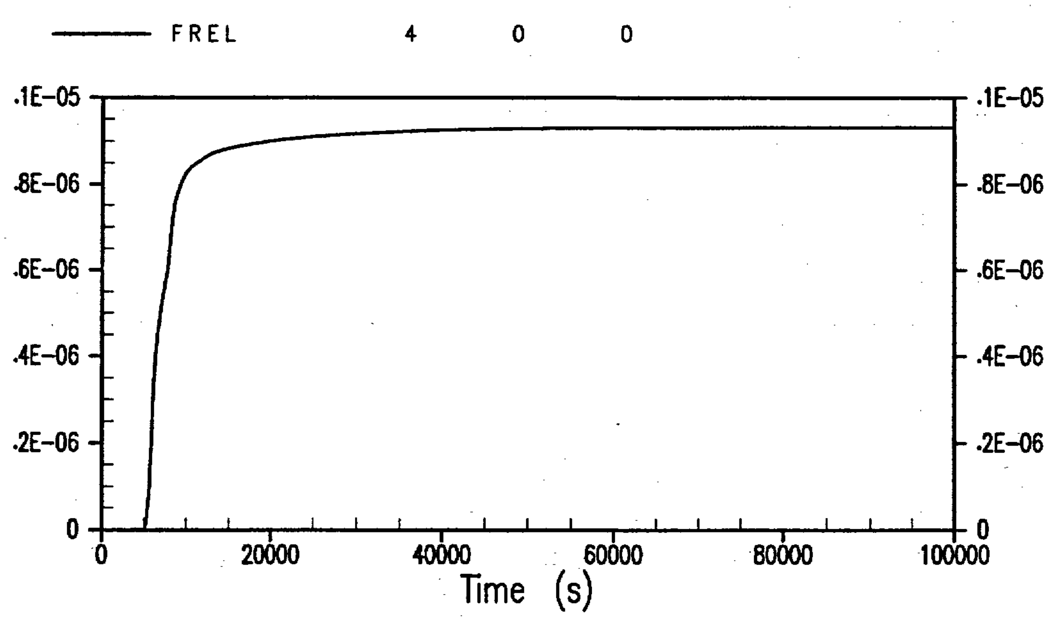


Figure 34-272

Case 3D-3: Mass Fraction of SrO Released to Environment DVI Line Break with Failed ADS

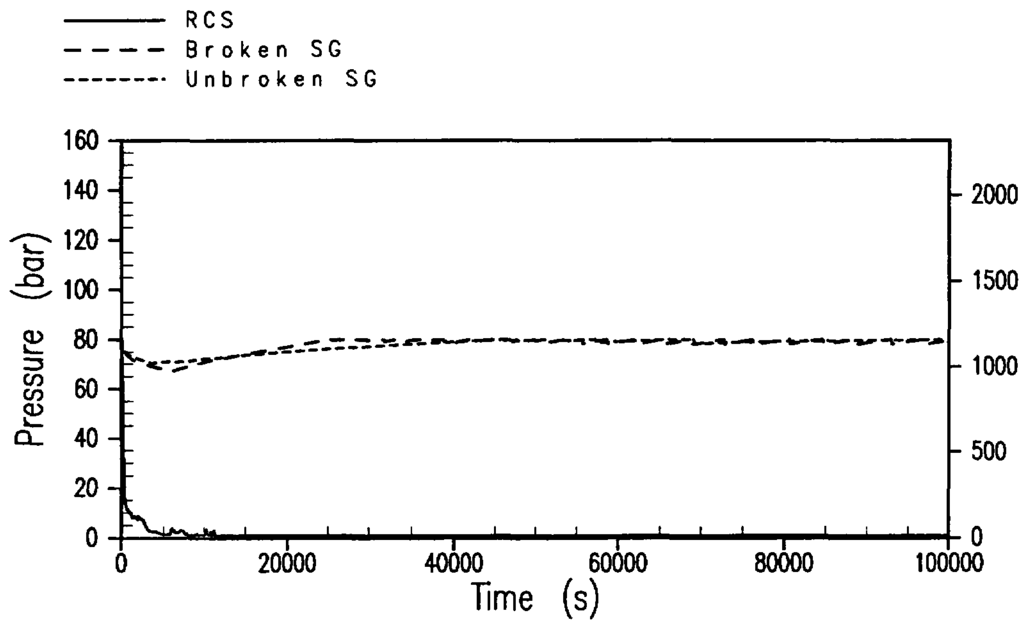


Figure 34-273

Case 3D-4: Reactor Coolant System and Steam Generator Pressure Spurious ADS-2, Failed CMTs, Diffusion Flame

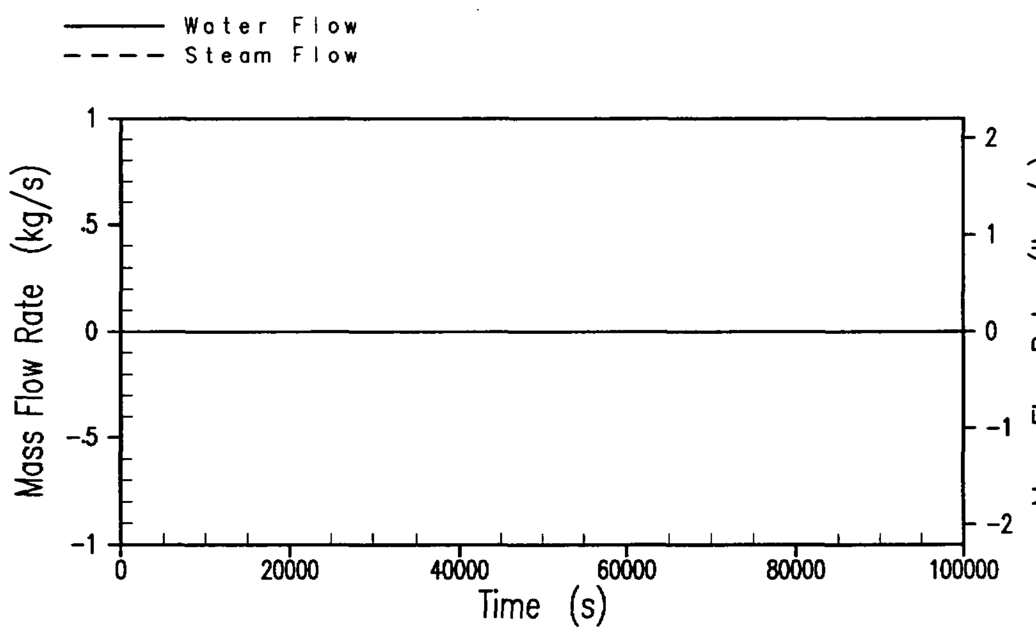


Figure 34-274

Case 3D-4: ADS Stage 4 Flow Rates Spurious ADS-2, Failed CMTs, Diffusion Flame

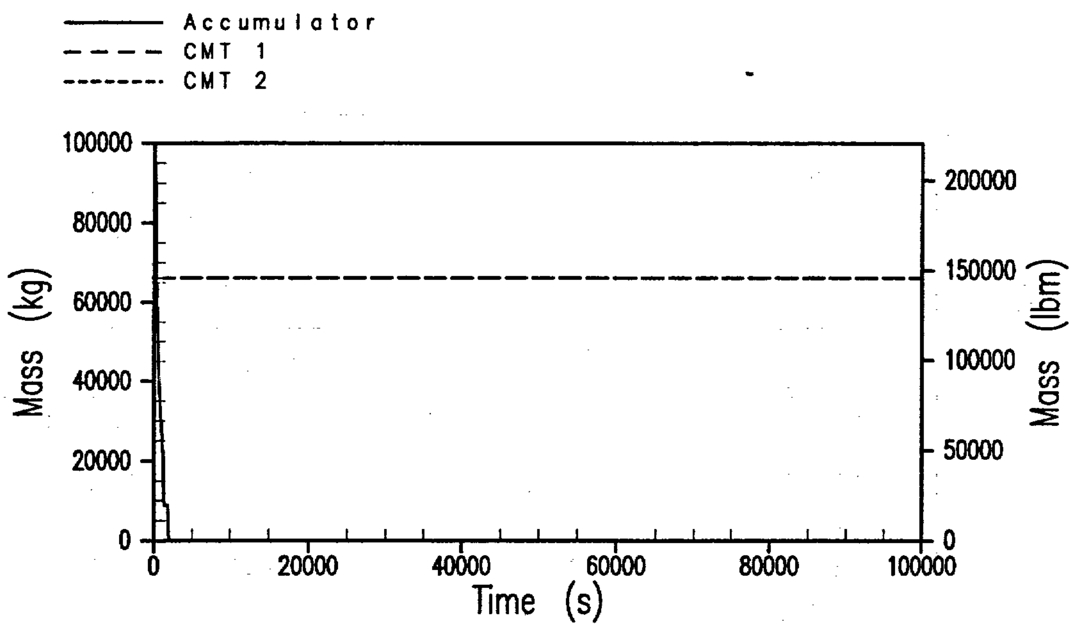


Figure 34-275

Case 3D-4: Accumulator/CMT Water Mass
Spurious ADS-2, Failed CMTs, Diffusion Flame

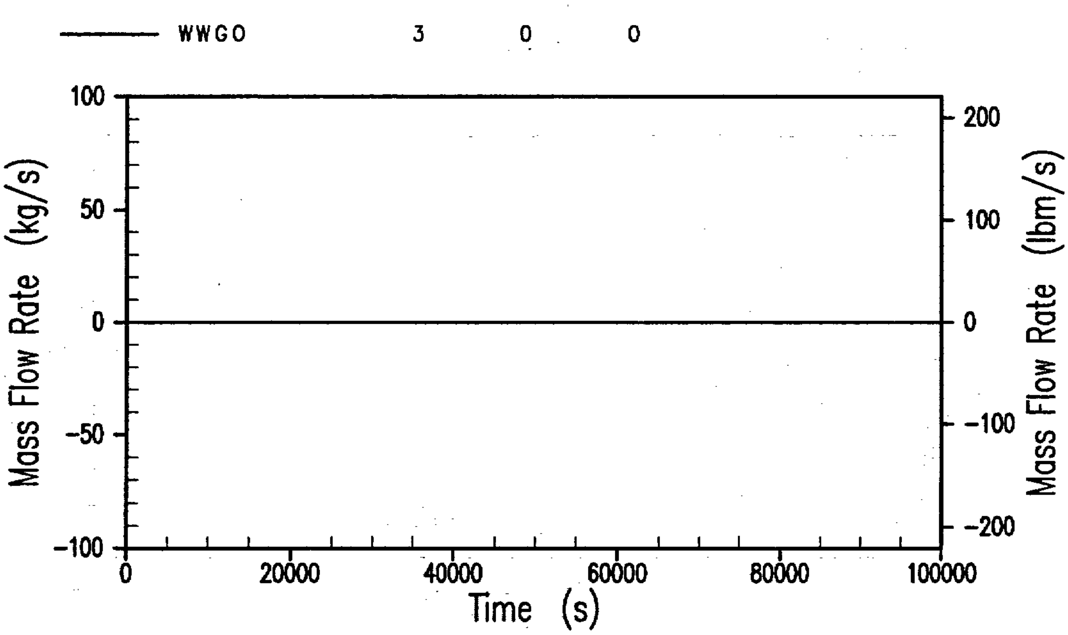


Figure 34-276

Case 3D-4: IRWST Injection Flow Rate
Spurious ADS-2, Failed CMTs, Diffusion Flame

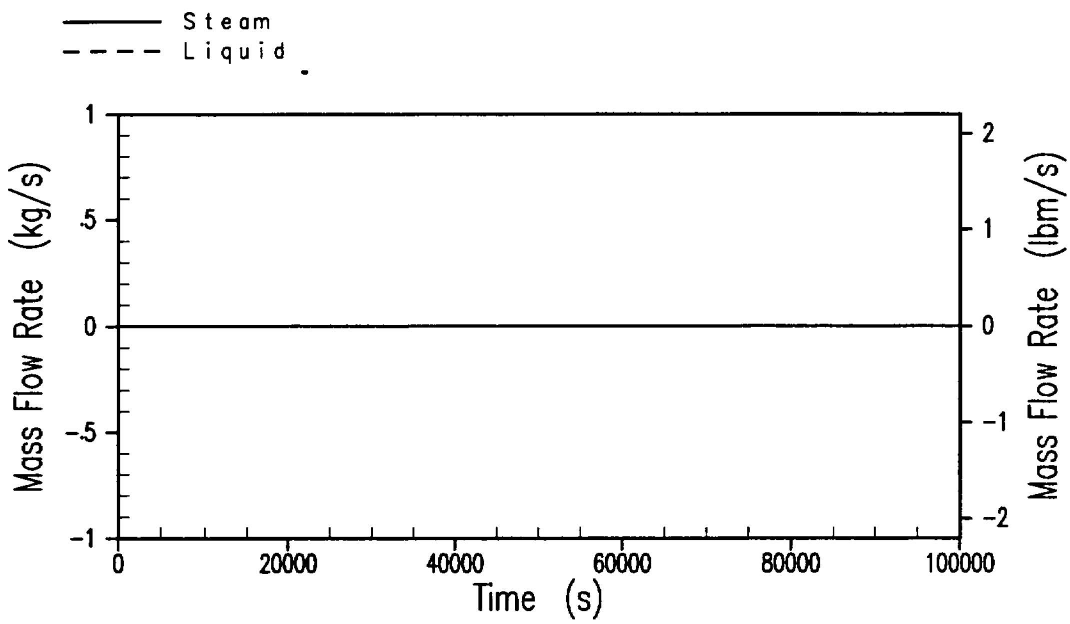


Figure 34-277

Case 3D-4: Break Flow Rate
Spurious ADS-2, Failed CMTs, Diffusion Flame

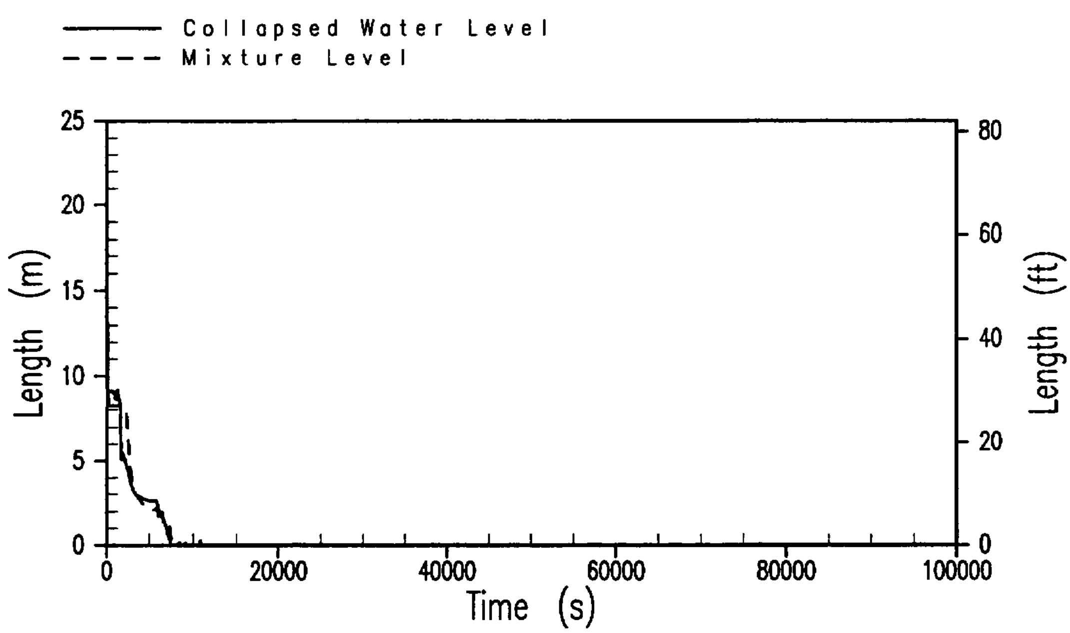


Figure 34-278

Case 3D-4: Reactor Vessel Water Level
Spurious ADS-2, Failed CMTs, Diffusion Flame

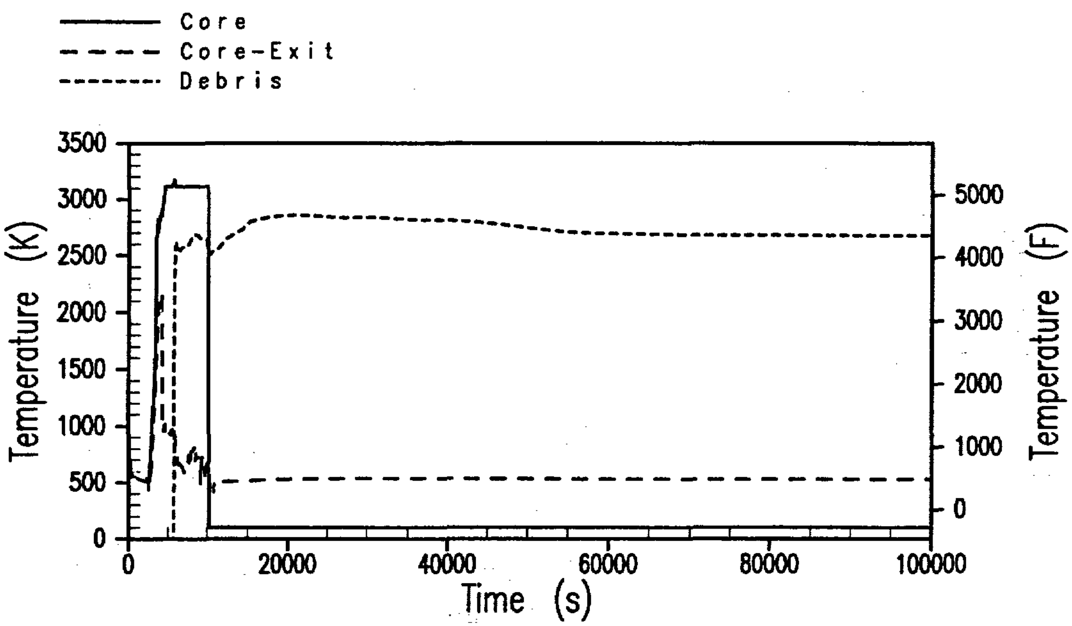


Figure 34-279

Case 3D-4: Core Temperatures
Spurious ADS-2, Failed CMTs, Diffusion Flame

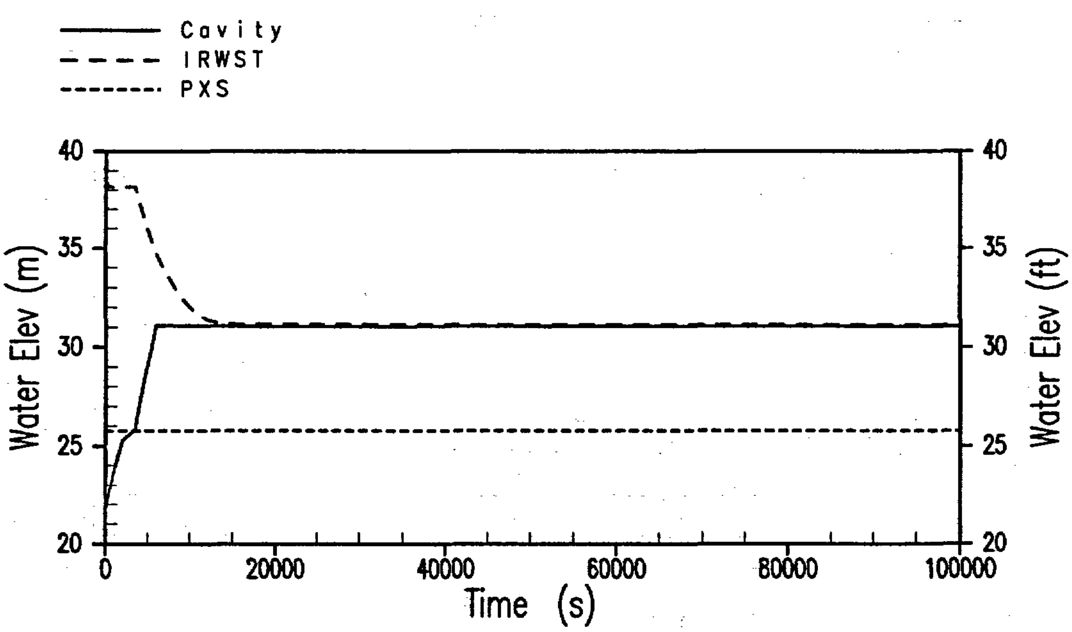


Figure 34-280

Case 3D-4: Containment Water Pool Elevations
Spurious ADS-2, Failed CMTs, Diffusion Flame

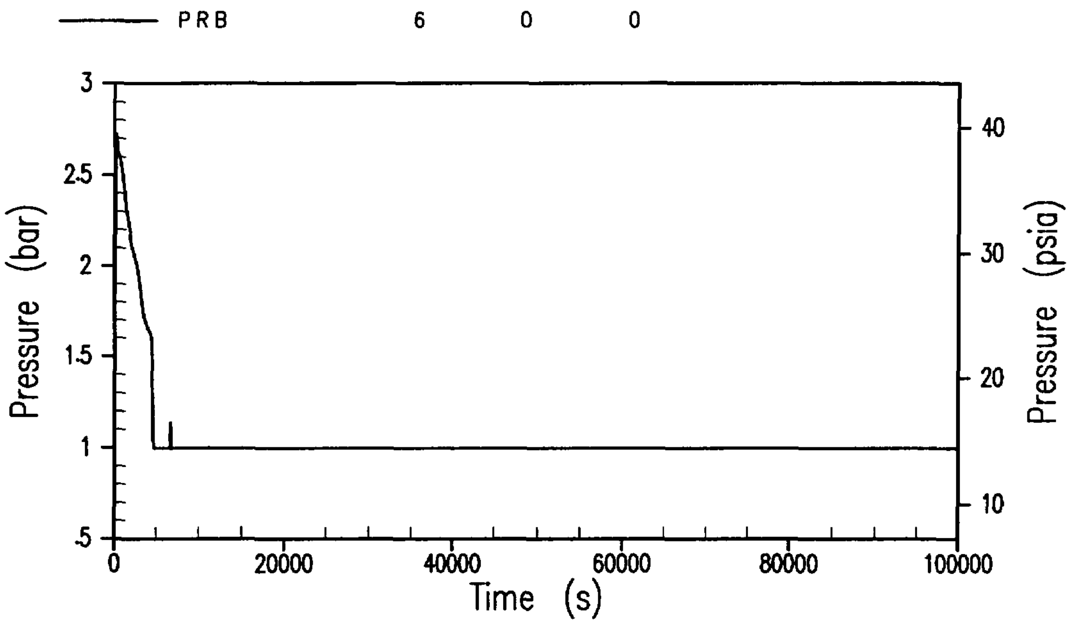


Figure 34-281

Case 3D-4: Containment Pressure
Spurious ADS-2, Failed CMTs, Diffusion Flame

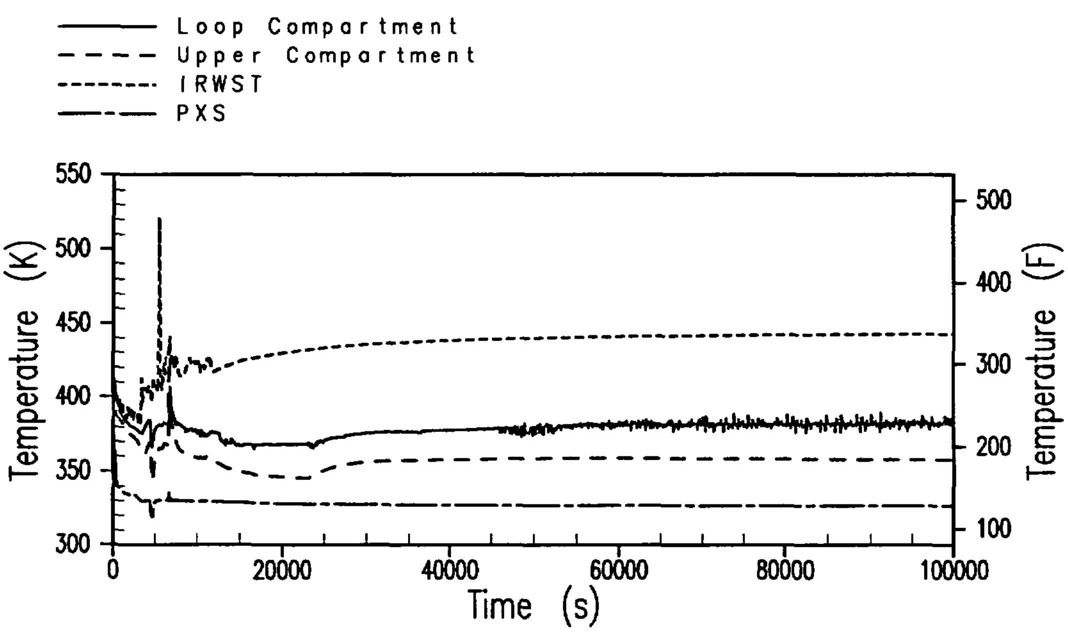


Figure 34-282

Case 3D-4: Containment Gas Temperature
Spurious ADS-2, Failed CMTs, Diffusion Flame

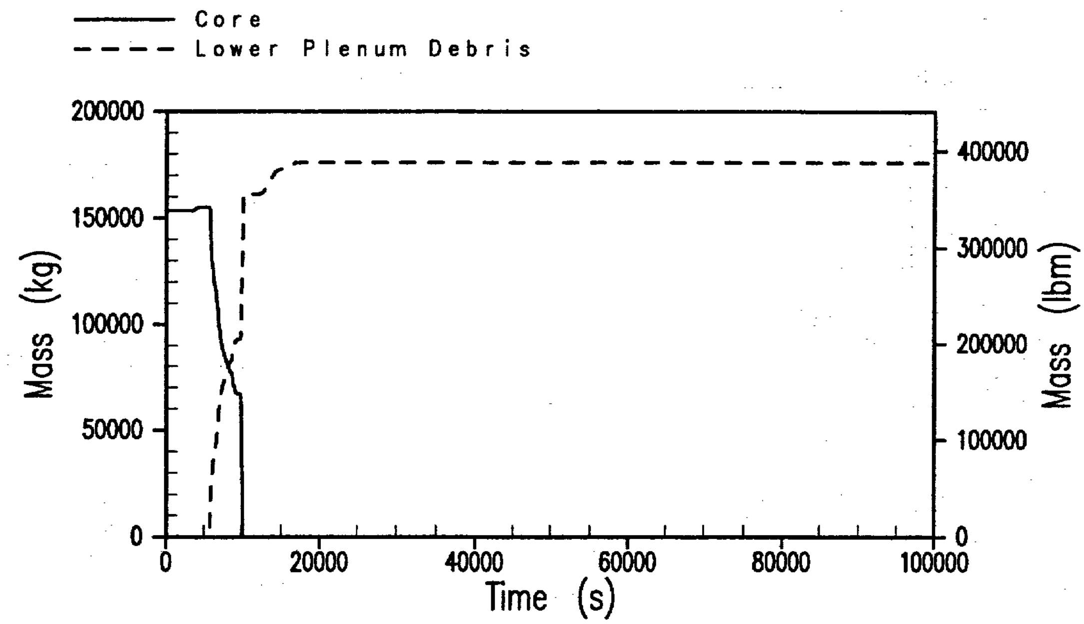


Figure 34-283

Case 3D-4: Core Mass
Spurious ADS-2, Failed CMTs, Diffusion Flame

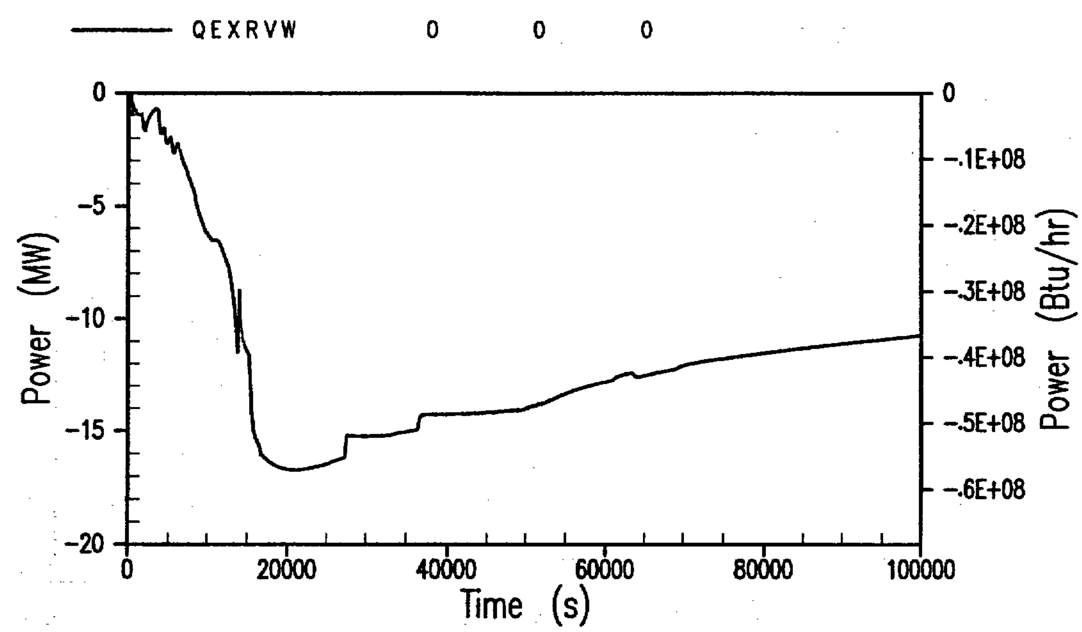


Figure 34-284

Case 3D-4: Reactor Pressure Vessel to Cavity Water Heat Transfer
Spurious ADS-2, Failed CMTs, Diffusion Flame

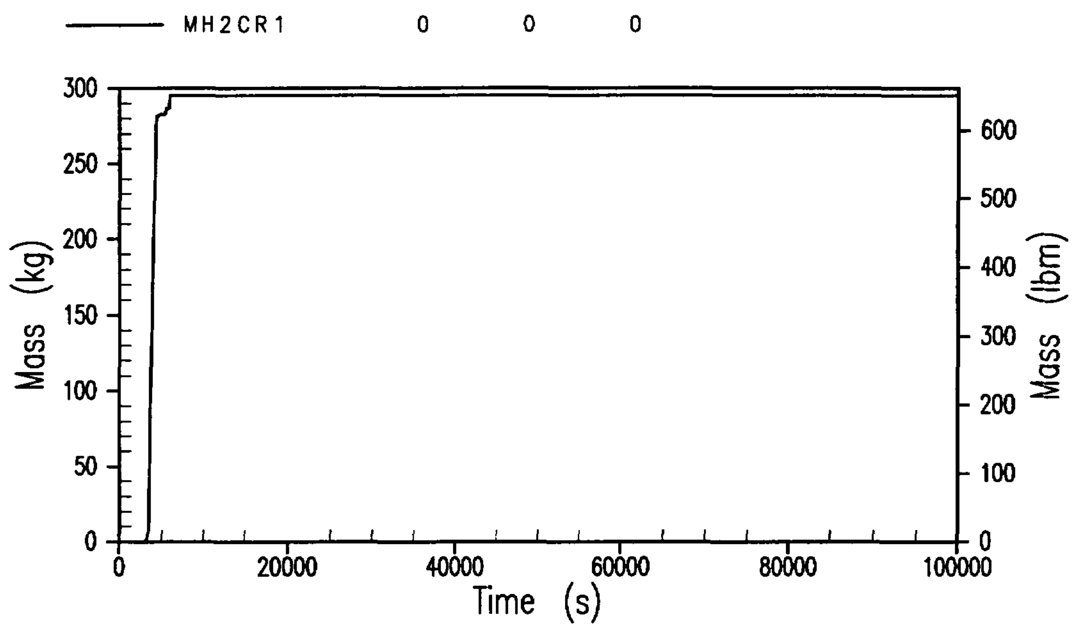


Figure 34-285

Case 3D-4: In-Vessel Hydrogen Generation
Spurious ADS-2, Failed CMTs, Diffusion Flame

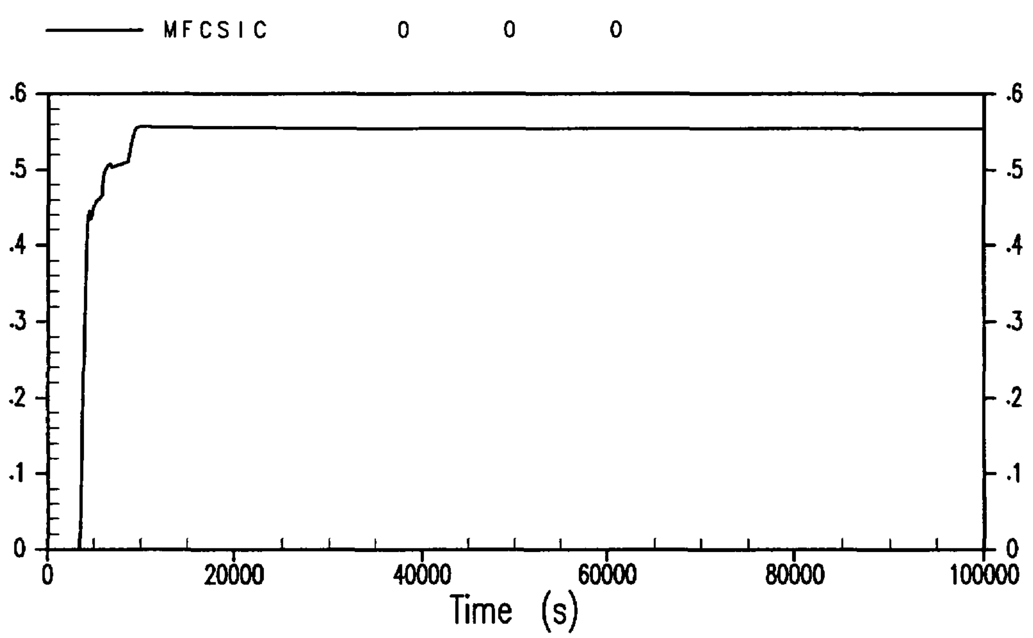


Figure 34-286

Case 3D-4: Mass Fraction of CsI Released to Containment
Spurious ADS-2, Failed CMTs, Diffusion Flame

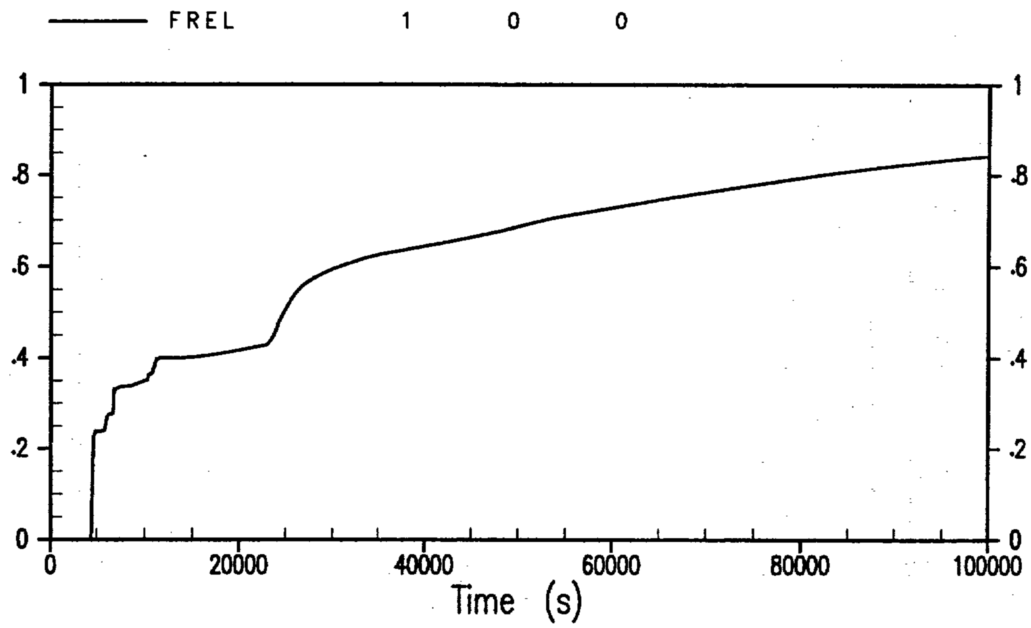


Figure 34-287

**Case 3D-4: Mass Fraction of Noble Gases Released to Environment
Spurious ADS-2, Failed CMTs, Diffusion Flame**

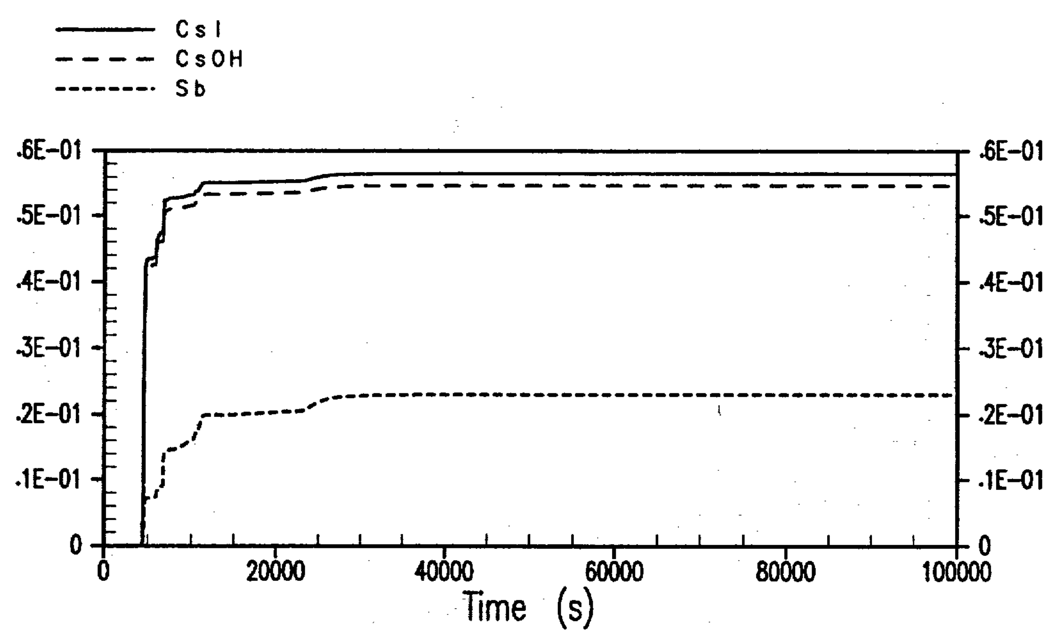


Figure 34-288

**Case 3D-4: Mass Fraction of Fission Products Released to Environment
Spurious ADS-2, Failed CMTs, Diffusion Flame**

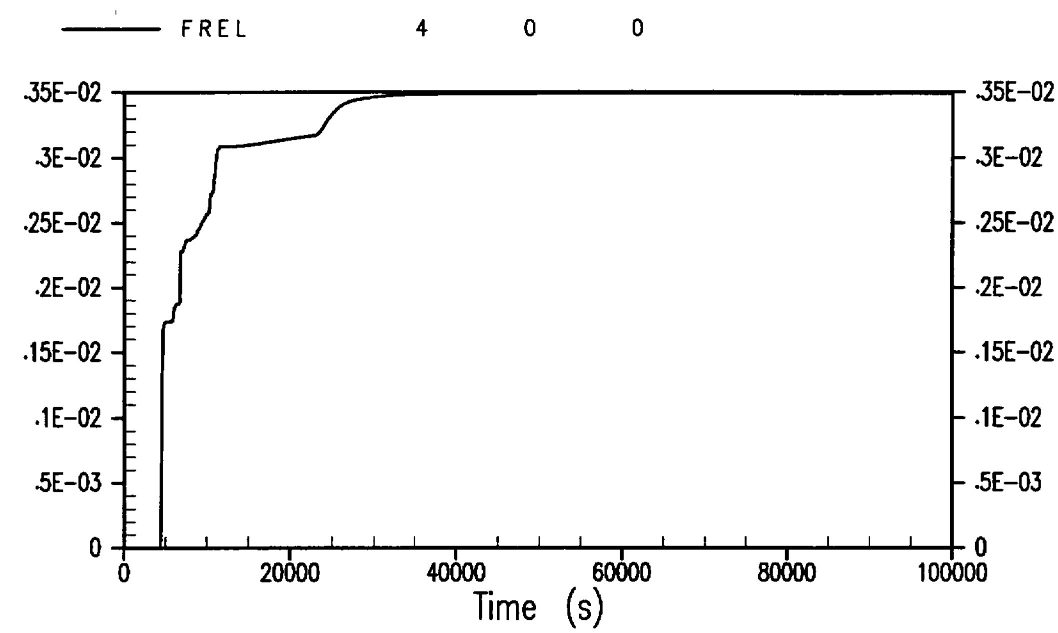


Figure 34-289

Case 3D-4: Mass Fraction of SrO Release to Environment
Spurious ADS-2, Failed CMTs, Diffusion Flame

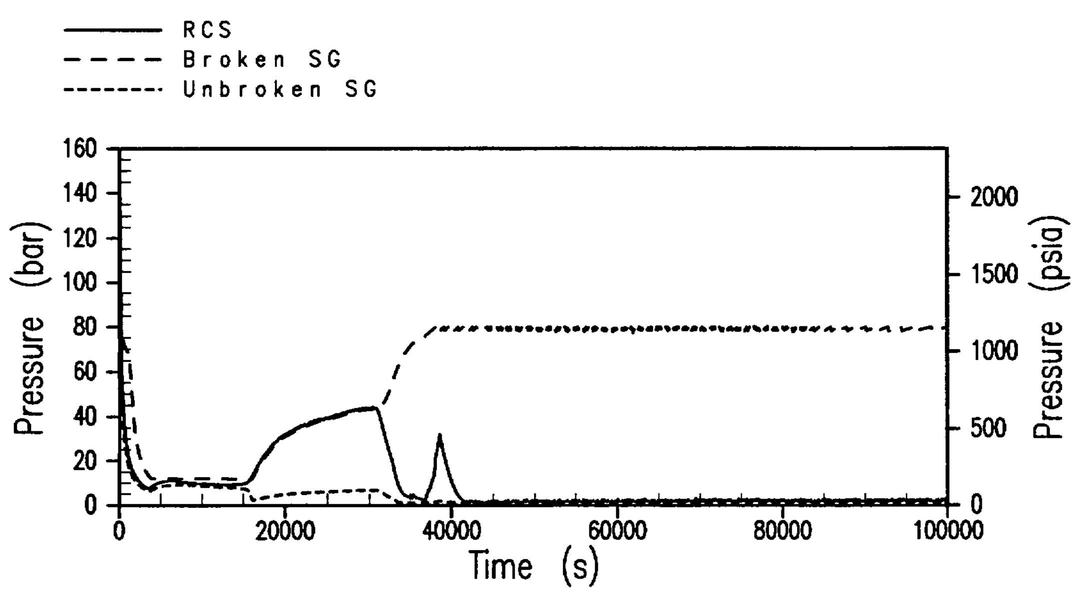


Figure 34-290

Case 6E-1: Reactor Coolant System and Steam Generator Pressure
SGTR Early Core Melt

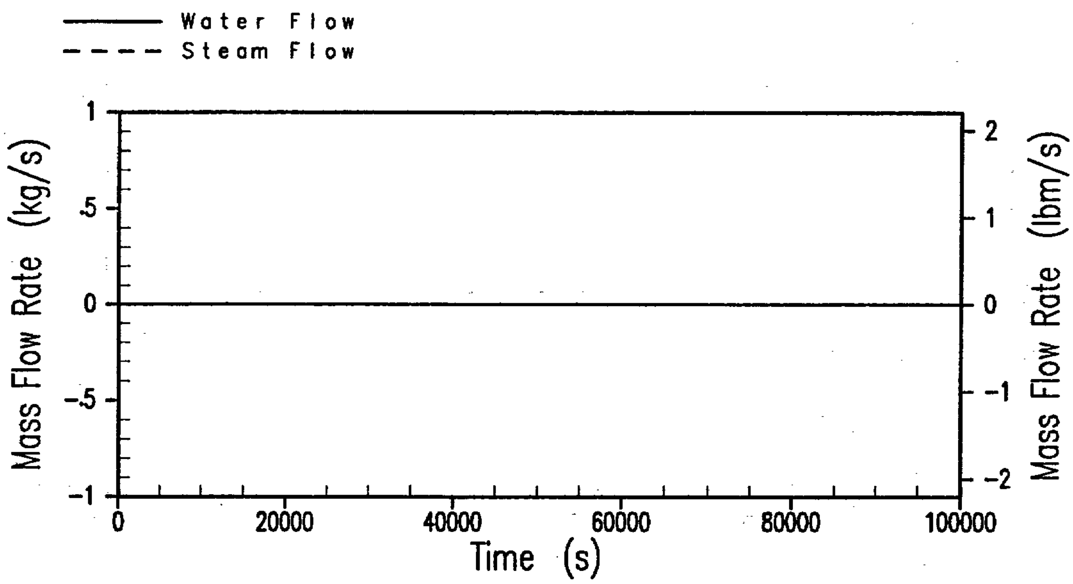


Figure 34-291

Case 6E-1: ADS Stage 4 Flow Rates
SGTR Early Core Melt

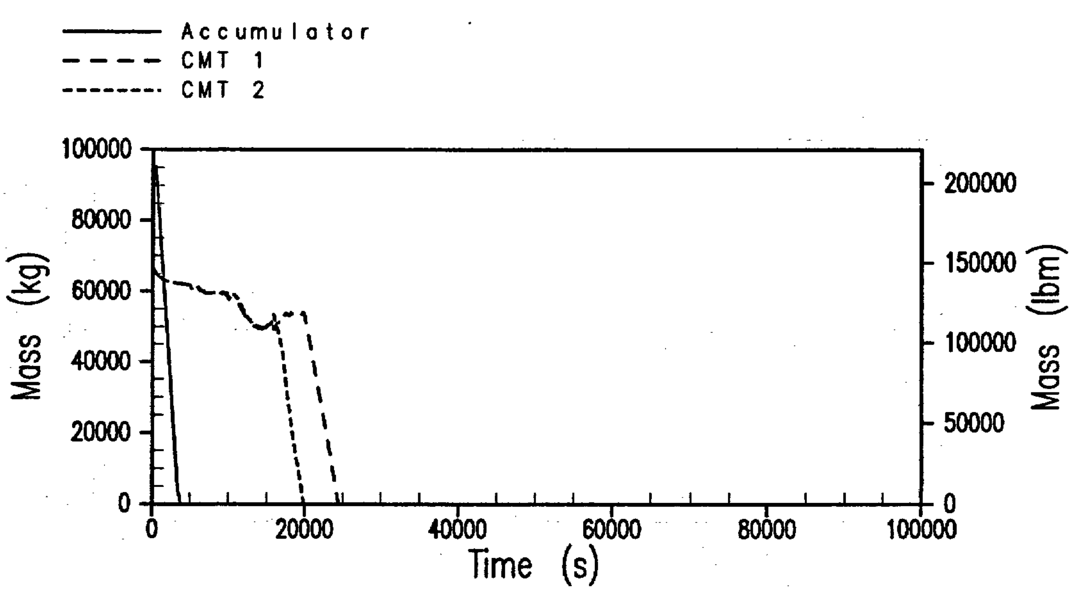


Figure 34-292

Case 6E-1: Accumulator/CMT Water Mass
SGTR Early Core Melt

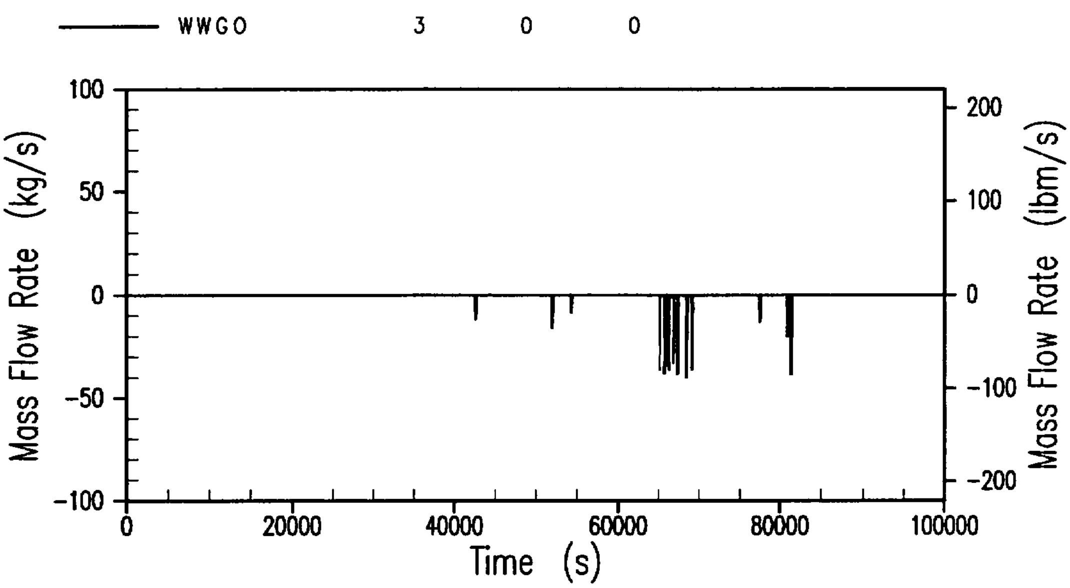


Figure 34-293

Case 6E-1: IRWST Injection Flow Rate SGTR Early Core Melt

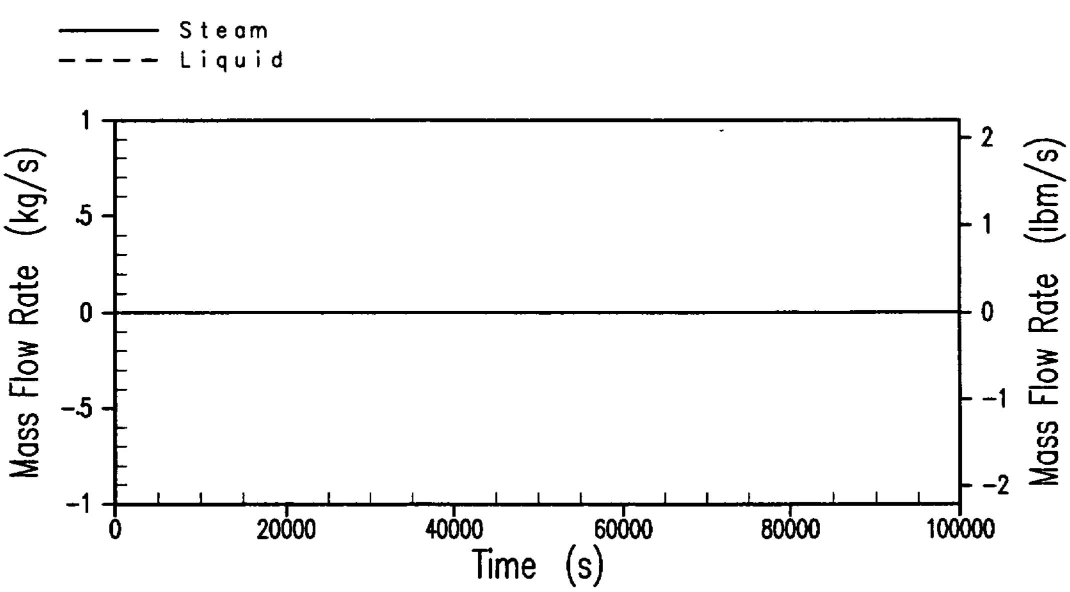


Figure 34-294

Case 6E-1: Break Flow Rate SGTR Early Core Melt

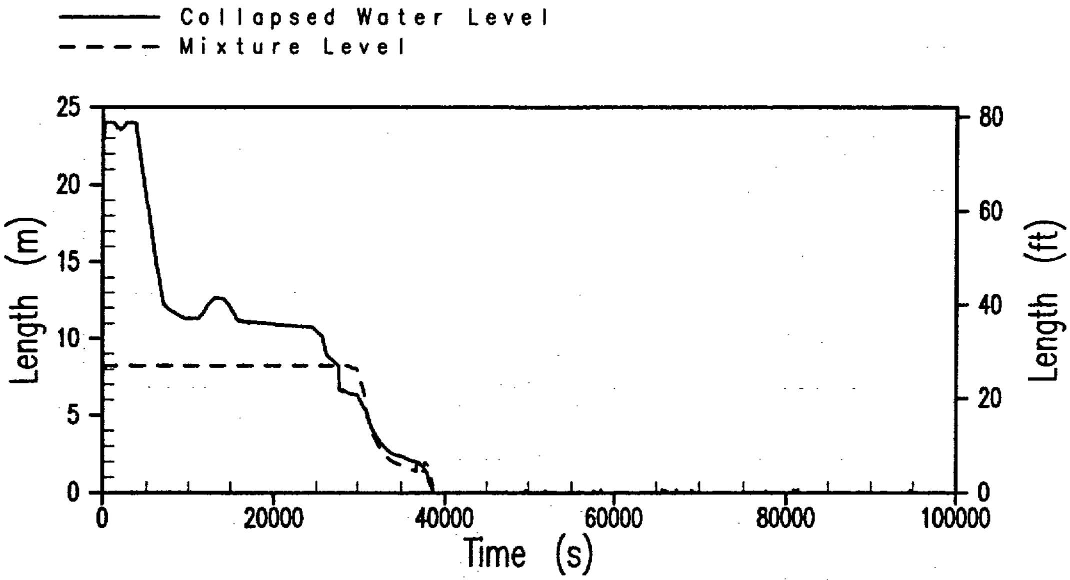


Figure 34-295

Case 6E-1: Reactor Vessel Water Level SGTR Early Core Melt

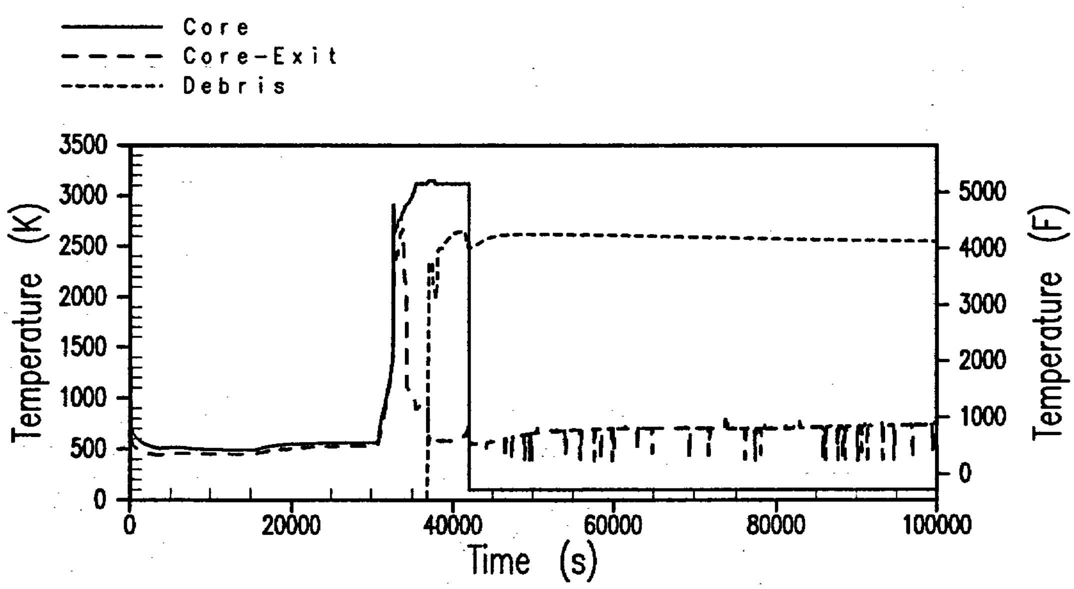


Figure 34-296

Case 6E-1: Core Temperatures SGTR Early Core Melt

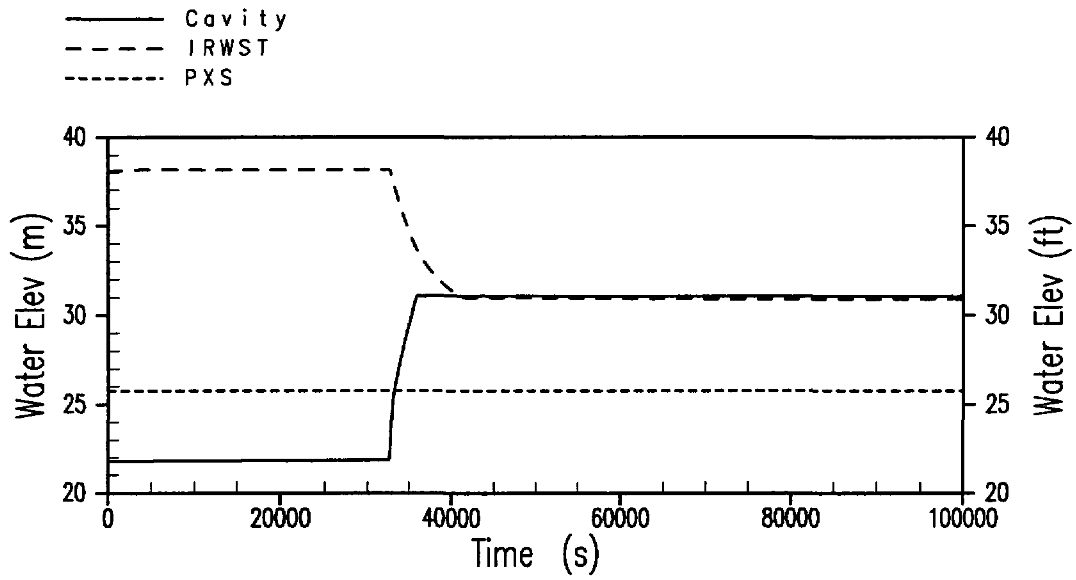


Figure 34-297

Case 6E-1: Containment Water Pool Elevations
SGTR Early Core Melt

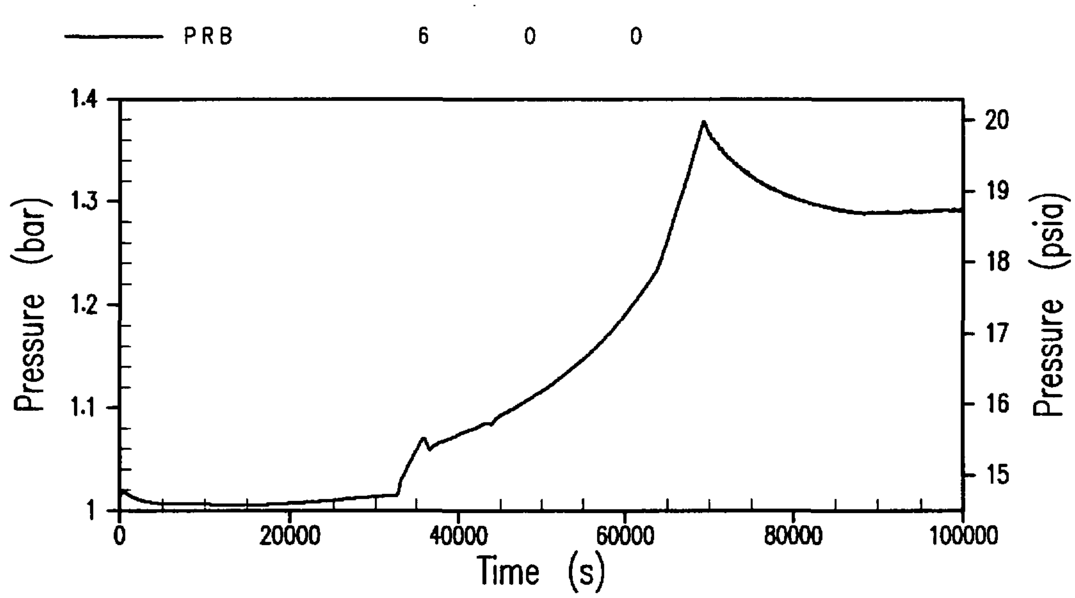


Figure 34-298

Case 6E-1: Containment Pressure
SGTR Early Core Melt

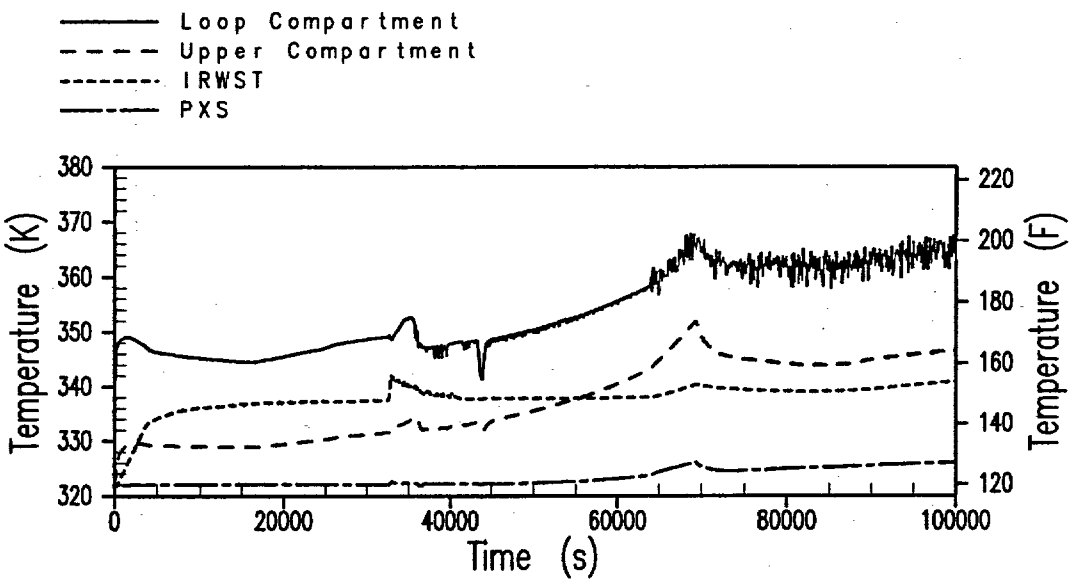


Figure 34-299

Case 6E-1: Containment Gas Temperature SGTR Early Core Melt

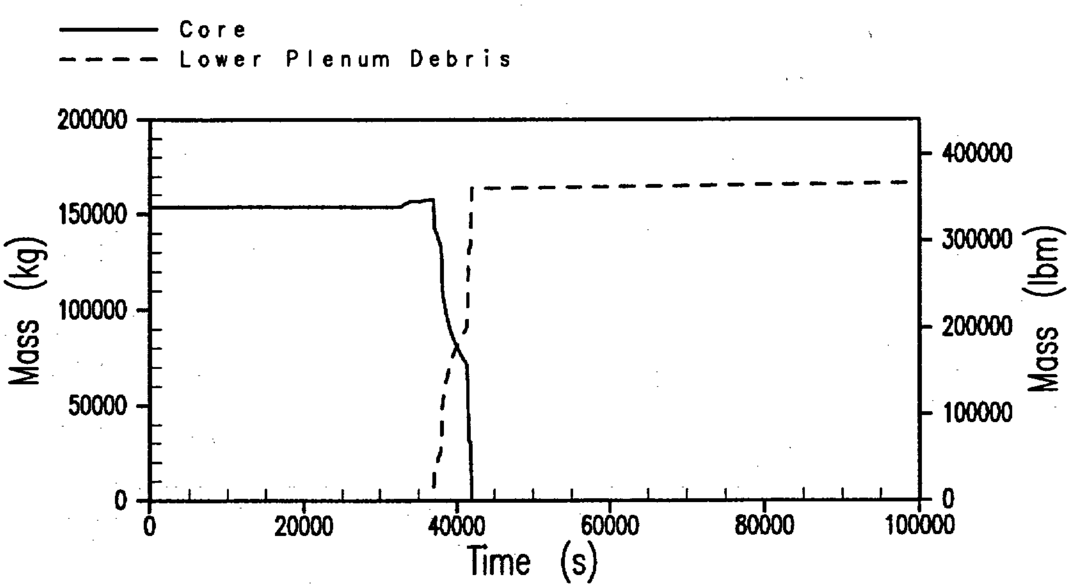


Figure 34-300

Case 6E-1: Core Mass SGTR Early Core Melt

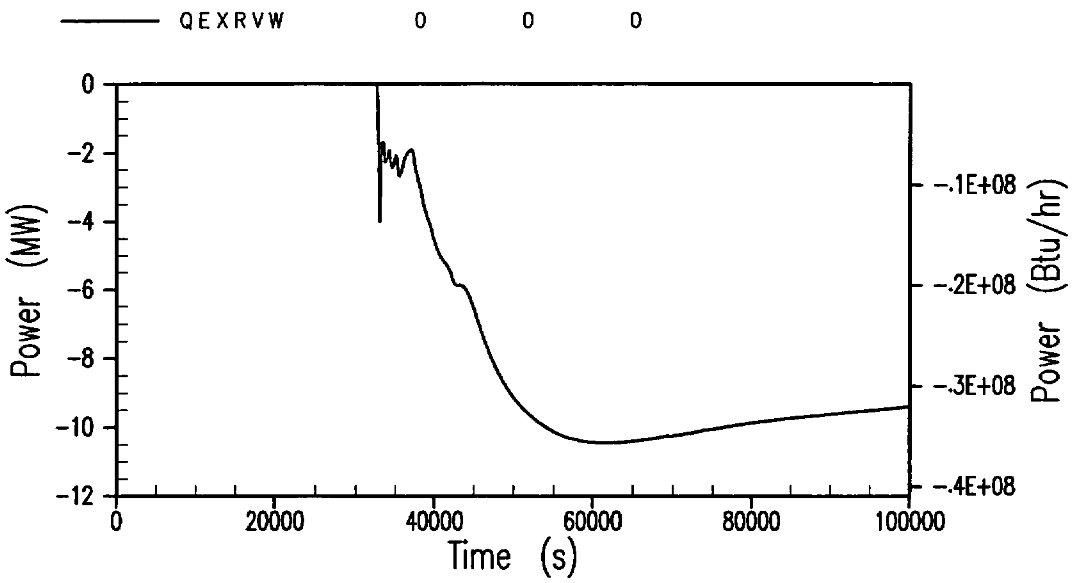


Figure 34-301

Case 6E-1: Reactor Pressure Vessel to Cavity Water Heat Transfer SGTR Early Core Melt

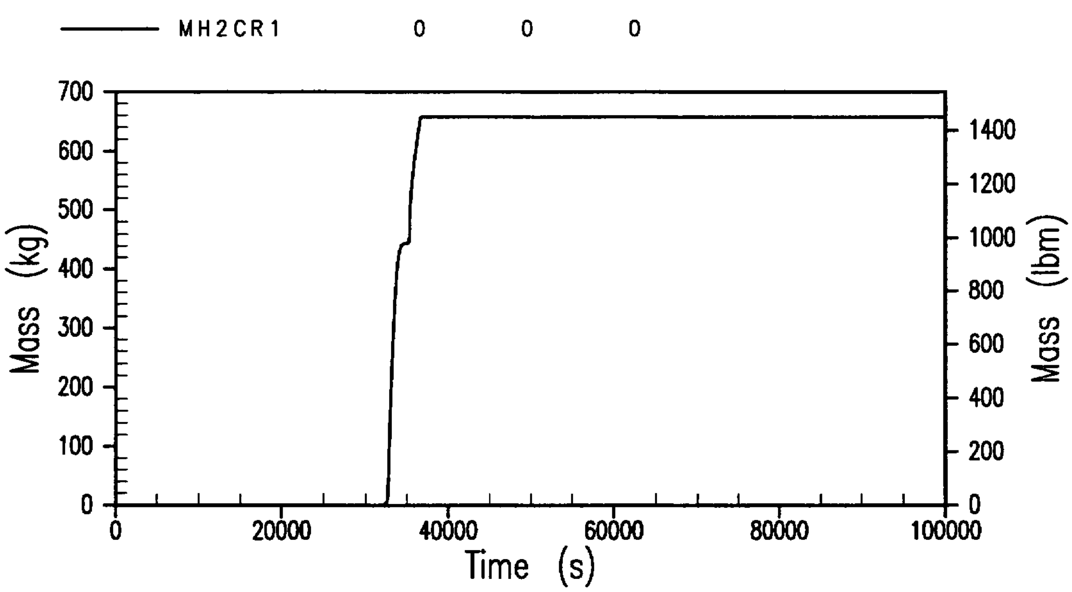


Figure 34-302

Case 6E-1: In-Vessel Hydrogen Generation SGTR Early Core Melt

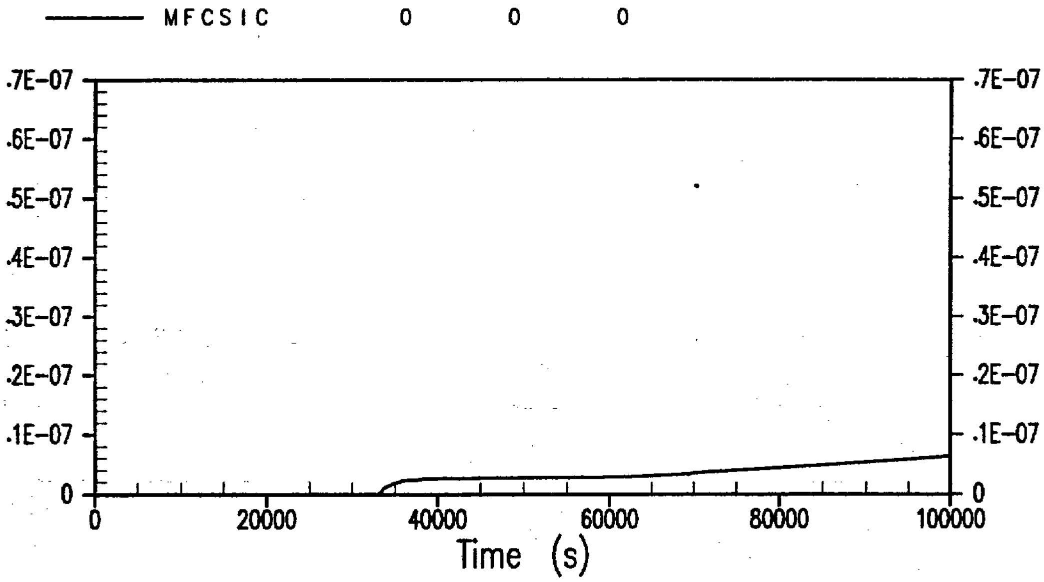


Figure 34-303

Case 6E-1: Mass Fraction of CsI Released to Containment SGTR Early Core Melt

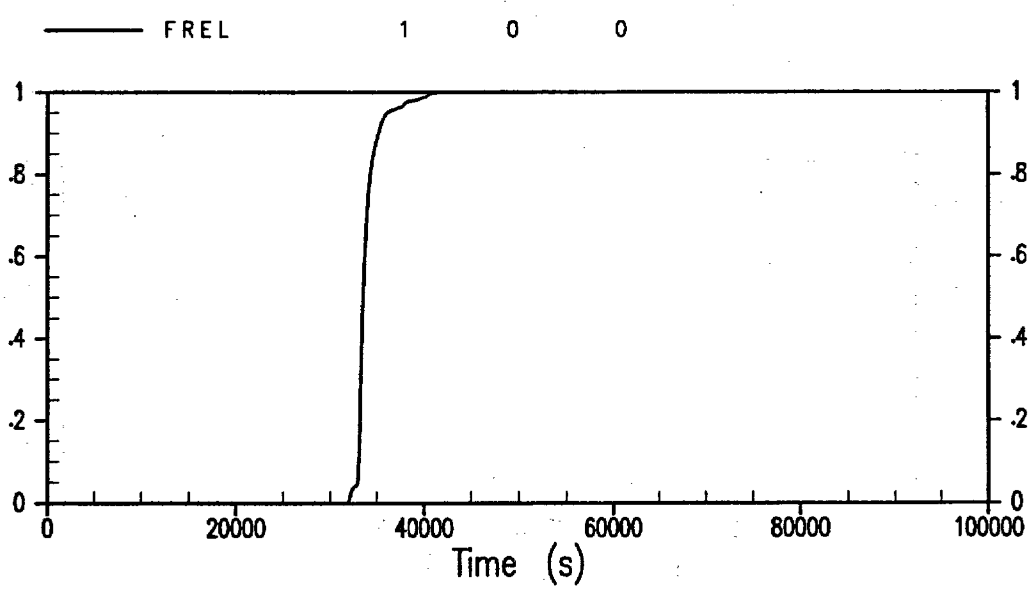


Figure 34-304

Case 6E-1: Mass Fraction of Noble Gases Released to Environment SGTR Early Core Melt

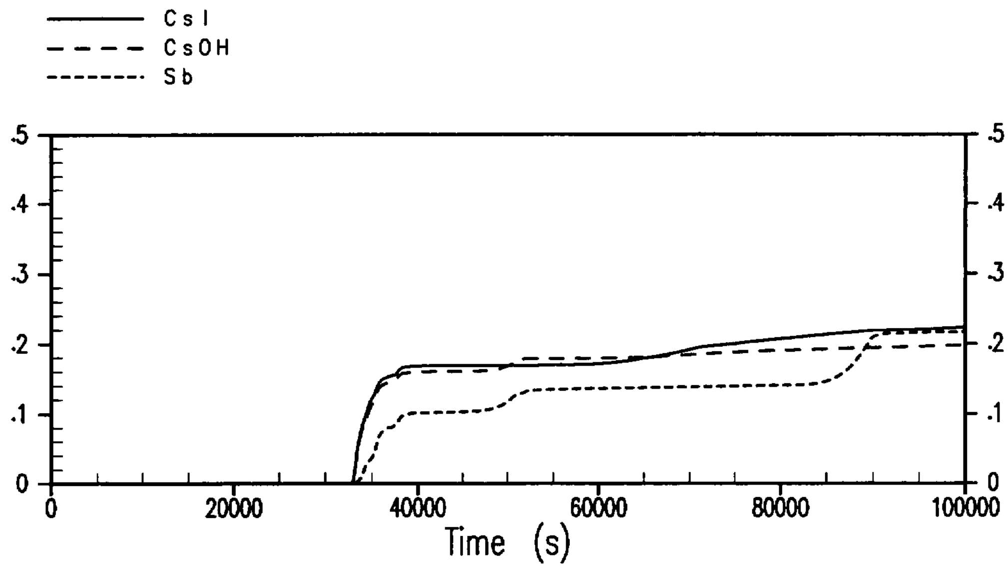


Figure 34-305

Case 6E-1: Mass Fraction of Fission Products Released to Environment SGTR Early Core Melt

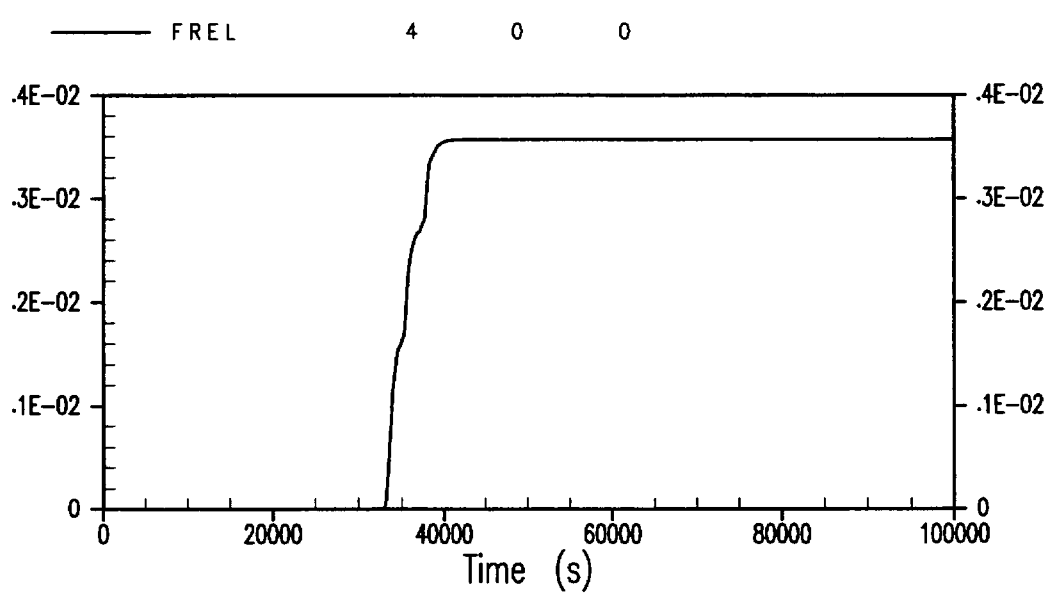


Figure 34-306

Case 6E-1: Mass Fraction of SrO Released to Environment SGTR Early Core Melt

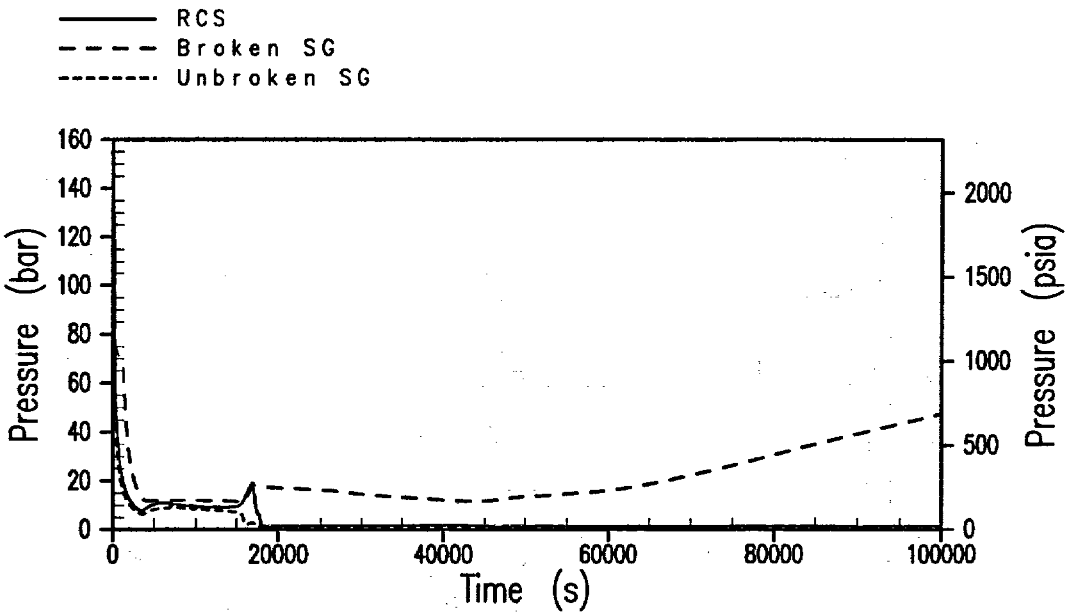


Figure 34-307

Case 6L-1: Reactor Coolant System and Steam Generator Pressure SGTR Core Melt Failure at Recirculation

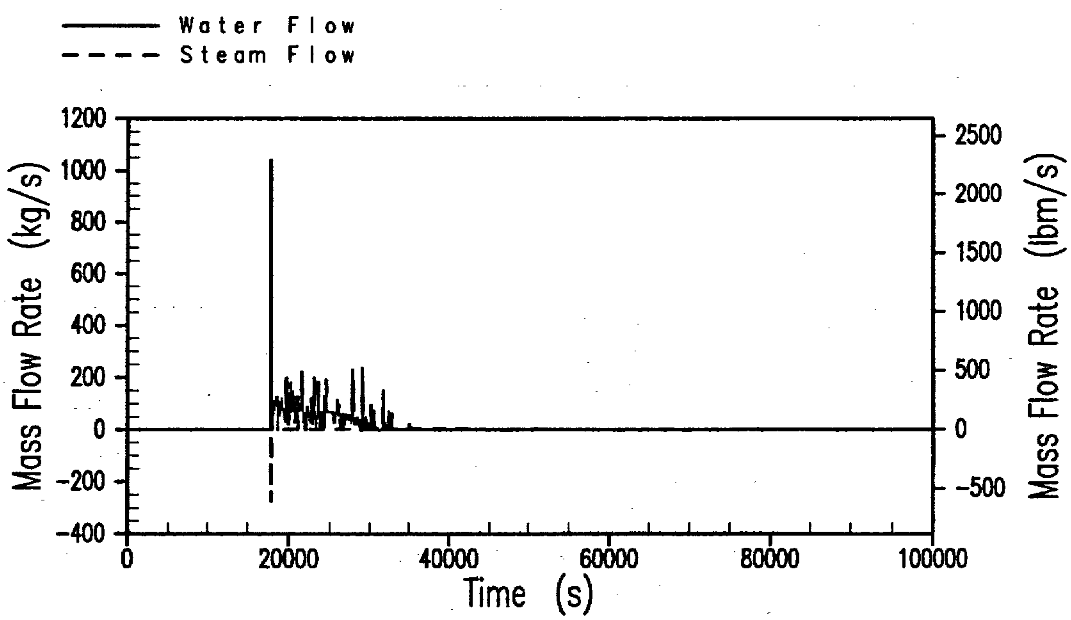


Figure 34-308

Case 6L-1: ADS Stage 4 Flow Rates SGTR Core Melt Failure at Recirculation

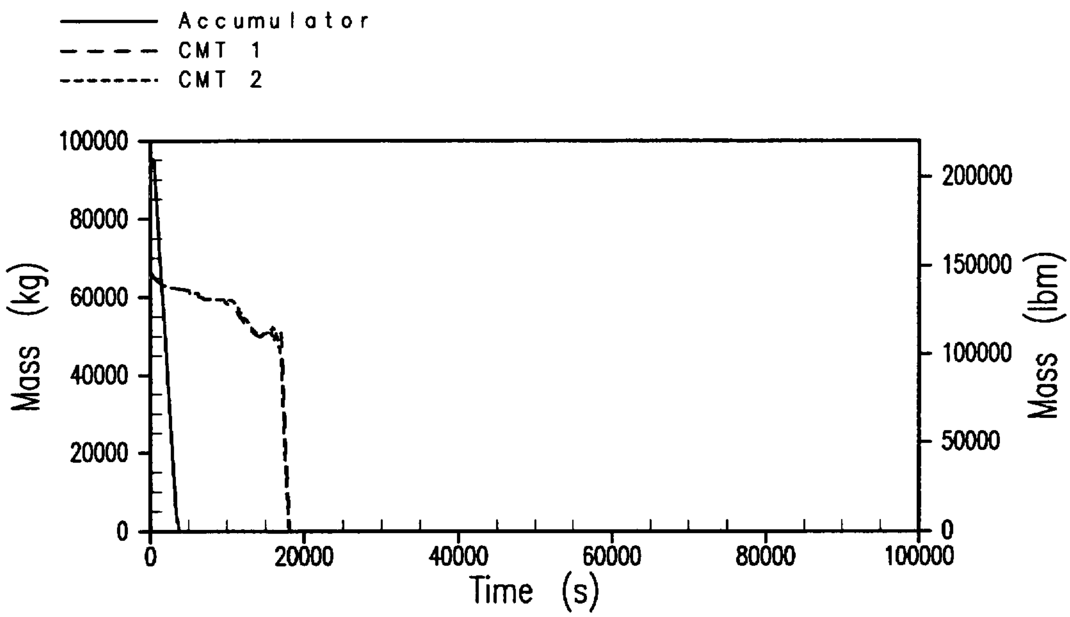


Figure 34-309

Case 6L-1: Accumulator/CMT Water Mass
SGTR Core Melt Failure at Recirculation

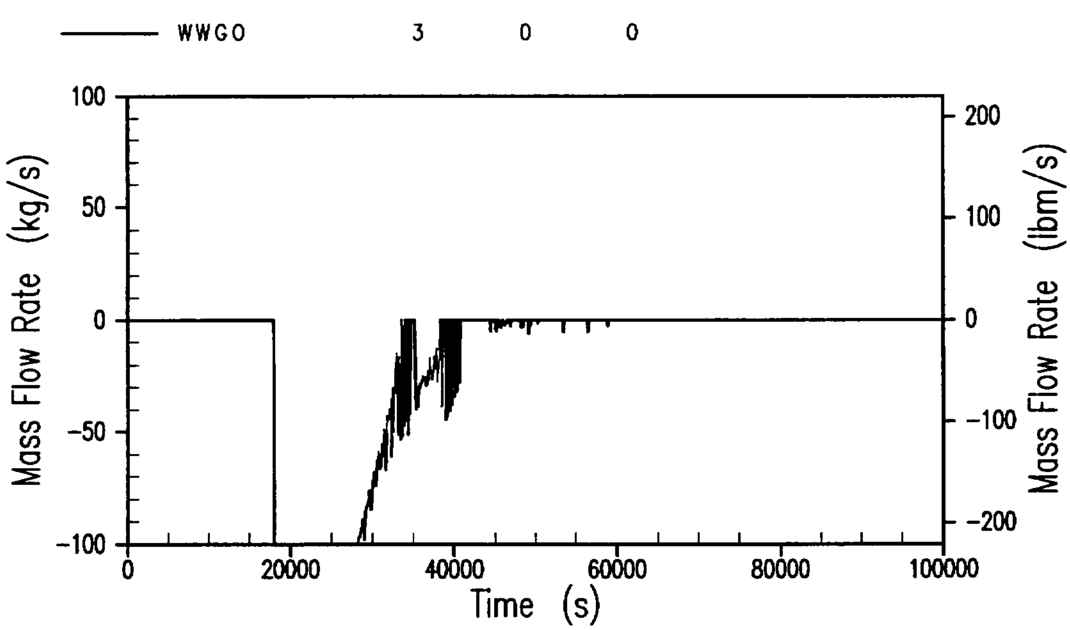


Figure 34-310

Case 6L-1: IRWST Injection Flow Rate
SGTR Core Melt Failure at Recirculation

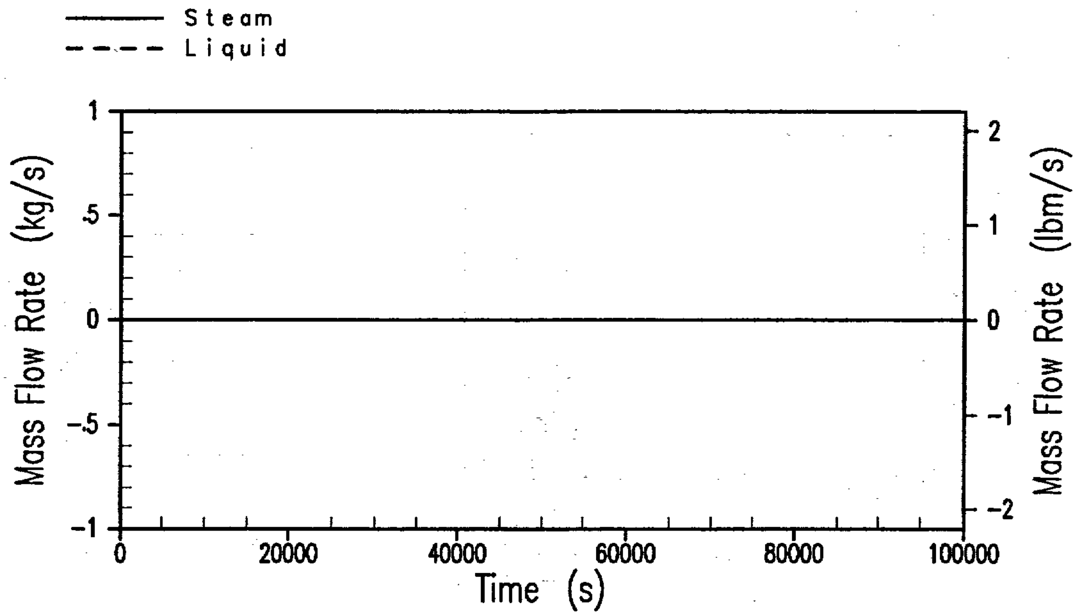


Figure 34-311

Case 6L-1: Break Flow Rate SGTR Core Melt Failure at Recirculation

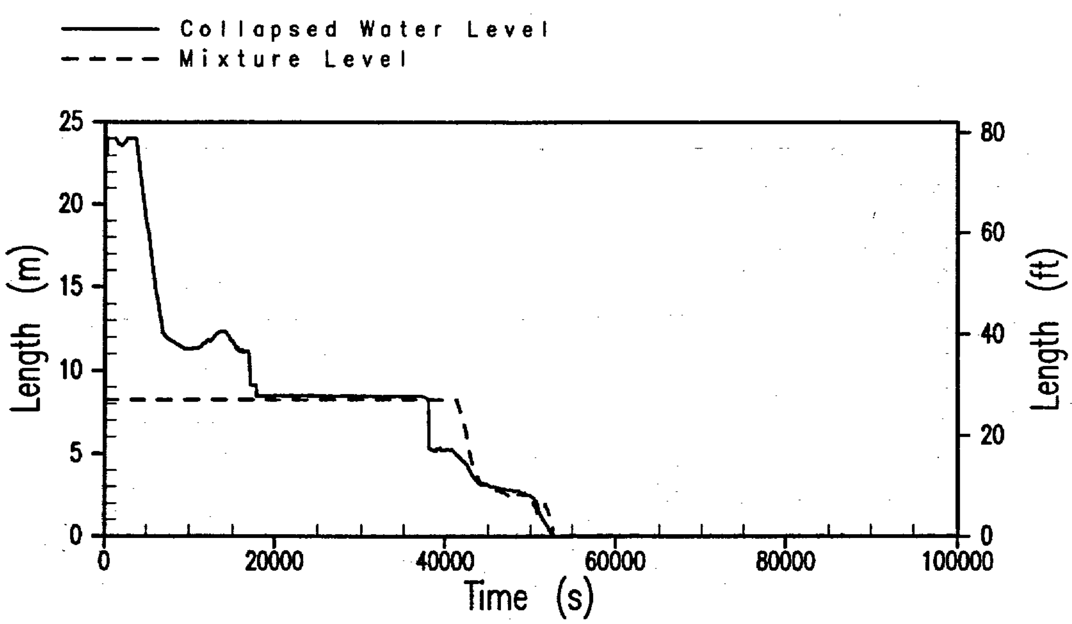


Figure 34-312

Case 6L-1: Reactor Vessel Water Level SGTR Core Melt Failure at Recirculation

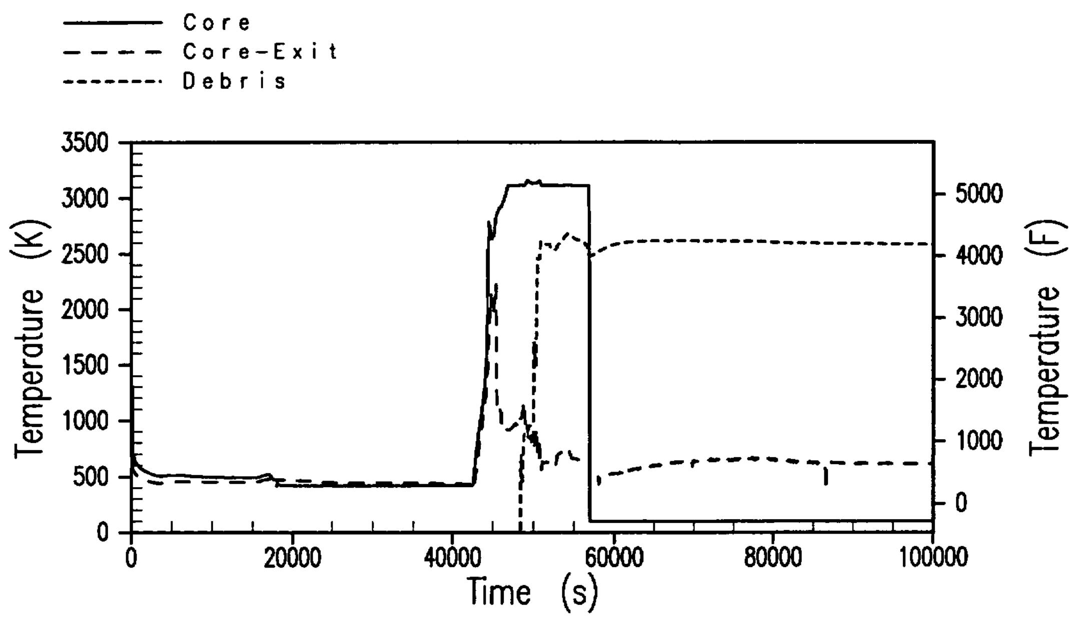


Figure 34-313

Case 6L-1: Core Temperatures
SGTR Core Melt Failure at Recirculation

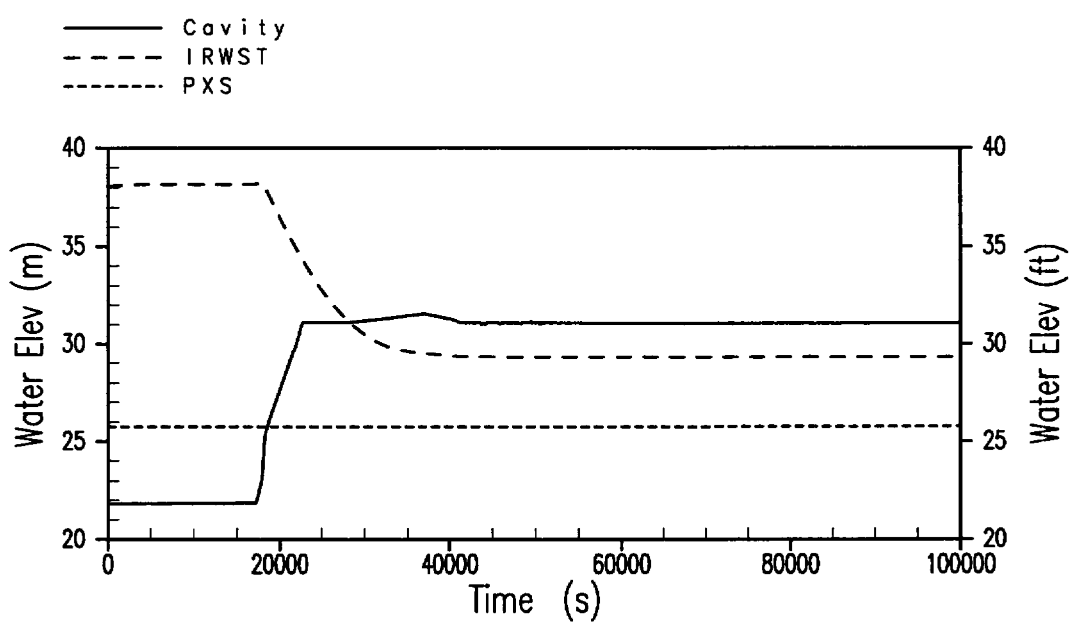


Figure 34-314

Case 6L-1: Containment Water Pool Elevations
SGTR Core Melt Failure at Recirculation

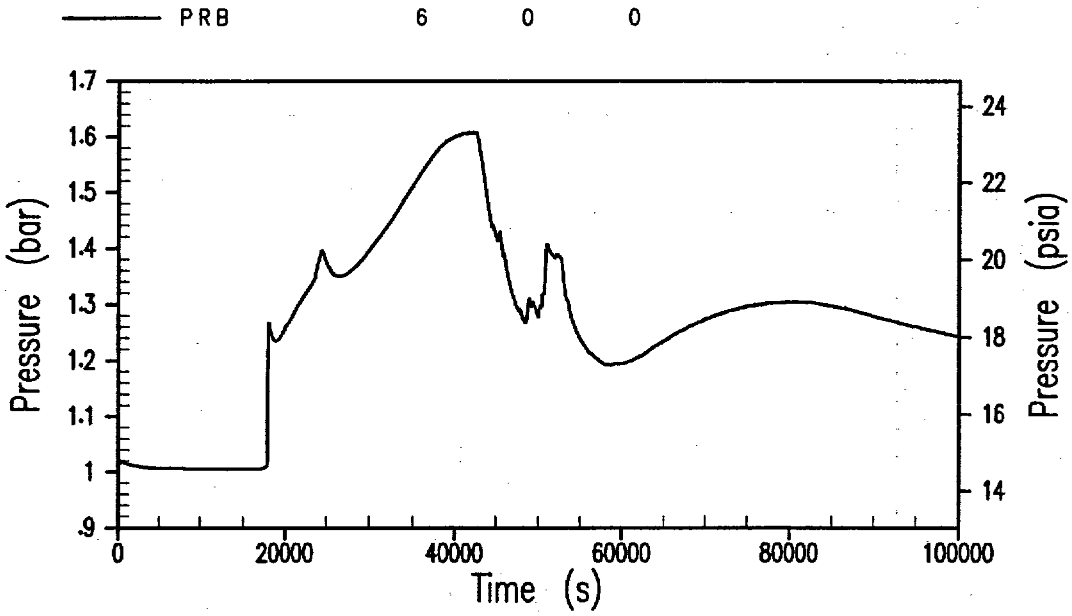


Figure 34-315

Case 6L-1: Containment Pressure
SGTR Core Melt Failure at Recirculation

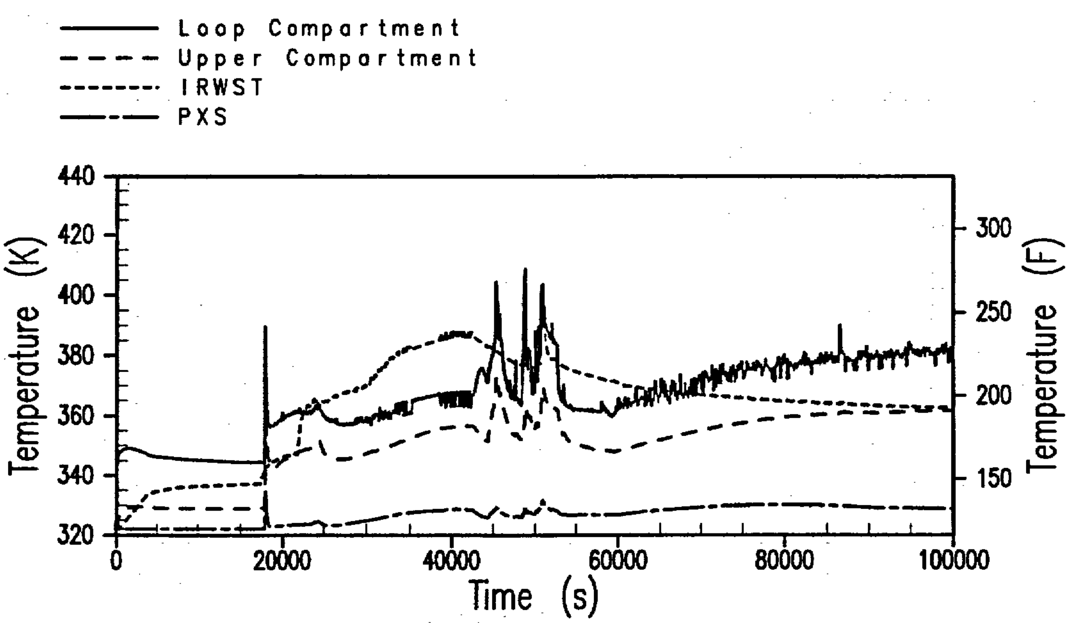


Figure 34-316

Case 6L-1: Containment Gas Temperature
SGTR Core Melt Failure at Recirculation

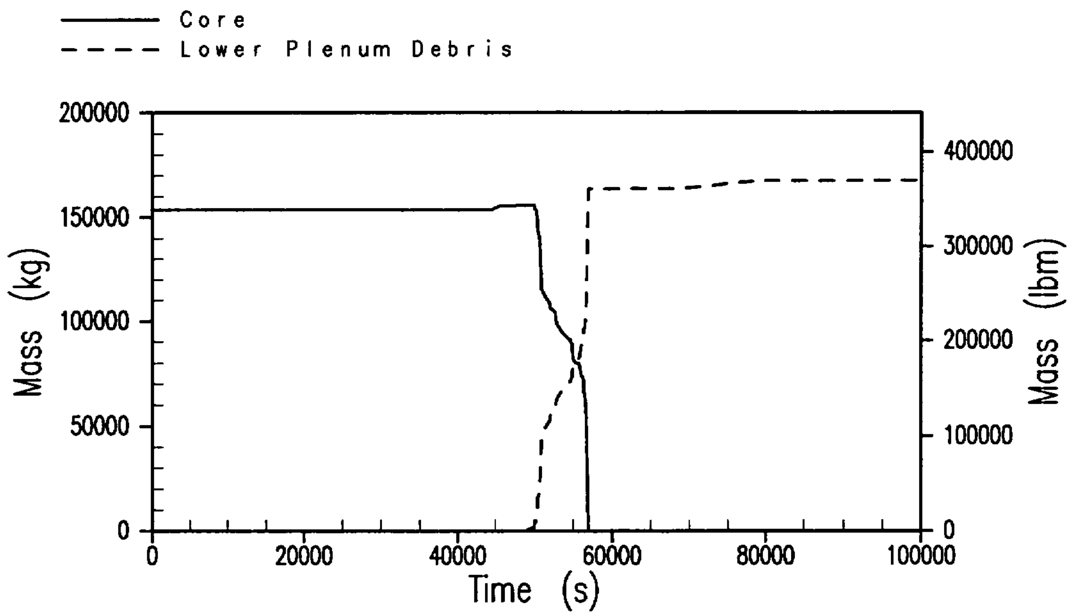


Figure 34-317

Case 6L-1: Core Mass
SGTR Core Melt Failure at Recirculation

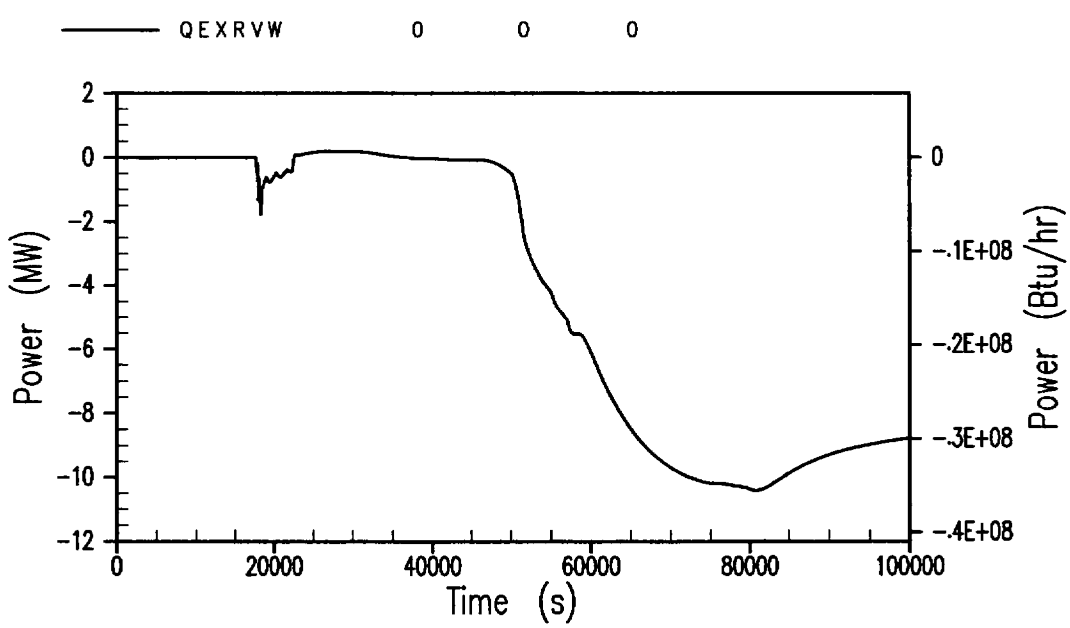


Figure 34-318

Case 6L-1: Reactor Pressure Vessel to Cavity Water Heat Transfer
SGTR Core Melt Failure at Recirculation

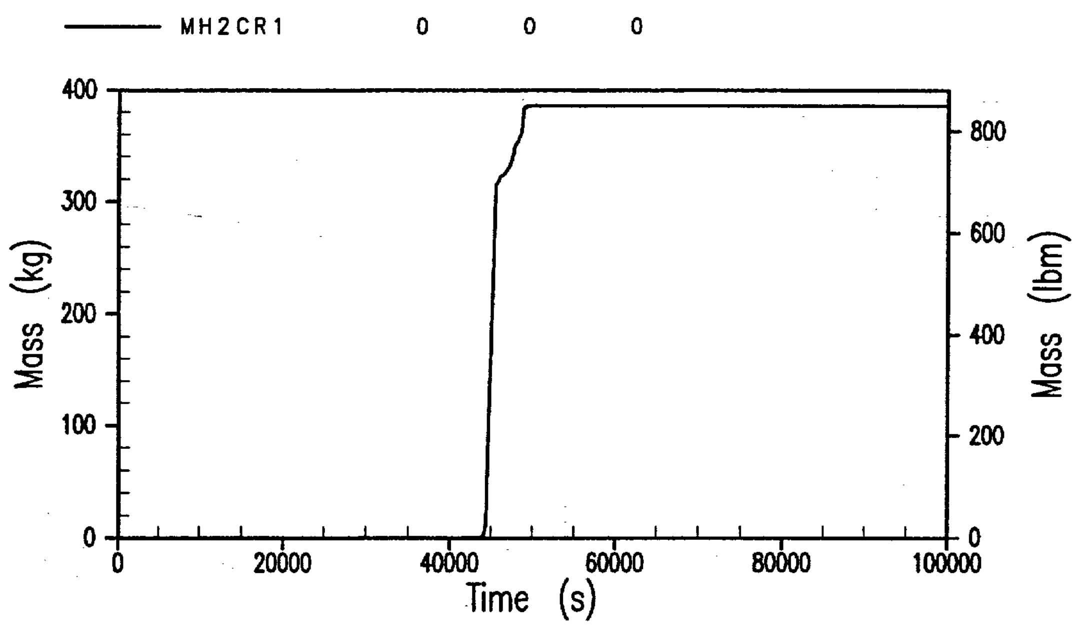


Figure 34-319

Case 6L-1: In-Vessel Hydrogen Generation SGTR Core Melt Failure at Recirculation

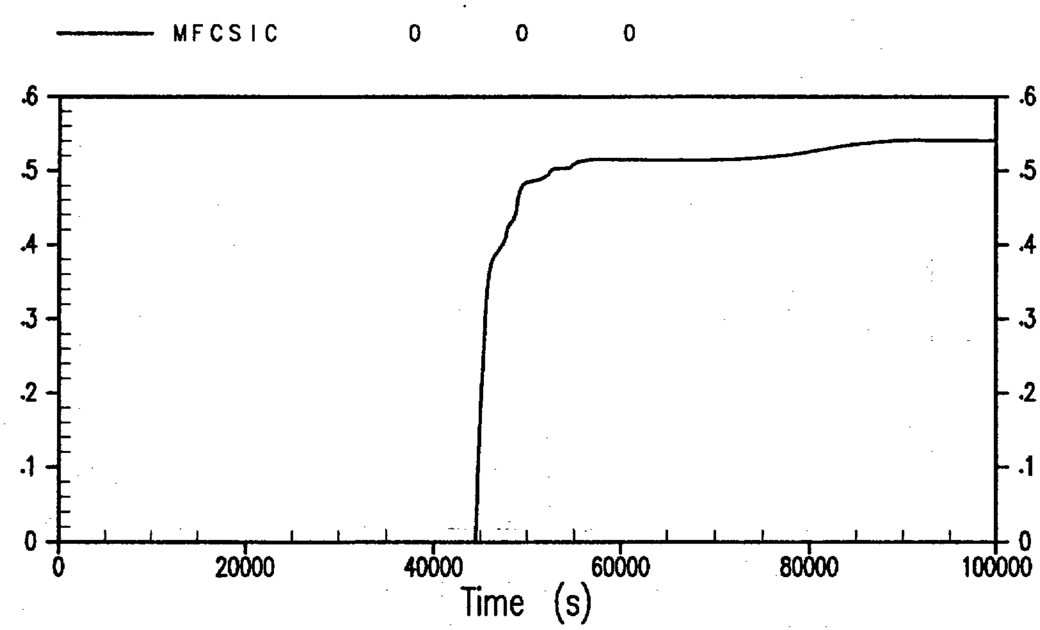


Figure 34-320

Case 6L-1: Mass Fraction of CsI Released to Containment SGTR Core Melt Failure at Recirculation

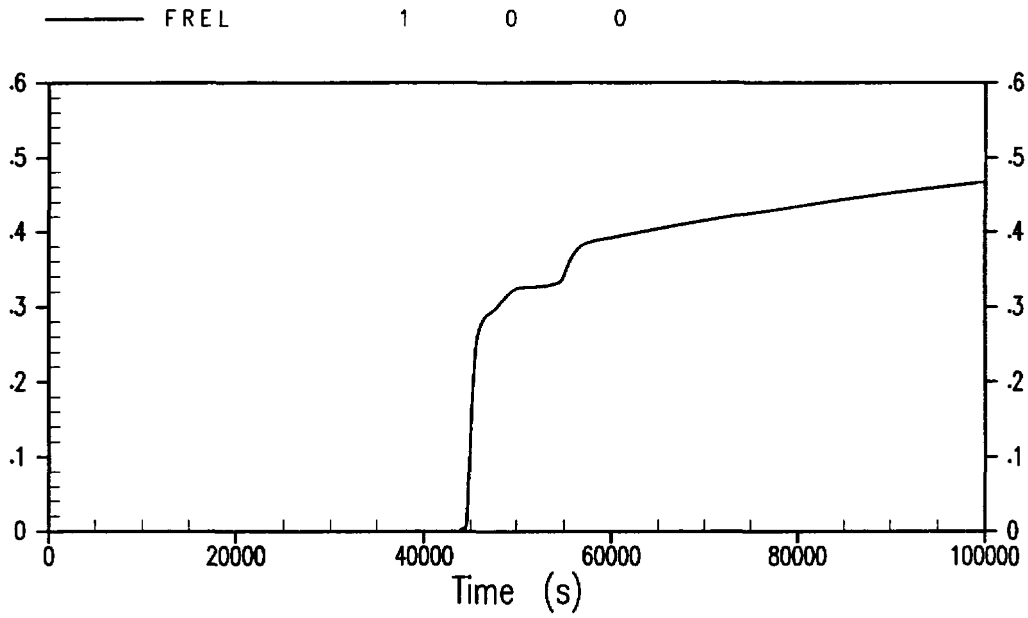


Figure 34-321

Case 6L-1: Mass Fraction of Noble Gases Released to Environment SGTR Core Melt Failure at Recirculation

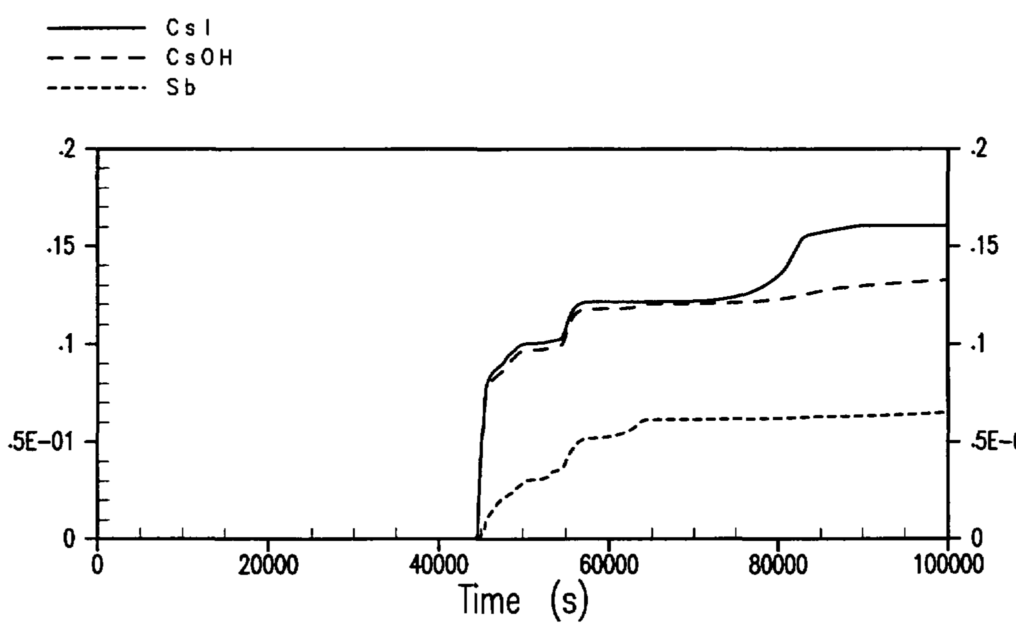


Figure 34-322

Case 6L-1: Mass Fraction of Fission Products Released to Environment SGTR Core Melt Failure at Recirculation

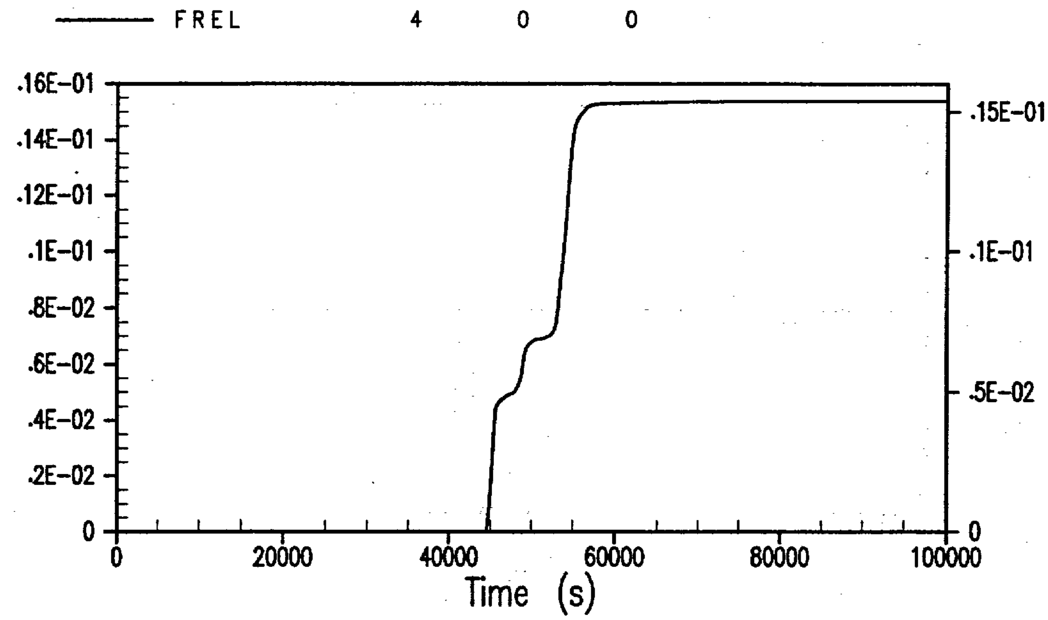


Figure 34-323

Case 6L-1: Mass Fraction of SrO Released to Environment SGTR Core Melt Failure at Recirculation

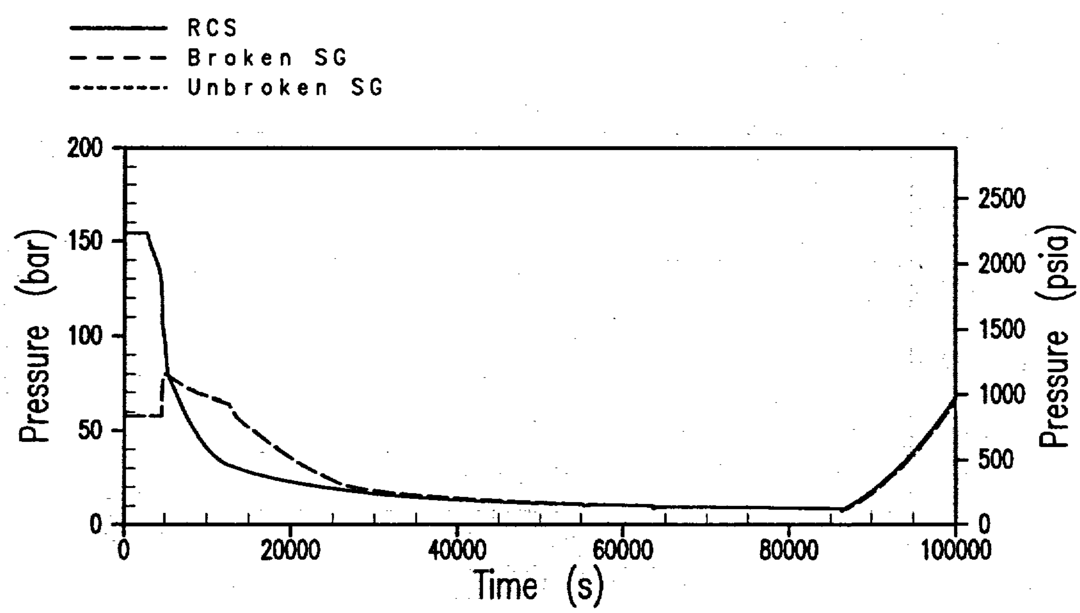


Figure 34-324

Case 1AP-1: Reactor Coolant System and Steam Generator Pressure SBLOCA with PRHR, CMTs Failed

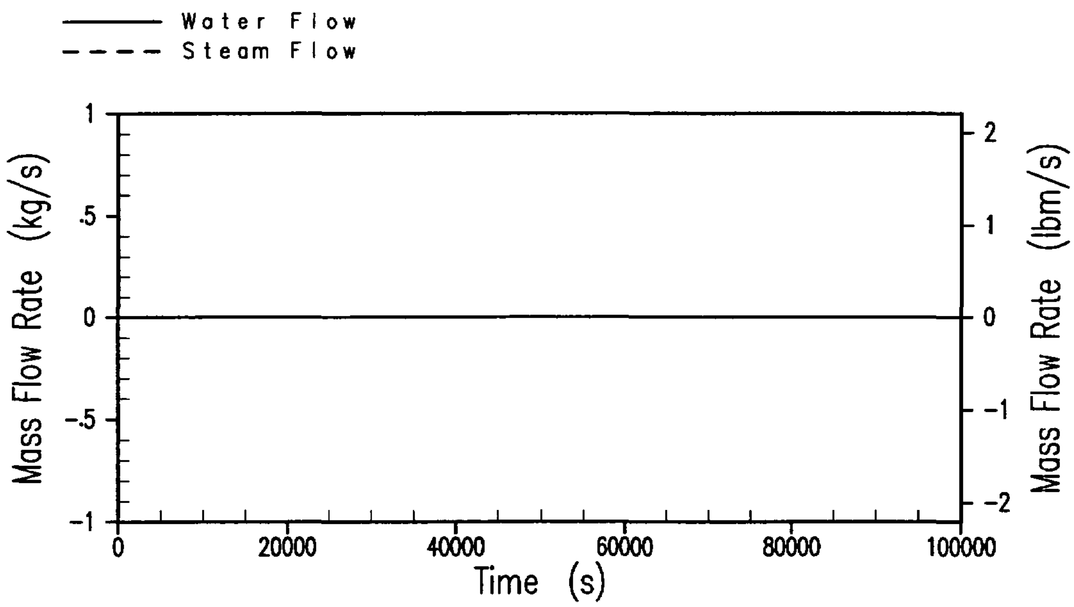


Figure 34-325

Case 1AP-1: ADS Stage 4 Flow Rates SBLOCA with PRHR, CMTs Failed

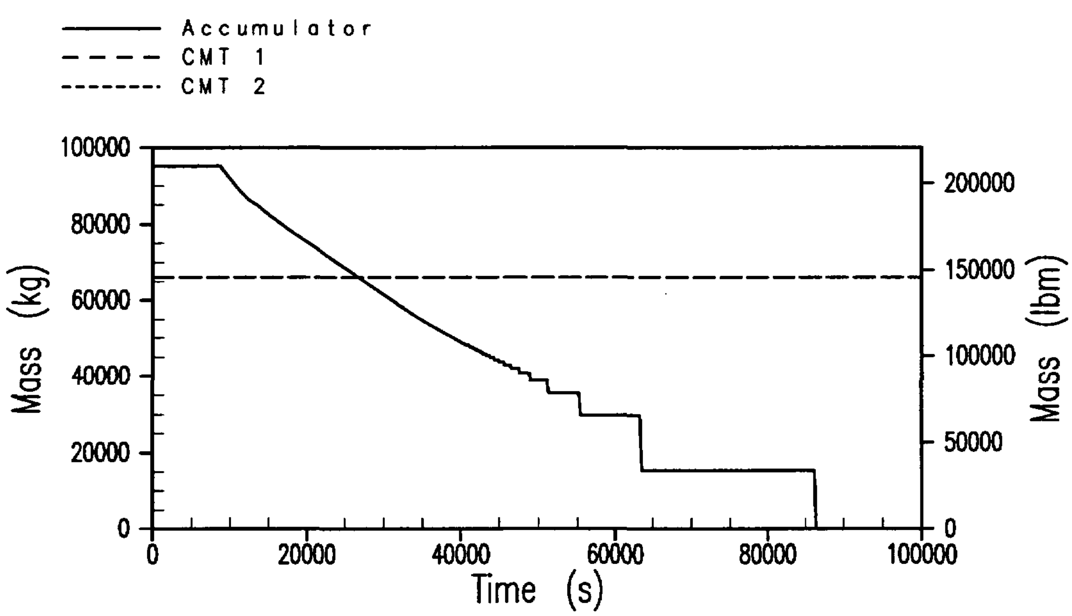


Figure 34-326

Case 1AP-1: Accumulator/CMT Water Mass SBLOCA with PRHR, CMTs Failed

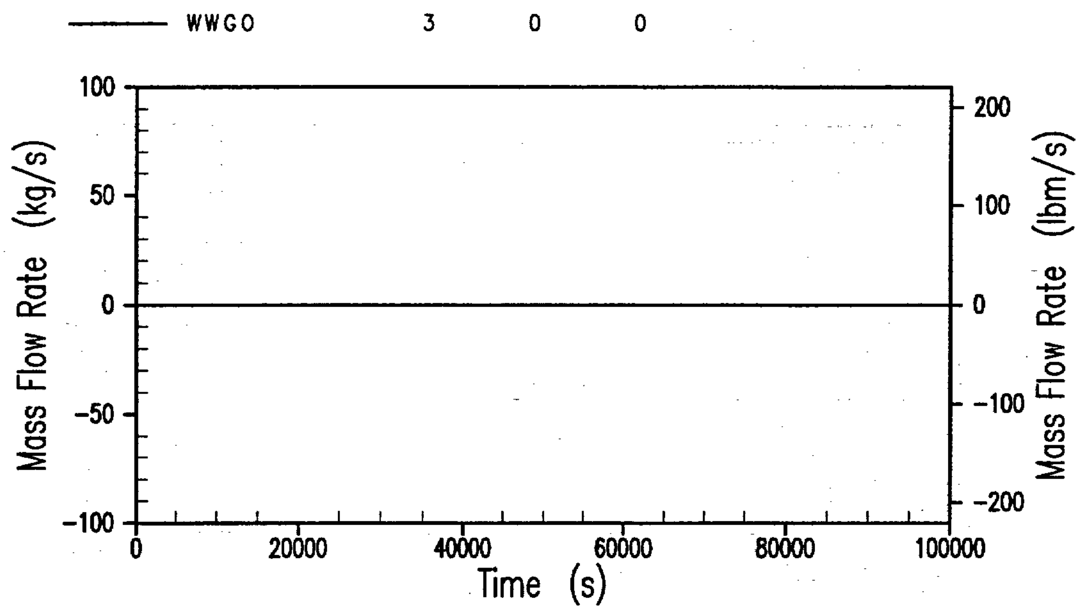


Figure 34-327

Case 1AP-1: IRWST Injection Flow Rate
SBLOCA with PRHR, CMTs Failed

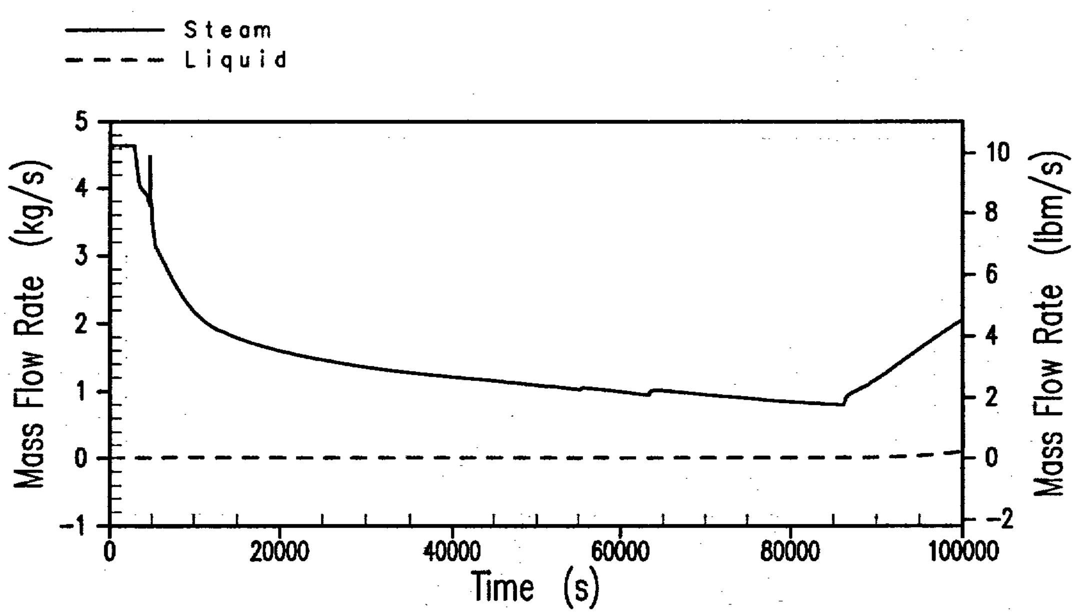


Figure 34-328

Case 1AP-1: Break Flow Rate
SBLOCA with PRHR, CMTs Failed

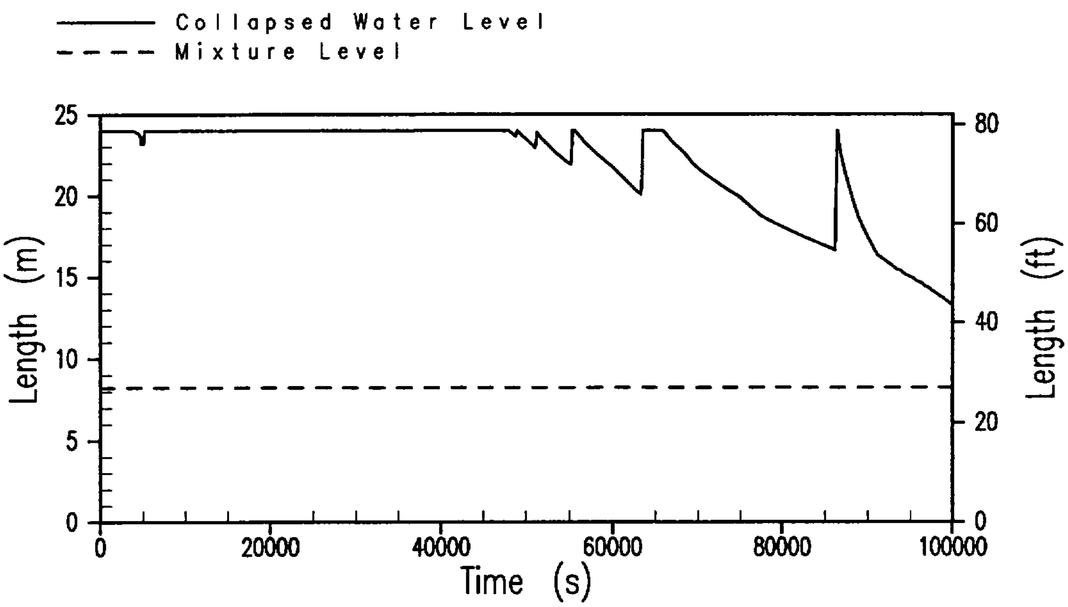


Figure 34-329

Case 1AP-1: Reactor Vessel Water Level SBLOCA with PRHR, CMTs Failed

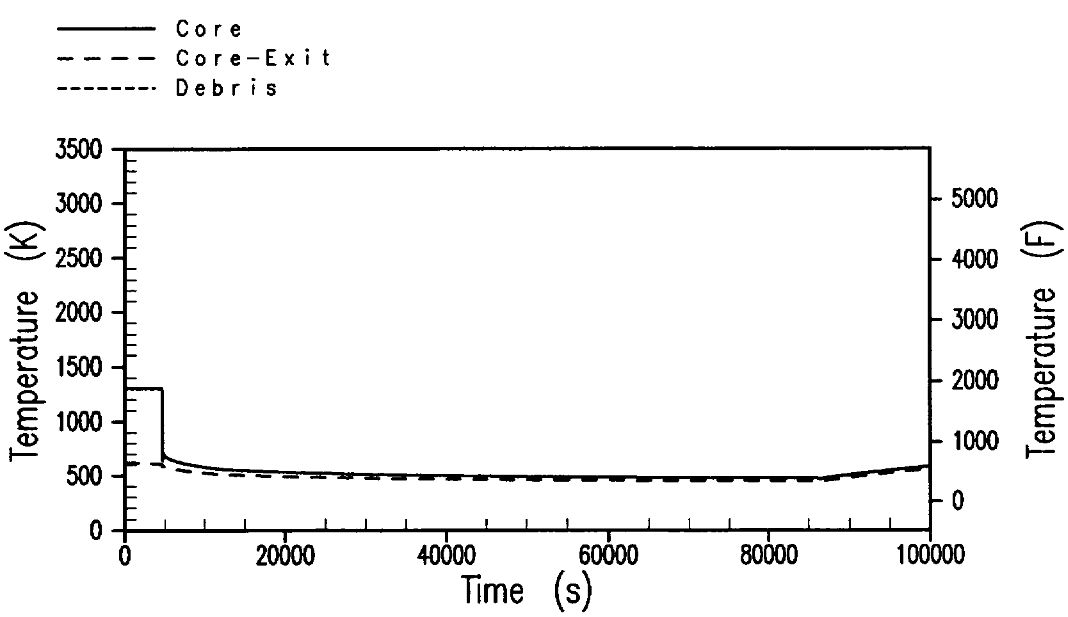


Figure 34-330

Case 1AP-1: Core Temperatures SBLOCA with PRHR, CMTs Failed

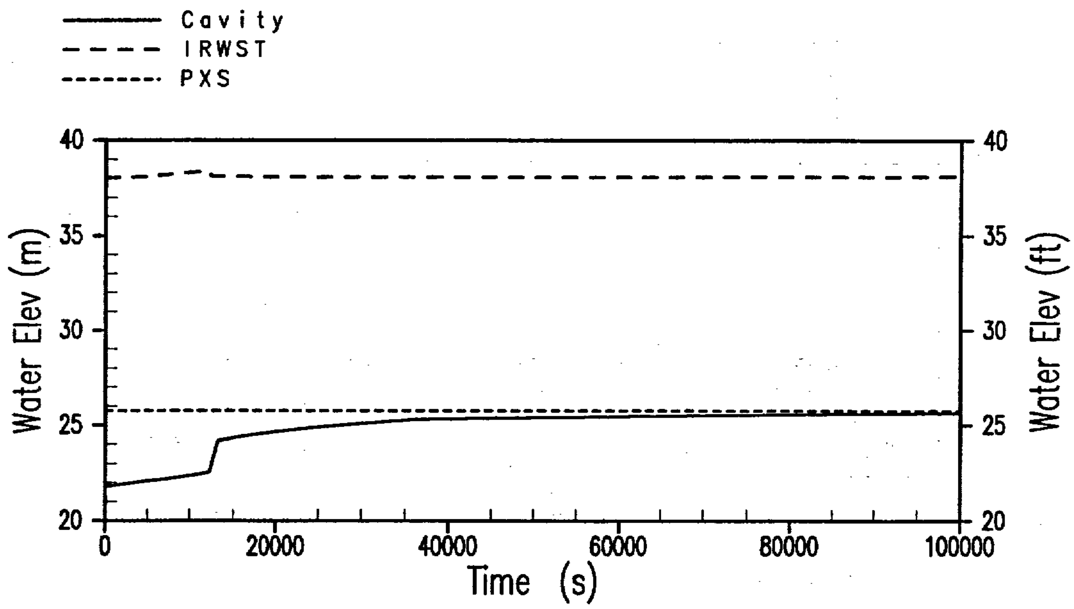


Figure 34-331

Case 1AP-1: Containment Pool Water Elevations SBLOCA with PRHR, CMTs Failed

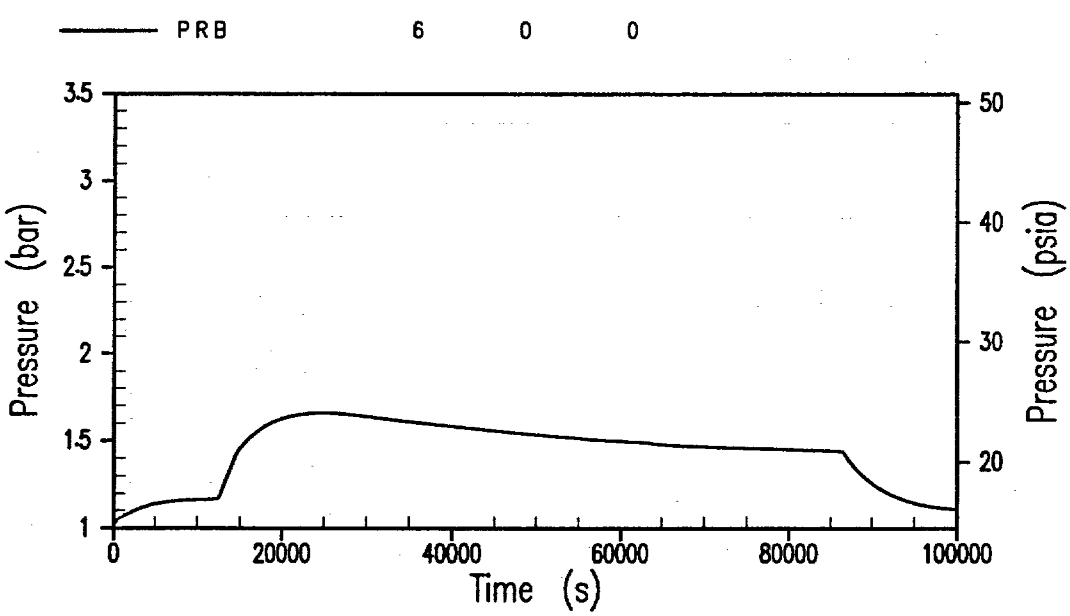


Figure 34-332

Case 1AP-1: Containment Pressure SBLOCA with PRHR, CMTs Failed

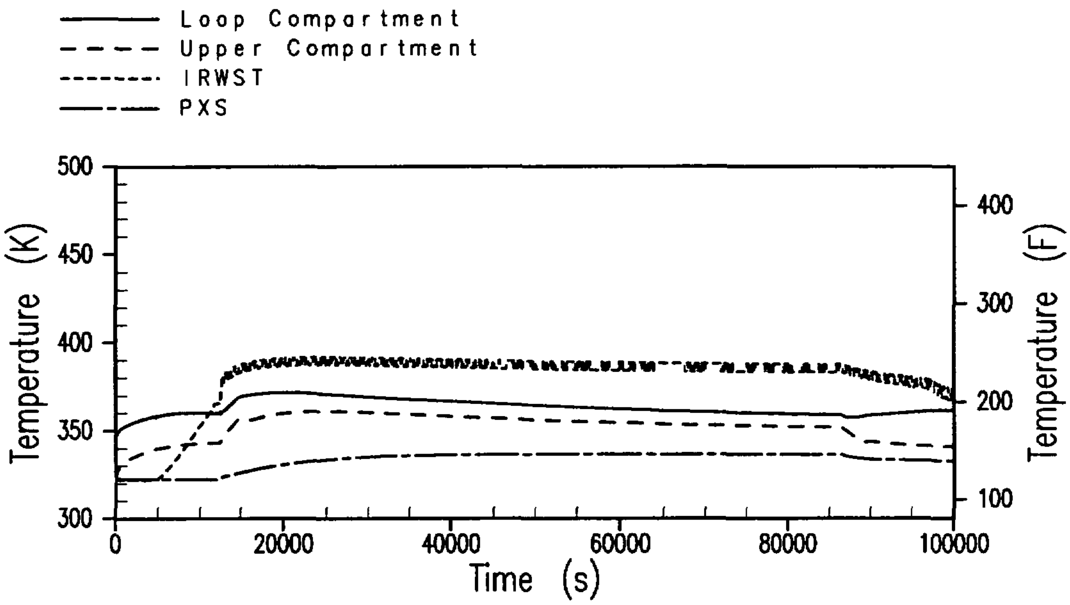


Figure 34-333

Case 1AP-1: Containment Gas Temperature
SBLOCA with PRHR, CMTs Failed

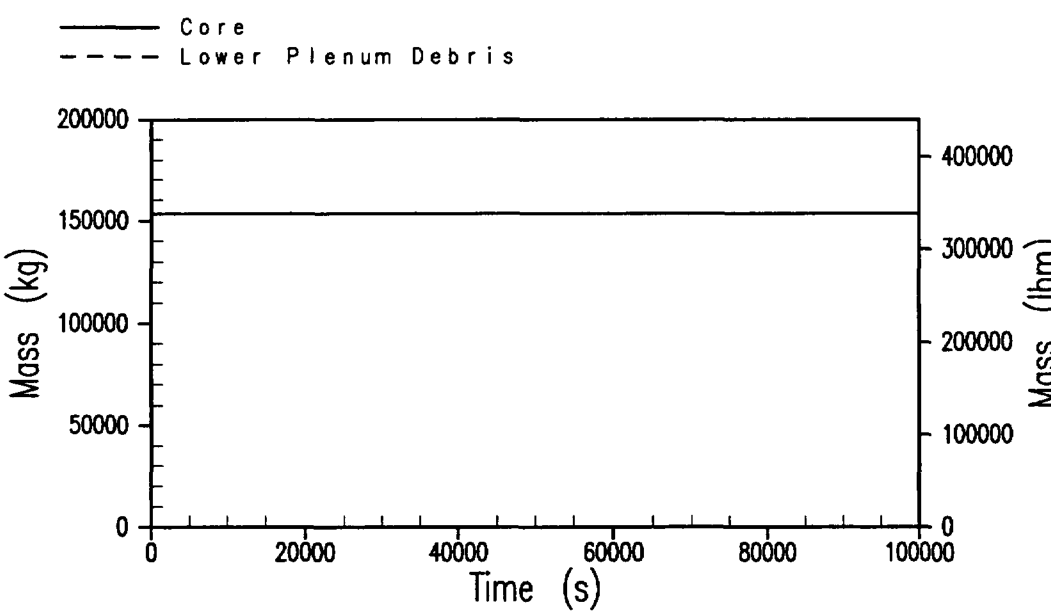


Figure 34-334

Case 1AP-1: Core Mass
SBLOCA with PRHR, CMTs Failed

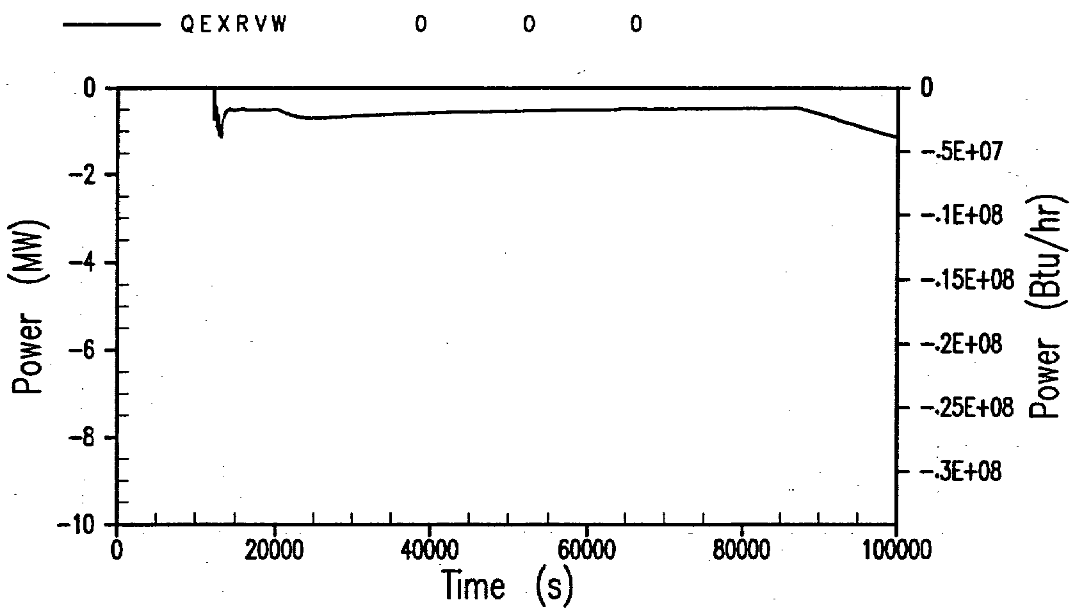


Figure 34-335

Case 1AP-1: Reactor Pressure Vessel to Cavity Water Heat Transfer
SBLOCA with PRHR, CMTs Failed

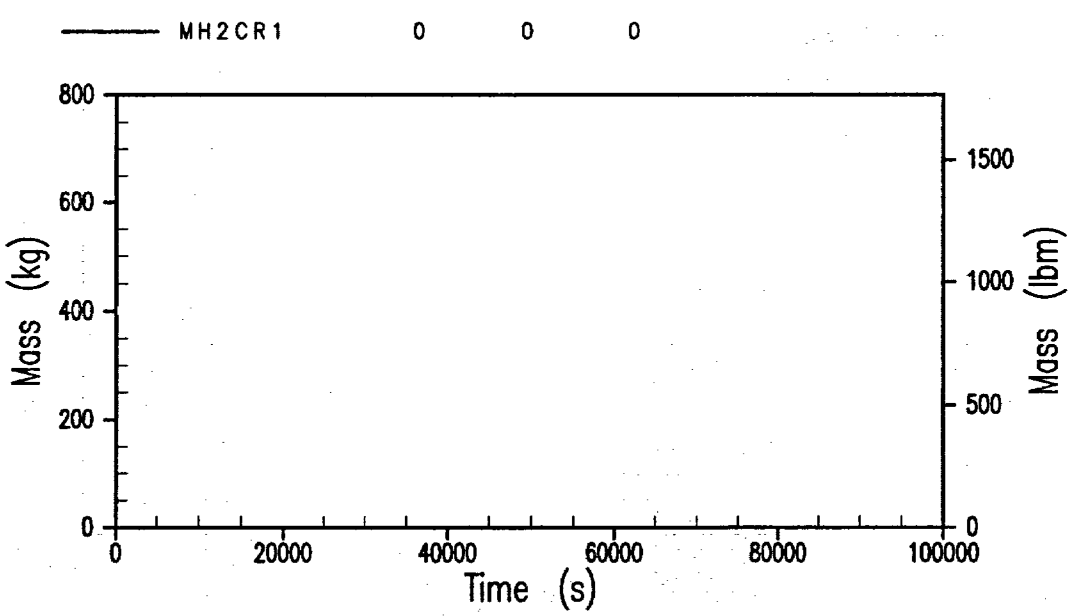


Figure 34-336

Case 1AP-1: In-Vessel Hydrogen Generation
SBLOCA with PRHR, CMTs Failed

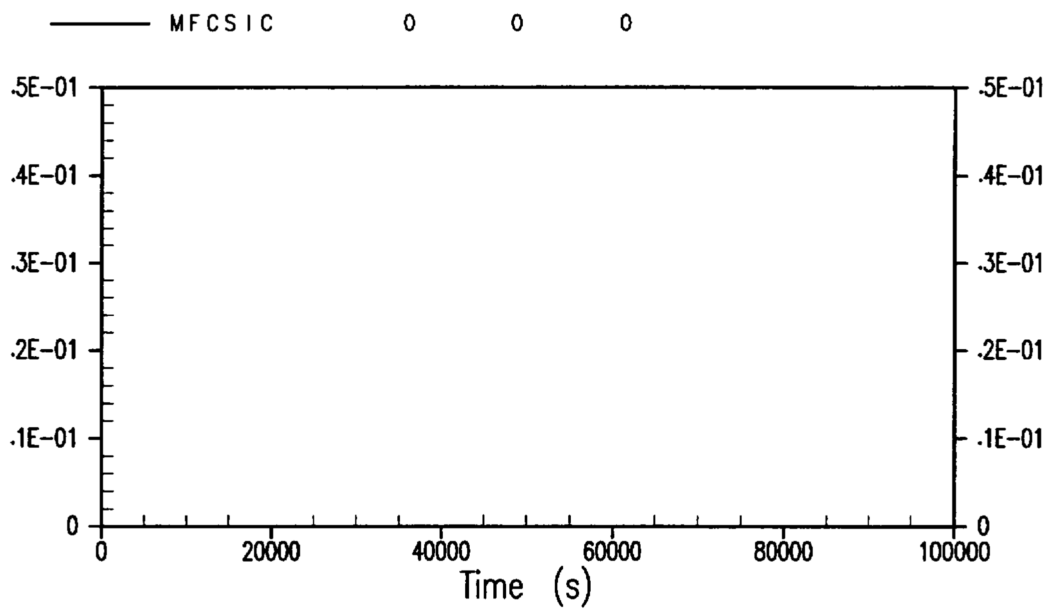


Figure 34-337

Case 1AP-1: Mass Fraction of CsI Released to Containment SBLOCA with PRHR, CMTs Failed

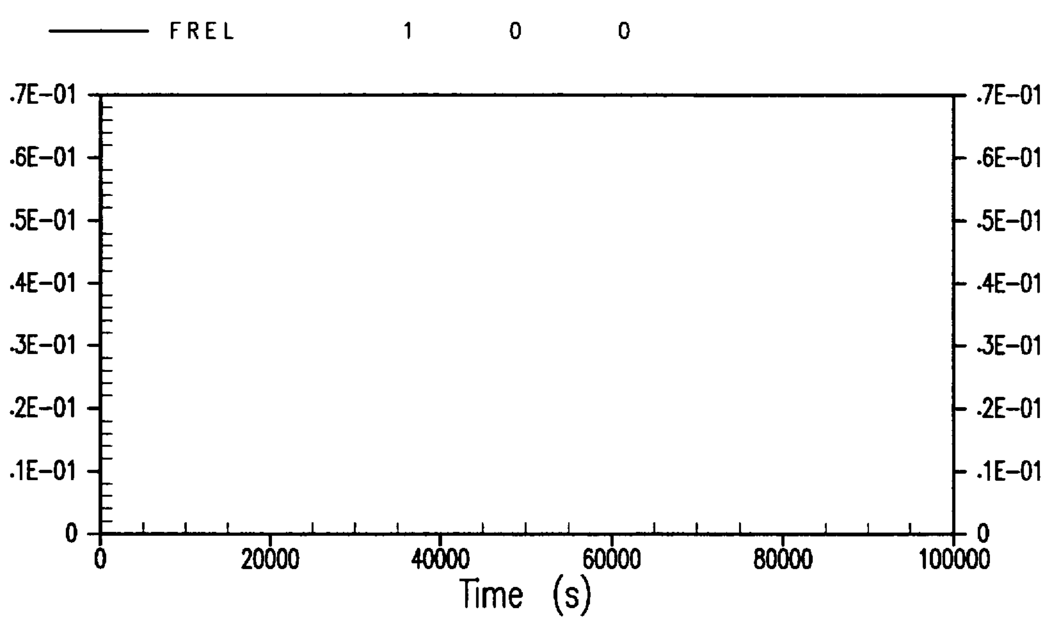


Figure 34-338

Case 1AP-1: Mass Fraction of Noble Gases Released to Environment SBLOCA with PRHR, CMTs Failed

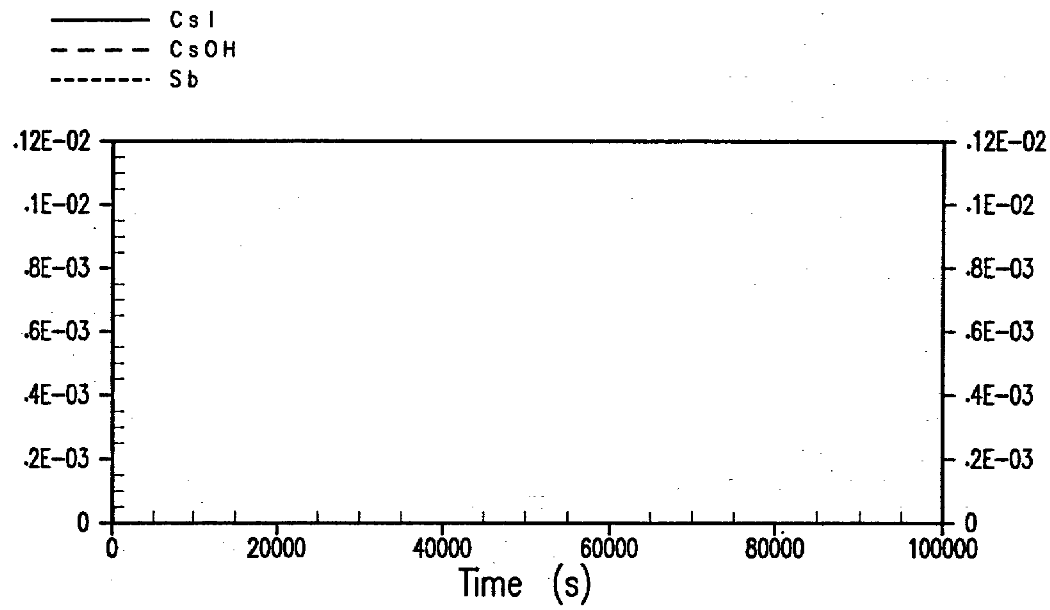


Figure 34-339

Case 1AP-1: Mass Fraction of Fission Products Released to Environment SBLOCA with PRHR, CMTs Failed

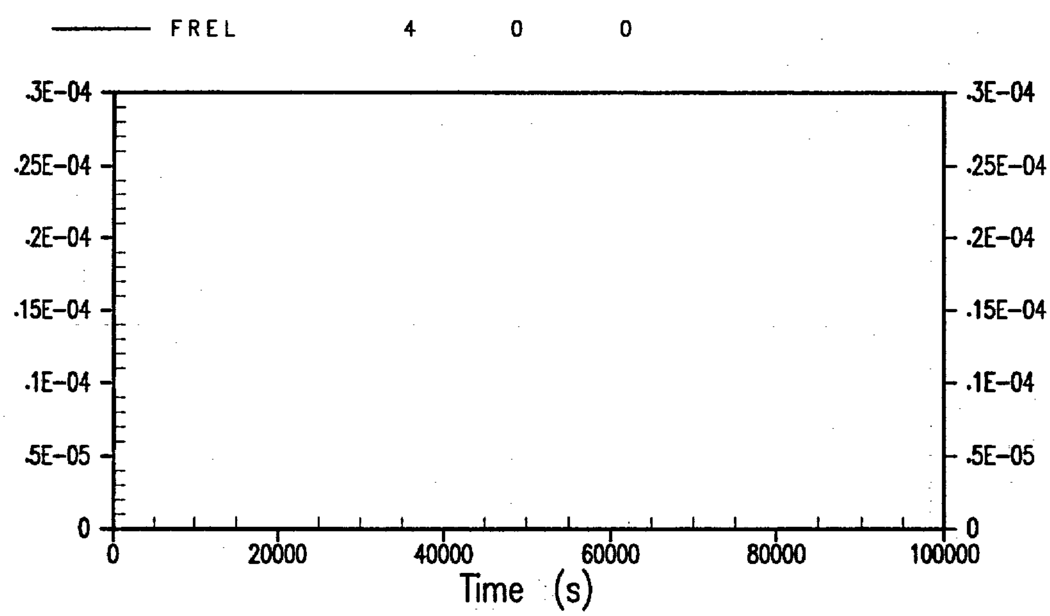


Figure 34-340

Case 1AP-1: Mass Fraction of SrO Released to Environment SBLOCA with PRHR, CMTs Failed

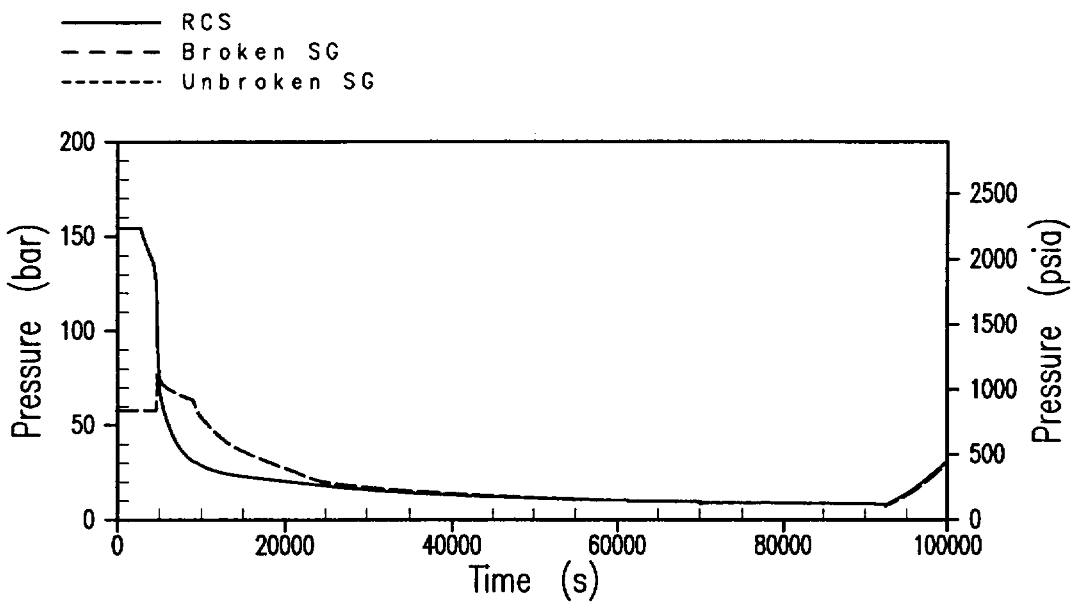


Figure 34-341

Case 1AP-2: Reactor Coolant System and Steam Generator Pressure SBLOCA with PRHR, CMTs Failed

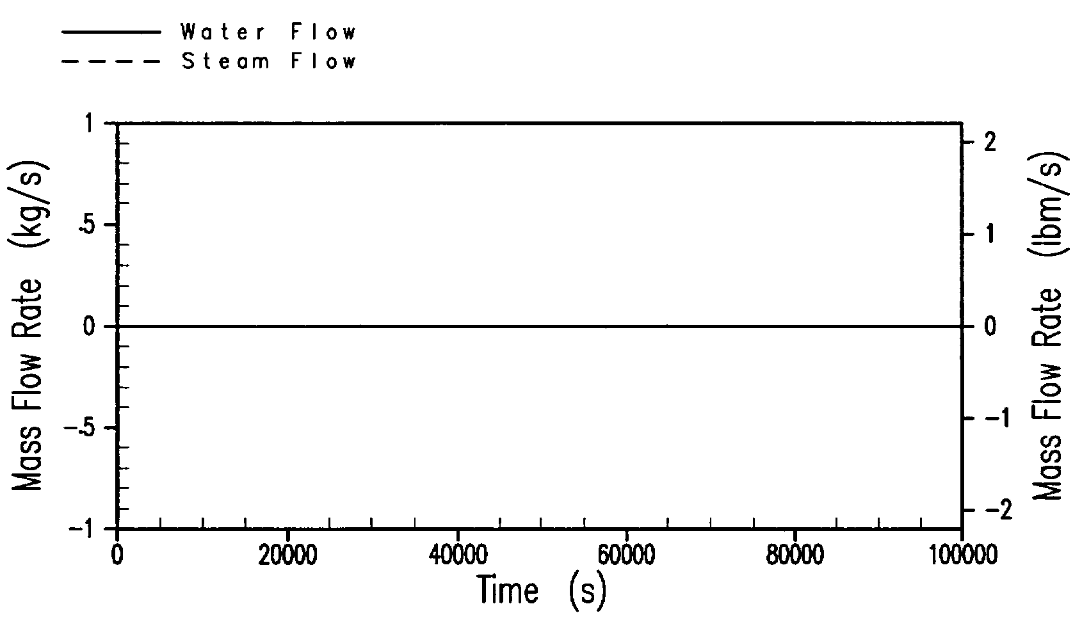


Figure 34-342

Case 1AP-2: ADS Stage 4 Flow Rates SBLOCA with PRHR, CMTs Failed

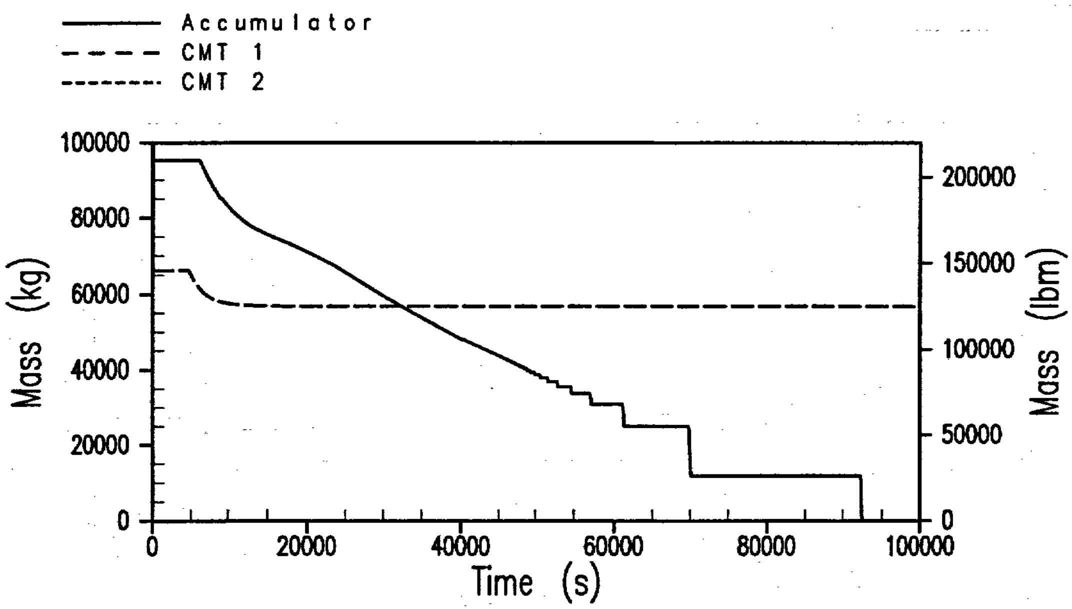


Figure 34-343

Case 1AP-2: Accumulator/CMT Water Mass SBLOCA with PRHR, CMTs Failed

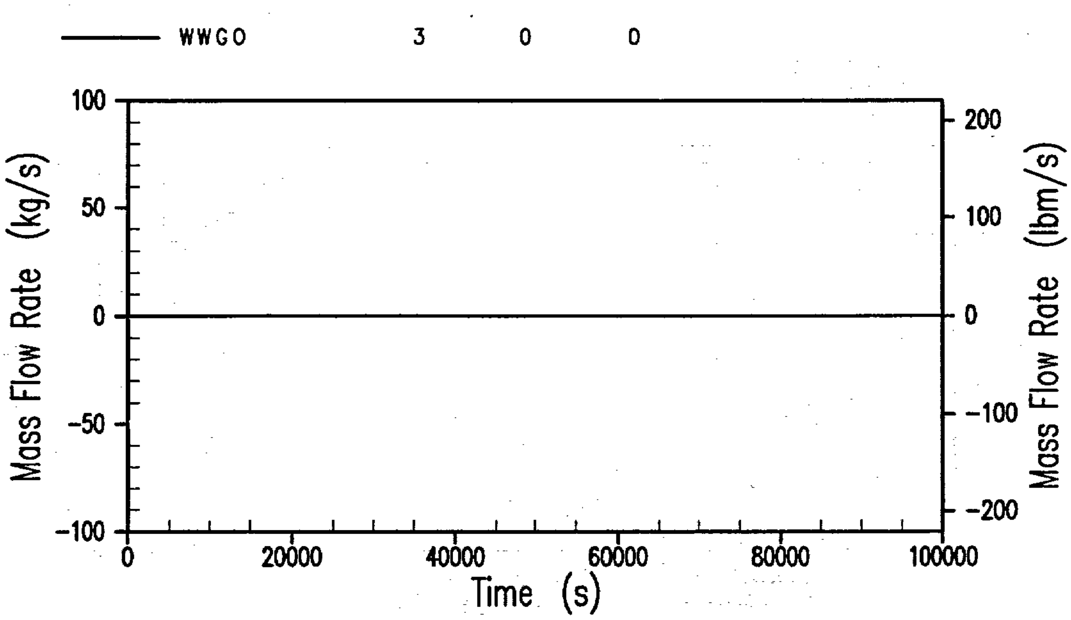


Figure 34-344

Case 1AP-2: IRWST Injection Flow Rate SBLOCA with PRHR, CMTs Failed

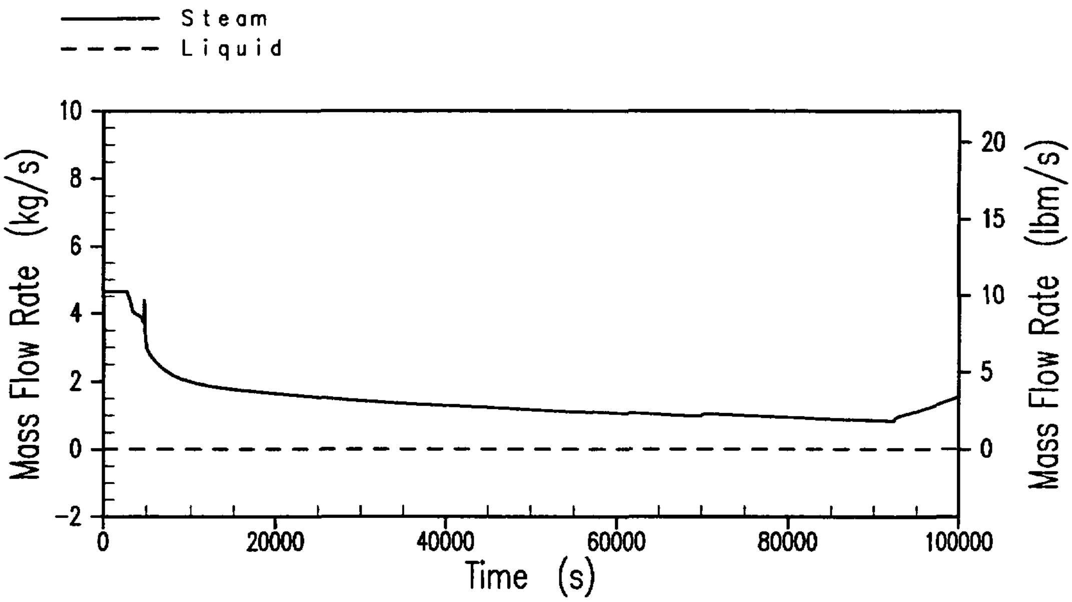


Figure 34-345

Case 1AP-2: Break Flow Rate SBLOCA with PRHR, CMTs Failed

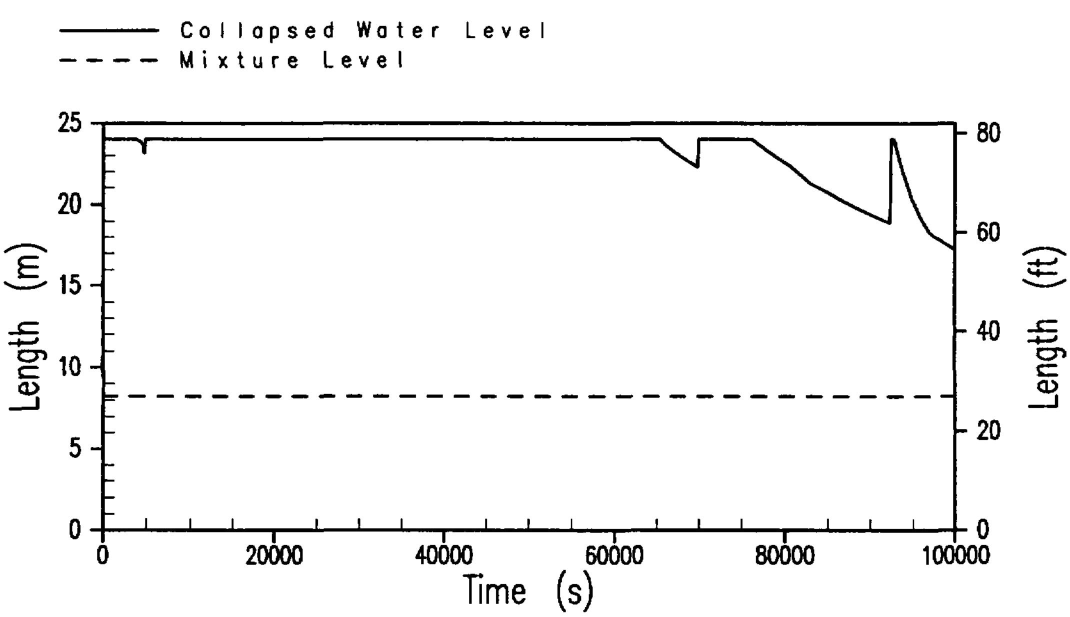


Figure 34-346

Case 1AP-2: Reactor Vessel Water Level SBLOCA with PRHR, CMTs Failed

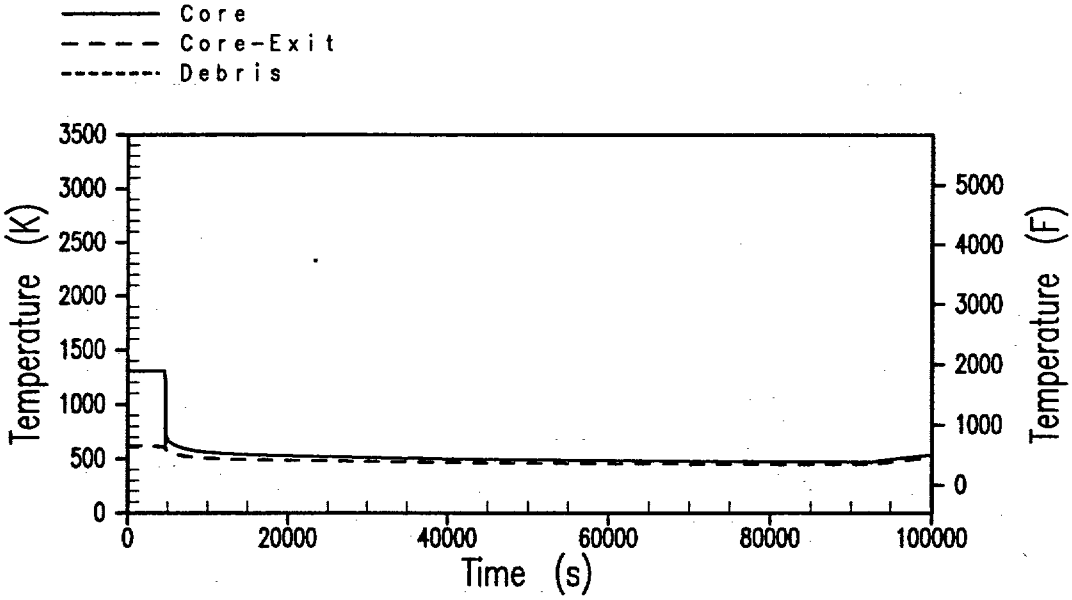


Figure 34-347

Case 1AP-2: Core Temperatures
SBLOCA with PRHR, CMTs Failed

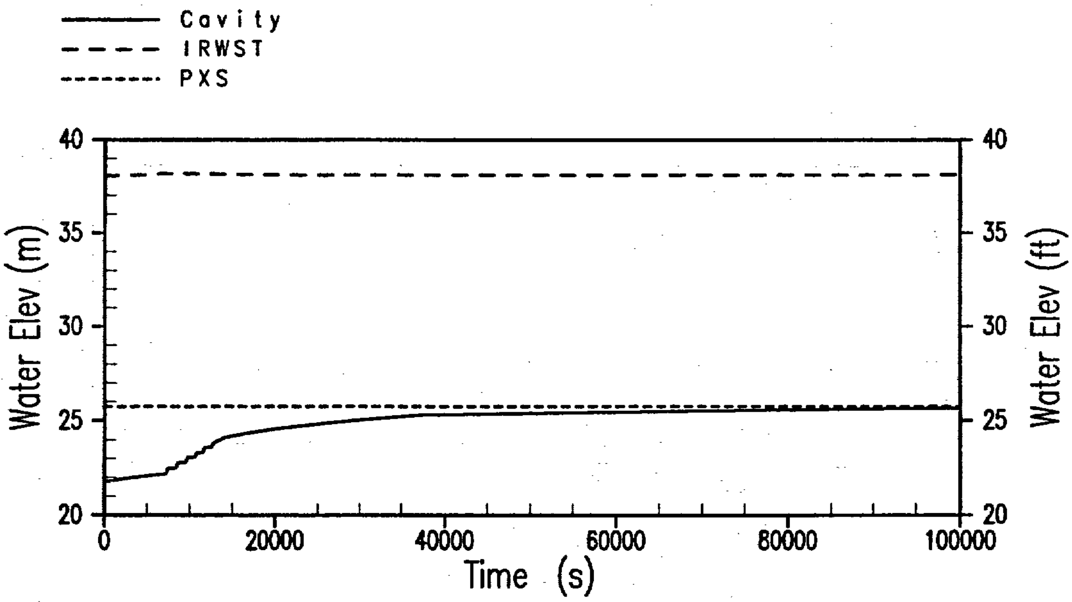


Figure 34-348

Case 1AP-2: Containment Water Pool Elevations
SBLOCA with PRHR, CMTs Failed

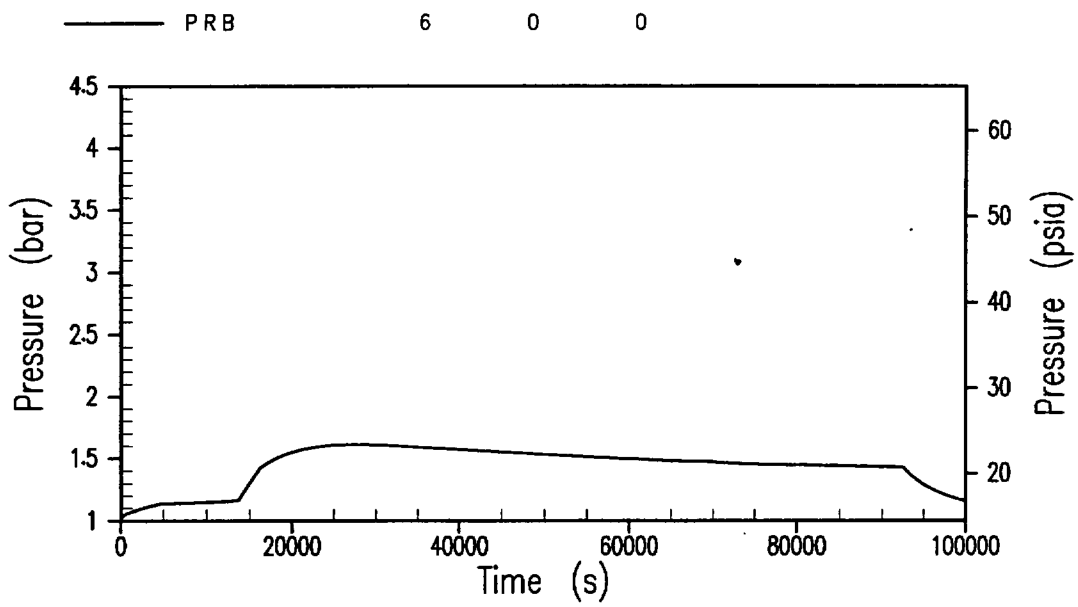


Figure 34-349

Case 1AP-2: Containment Pressure SBLOCA with PRHR, CMTs Failed

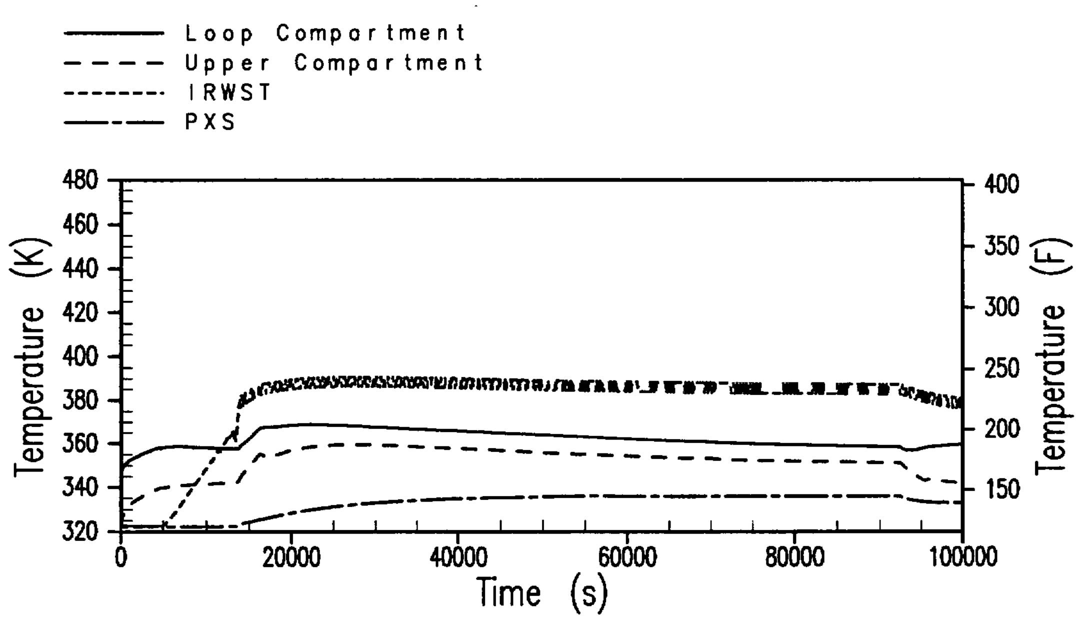


Figure 34-350

Case 1AP-2: Containment Gas Temperature SBLOCA with PRHR, CMTs Failed

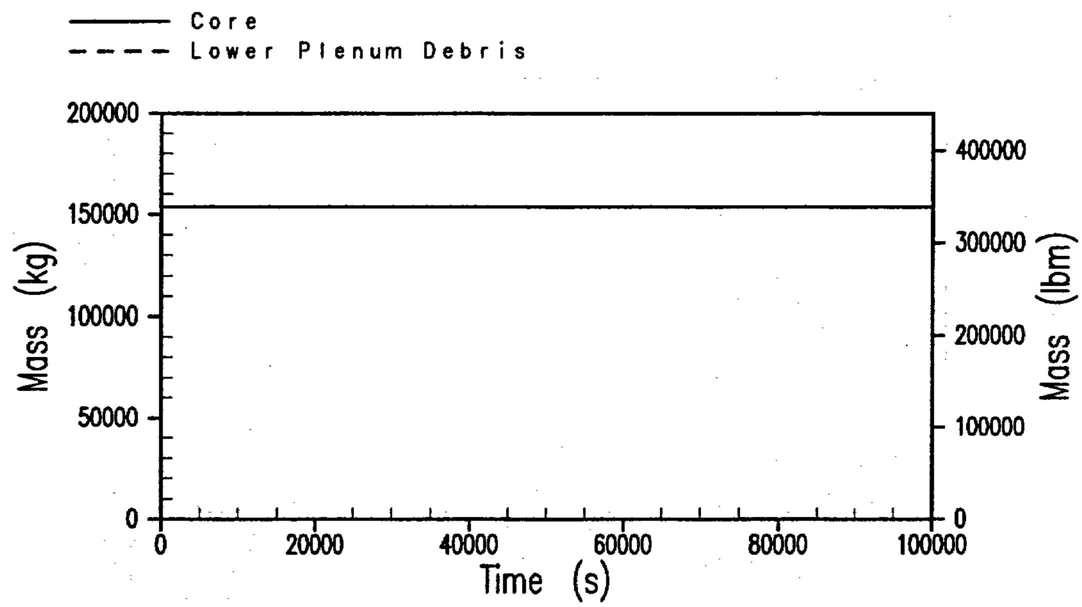


Figure 34-351

Case 1AP-2: Core Mass
SBLOCA with PRHR, CMTs Failed

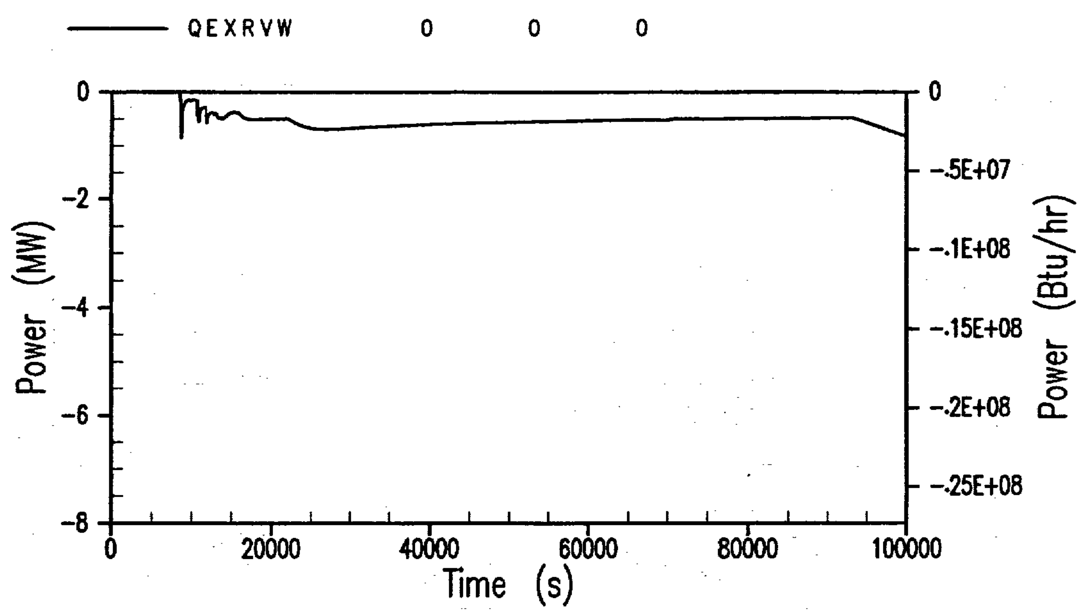


Figure 34-352

Case 1AP-2: Reactor Pressure Vessel to Cavity Water Heat Transfer
SBLOCA with PRHR, CMTs Failed

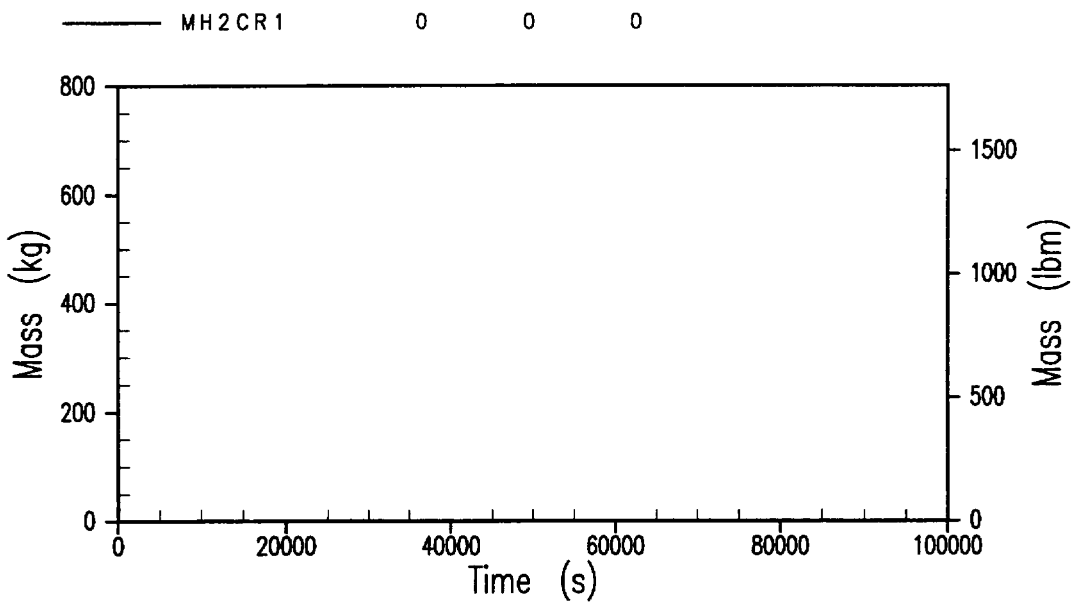


Figure 34-353

Case 1AP-2: In-Vessel Hydrogen Generation SBLOCA with PRHR, CMTs Failed

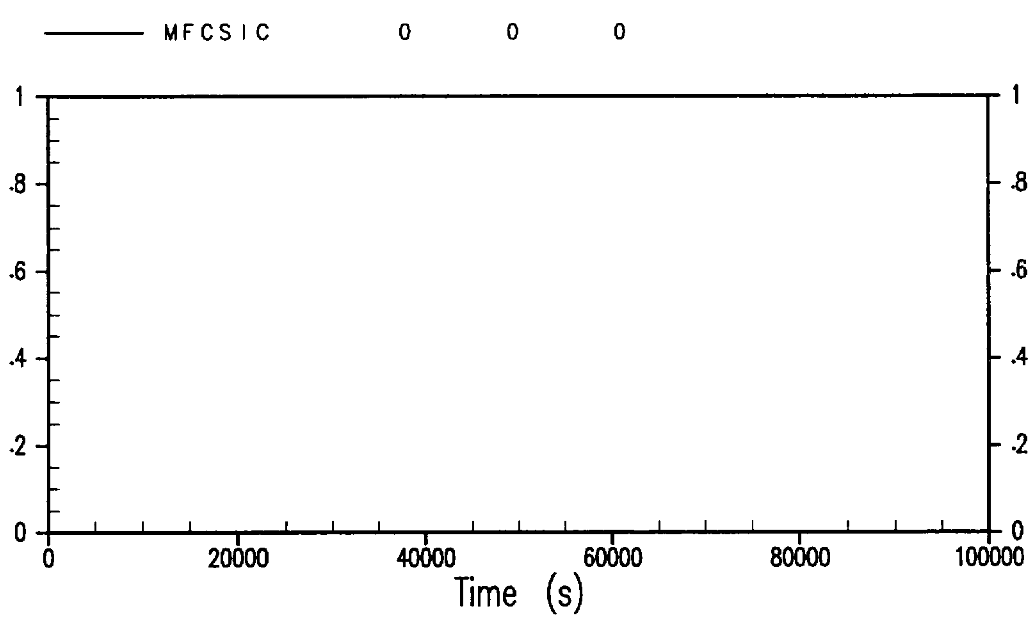


Figure 34-354

Case 1AP-2: Mass Fraction of CsI Released to Containment SBLOCA with PRHR, CMTs Failed

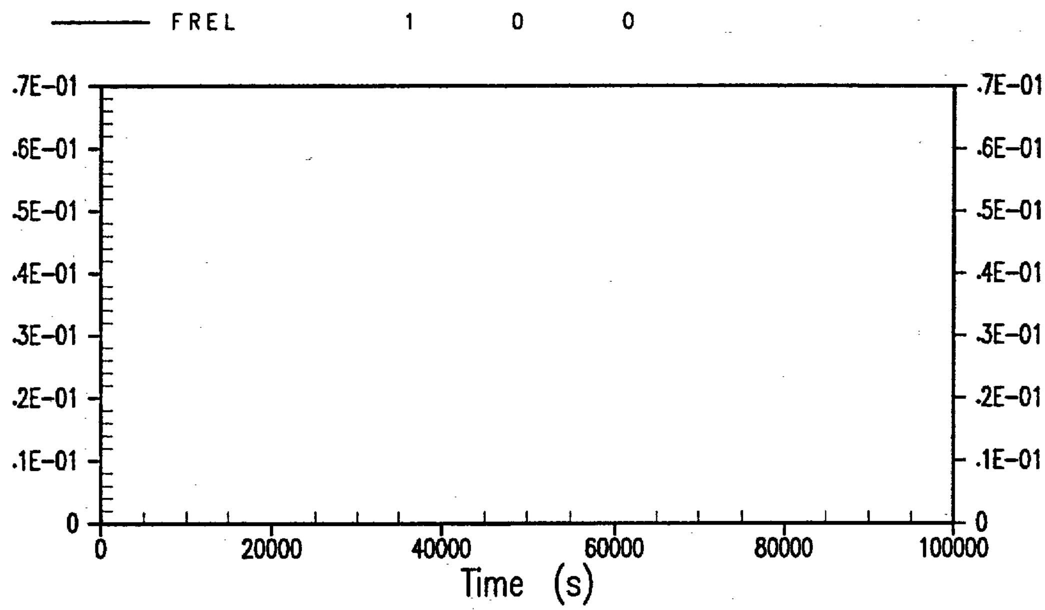


Figure 34-355

Case 1AP-2: Mass Fraction of Noble Gases Released to Environment SBLOCA with PRHR, CMTs Failed

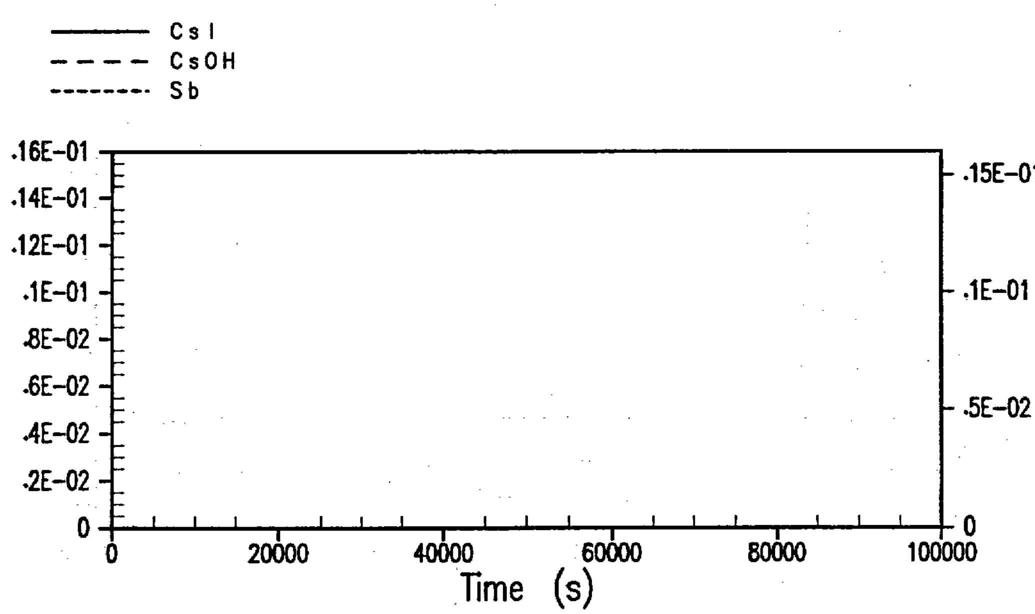


Figure 34-356

Case 1AP-2: Mass Fraction of Fission Products Released to Environment SBLOCA with PRHR, CMTs Failed

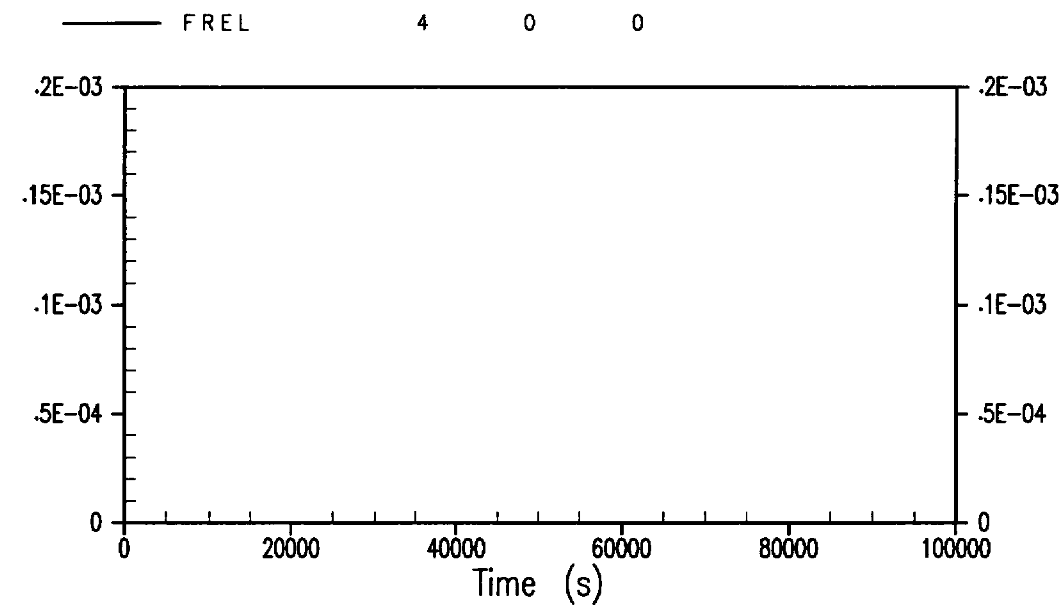


Figure 34-357

Case 1AP-2: Mass Fraction of SrO Released to Environment SBLOCA with PRHR, CMTs Failed

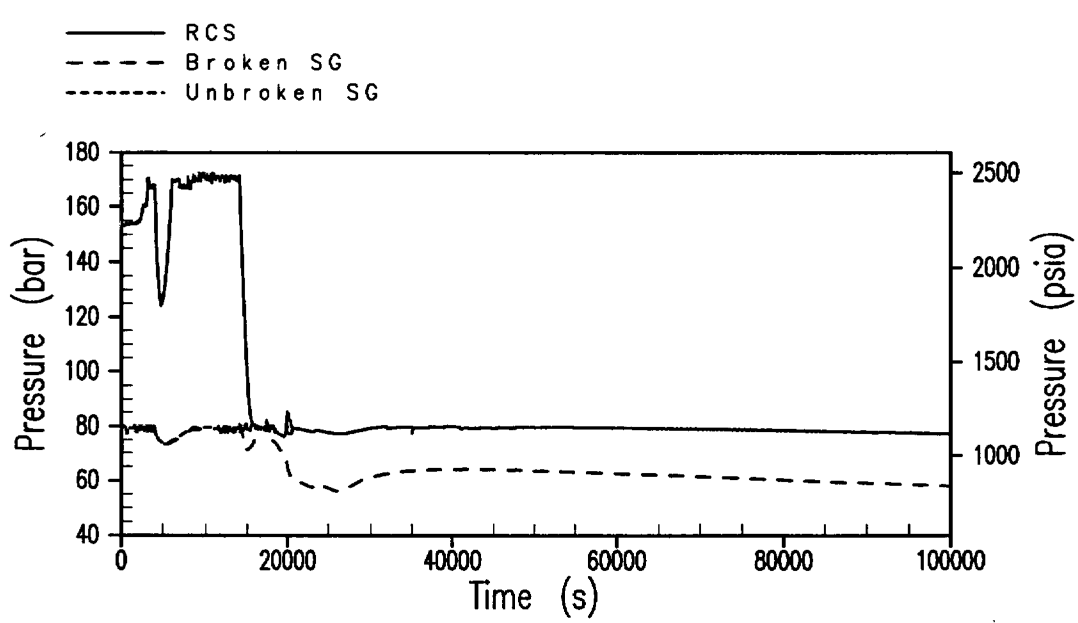


Figure 34-358

Case 1A-1: Reactor Coolant System and Steam Generator Pressure Transient with Creep of SG Tubes

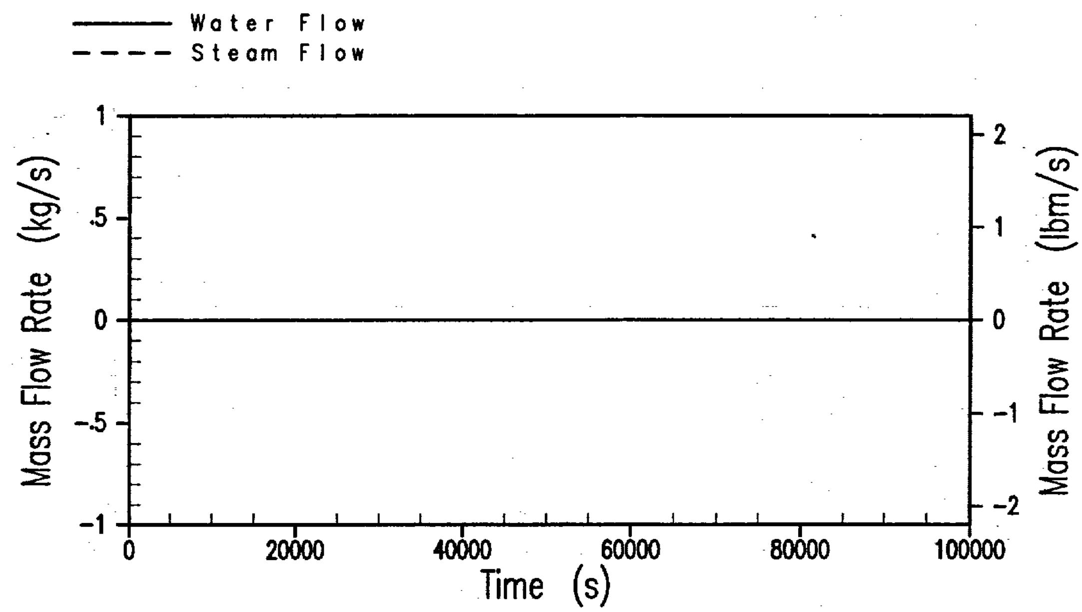


Figure 34-359

Case 1A-1: ADS Stage 4 Flow Rates Transient with Creep of SG Tubes

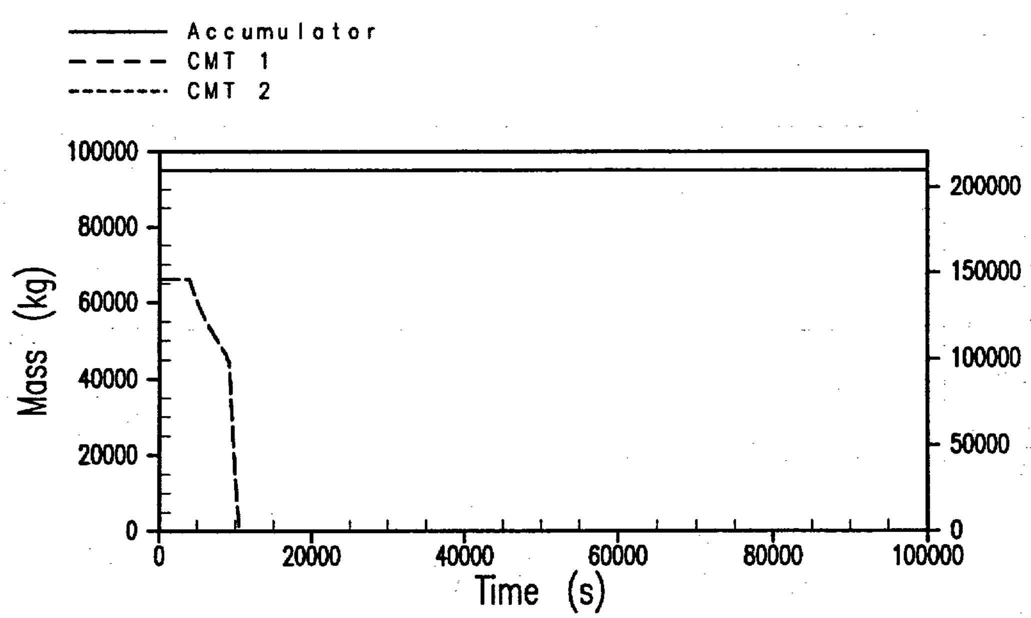


Figure 34-360

Case 1A-1: Accumulator/CMT Water Mass Transient with Creep of SG Tubes

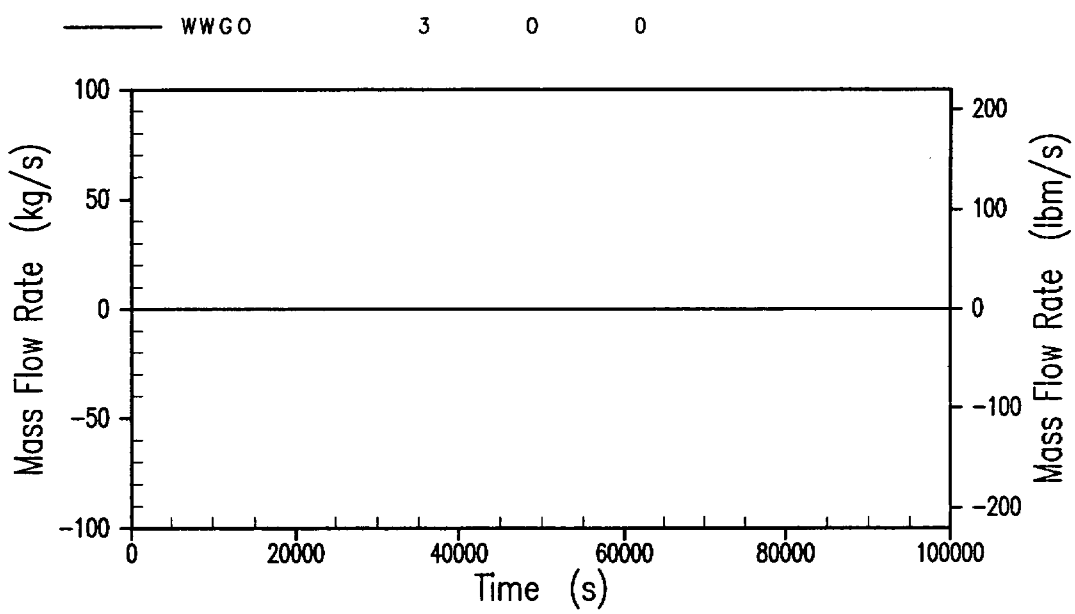


Figure 34-361

Case 1A-1: IRWST Injection Flow Rate Transient with Creep of SG Tubes

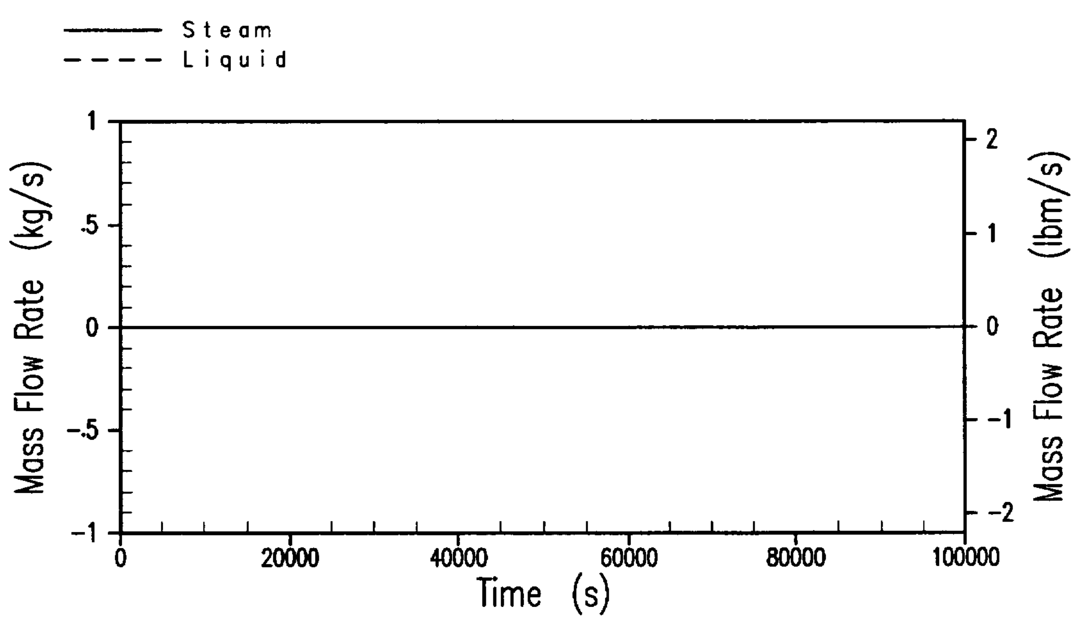


Figure 34-362

Case 1A-1: Break Flow Rate Transient with Creep of SG Tubes

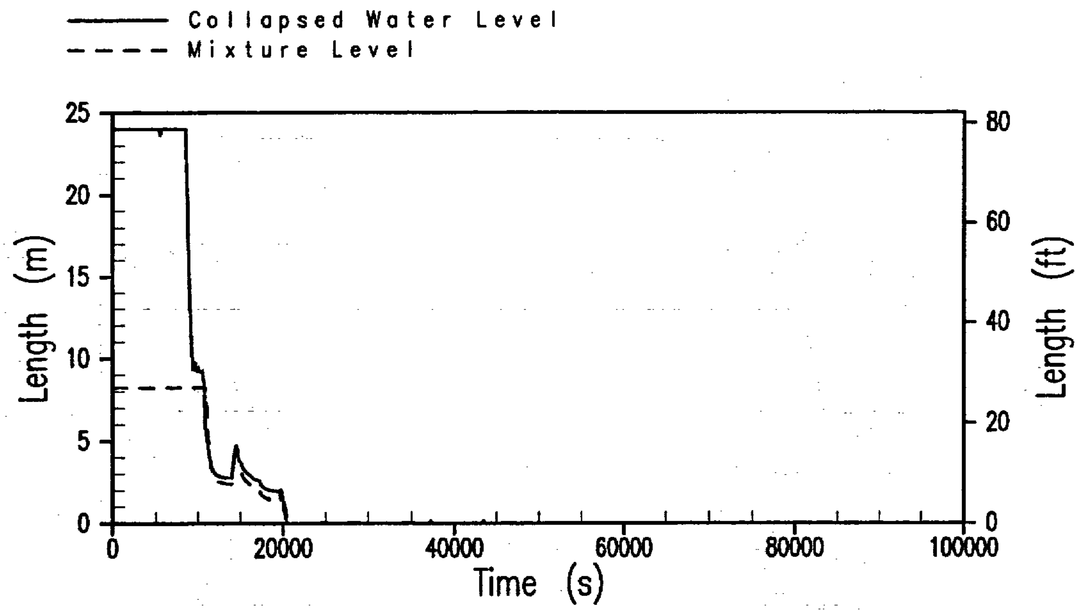


Figure 34-363

Case 1A-1: Reactor Vessel Water Level Transient with Creep of SG Tubes

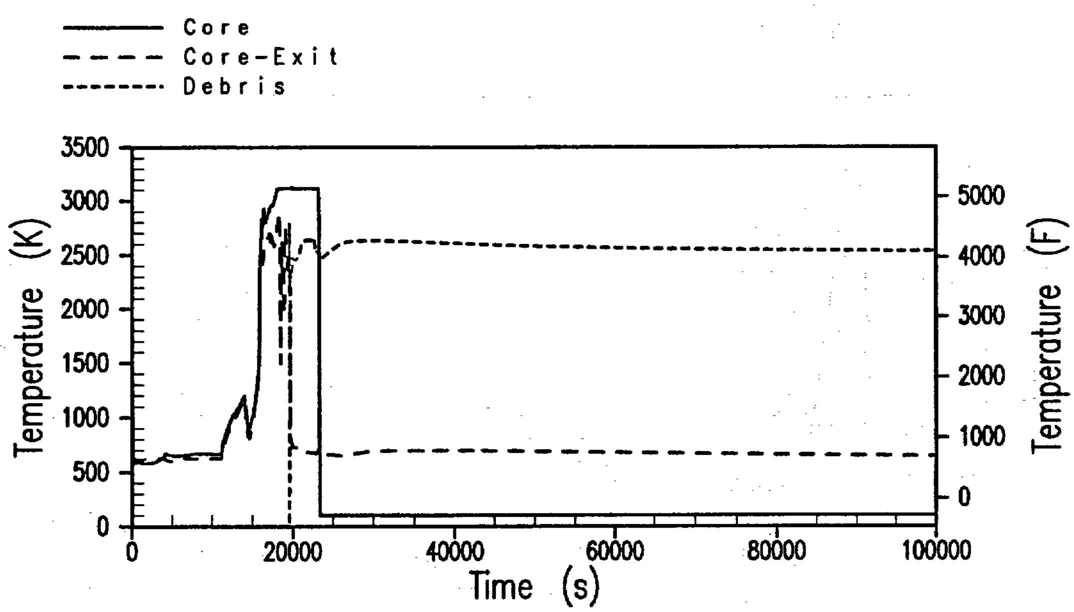


Figure 34-364

Case 1A-1: Core Temperatures Transient with Creep of SG Tubes

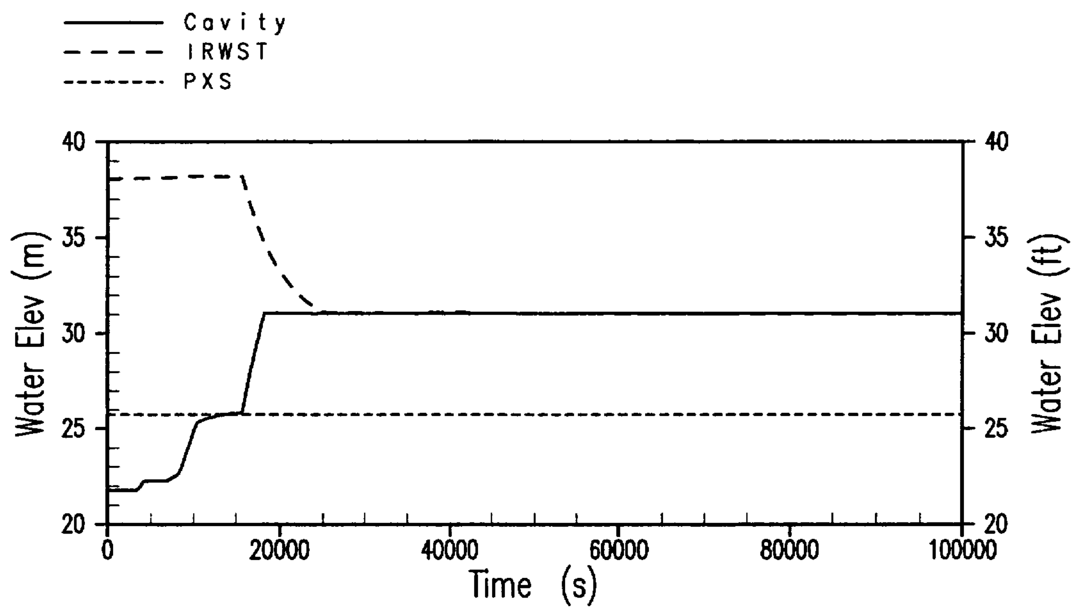


Figure 34-365

Case 1A-1: Containment Pool Water Elevations Transient with Creep of SG Tubes

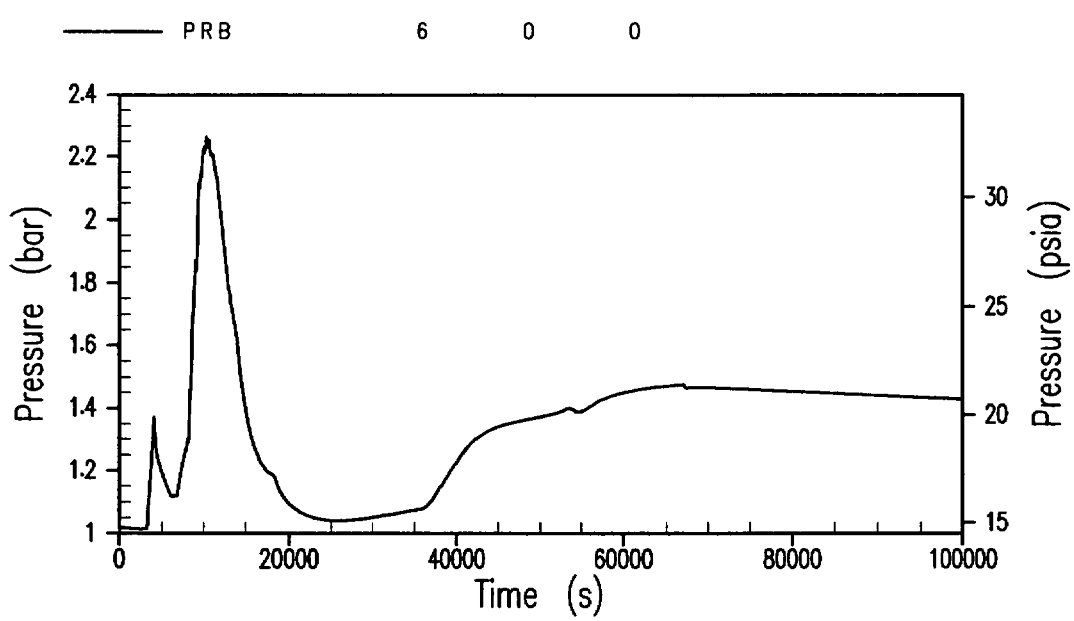


Figure 34-366

Case 1A-1: Containment Pressure Transient with Creep of SG Tubes

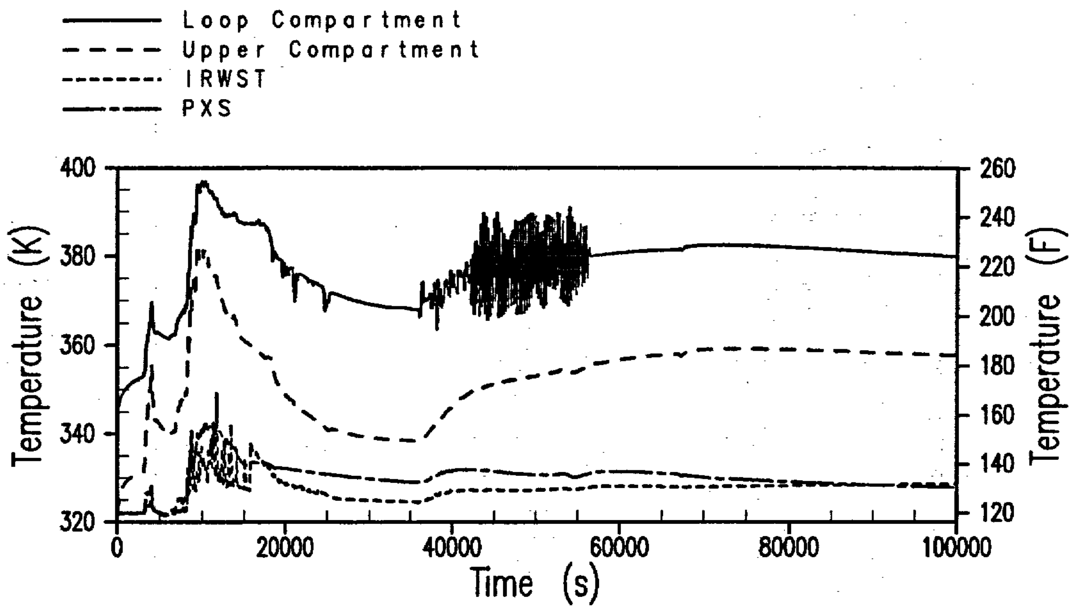


Figure 34-367

Case 1A-1: Containment Gas Temperature Transient with Creep of SG Tubes

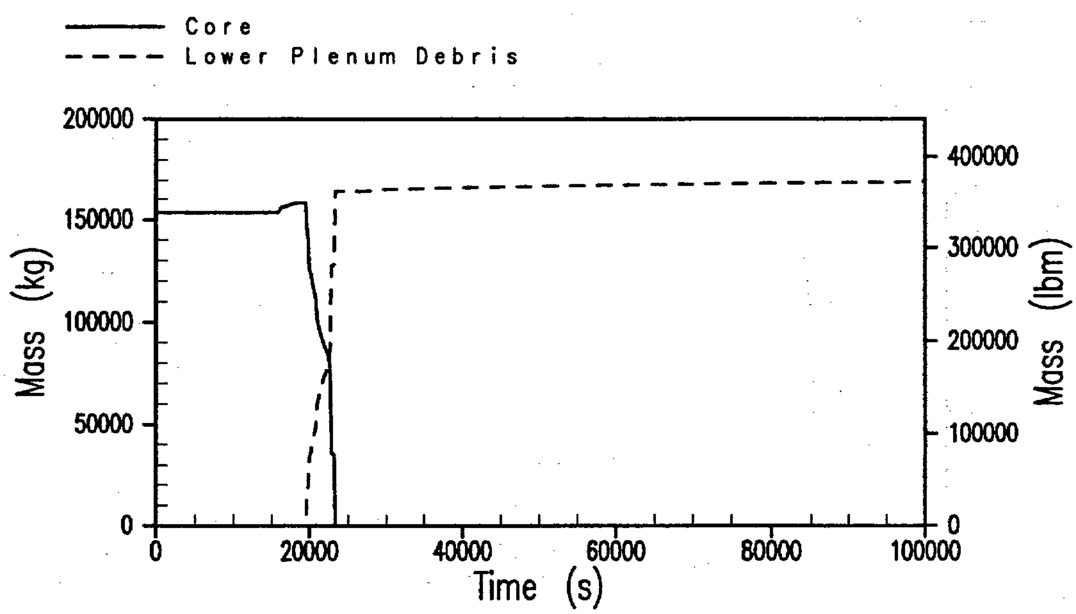


Figure 34-368

Case 1A-1: Core Mass Transient with Creep of SG Tubes

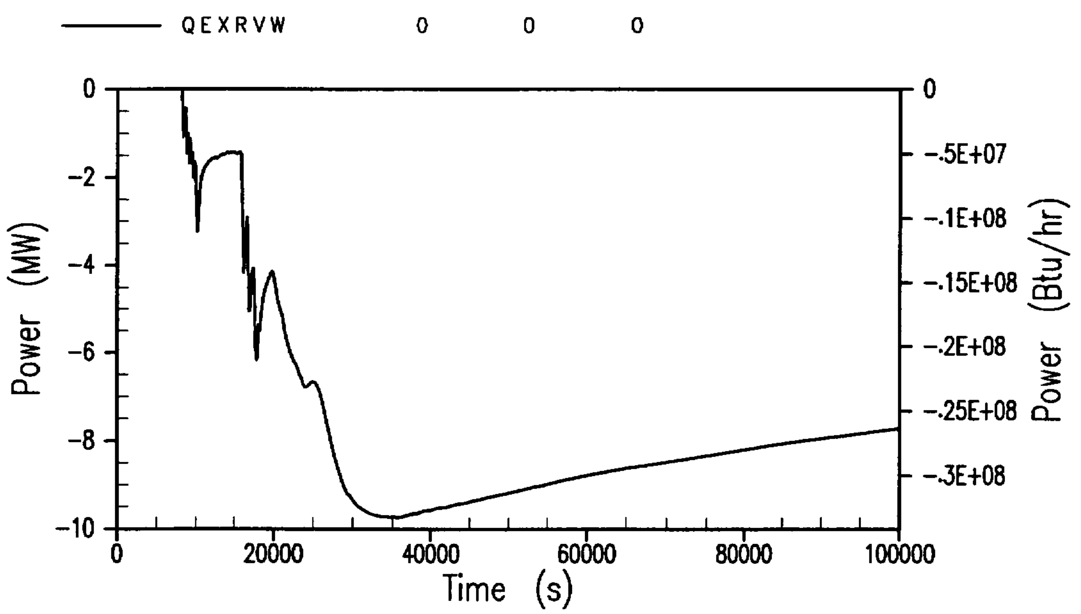


Figure 34-369

Case 1A-1: Reactor Pressure Vessel to Cavity Water Heat Transfer Transient with Creep of SG Tubes

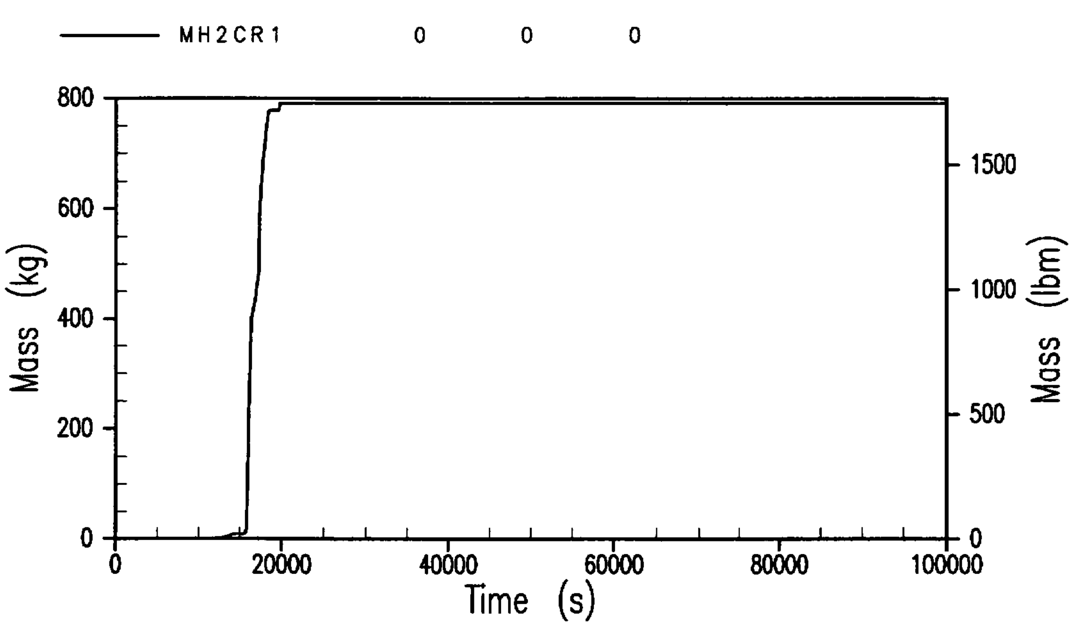


Figure 34-370

Case 1A-1: In-Vessel Hydrogen Generation Transient with Creep of SG Tubes

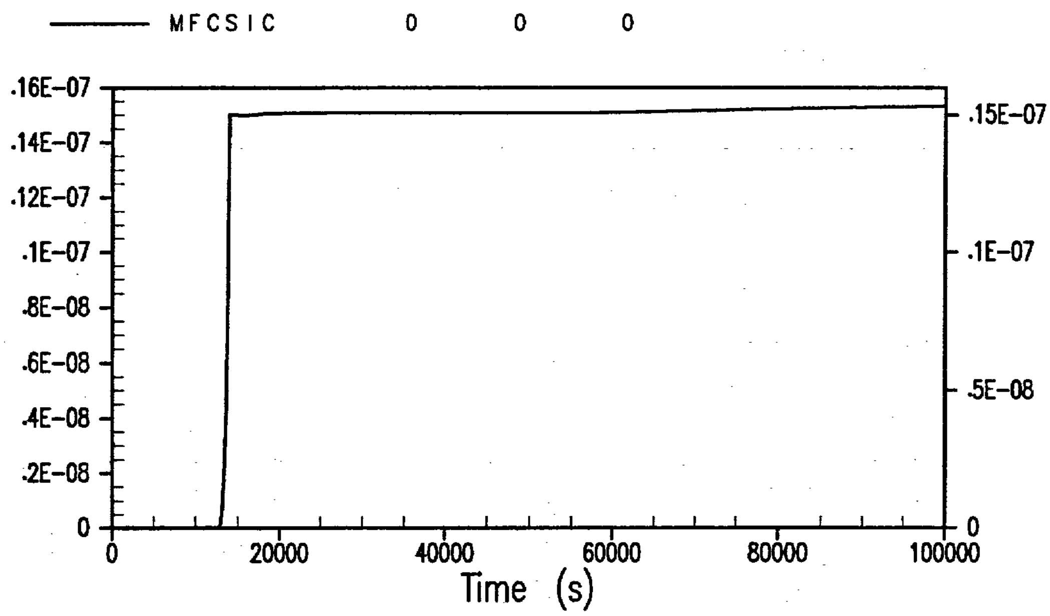


Figure 34-371

Case 1A-1: Mass Fraction of CsI Released to Containment Transient with Creep of SG Tubes

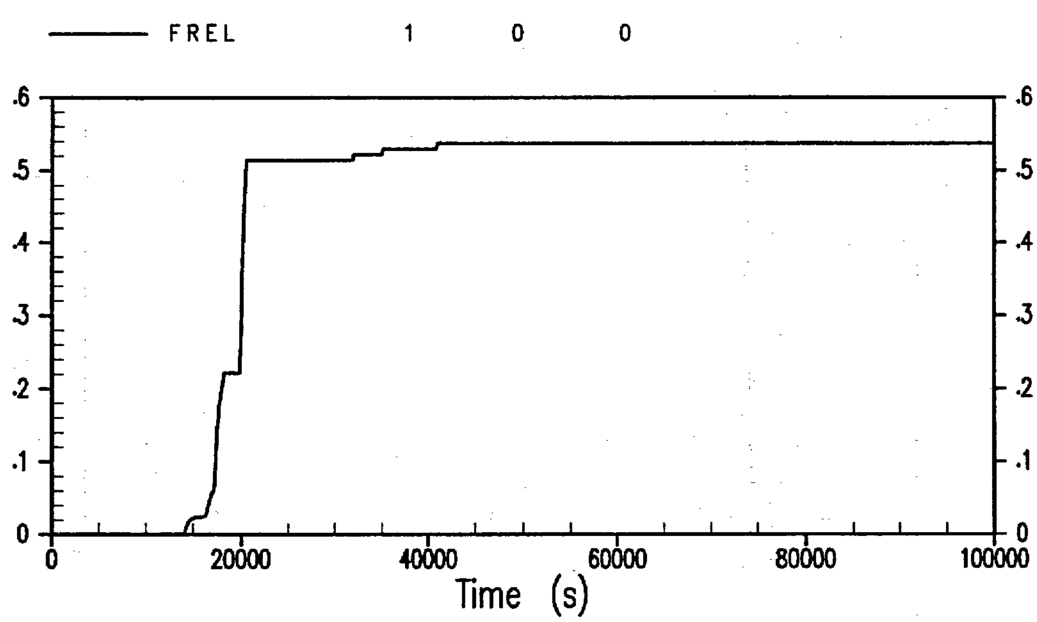


Figure 34-372

Case 1A-1: Mass Fraction of Noble Gases Released to Environment Transient with Creep of SG Tubes

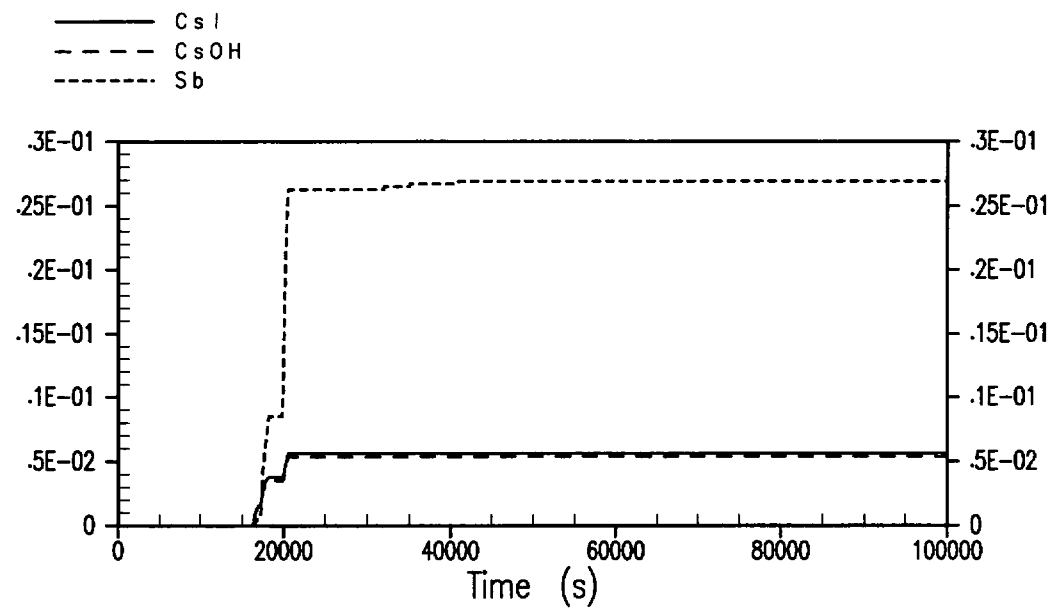


Figure 34-373

Case 1A-1: Mass Fraction of Fission Products Released to Environment Transient with Creep of SG Tubes

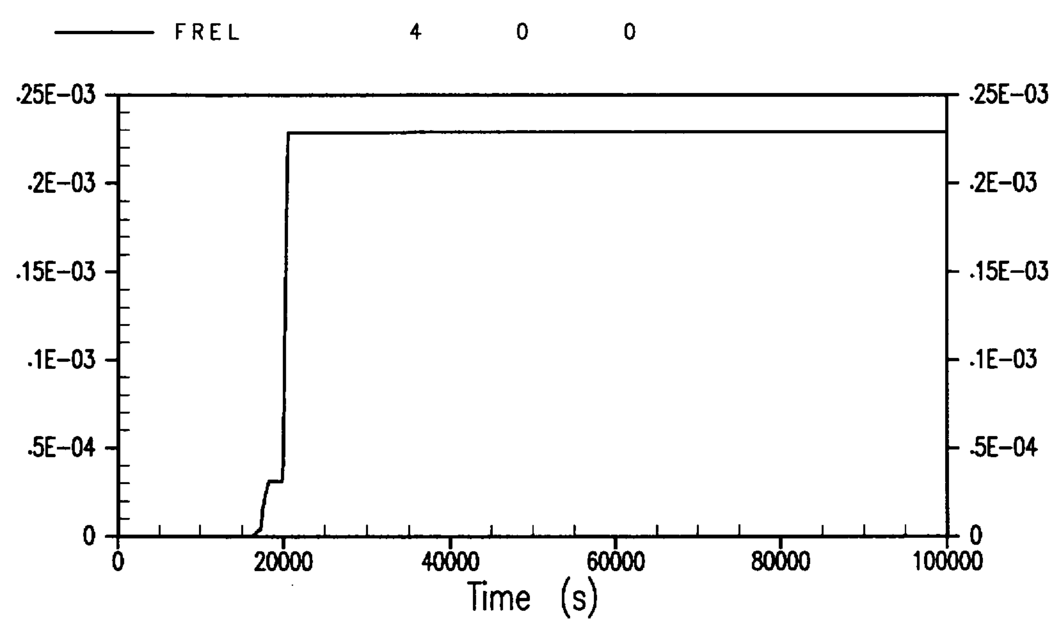


Figure 34-374

Case 1A-1: Mass Fraction of SrO Released to Environment Transient with Creep of SG Tubes

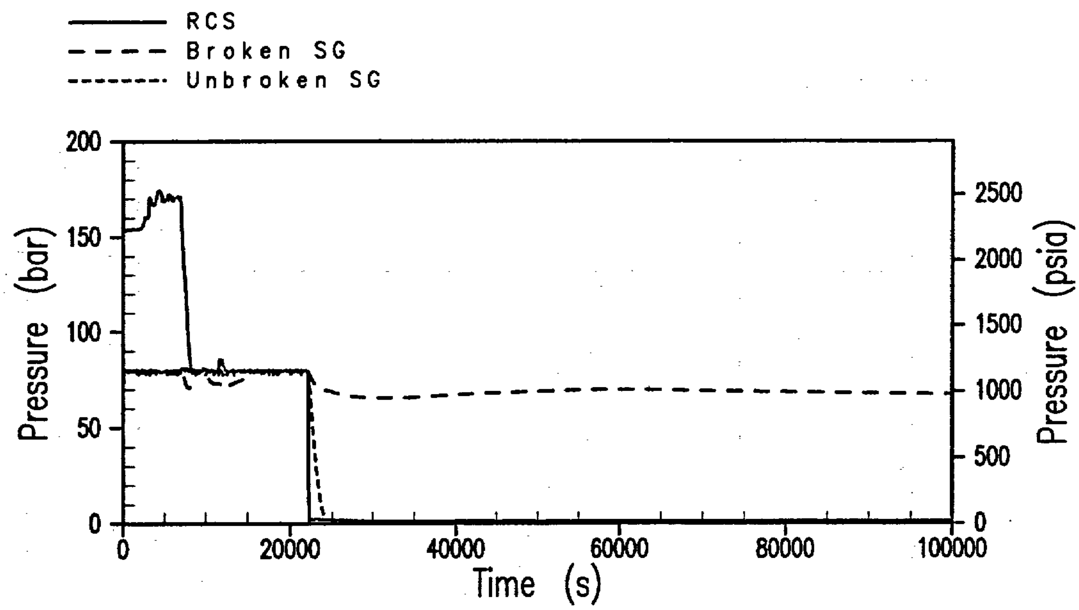


Figure 34-375

Case 1A-2: Reactor Coolant System and Steam Generator Pressure Transient with Creep of SG Tubes

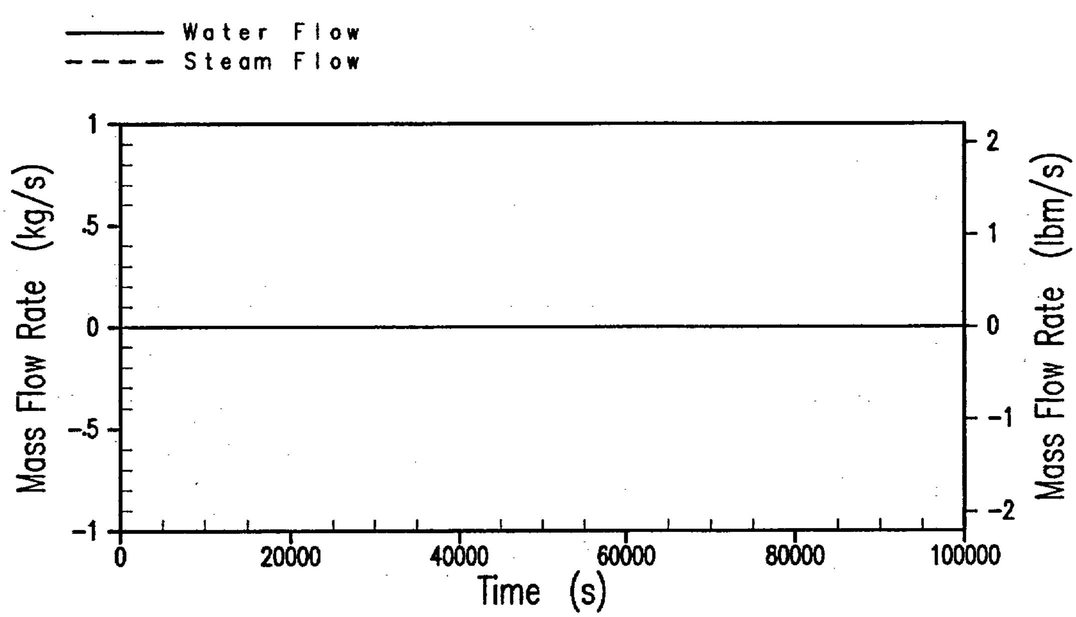


Figure 34-376

Case 1A-2: ADS Stage 4 Flow Rates Transient with Creep of SG Tubes

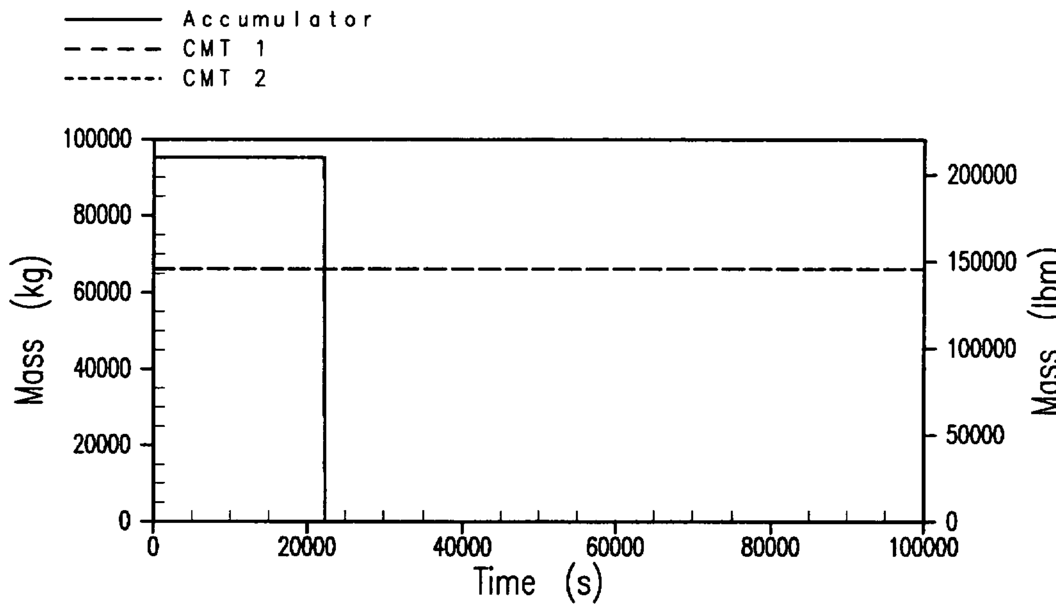


Figure 34-377

Case 1A-2: Accumulator/CMT Water Mass Transient with Creep of SG Tubes

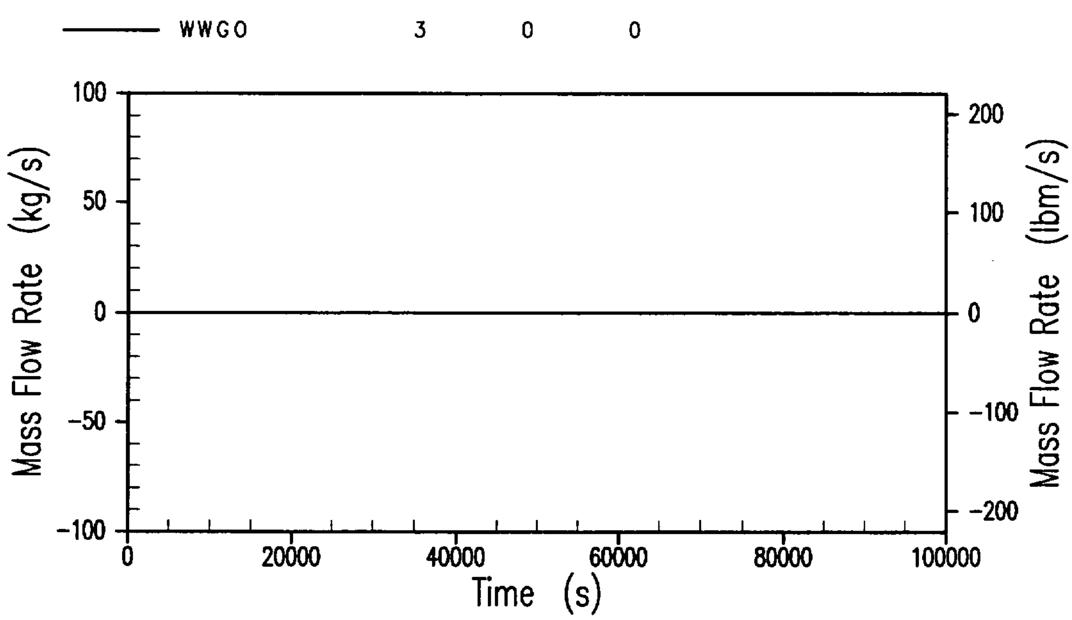


Figure 34-378

Case 1A-2: IRWST Injection Flow Rate Transient with Creep of SG Tubes

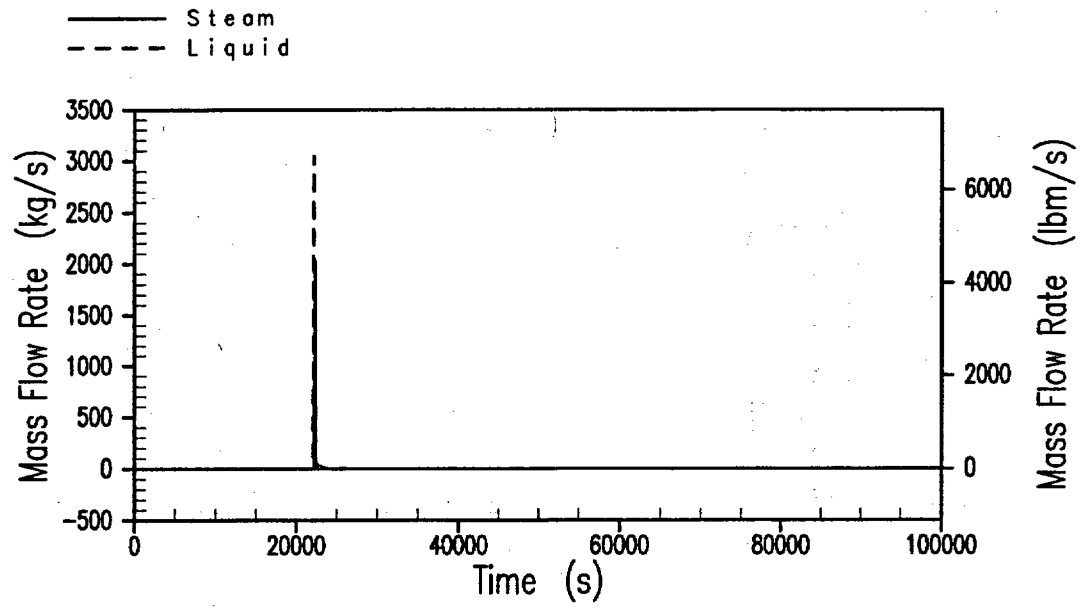


Figure 34-379

Case 1A-2: Break Flow Rate Transient with Creep of SG Tubes

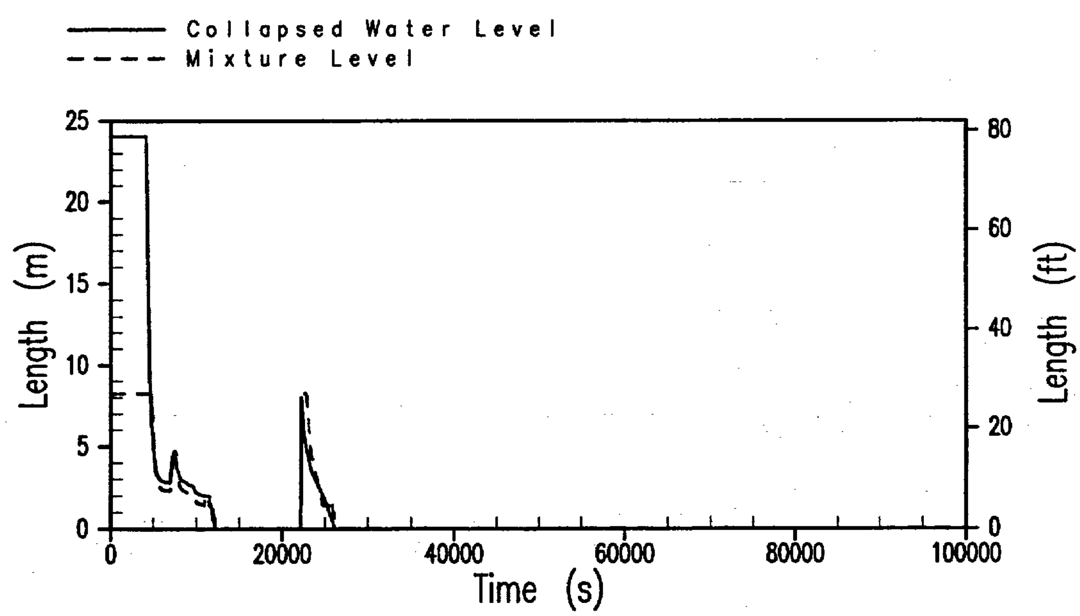


Figure 34-380

Case 1A-2: Reactor Vessel Water Level Transient with Creep of SG Tubes

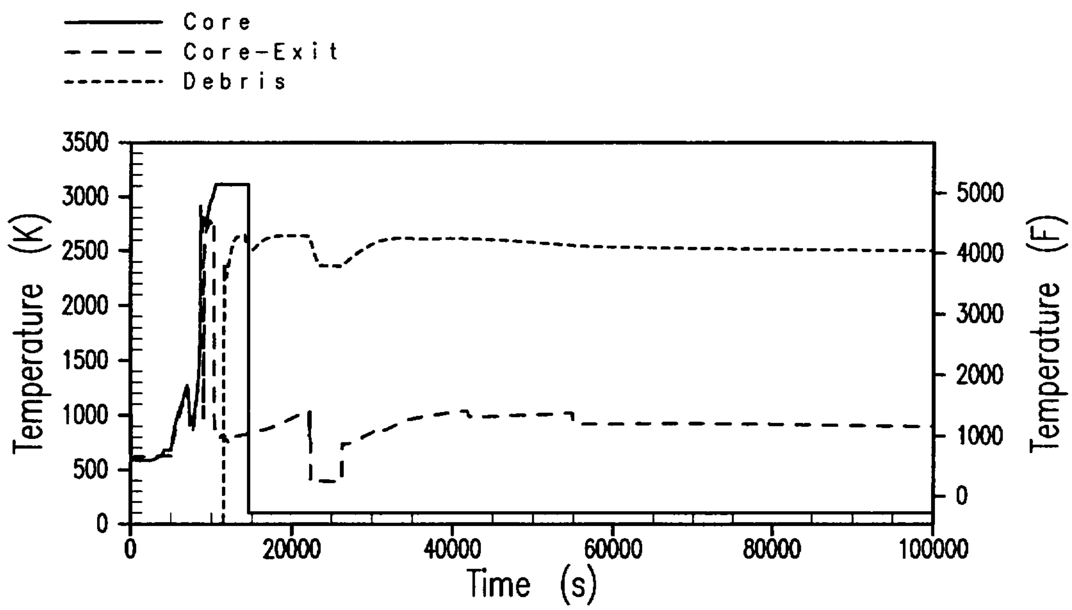


Figure 34-381

Case 1A-2: Core Temperatures Transient with Creep of SG Tubes

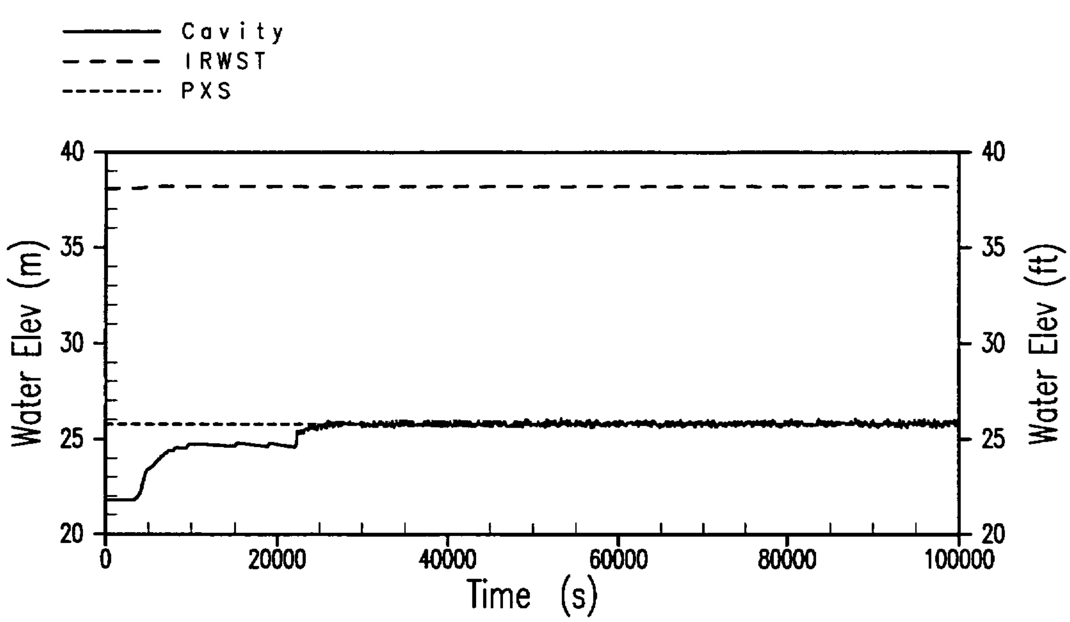


Figure 34-382

Case 1A-2: Containment Water Pool Elevations Transient with Creep of SG Tubes

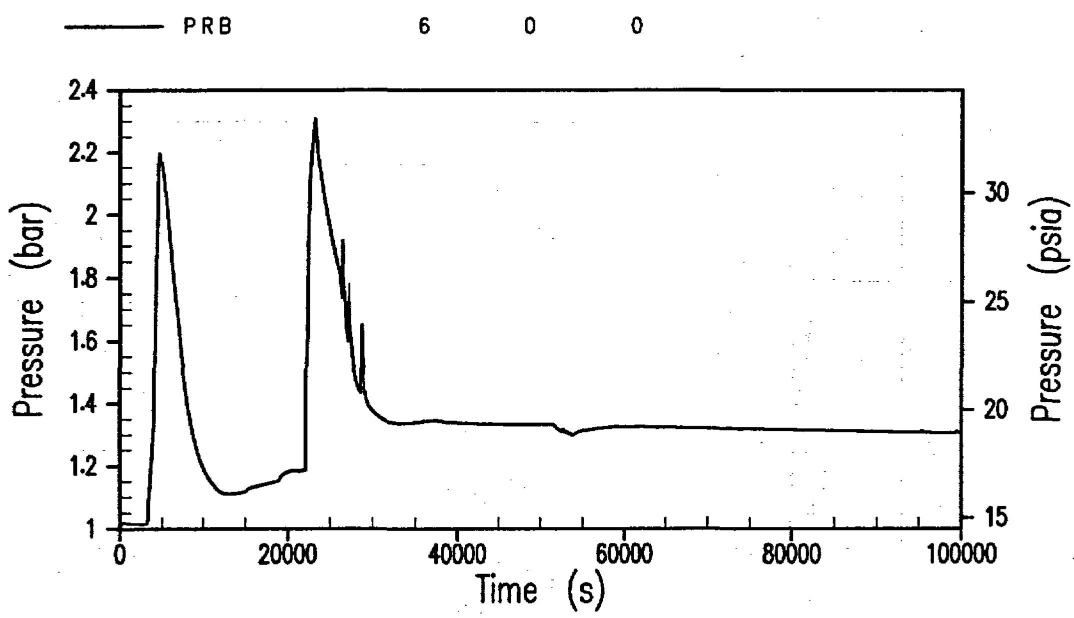


Figure 34-383

Case 1A-2: Containment Pressure Transient with Creep of SG Tubes

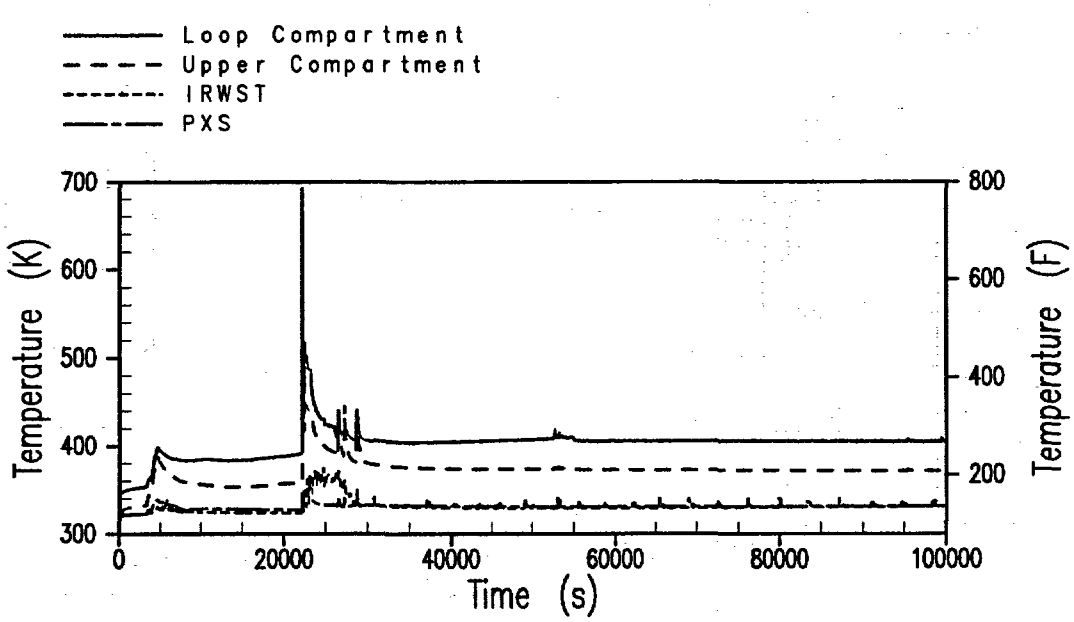


Figure 34-384

Case 1A-2: Containment Gas Temperature Transient with Creep of SG Tubes

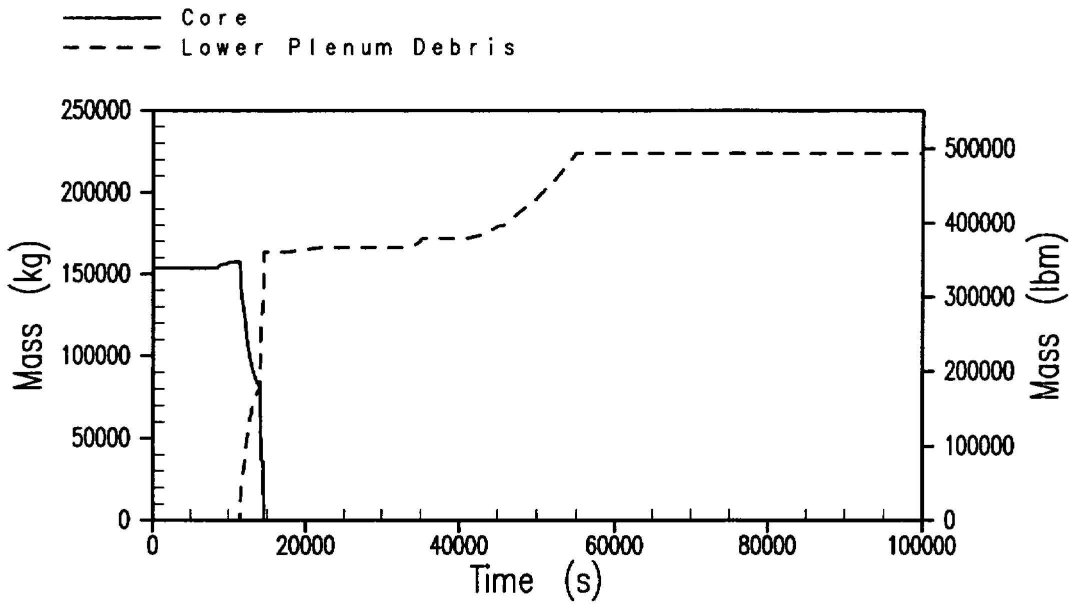


Figure 34-385

Case 1A-2: Core Mass Transient with Creep of SG Tubes

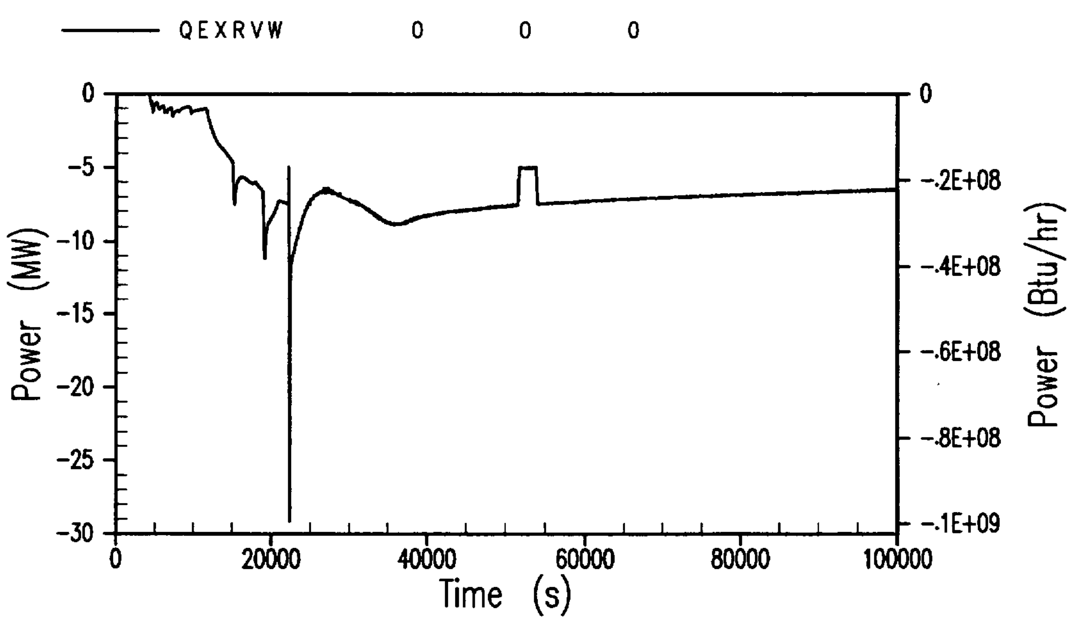


Figure 34-386

Case 1A-2: Reactor Pressure Vessel to Cavity Water Heat Transfer Transient with Creep of SG Tubes

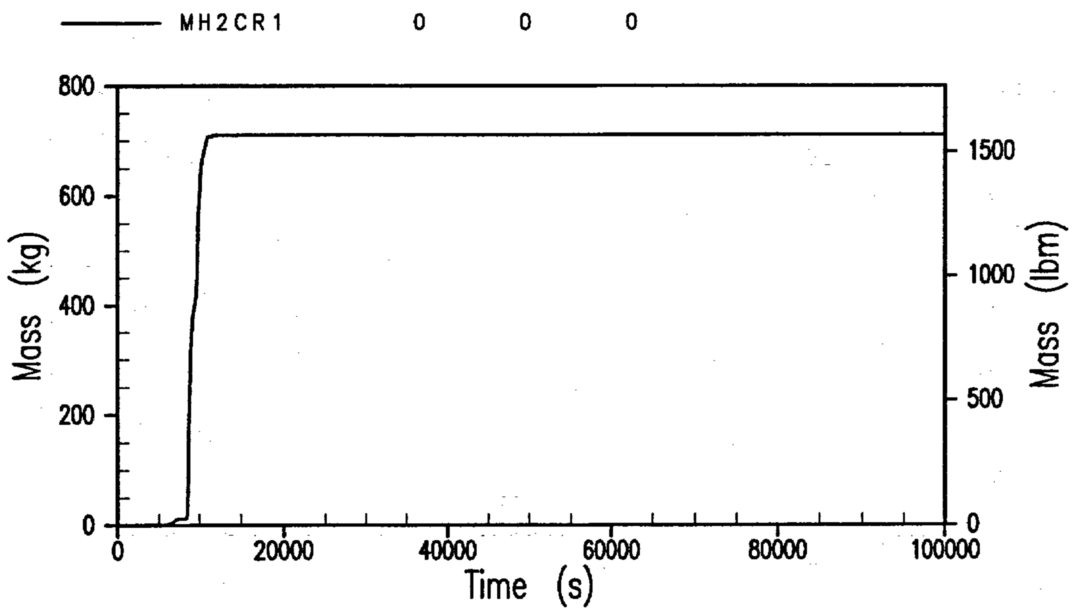


Figure 34-387

Case 1A-2: In-Vessel Hydrogen Generation Transient with Creep of SG Tubes

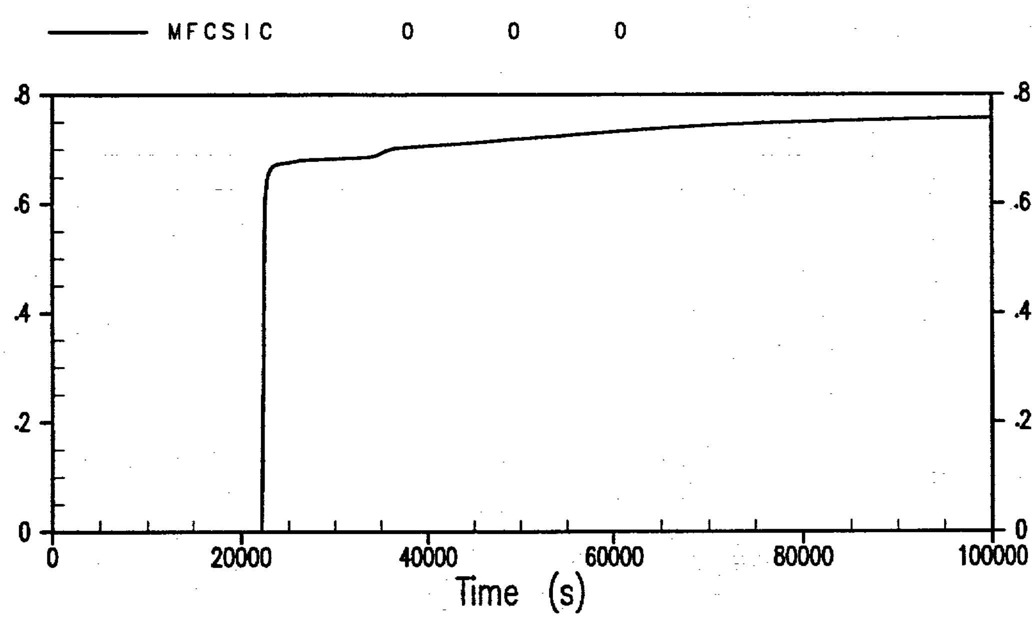


Figure 34-388

Case 1A-2: Mass Fraction of CsI Released to Containment Transient with Creep of SG Tubes

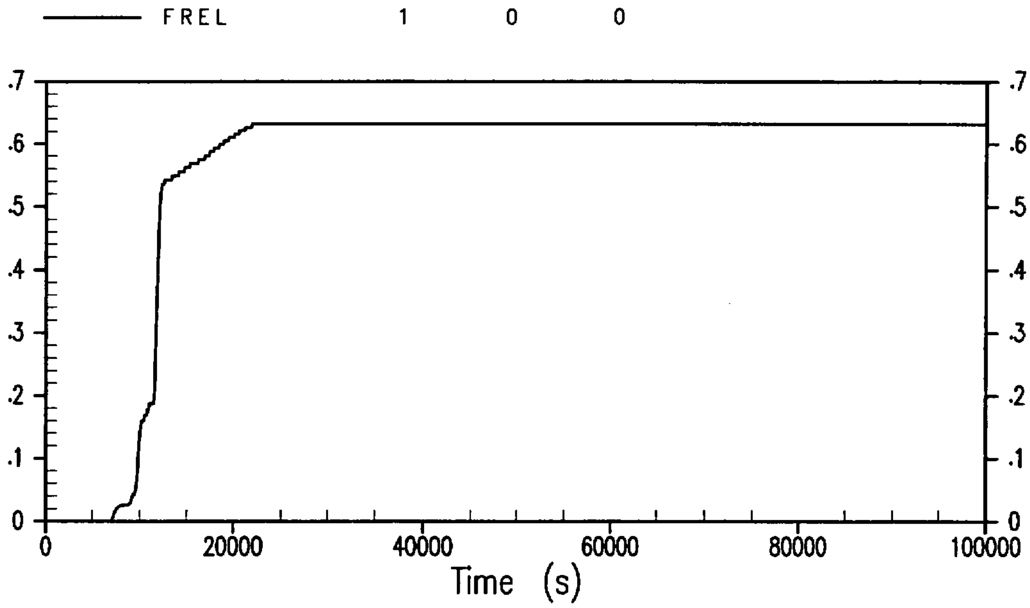


Figure 34-389

Case 1A-2: Mass Fraction of Noble Gases Released to Environment Transient with Creep of SG Tubes

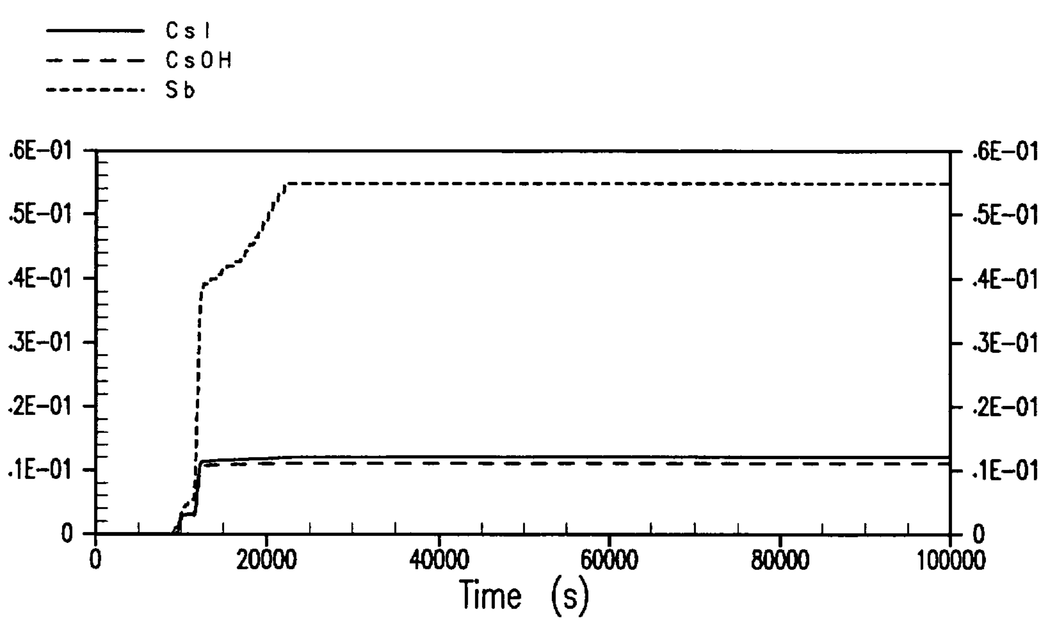


Figure 34-390

Case 1A-2: Mass Fraction of Fission Products Released to Environment Transient with Creep of SG Tubes

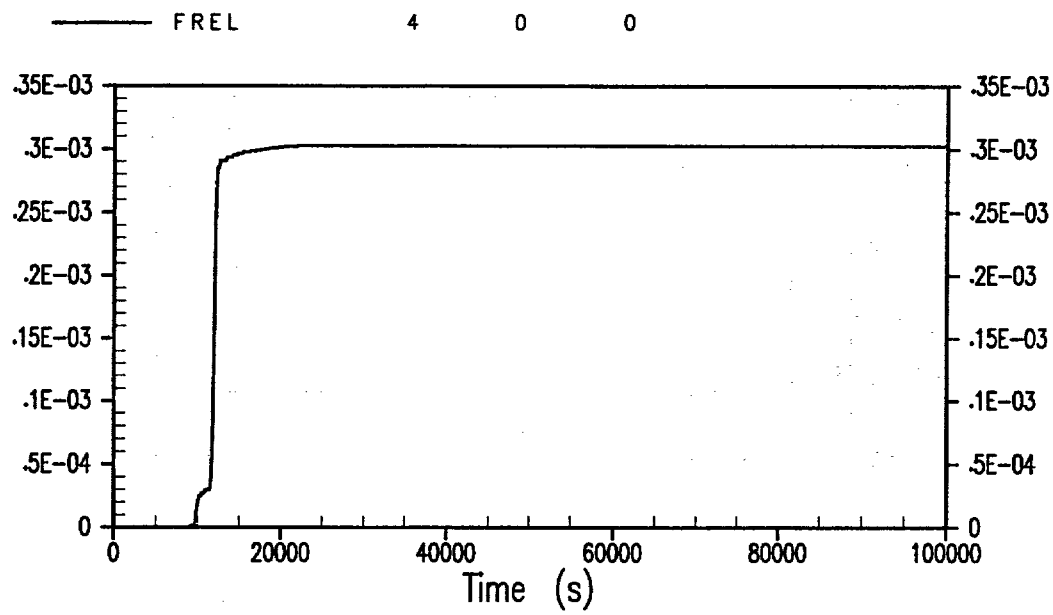


Figure 34-391

Case 1A-2: Mass Fraction of SrO Released to Environment Transient with Creep of SG Tubes

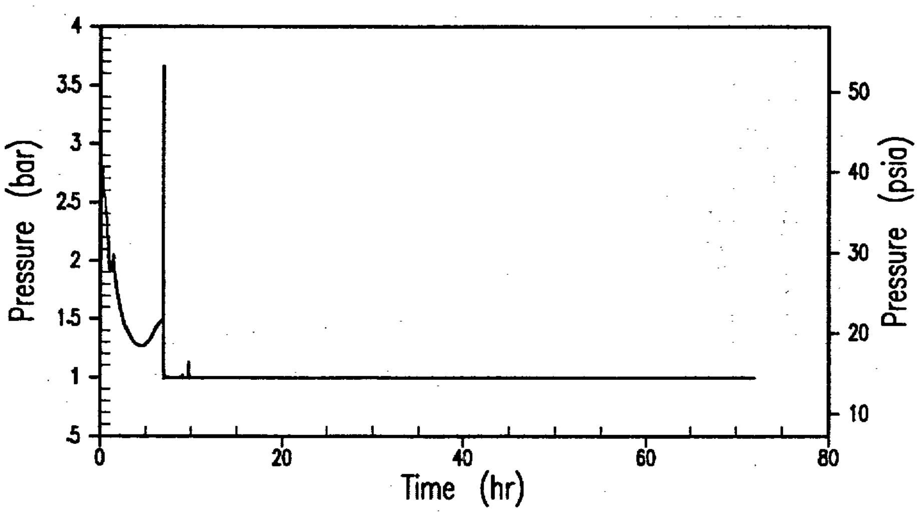


Figure 34-392

Case 3BE-1: Containment Pressure DDT Intermediate Containment Failure

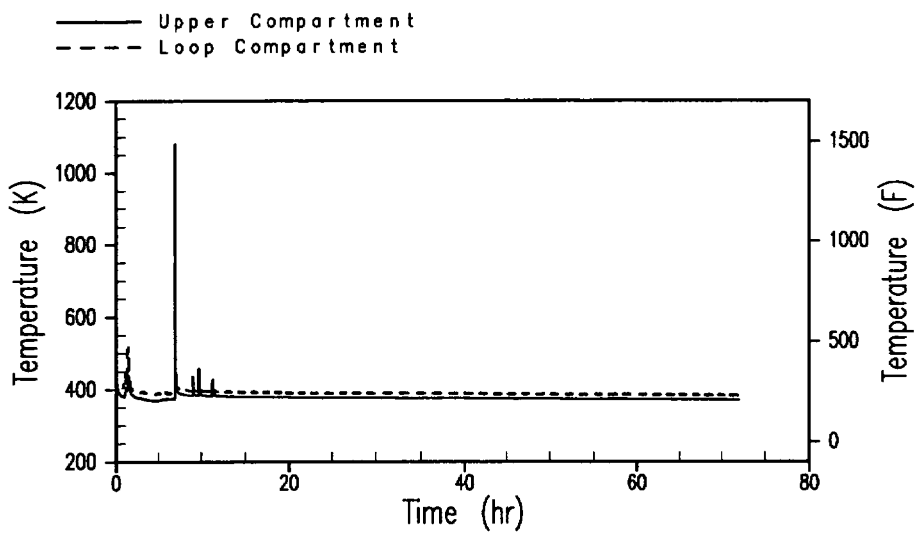


Figure 34-393

Case 3BE-1: Containment Gas Temperature DDT Intermediate Containment Failure

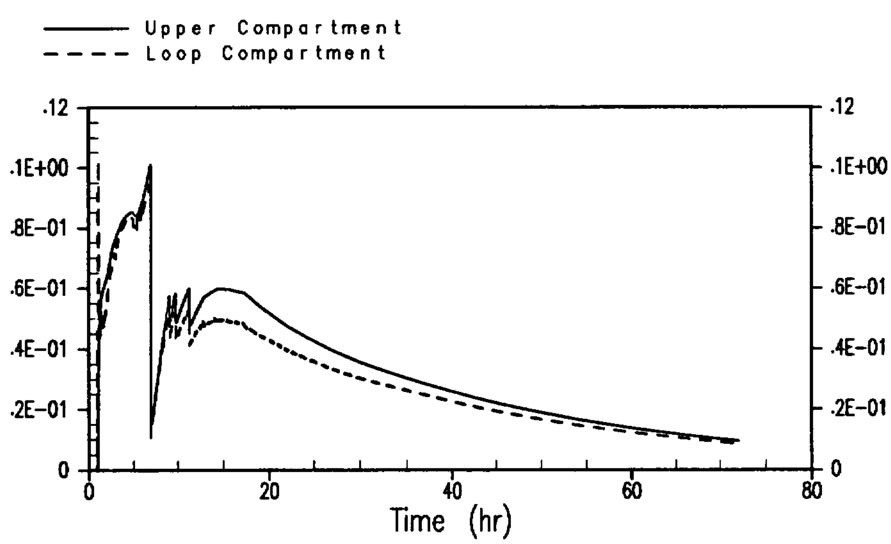


Figure 34-394

Case 3BE-1: Containment Hydrogen Concentration DDT Intermediate Containment Failure

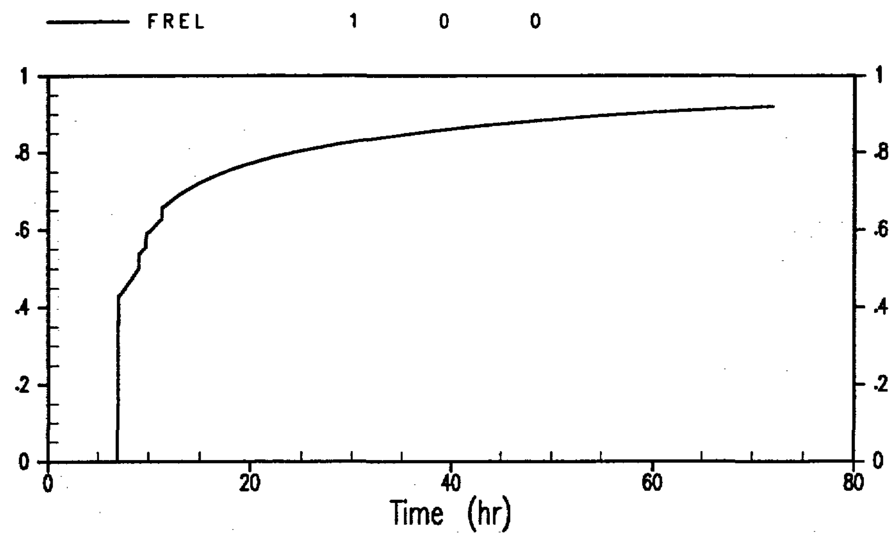


Figure 34-395

Case 3BE-1: Noble Gases Release Fraction DDT Intermediate Containment Failure

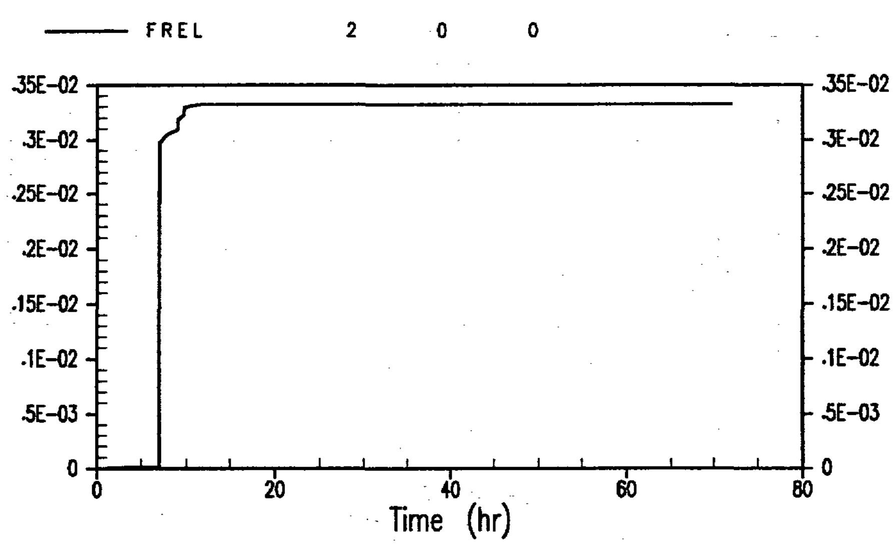


Figure 34-396

Case 3BE-1: CsI and RbI Release Fraction DDT Intermediate Containment Failure

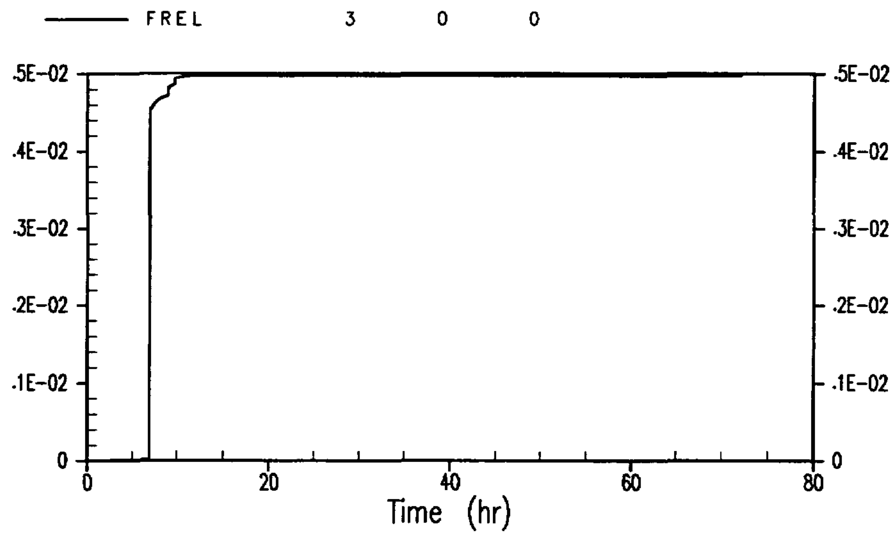


Figure 34-397

Case 3BE-1: TeO_2 Release Fraction
DDT Intermediate Containment Failure

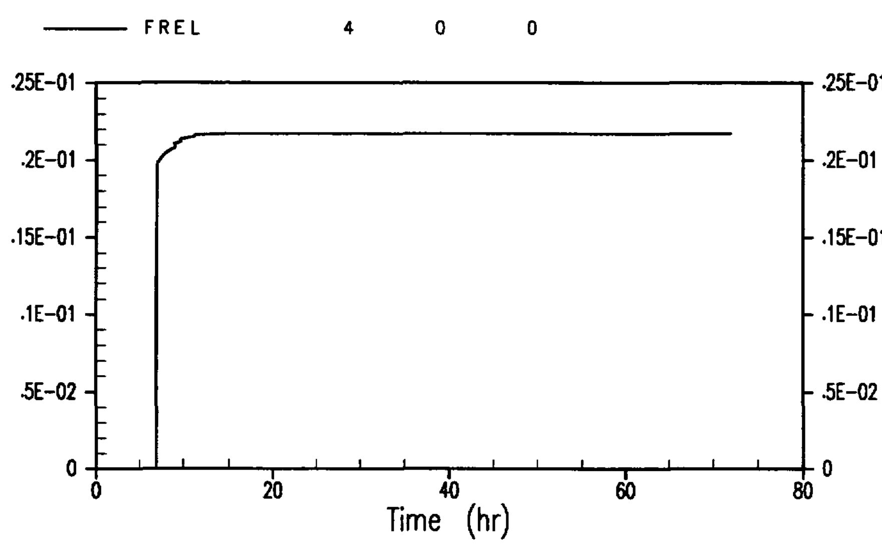


Figure 34-398

Case 3BE-1: SrO Release Fraction
DDT Intermediate Containment Failure

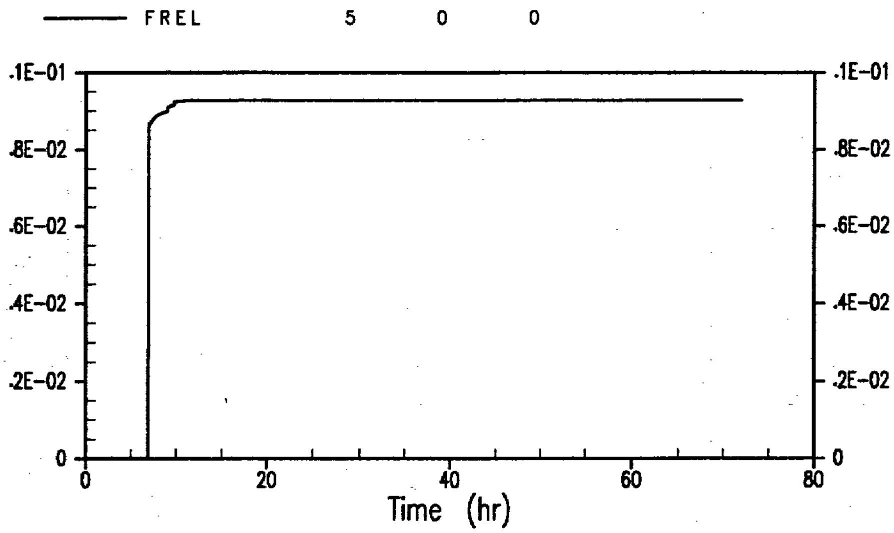


Figure 34-399

Case 3BE-1: MoO_2 Release Fraction DDT Intermediate Containment Failure

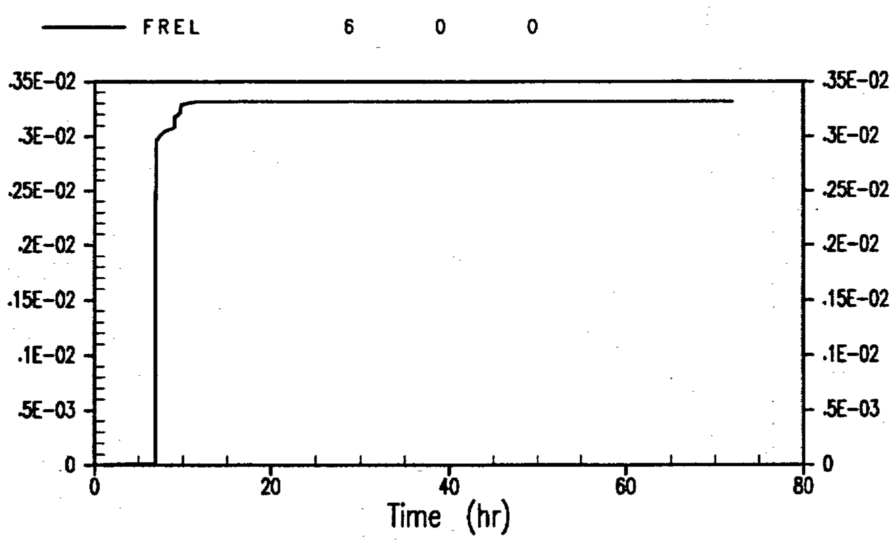


Figure 34-400

Case 3BE-1: CsOH and RbOH Release Fraction DDT Intermediate Containment Failure

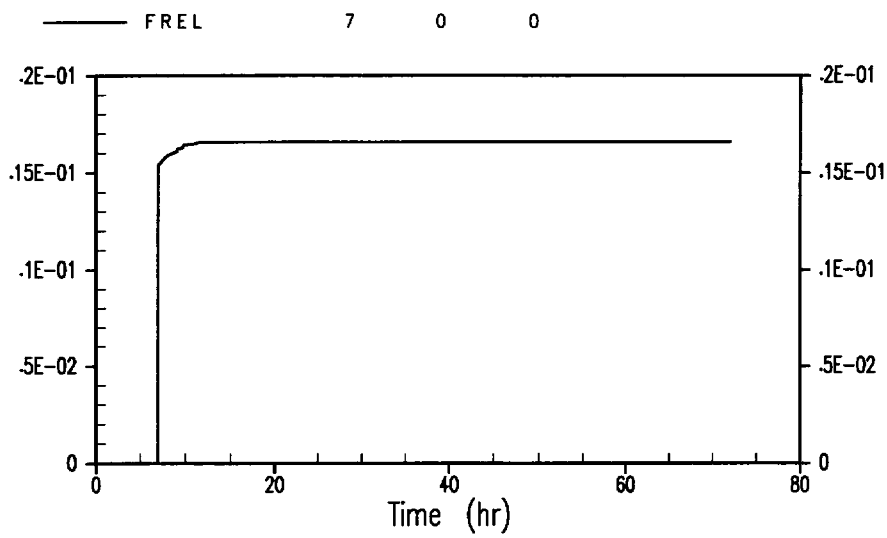


Figure 34-401

Case 3BE-1: BaO Release Fraction
DDT Intermediate Containment Failure

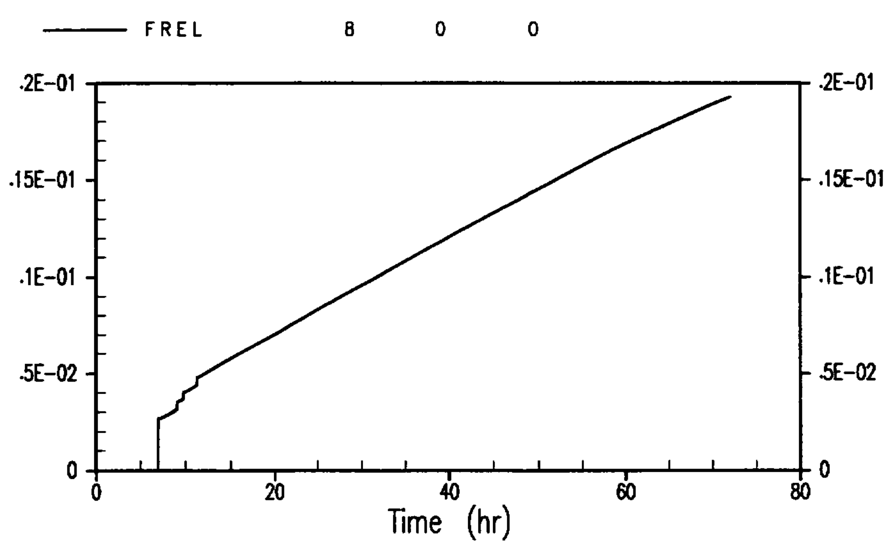


Figure 34-402

Case 3BE-1: La_2O_3 Release Fraction
DDT Intermediate Containment Failure

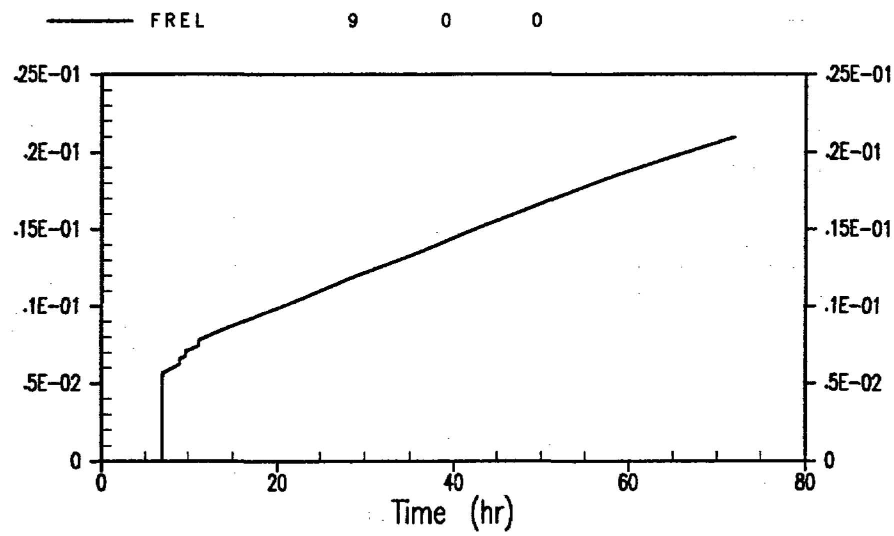


Figure 34-403

Case 3BE-1: CeO_2 Release Fraction DDT Intermediate Containment Failure

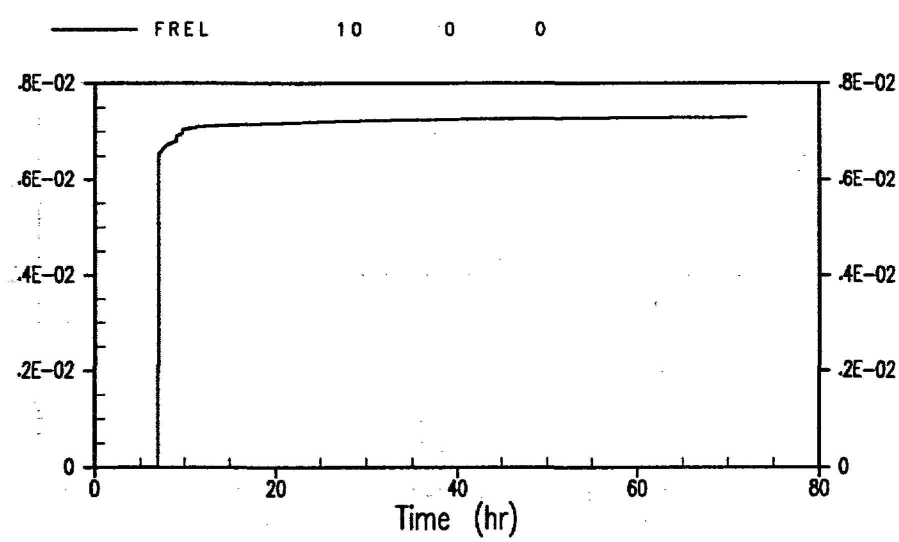


Figure 34-404

Case 3BE-1: Sb Release Fraction DDT Intermediate Containment Failure

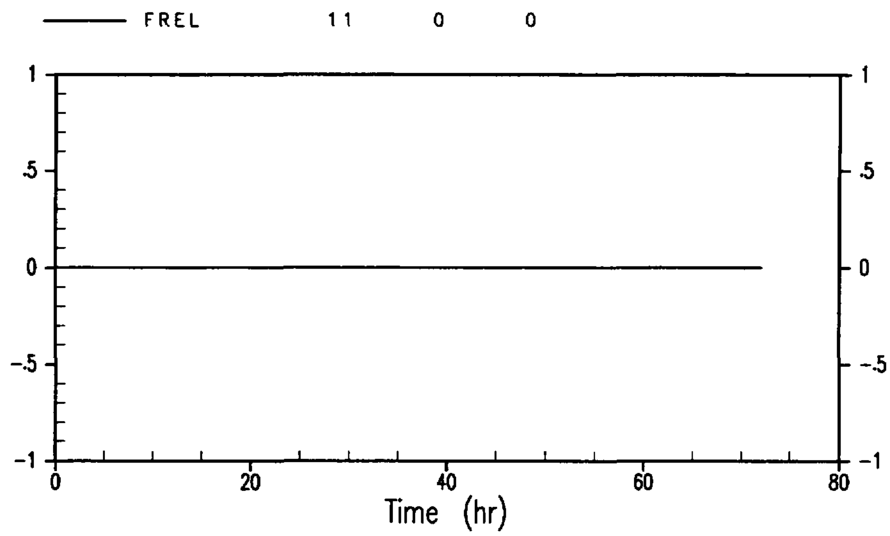


Figure 34-405

Case 3BE-1: Te_2 Release Fraction
DDT Intermediate Containment Failure

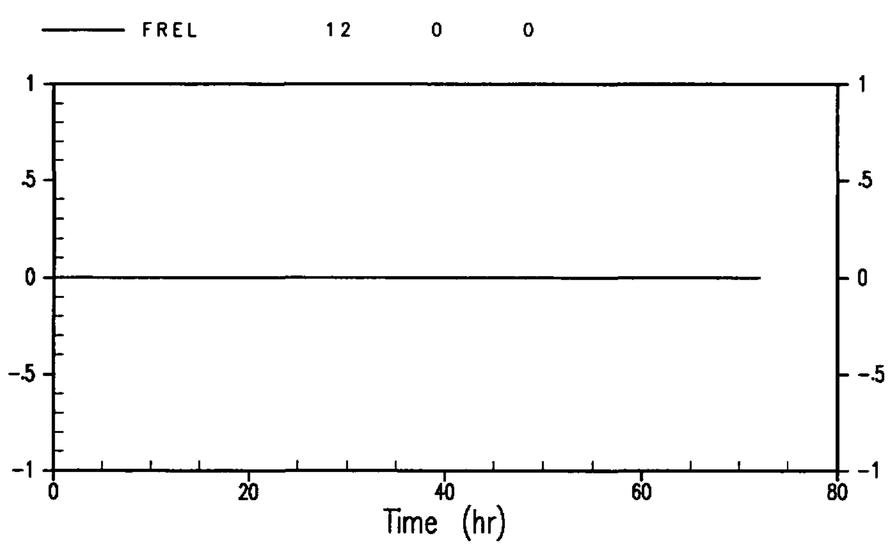


Figure 34-406

Case 3BE-1: UO_2 Release Fraction
DDT Intermediate Containment Failure

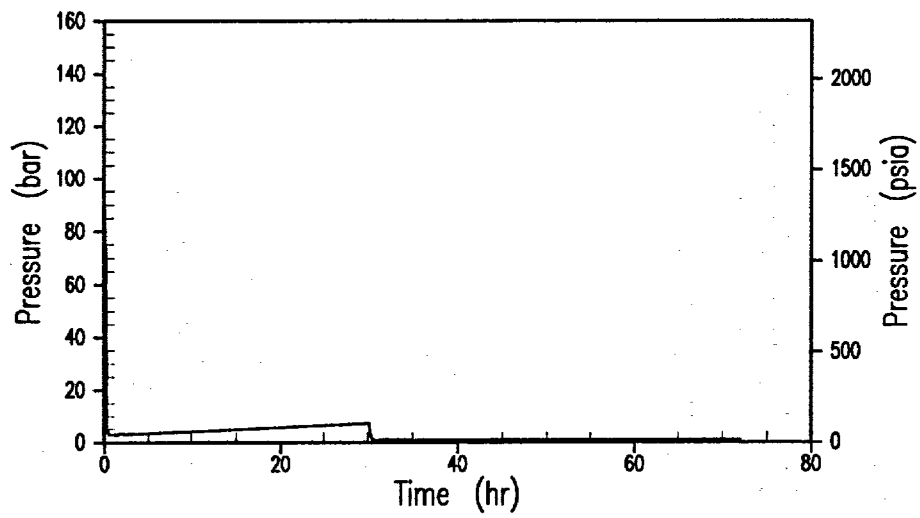


Figure 34-407

Case 3BE-1: RCS Pressure
No PCS Water Cooling and Late Containment Failure

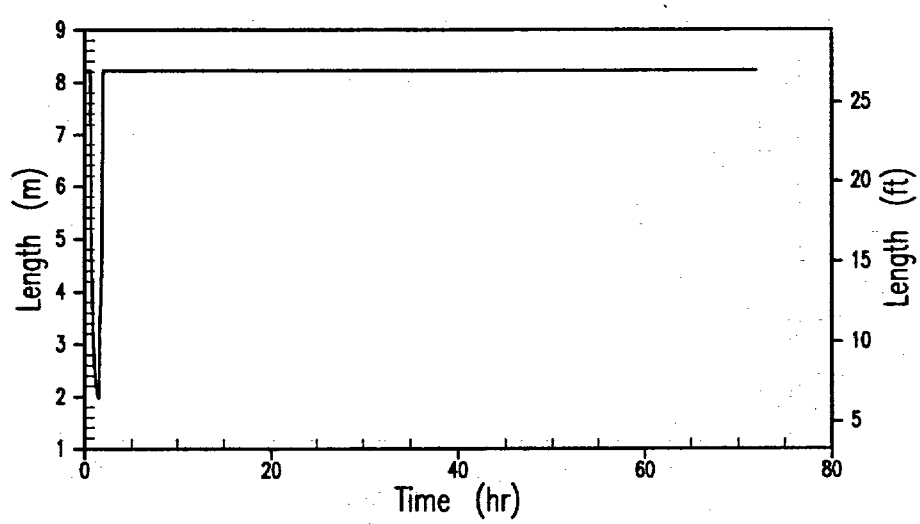


Figure 34-408

Case 3BE-1: Reactor Vessel Mixture Level
No PCS Water Cooling and Late Containment Failure

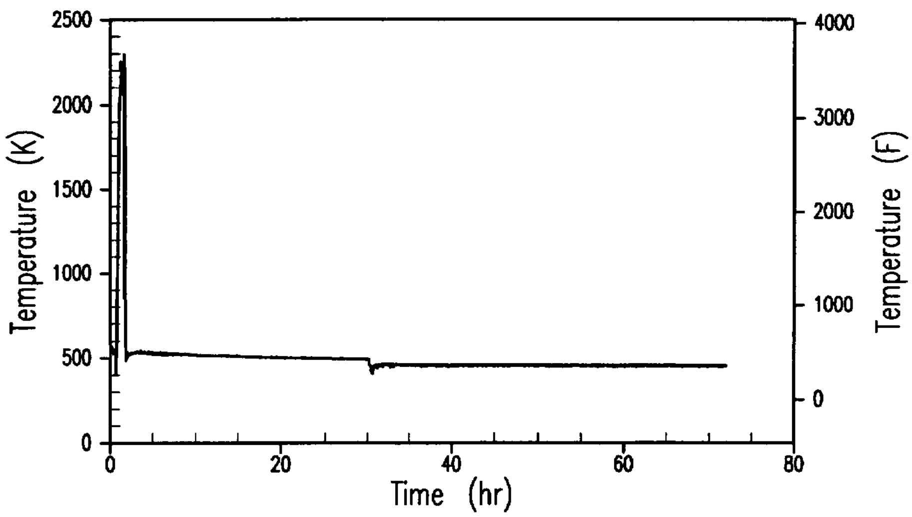


Figure 34-409

Case 3BE-1: Core-Exit Temperature
No PCS Water Cooling and Late Containment Failure

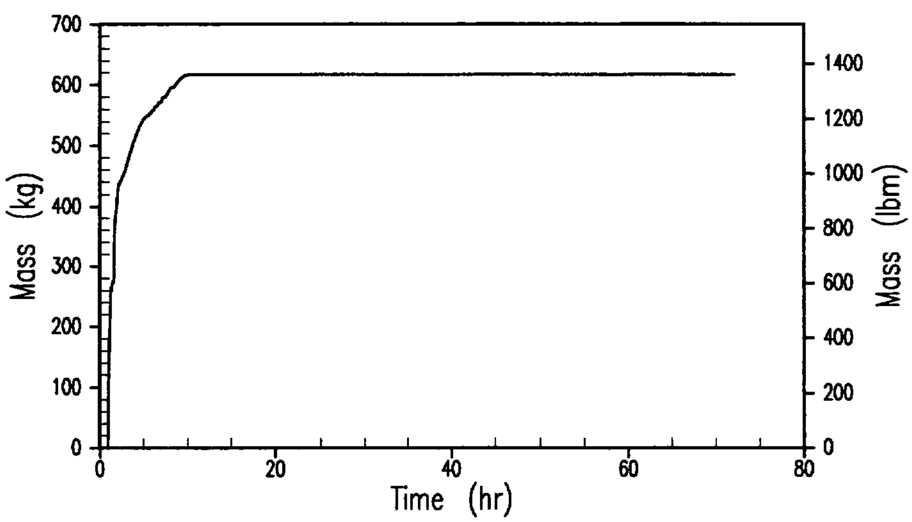


Figure 34-410

Case 3BE-1: In-Vessel Hydrogen Generation
No PCS Water Cooling and Late Containment Failure

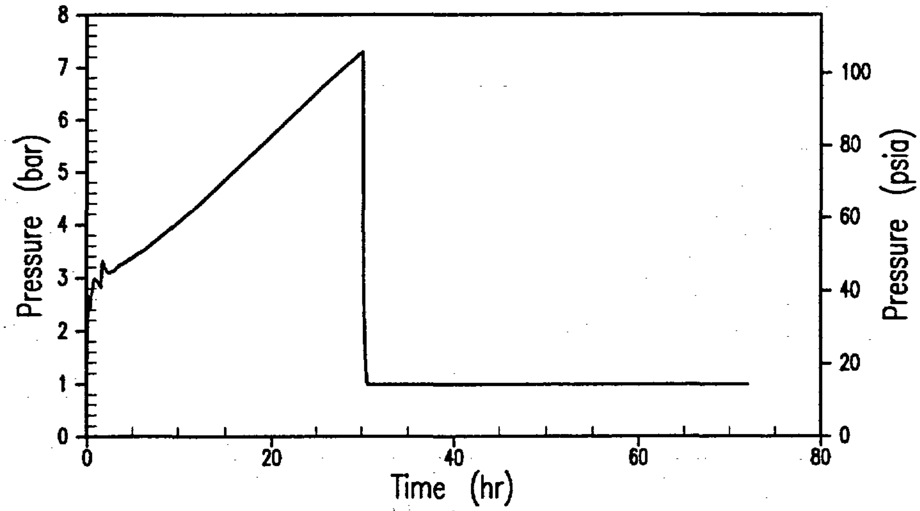


Figure 34-411

Case 3BE-1: Containment Pressure
No PCS Water Cooling and Late Containment Failure

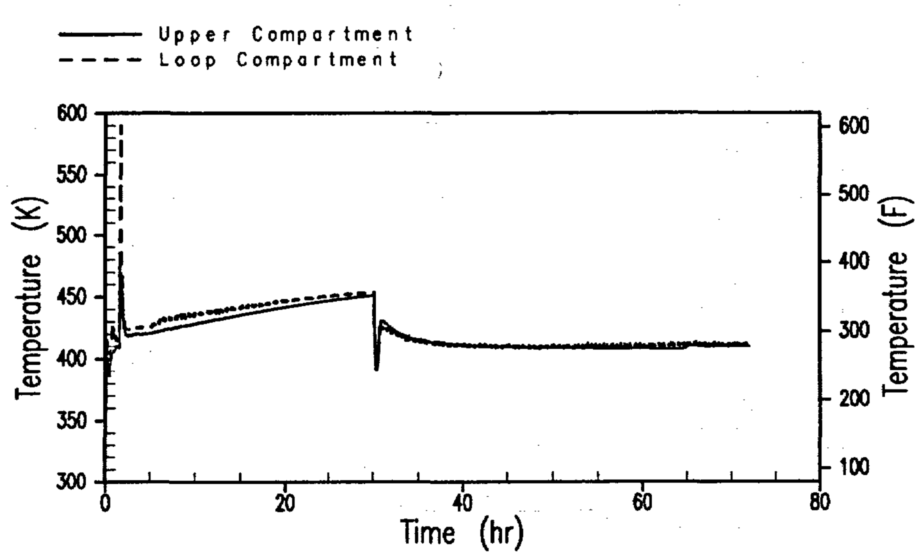


Figure 34-412

Case 3BE-1: Containment Gas Temperature
No PCS Water Cooling and Late Containment Failure

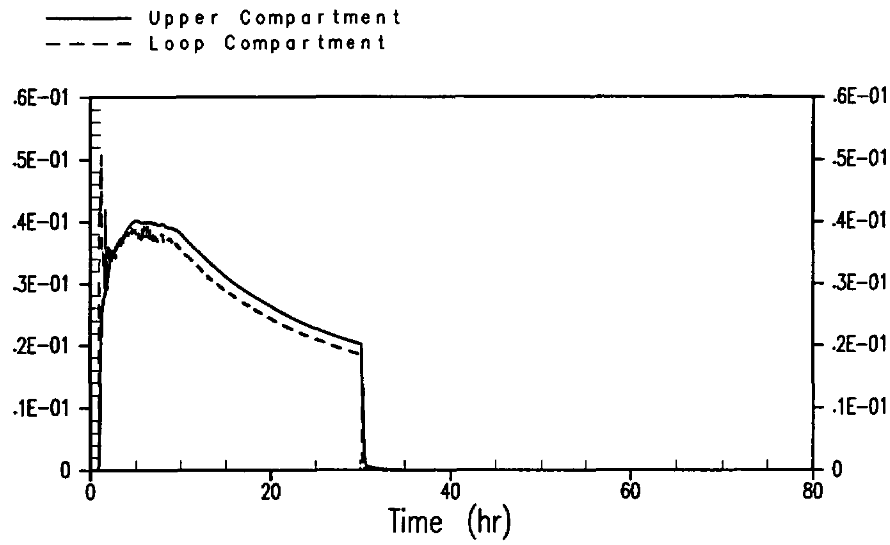


Figure 34-413

Case 3BE-1: Containment Hydrogen Concentration
No PCS Water Cooling and Late Containment Failure

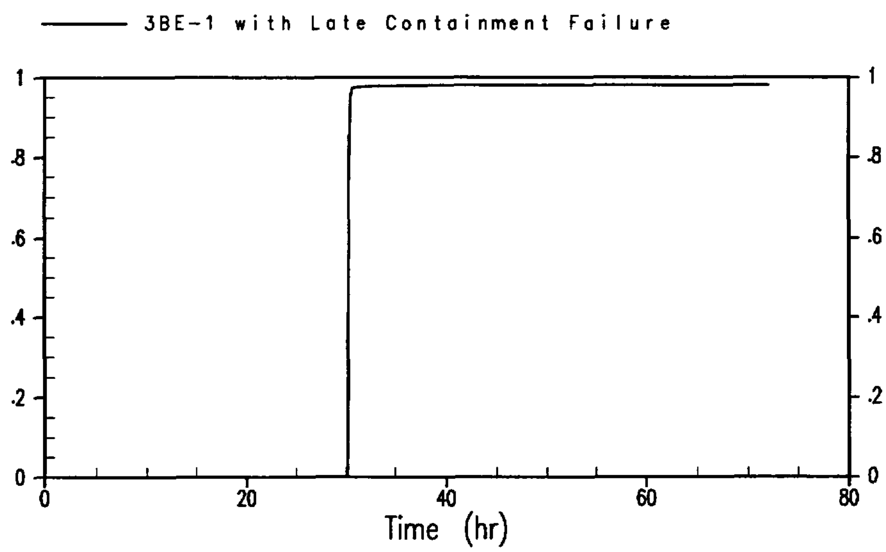


Figure 34-414

Case 3BE-1: Noble Gases Release Fraction
No PCS Water Cooling and Late Containment Failure

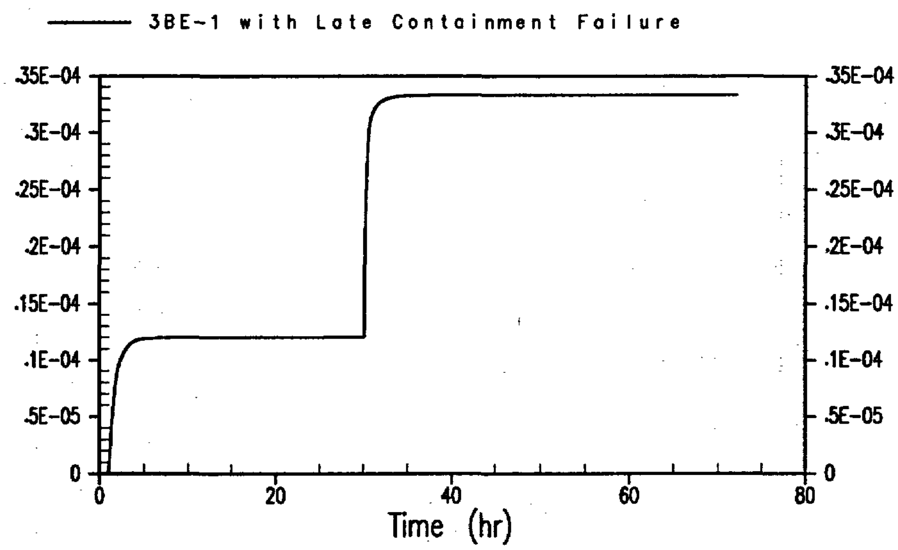


Figure 34-415

Case 3BE-1: CsI and RbI Release Fraction
No PCS Water Cooling and Late Containment Failure

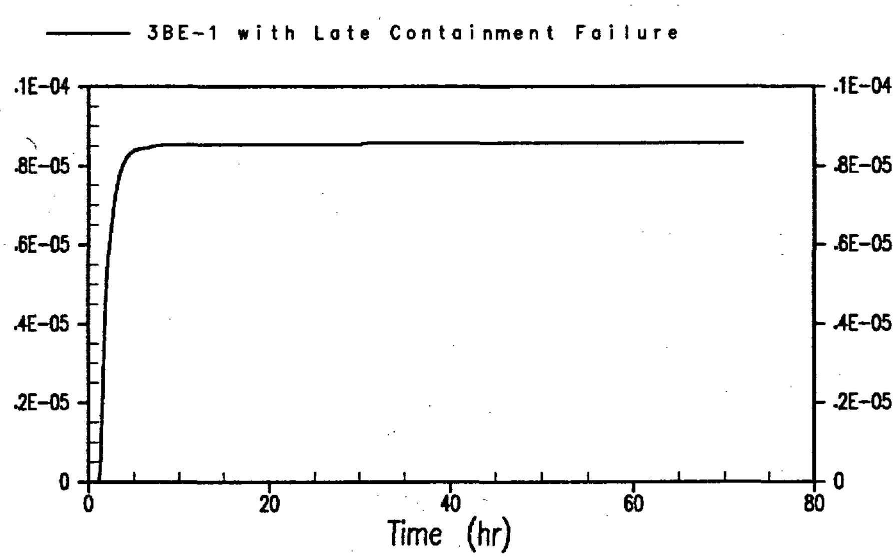


Figure 34-416

Case 3BE-1: TeO_2 Release Fraction
No PCS Water Cooling and Late Containment Failure

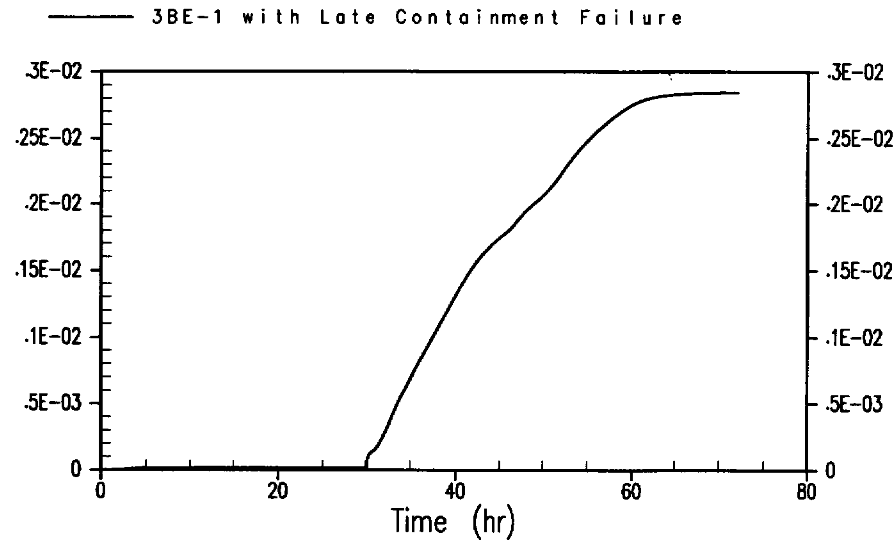


Figure 34-417

Case 3BE-1: SrO Release Fraction
No PCS Water Cooling and Late Containment Failure

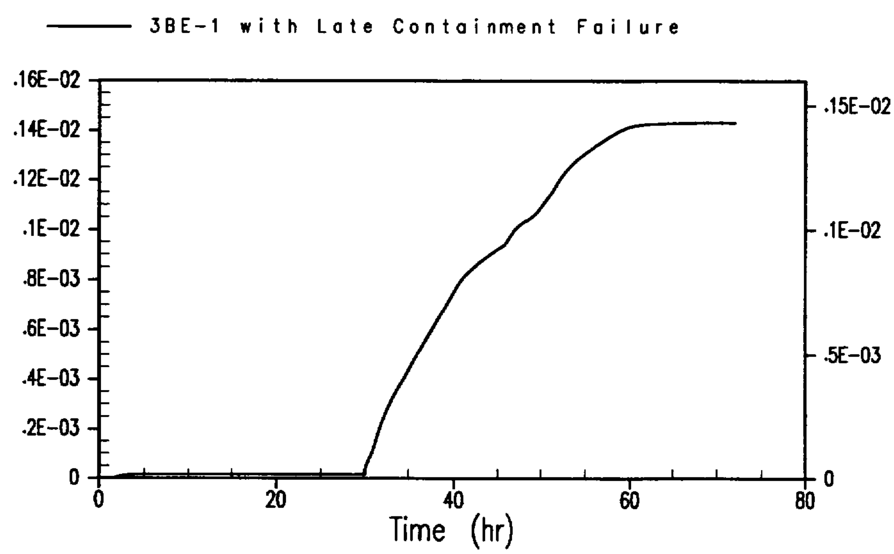


Figure 34-418

Case 3BE-1: MoO_2 Release Fraction
No PCS Water Cooling and Late Containment Failure

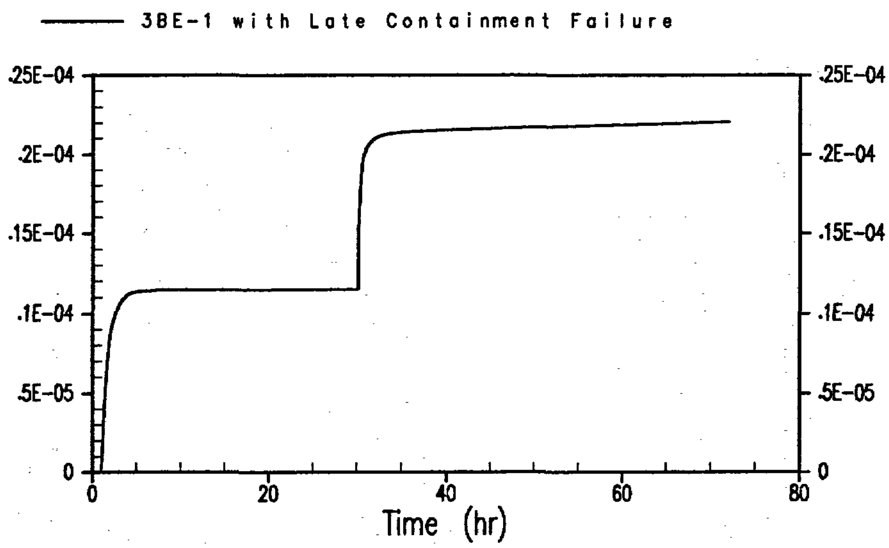


Figure 34-419

Case 3BE-1: CsOH and RbOH Release Fraction
No PCS Water Cooling and Late Containment Failure

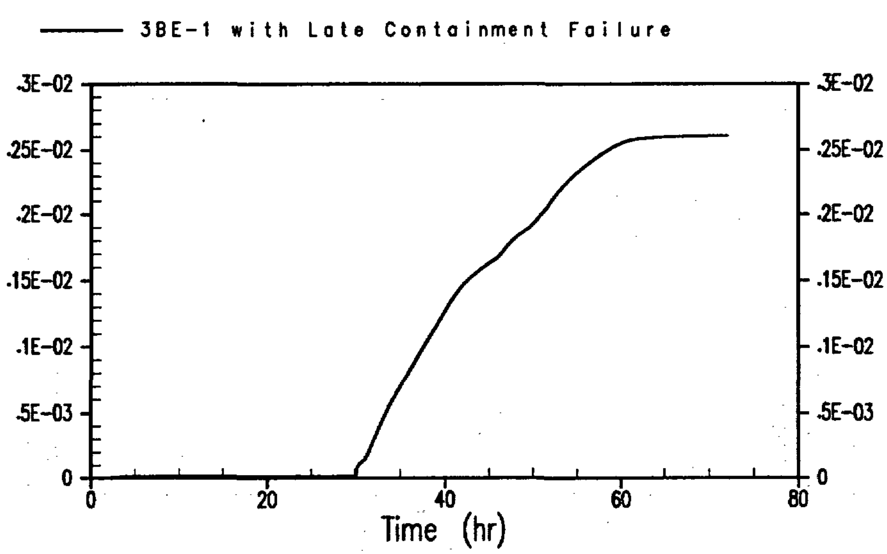


Figure 34-420

Case 3BE-1: BaO Release Fraction
No PCS Water Cooling and Late Containment Failure

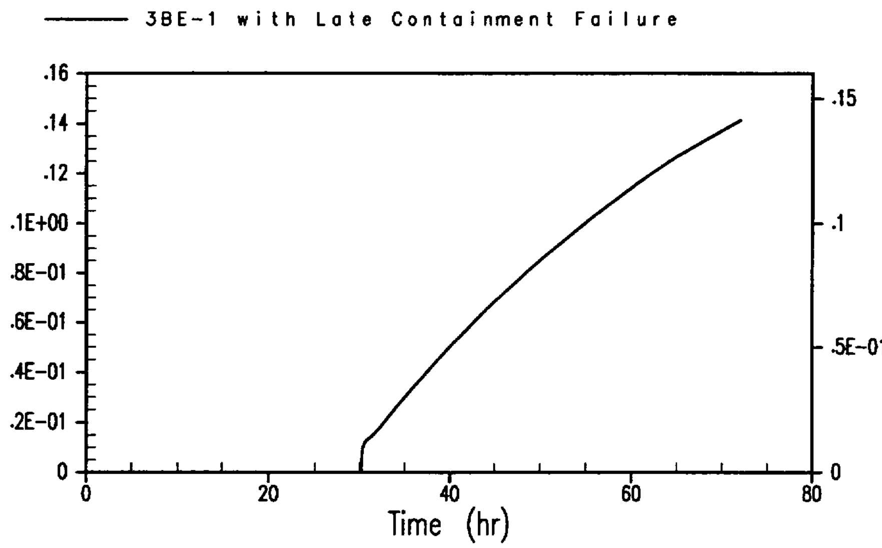


Figure 34-421

Case 3BE-1: La_2O_3 Release Fraction
No PCS Water Cooling and Late Containment Failure

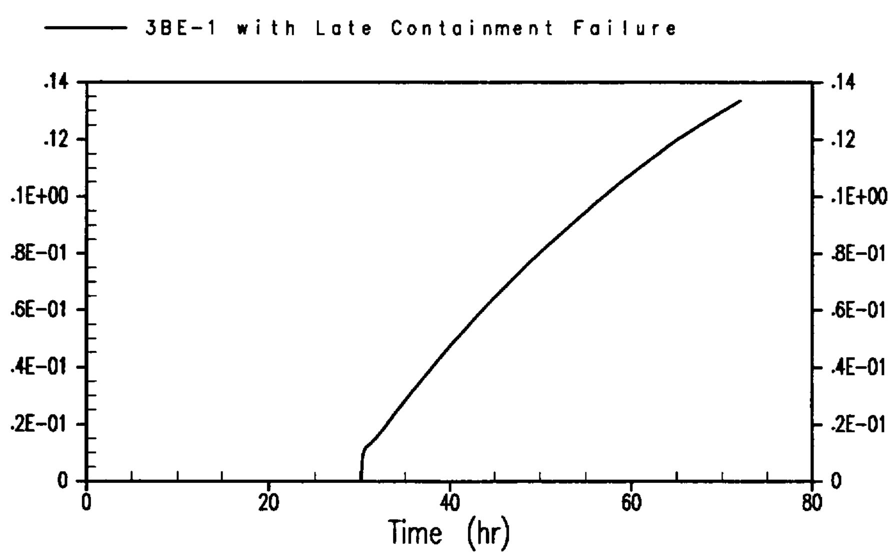


Figure 34-422

Case 3BE-1: CeO_2 Release Fraction
No PCS Water Cooling and Late Containment Failure

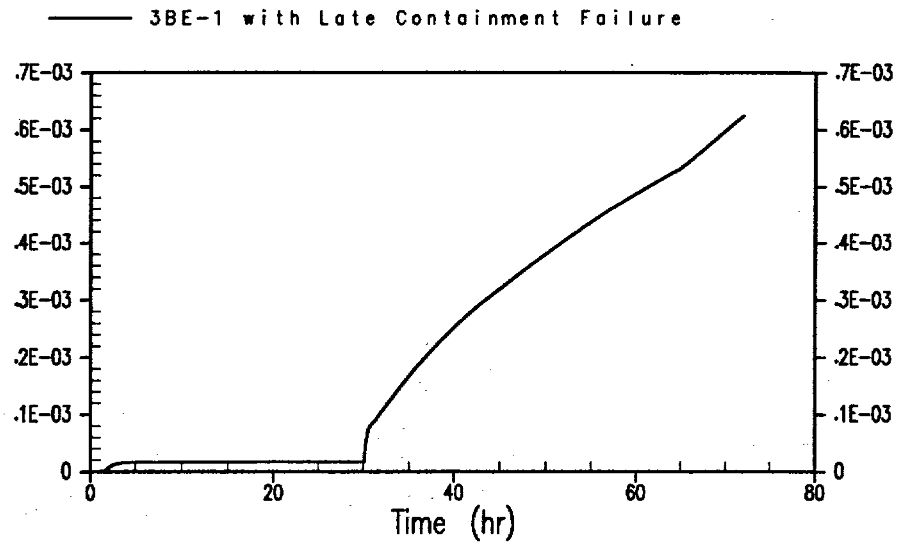


Figure 34-423

Case 3BE-1: Sb Release Fraction
No PCS Water Cooling and Late Containment Failure

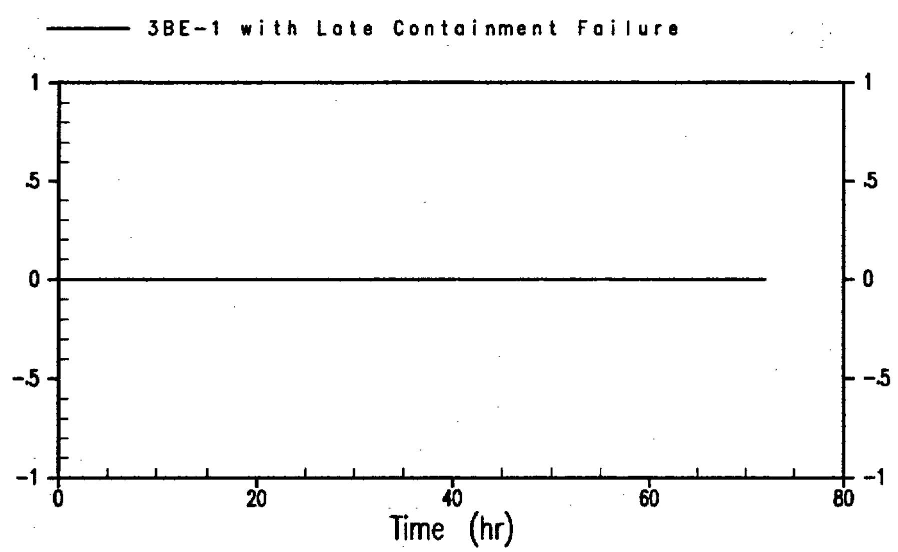


Figure 34-424

Case 3BE-1: Te_2 Release Fraction
No PCS Water Cooling and Late Containment Failure

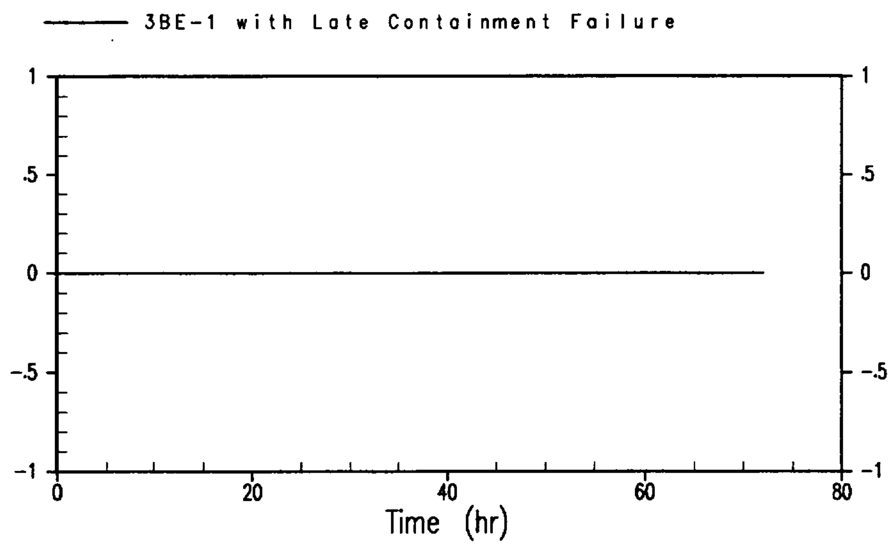


Figure 34-425

Case 3BE-1: UO_2 Release Fraction
No PCS Water Cooling and Late Containment Failure

CHAPTER 42

CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION

42.1 Introduction

The probability distribution for containment failure due to internal pressurization of the containment has been developed for the AP1000 containment vessel.

The AP1000 containment and its structural properties are described in subsection 3.8.2 of the *AP1000 Design Control Document* (DCD). The limiting containment failure modes that have been identified include:

- General yielding of the cylindrical shell
- Buckling of the ellipsoidal head
- Buckling of the two 16-ft. equipment hatches
- Yielding of the personnel airlock

Other containment failure modes are examined, as discussed in subsection 3.8.2 of the DCD. Other failure modes, such as general yielding of the ellipsoidal head and failure of the piping penetrations, are not considered to be independent containment failure modes. Rather, these other failure modes are bounded by the failure criteria for the limiting failure identified above. Failures of the mechanical penetration bellows, and leakage of the equipment hatches due to ovalization, do not occur prior to general yielding of the cylinder. Failures of the electrical penetration assemblies do not occur prior to general yielding of the cylinder for temperatures equal to or less than 400°F.

Each of the limiting failure modes is examined to determine the best estimate of the failure pressure. In addition, the random and subjective uncertainties associated with each of the failure modes are identified. These failure characteristics are then used to develop a probabilistic model to predict the containment failure due to internal static pressurization. The details of the model development and the results of the analysis are presented in the following sections.

42.2 Probabilistic Model

To define the probability of a containment failure due to internal pressurization, it is necessary to select a statistical distribution with the correct properties. The engineering justification for a particular probability density function is made based on the gathering and evaluation of relevant information that can serve to characterize the nature of the random data and physical processes that lead to the random data. The nature of the random data, and in particular any limits or bounds on the data, is as important as the predicted means and variances from statistical analysis of the data. Thus, specific limits in the data and characteristics, such as skewness, are utilized to specify the probability density function. Five potential probability distributions are considered: the Gaussian, the Gamma, the Gumbel, the lognormal, and the Weibull.

Based on a review of the characteristics of the five potential probability distributions, it was determined that both the Weibull and the lognormal distributions would be suitable to describe the containment failure probabilities. An additional review of the containment failure probability distributions reported in a number of the Individual Plant Examinations submitted to the Nuclear Regulatory Commission (in response to the Commission's Generic Letter 88-20) indicates that the lognormal distribution is the most commonly used distribution form for predicting containment failure from internal pressurization. Therefore, the lognormal distribution is selected to construct the conditional containment failure probability distribution.

42.3 Containment Failure Characteristics

The characteristic parameters for containment failure due to internal pressurization are derived from detailed analyses of the containment vessel, supplemented by applicable test data for certain design features of the containment, as described in subsection 3.8.2 of the DCD. For the construction of the conditional containment failure probability distribution, the required characteristic parameters are the median failure pressure and the statistical variance that represent the uncertainty associated with these values.

42.3.1 Median Values for Containment Failure

The development of the conditional containment failure probability distribution requires the specification of the median value for containment failure for each of the possible containment failure modes. Subsection 3.8.2 of the DCD provides values for the ultimate containment pressure capability at 100°F and 400°F. These failure pressures are based on code-specified minimum material properties. To obtain the median values for the probability distribution, the failure pressures of subsection 3.8.2 of the DCD are adjusted to account for the expected material properties and this adjusted best-estimate failure pressure is considered as the median value of the lognormal distribution.

The containment vessel is designed using SA738, Grade B material. This has a specified minimum yield of 60 ksi and minimum ultimate of 85 ksi. Test data for materials having similar chemical properties to SA738 were reviewed from two United States and two Japanese steel suppliers. Some of the data were from tests of steel procured to SA537, Class 2, while the remaining data were identified by the steel supplier as having similar chemistry. In a sample of 122 tests for thicknesses equaling or exceeding 1.50 inches and less than 1.75 inches, the actual yield had a mean value of 69.1 ksi with a standard deviation of 3.3 ksi, giving a mean yield value equal to 1.15 times the specified minimum yield with a coefficient of variation of 0.048. Test data for 389 tests for thicknesses from 0.31 inch to 3.16 inches showed a mean yield value of 71.7 ksi with a standard deviation of 5.7 ksi, giving a mean yield value equal to 1.19 times the specified minimum yield with a coefficient of variation of 0.079.

Reference 42-1 confirms that the actual yield strength of containment construction material can typically be expected to be 9 to 22 percent higher than the specified minimum material strength with coefficients of variation of 6 to 13 percent (the lower yield strengths reported are not applicable to containment material. The ABS steel is procured to an ABS specification and not to the American Society for Testing and Materials (ASTM)

specification; the static yield stress is a little lower than ASTM test yield. Since the median containment strength is to be used to construct a probability distribution that includes random uncertainties in material properties as well as subjective uncertainties in modeling of the containment strength, it is appropriate to use the expected, as-built containment strength (i.e., best estimate) for the median value of the distribution. However, since as-built information is not available for the AP1000, the fragility is conservatively calculated using only a 10-percent increase above the specified yield and this value is used as the median value of the lognormal distribution. This is consistent with the recommendation of Reference 42-3.

The containment internal pressure value used for the median value of the containment failure probability distribution is the expected failure pressure, evaluated at 400°F. A review of the severe accident sequences in which the containment internal pressure approaches the failure pressure of the containment leads to the conclusion that the containment shell is likely to be at the containment saturation temperature (for the internal containment pressure) for most severe accident sequences. With the passive containment cooling provided by the containment design, the highest likelihood of containment failure due to overpressurization is due to extreme cases of severe accident phenomena (e.g., hydrogen detonations and noncoolable ex-vessel core debris). The temperature of the containment vessel steel does not significantly exceed the design temperature of 300°F. Therefore, the use of a uniform containment shell temperature of 400°F for evaluation of the containment material properties is bounding for the prediction of the conditional containment failure probability distribution.

It is noted that a containment conditional failure probability distribution for a containment temperature at 331°F which corresponds to saturation at 90 psig is also developed. This distribution is referenced in the discussion on passive containment cooling system (PCS) failure and fission-product release category CFL (see Chapters 34 and 45). The 90 psig [620 KPa] is the maximum pressure calculated in accordance with 10 CFR 50.34 for the severe accident phenomena for Service Level C evaluation that includes hydrogen burn.

A maximum containment pressure of 81 psig [559 KPa] is calculated at 24 hours following the onset of core damage for the bounding severe accident phenomena as described in subsection 40.4.2. This bounds the more likely severe accident challenges that are required to be evaluated against Service Level C in accordance with SECY-93-087 Requirements.

The values used to construct the conditional containment failure probability distribution are identified in the next section.

42.3.2 Uncertainties in Containment Failure

The uncertainties identified and examined include both random uncertainties and subjective uncertainties. The broad categories of uncertainties considered are:

Geometric Properties: This category of uncertainty is principally concerned with the variations between the as-built containment vessel and the design utilized in the analysis. Some of these variations include containment dimensions, placement of stiffeners, and thickness of the steel plates used to make up the containment vessel. Also included in this category are construction practices such as the strength of weldments, etc. It has been

reported [Reference 42-1] that the overall uncertainty in the containment strength is generally insensitive to variations in geometric properties, except for buckling mode of failure.

Structural Analysis: The uncertainties in the overall containment strength can be sensitive to uncertainties in assumptions and models used in the structural analysis of the ultimate strength of the containment structure. Some of the sources of uncertainty include: the definition of containment failure used in the analysis, the simplified geometric model used in the analysis, the analysis method, the analysis focus of failure locations and modes, the yield criterion for biaxial stresses, the rate of loading, the effect of non-uniform geometries, the effect of local temperature and the interpretation of test results to construct the analytical model. These uncertainties are subjectively evaluated since no complete investigation of these uncertainties is available. Reference 42-1 provides several estimates of the actual-to-predicted results, which vary according to the failure mode assumed in the analysis, the person doing the evaluation, and the method of analysis. The range suggested by these values is a mean value for the actual-to-predicted results tending to unity and a standard deviation in the range between 0.08 and 0.24. Reference 42-2 suggests that a value of 0.12 be used in constructing the probability distribution for the ultimate strength of the containment.

Material Properties: Uncertainties in material properties can be important in estimating the overall containment failure uncertainty. The total uncertainties in materials consider the estimation of statistical properties from a small sample (e.g., is the calculated mean the real mean) and assumptions on uniformity of properties. There is a wide range of application of material properties to estimate uncertainties and, except for the buckling mode of failure, most analyses neglect all uncertainties except the random, measurable variations in material properties. Reference 42-1 provides several estimates of the uncertainty in material properties that show a coefficient of variation in the range of 0.044 to 0.11 for conditions that may be applicable to the passive containment shell. Reference 42-2 recommends that a coefficient of variation between 0.06 and 0.08 be used to define the random variation in material properties for the containment shell. Based on sampling of test results of material similar to that specified for the AP1000 containment shell as described in subsection 42.3.1, the coefficient of variation was found to be 0.048. Finally, Reference 42-3 notes a coefficient of variation of 0.11 for material properties.

Gross Errors: Gross errors in construction and/or design are not quantifiable since they lead to catastrophic results that are not predictable by reliability methods.

The values used to construct the conditional containment failure probability distribution are identified in the next section.

42.4 Containment Failure Predictions

42.4.1 Containment Cylindrical Shell

The response of the cylindrical portion of the containment vessel to internal pressurization has been analyzed, and the results reported in Table 3.8.2-2 of the DCD. The best estimate of the pressure at which failure would occur is 129 psig, based on specified material properties at a uniform containment wall temperature of 400°F. This was adjusted to 141 psig to account for the expected actual material properties. For consideration of a containment wall

temperature of 331°F, the containment failure pressure was determined by increasing the 400°F failure pressure by 6 psig, based on the temperature effect estimates provided in Subsection 3.8.2 of the DCD. Thus, for a 331°F containment temperature, the failure pressure is calculated to be 147 psig.

A coefficient of variation of 0.11 is used to represent the random uncertainty in material properties, based on References 42-1 and 42-3. For the subjective uncertainty associated with modeling of the ultimate containment failure pressure, a coefficient of variation of 0.12 is used, based on Reference 42-2.

42.4.2 Ellipsoidal Upper Head

The response of the ellipsoidal upper head of the containment vessel to internal pressurization has been analyzed, and the results are reported in subsection 3.8.2 and Table 3.8.2-2 of the DCD. Failure is predicted to occur either in the knuckle region or at the crown and may be initiated by buckling in the knuckle region. Failures due to tensile stresses (plastic collapse) are bounded by the variations considered for yield of the cylindrical shell. Only the buckling failure mode at the knuckle region can be considered to be an independent failure mode that must be separately considered in determining the conditional containment failure probability distribution.

The best-estimate internal pressure at which the ellipsoidal head of the containment vessel would fail due to post-yield buckling in the knuckle region is 144 psig, using minimum specified yield strength of the containment materials at 400°F. Since this buckling is associated with yield in the knuckle region, the capacity was adjusted to account for actual material properties by the ratio of actual to minimum yield to give a predicted pressure of 159 psig. For consideration of a containment wall temperature of 331°F, the containment failure pressure was determined by increasing the 400°F failure pressure by 7 psig, based on the temperature effect estimates provided in subsection 3.8.2 of the DCD. Thus, for a 331°F containment temperature, the failure pressure is calculated to be 166 psig.

A coefficient of variation of 0.11 is used to represent the random uncertainty in material properties, based on References 42-1 and 42-3. For the subjective uncertainty associated with modeling of the ultimate containment failure pressure, a coefficient of variation of 0.12 is used, based on Reference 42-2.

42.4.3 Equipment Hatches

The response of the two 16-foot diameter equipment hatches to internal pressurization has been analyzed, and the results are reported in subsection 3.8.2 of the DCD. The containment internal pressure acts on the concave face of the dished head and the hatch covers are in compression under containment internal pressure loads. The predicted failure mode is elastic buckling of the hatch covers. The best estimate of the pressure at which failure would occur for the 16-foot equipment hatches is 297 psig at a uniform containment wall temperature of 400°F, based on 150 percent of the critical buckling pressure as indicated by a review of test data for buckling of spherical caps. For consideration of a containment temperature of 331°F, the containment failure pressure was determined by increasing the 400°F failure pressure by 4 psig, based on the temperature effect estimates provided in subsection 3.8.2 of the DCD,

and assuming 150 percent of this pressure, as discussed above. Thus, for a 331°F containment temperature, the failure pressure for the 16-foot equipment hatches is 301 psig.

A coefficient of variation of 0.11 is used to represent the random uncertainty in material properties, based on References 42-1 and 42-3. For the subjective uncertainty associated with modeling of the ultimate containment failure pressure, a coefficient of variation of 0.12 is used, based on Reference 42-2.

The contribution to the CCFP from each equipment hatch has been taken as independent.

42.4.4 Personnel Airlock

The response of the personnel airlock to internal pressurization has also been analyzed, and the results are reported in subsection 3.8.2 of the DCD. The estimated pressure at which failure would occur is in excess of 300 psig, based on test results. Since this median failure pressure is far above the median failure estimates for the other containment failure modes, no further analysis of the personnel airlock is performed. Since its expected contribution to the overall containment failure probability distribution is negligible, it is not included further in the development of the conditional containment failure probability distribution.

42.5 Overall Failure Distribution

Based on the uncertainties defined above and the best-estimate containment failure pressure at the bounding severe accident temperature of 400°F, a containment failure probability distribution can be constructed. The best-estimate containment failure pressure is used as the median value of the lognormal distribution. The median value and uncertainties used to construct the lognormal distributions for each failure mode are given in Table 42-1. Table 42-2 provides the same parameters for consideration of a containment temperature of 331°F.

The lognormal conditional containment failure probability distribution is calculated via the distribution function:

$$F(x) = \exp(\mu + k\beta)$$

where:

$F(x)$ = lognormal distribution of x
μ = natural logarithm of median
k = lognormal multiplier
β = lognormal standard deviation

The appropriate lognormal standard deviation is defined from the coefficient of variation according to:

$$V_{tot} = (\exp(\beta^2) - 1.0)^{0.5}$$

where:

V_{tot} = total coefficient of variation
β = lognormal standard deviation

The total coefficient of variation, V_{tot}, is calculated via the square root of the sum of the squares of the modeling coefficient of variation and the material coefficient of variation:

$$V_{tot} = (V^2_{model} + V^2_{material})^{0.5}$$

Using the parameters given in Table 42-1, the conditional containment failure probability distribution is developed using a lognormal distribution for each of the failure modes. Figure 42-1 presents a graphical representation of the conditional containment failure probability distribution for each of the failure locations as well as the overall failure distribution for the AP1000 containment.

The conditional containment failure probability for each of the failure locations and the cumulative containment failure probability, over the range of 80 to 240 psig, is given in Table 42-3. The analogous data for a containment temperature of 331°F are presented in Table 42-4 and Figure 42-2, respectively.

42.6 Summary and Conclusions

The cumulative containment failure probability distribution has been developed, using a lognormal distribution, which is based on best-estimate predictions of containment strength and accounts for random uncertainties in material properties and subjective modeling uncertainties. Based on this model, the median internal pressure at which the AP1000 containment vessel is predicted to fail for a containment temperature of 400°F is 135 psig. This is the best-estimate or expected containment failure pressure. This value is comparable to, or slightly higher than, the expected containment failure probability for other conventional pressurized water reactor (PWR) plants using pre-stressed or post-tensioned concrete containment structures. The 5th and 95th percentile failure probabilities for a containment temperature of 400°F are 106 psig and 169 psig, respectively.

For consideration of a containment temperature of 331°F, the median failure pressure is 141 psig while the 5th and 95th percentile failure probabilities are 110 psig and 176 psig, respectively.

The cutoff for consideration of containment failure due to internal pressurization during a severe accident is defined as the pressure at which the containment failure probability is less than 10^{-3}. Below this point, the failure probability is so low that, when combined with the small core damage frequency numbers, the overall probability of a core damage accident resulting in containment failure is in the 10^{-10} range. This is generally considered to be a negligible calculated number. From the lognormal distribution, the containment pressure corresponding to a 10^{-3} probability of failure is approximately 95 psig.

42.7 References

42-1 "Reliability of Containments Under Overpressure," L. Greimann and F. Fanous, *Pressure Vessel and Piping Technology*, 1985, pp. 835 - 856.

42-2 "Reliability of Steel Containment Strength," L. Greimann, et al., NUREG/CR-2442, June 1988.

42-3 "Development of a Probability Based Load Criterion for American National Standard A58," National Bureau of Standards Special Publication 577, U.S. Government Printing Office, Washington, 1980.

Table 42-1

PARAMETERS USED IN THE CONSTRUCTION OF THE AP1000 CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION FOR CONTAINMENT TEMPERATURE = 400°F

Failure Location	Failure Mode	Median Failure Pressure (psig)	Coefficient of Variation	
			Material	Modeling
Cylindrical Shell	Membrane Yield	141	0.11	0.12
Ellipsoidal Head	Buckling	159	0.11	0.12
16-Ft. Equipment Hatch 1	Buckling	297	0.11	0.12
16-Ft. Equipment Hatch 2	Buckling	297	0.11	0.12
Personnel Hatch	--	300	0.11	0.12

Table 42-2

PARAMETERS USED IN THE CONSTRUCTION OF THE AP1000 CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION FOR CONTAINMENT TEMPERATURE = 331°F

Failure Location	Failure Mode	Median Failure Pressure (psig)	Coefficient of Variation	
			Material	Modeling
Cylindrical Shell	Membrane Yield	147	0.11	0.12
Ellipsoidal Head	Buckling	166	0.11	0.12
16-Ft. Equipment Hatch 1	Buckling	297	0.11	0.12
16-Ft. Equipment Hatch 2	Buckling	297	0.11	0.12
Personnel Hatch	--	300	0.11	0.12

Table 42-3

CUMULATIVE CONTAINMENT FAILURE PROBABILITY, TEMP = 400°F

Containment Pressure (psig)	Probability of Containment Failure				
	Cylinder	Head	16-ft. Hatch 1	16-ft. Hatch 2	Total
75	6.42E-05	0.00E+00	0	0	6.4162357E-05
80	2.55E-04	1.29E-05	0	0	2.6757609E-04
85	9.51E-04	7.11E-05	0	0	1.0216351E-03
90	2.92E-03	2.41E-04	0	0	3.1632982E-03
95	7.85E-03	8.03E-04	0	0	8.6436719E-03
100	1.79E-02	2.22E-03	0	0	2.0063917E-02
105	3.63E-02	5.52E-03	0	0	4.1621218E-02
110	6.43E-02	1.23E-02	0	0	7.5748576E-02
115	1.06E-01	2.36E-02	0	0	1.2761578E-01
120	1.65E-01	4.38E-02	0	0	2.0188557E-01
125	2.34E-01	7.11E-02	0	0	2.8856262E-01
130	3.17E-01	1.10E-01	0	0	3.9219245E-01
135	4.00E-01	1.62E-01	0	0	4.9744637E-01
140	4.83E-01	2.20E-01	0	0	5.9704704E-01
145	5.62E-01	2.94E-01	0	0	6.9031671E-01
150	6.38E-01	3.67E-01	1.439E-05	1.439E-05	7.7129628E-01
155	7.15E-01	4.41E-01	3.481E-05	3.481E-05	8.4093741E-01
160	7.75E-01	5.14E-01	8.179E-05	8.179E-05	8.9061391E-01
165	8.21E-01	5.82E-01	0.0001606	0.0001606	9.2500334E-01
170	8.66E-01	6.50E-01	0.000308	0.000308	9.5317929E-01
175	9.06E-01	7.18E-01	0.0005847	0.0005847	9.7356417E-01
180	9.30E-01	7.72E-01	0.0010675	0.0010675	9.8397554E-01
185	9.52E-01	8.12E-01	0.0018581	0.0018581	9.9097418E-01
190	9.65E-01	8.52E-01	0.0030475	0.0030475	9.9482087E-01
195	9.76E-01	8.93E-01	0.0050676	0.0050676	9.9748024E-01
200	9.83E-01	9.17E-01	0.0077772	0.0077772	9.9857868E-01

Table 42-4

CUMULATIVE CONTAINMENT FAILURE PROBABILITY, TEMP = 331°F

Containment Pressure (psig)	Probability of Containment Failure				
	Cylinder	Head	16-ft. Hatch 1	16-ft. Hatch 2	Total
75	1.84E-05	0.00E+00	0	0	1.8353575E-05
80	9.60E-05	0.00E+00	0	0	9.6027695E-05
85	4.04E-04	1.98E-05	0	0	4.2376543E-04
90	1.36E-03	9.07E-05	0	0	1.4485475E-03
95	3.83E-03	3.06E-04	0	0	4.1360177E-03
100	9.12E-03	9.39E-04	0	0	1.0054584E-02
105	1.95E-02	2.49E-03	0	0	2.1953678E-02
110	3.90E-02	5.80E-03	0	0	4.4573820E-02
115	6.67E-02	1.26E-02	0	0	7.8462291E-02
120	1.08E-01	2.35E-02	0	0	1.2862289E-01
125	1.64E-01	4.25E-02	0	0	1.9967182E-01
130	2.29E-01	6.76E-02	0	0	2.8119018E-01
135	3.09E-01	1.03E-01	0	0	3.7964769E-01
140	3.88E-01	1.53E-01	0	0	4.8173260E-01
145	4.68E-01	2.04E-01	0	0	5.7640913E-01
150	5.44E-01	2.74E-01	0	0	6.6921873E-01
155	6.18E-01	3.45E-01	2.329E-05	2.329E-05	7.4974381E-01
160	6.92E-01	4.15E-01	6.325E-05	6.325E-05	8.1985324E-01
165	7.59E-01	4.86E-01	0.000115	0.000115	8.7625944E-01
170	8.03E-01	5.52E-01	0.0002287	0.0002287	9.1180652E-01
175	8.47E-01	6.18E-01	0.000456	0.000456	9.4139587E-01
180	8.90E-01	6.83E-01	0.000817	0.000817	9.6526821E-01
185	9.18E-01	7.48E-01	0.0014694	0.0014694	9.7932724E-01
190	9.40E-01	7.88E-01	0.0023959	0.0023959	9.8738440E-01
195	9.57E-01	8.26E-01	0.0040207	0.0040207	9.9260555E-01
200	9.69E-01	8.65E-01	0.0060227	0.0060227	9.9592431E-01
205	9.78E-01	9.02E-01	0.0092794	0.0092794	9.9791316E-01
210	9.84E-01	9.22E-01	0.0141633	0.0141633	9.9881465E-01
215	9.90E-01	9.42E-01	1.95E-02	1.95E-02	9.9945360E-01
220	9.93E-01	9.57E-01	2.74E-02	2.74E-02	9.9971245E-01

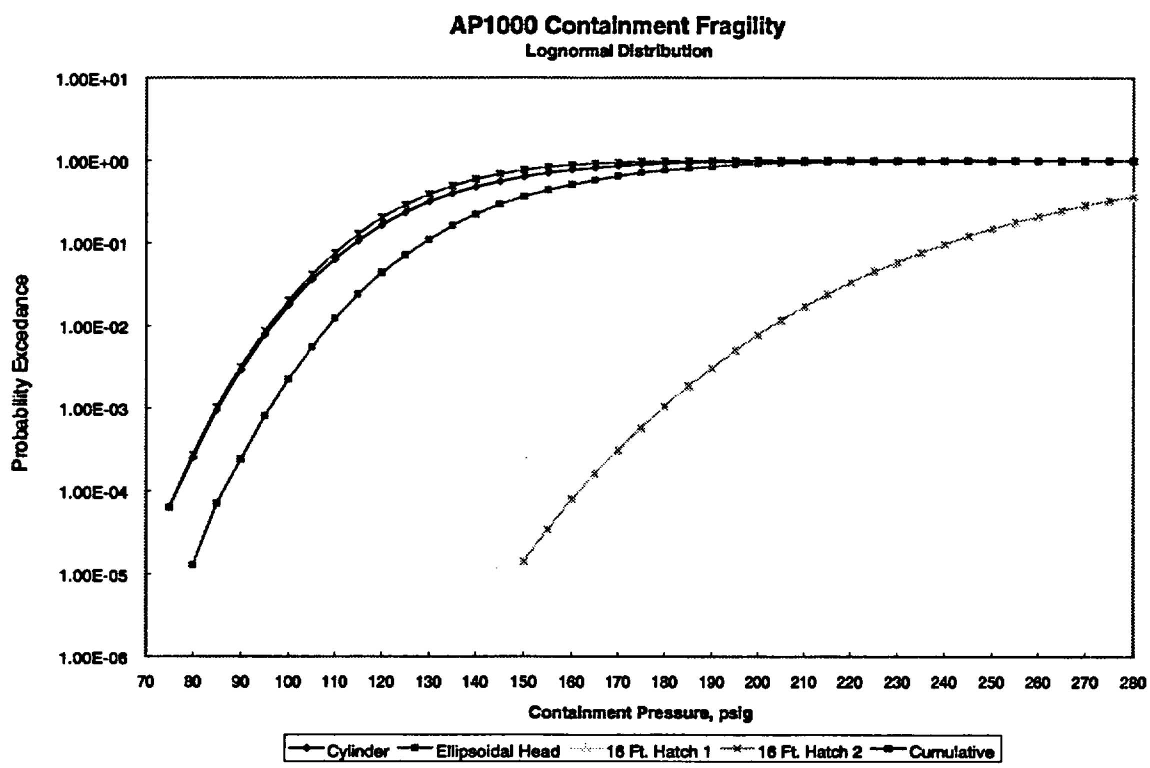


Figure 42-1

AP1000 Containment Fragility at Containment Temperature of 400°F

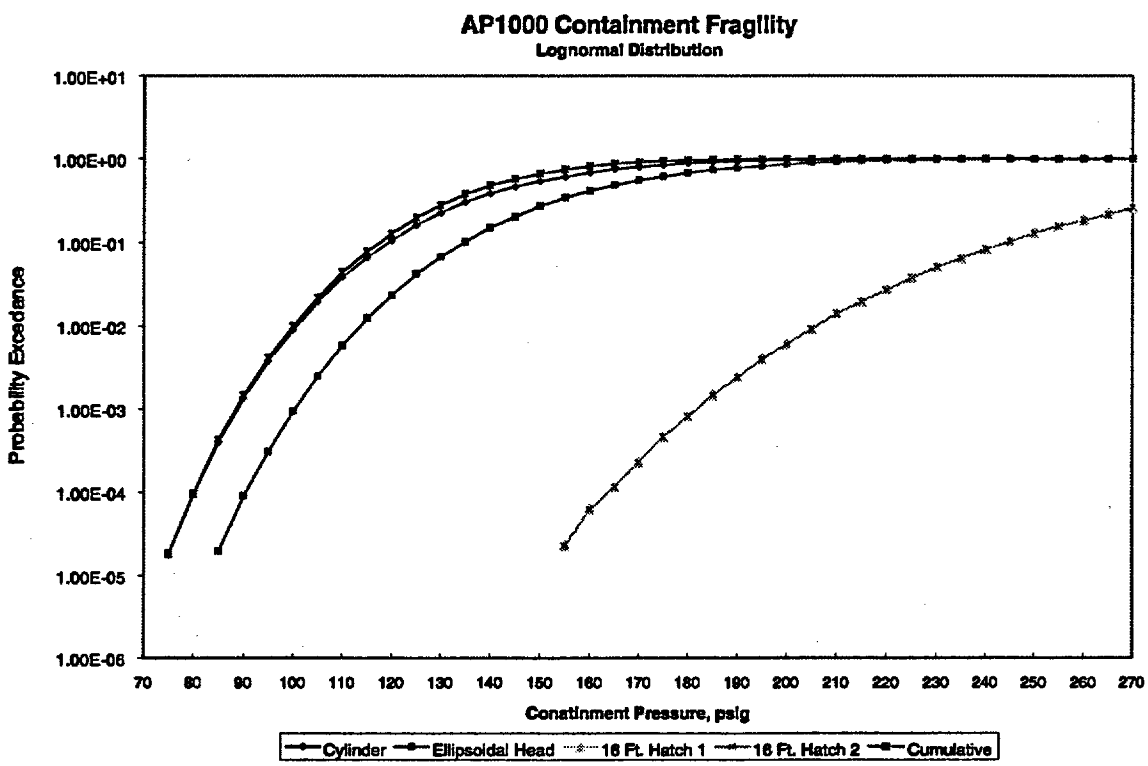


Figure 42-2

AP1000 Containment Fragility at Containment Temperature of 331°F

CHAPTER 43

RELEASE FREQUENCY QUANTIFICATION

43.1 Introduction

The scope of this chapter is to provide for internal initiating events at power the fission product release category frequencies defined by the end states of the containment event tree model developed in Chapter 35.

The following seven fission product release categories are defined by the end states of the containment event tree:

Release Category	Description
BP	Containment Bypass
CFE	Early Containment Failure
CFI	Intermediate Containment Failure
CFL	Late Containment Failure
CFV	Containment Venting
CI	Containment Isolation Failure
IC	Intact Containment

In Chapter 33, the plant core damage frequency (CDF) for internal initiating events at power is calculated. The end states of the event trees used for core damage modeling are referred to as plant damage states (PDS). In this chapter, first the PDS frequencies are calculated and PDS cutsets are identified in Section 43.1. Then the containment event tree (CET) node probabilities are calculated in Section 43.2. Finally, the CETs for all PDSs are quantified to calculate the fission product release category frequencies (Section 43.3).

The summary of results is discussed in Section 43.4; importance and sensitivity analyses are provided in Section 43.5. Conclusions and insights are given in Section 43.6.

Two acronyms used in this chapter are defined below.

- Containment Effectiveness (C_{eff}):

  Ratio of the frequency of core damage sequences ending in "Intact Containment" (IC) end state to the plant CDF.

- Large Release Frequency (LRF):

  Frequency of containment failure plus bypass sequences (excluding IC).

  LRF includes frequencies of BP, CI, CFE, CFI, CFL, and CFV release categories.

Also, the terms "accident class" and "plant damage state" are used interchangeably in the present document.

43.2 Plant Damage State Frequency Calculations

During the plant CDF analysis of Chapter 33 for internal initiating events at power, 190 dominant accident sequences are identified and their cutsets are stored in individual files. These sequences and summary of information about them is provided in Table 43A-1 of Attachment 43A. Note that each sequence file starts with the 2-character designation for an end state (PDS). These PDS designations are:

PDS	Accident Class	Description
1A	1A	High RCS Pressure (Transient or SLOCA)
1P	1AP	High RCS Pressure (PRHR operating or MLOCA)
3A	3A	High RCS Pressure and ATWS
3C	3C	Vessel Failure
3D	3D+1D	Partial RCS Depressurization
2E	3BE	RCS Depressurized
2L	3BL	RCS Depressurized (Gravity Injection successful; Sump Recirculation fails)
2R	3BR	RCS Depressurized (CMT and ACC fail)
6	6E+6L	Containment Bypass by SGTR or ISLOCA
Others		Not further modeled since the CDF is very small (1.2 E-11/year)

Thus, 9 PDS categories are identified at the end of CDF analysis for further processing. The CDF for each of these PDS categories is calculated as shown in Table 43-1 and Figure 43-1.

Attachment 43A provides information about calculation of PDS frequencies. Note that PDS and accident class designators are used interchangeably throughout the chapter.

43.3 Containment Event Tree Node Frequencies

43.3.1 CET Nodes

For each PDS state defined in Section 43.2, the CET (as defined in Chapter 35) is to be quantified with potentially different event tree nodal probabilities to obtain the Release

Frequency Calculations (RFCs). The PDS cutset files are the input to the CET as the "initiating events." There are 14 CET top events:

1.	AC (PDS)	PDS Occurs (CUTSETS)
2.	DP	RCS Depressurization After Core Uncovery (CUTSETS)
3.	IS	Containment Isolation (CUTSETS)
4.	IR	Reactor Cavity Flooding (CUTSETS)
5.	RFL	Reflooding of a Degraded Core
6.	VF	Debris Relocation to the Reactor Cavity
7.	PC	Passive Containment Cooling
8.	VT	Containment Venting – Operator Action
9.	IF	Overpressured Containment Intact at 24 Hrs
10.	IG	Hydrogen Control System (CUTSETS)
11.	DF	Diffusion Flame
12.	DTE	Early Hydrogen Detonation
13.	DFG	Hydrogen Deflagration
14.	DTI	Intermediate Hydrogen Detonation

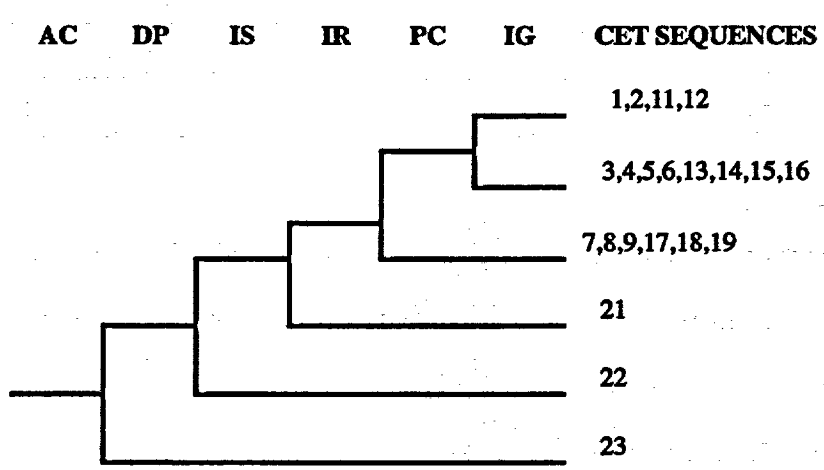
The CET is shown in Figure 43-2.

Five of the 14 event tree nodes are represented by cutsets, rather than scalars. The Boolean Logic multiplication of these nodes must be performed first, and their nodal probabilities are obtained, before the CET is quantified using scalar operations. To reduce the cutsets to scalar probabilities, the model in the next subsection is first used.

43.3.2 CET Node Probabilities From Boolean Expressions

In this section, a model is developed to calculate the probabilities of those CET nodes represented by fault tree models, and resulting cutset files. There are four such nodes (DP, IS, IR, IG) plus the accident classes (AC), as given in the previous subsection.

A sub-event tree containing the five nodes with cutsets is constructed as follows:



CET sequences 10 and 20 not shown above contain success of IS, and IR nodes, but do not involve the PC and IG nodes.

Boolean multiplication by using the WLINK code is first used to evaluate the expression such as:

SYS-AC SYS-DP	CET Seq. 23
SYS-AC DEL-DP SYS-IS	CET Seq. 22
SYS-AC DEL-DP DEL-IS SYS-IR	CET Seq. 21
SYS-AC DEL-DP DEL-IS DEL-IR SYS-PC	
SYS-AC DEL-DP DEL-IS DEL-IR DEL-PC SYS-IG	

whenever applicable for each PDS category. Then, scalar event tree node probabilities are assigned to each of the nodes AC, DP, IS, IR, PC, and IG by taking the appropriate ratios of the above numbers with the PDS frequencies.

To perform the above-mentioned scalar probability assignment to the five nodes, first the success criteria definitions in Chapter 35 are used to identify the needed cutset files for each PDS state. These are summarized as follows:

AC	DP	IS	IR	PC	IG
2E	0	CIC	IWF	PCS	VLH
2L	0	CIC	0	PCS	VLH
2R	0	CID	0	PCS	VLH
1A	ADTLT	CIC	0	PCS	VLH
1P	ADTLT	CIC	0	PCS	VLH
3A	ADALT	CID	0	PCS	VLH
3C	0	XCID	0	PCS	VLH
3D	0	CIC	IWF	PCS	VLH
6	Note 6				

<u>Notes</u>:

1. 0 means the success of the node is given by the definition of the PDS state.

2. 1 means the failure of the node is given by the definition of the PDS state.

3. XCID = CID + OTH-CNU

4. ADALT = CM2NL + RCN + PRTA + OTH-SGTR

5. OTH-CNU = 0.001
   OTH-SGTR = 0.01

6. DP failure for PDS-6 is calculated in Attachment 43C for the other CET nodes, 3BL probabilities are used; for IR node, 3BE is used.

From the above definitions, Boolean expressions are defined for the sub-event tree for all PDSs. These are shown in Table 43-2. Twenty nine runs with WLINK are made for each of these expressions, which are named Q1 through Q29. The frequencies obtained in this file will be referred to as Q1 through Q29, respectively. These frequencies are placed in column D of Table 43-3.

Another set of probabilities are defined as P1 through P15 (representing success paths associated with CET nodes represented by fault trees) in Table 43-4 and are calculated using WLINK code system. The results are given in Table 43-3. These probabilities are also placed in Table 43-3, column G.

The PDS frequencies are calculated in Attachment A and are placed in column A of Table 43-3.

Q, P, and PDS frequencies are used to calculate the probabilities of various CET event tree nodes, as given in Table 43-3. This table contains the following data.

Column B on the top left-hand-side contains the PDS frequencies input. Column D contains the frequencies Q1 to Q29. Column H contains the frequencies P1 through P15. Column L shows the DP, IS, IR, PC and IG node probabilities calculated in the spreadsheet. The second page of the table contains the actual event tree node probabilities used to quantify the CETs.

All the probabilities used for CET quantification of the nine PDS states are summarized on the second page of Table 43-3. These probabilities are either calculated in this section, as shown above, or are taken from PRA Chapters.

When a CET node involves a Boolean expression (e.g., FT cutsets), the split fraction for that node is calculated as follows:

> A Boolean expression qn is generated to calculate the product of cutsets of the PDS state, the failed node, and the success of the other nodes in between containing Boolean expression. Another Boolean expression, pm, containing the product of PDS state cutsets and the success of other nodes in between the PDS and the node in question is also created. The ratio of the value of qn to pm is the conditional probability of failure of the node in question. Note that this conditional probability must be equal to or larger than the value of the Boolean expression for the node in question. The equality only holds if the cutsets of the node are not contained in the PDS cutsets (those that are not already removed by the failure of the previous nodes with Boolean expressions).

By this process, the Boolean expressions are replaced by scalar split fractions to quantify the CET.

43.3.3 Probabilities for Hydrogen-Related CET Nodes

The probabilities of CET event nodes DF, DTE, DFG, and DTI are taken from Chapter 35. These probabilities are summarized below:

Accident Class	DF Node Probability	DTE Node Probability	DFG Node Probability	DTI Node Probability
3BE	0	0.245 if RFL is successful	0	0.124 if RFL is successful
	0	0.117 if RFL fails	0	0.0013 if RFL fails
3BL	0	0.005	0	0.0013
3BR	0	0.19	0	0.13
1A	0	0	0	0
1AP	0.017	0.054	0	0.13
3A	0	0	0	0
3C	0	0.19	0	0.13
3D	0.017	0.115	0	0.0013
6	0	0.005	0	0.0013

43.3.4 Other CET Node Probabilities

The remaining CET nodes are RFL and VF. Probabilities of RFL and VF nodes are taken from Chapter 35.

The VT and IF nodes are assigned conservative failure probabilities.

These probabilities are given in Table 43-3, and are also summarized below:

PDS	RFL	VF	VT	IF
2E	0.267	0	1	1
2L	1.0	0	1	1
2R	0	0	1	1
1A	0	0	1	1
1P	0	0	1	1
3A	0	0	1	1
3C	0	0.1	1	1
3D	1.0	0	1	1
6	1.0	0	1	1

43.4 Containment Event Tree Quantification

43.4.1 Containment Event Tree

The CETs are quantified by using the event tree node probabilities from Table 43-3. The results are shown in Figures 43-3 through 43-11.

Most of the CET sequences go to the containment intact containment end state, which does not have severe fission product release potential. Only 8.1 percent of the PDS frequency goes to containment failure end states, such as BP, CFE, etc. Thus, the containment effectiveness is 91.9 percent in avoiding severe release given core damage.

Contribution of PDS to LRF is shown in Table 43-5 and Figure 43-12.

43.4.2 Dominant CET Sequences

Dominant CET sequences contributing to LRF are given in Table 43-6. The top sequences are BP release category.

43.4.3 LRF Cutsets for Dominant Sequences

The large release frequency cutsets in terms of initiating events, component and operator action failures, and containment safeguards failures are identified for the dominant accident sequences. For this purpose, the top 6 LRF CET sequences are used from Table 43-6.

The cutsets for the dominant CET LRF sequences are following:

	SEQUENCE		
1	23	BP	3A
2	23	BP	6
3	21	CFE	2E
4	21	CFE	3D
5	23	BP	1A
6	10	CFE	3C

43.5 Summary of Results

The fission product release category frequencies from the nine PDS states quantified in Section 43.4 are combined to obtain the total release category frequencies. These results are summarized in Tables 43-7, 43-8 and 43-9.

The results show that following a core damage event, the containment will be intact 91.9 percent of the time, preventing a severe fission product release. This is given by the ratio

of the CET end state IC (Intact Containment) frequency divided by the CDF. This quantity is termed as Containment Effectiveness which has a value of 0.919.

8.1 percent of the total CDF for internal initiating events (events at power) results in containment failure (including containment bypass), leading to potentially severe release categories (CET end states other than IC). The frequency of CET sequences where the containment is bypassed or failed (LRF) is 1.95 E-08/year. The containment event tree quantification results are displayed in Figure 43-13.

The containment bypass and failure CET sequences are dominated by release categories BP (bypass) and CFE (early containment failure) with contributions of 6.6 percent and 3.9 percent respectively to the plant CDF. With a total frequency of 1.8 E-08, these two categories make up 92 percent of the plant LRF, followed by 7 percent contribution from containment isolation failure category. Contributions of CFL and CFI categories to LRF are negligible.

Figure 43-12 shows the contribution of accident classes to LRF.

43.6 Importance and Sensitivity Analyses

In this section, CET node importance and sensitivity analyses are performed to provide a better understanding of the contributors to LRF.

43.6.1 CET Event Node Importance Analysis

In this section, the importances of the eleven CET nodes are calculated by setting the failure probability of each of these nodes to 1.0 (failure). The results are summarized in Table 43-10.

43.6.2 No Credit Taken for DP Node for PDS-6

Set DP(fail) = 1.0 for PDS-6.

In this case, the LRF becomes 2.49 E-08/year, with a containment failure probability of 10.3 percent.

43.6.3 Lesser Reliability for Containment Isolation

Set IS(fail) = 0.1 (all PDS)

In this case, the LRF becomes 4.05 E-08/year, with a containment failure probability of 16.8 percent.

43.6.4 Lesser Reliability for Hydrogen Igniters

In this sensitivity analysis, the VLH (IG node) probability is assigned a value of 0.1 for all PDS. The LRF becomes 2.31 E-08/year.

From this sensitivity analysis results, it is concluded that the LRF is not sensitive to the VLH failure as long is this failure probability is 0.1 or less. On the other hand, the LRF is sensitive to the failure of VLH (e.g. when no credit is taken for VLH).

43.6.5 Lesser Reliability for PCS

In this sensitivity analysis, the PCS failure probability is assigned a value of 0.001 for all PDSs. The LRF becomes 1.97 E-08/year.

From this sensitivity analysis results, it is concluded that the LRF is not sensitive to the PCS failure as long is this failure probability is 0.001 or less. On the other hand, the LRF is sensitive to the failure of PCS (e.g., when no credit is taken for PCS).

43.6.6 No Credit for Depressurization for High Pressure PDS

Set DP(fail) = 1.0 for all HP PDS: 1A, 1AP, 3A, 6.

This is the same as the node importance calculated in 44.5.1. The LRF is 2.91 E-08/year.

43.6.7 Set PDS-3C Vessel Failure Probability to 1.0

Set VF(fail) = 1.0 for PDS-3C.

This is the same as the node importance calculated in 44.5.1. The LRF is 2.85 E-08/year.

43.6.8 Set 3D and 1AP Diffusion Flame and Detonation Failure Probability to 1.0

Set DF(fail) = 1.0 for PDS-3D and 1AP.

Set DTE(fail) = 1.0 for PDS-3D and 1AP.

In this case, the LRF becomes 7.66 E-08/year.

43.7 Other Importance and Sensitivity Analyses

In this section, the initiating event importances are calculated and reported. Also, a sensitivity analysis is made for the case when standby nonsafety systems are unavailable.

43.7.1 Initiating Event Importances

In order to calculate the initiating event importances, first more LRF cutsets need to be collected to have accurate results. For this purpose, dominant cutsets from additional dominant sequences are collected. In this process, some of the split fractions assigned to PDS-6 are more accurately calculated. This caused the LRF frequency to reduce slightly to 1.91E-08/year. The initiating event importances thus calculated are reported in Table 43-11. ATWS, SGTR, SPADS, and SI-LB initiating events lead the list of contributors to LRF, with a total contribution of 56 percent.

Since the base case LRF was already calculated to be 1.95E-08/yr and reported in various places, it will be retained as the value of record.

43.7.2 Sensitivity to Standby Systems

This sensitivity case is analogous to the similar case for CDF, reported in Chapter 50 to support RTNSS. A sensitivity study is performed to estimate the LRF increase when no credit is taken for nonsafety standby systems. This study removes (assumes to fail) the hydrogen ignitors in addition to the CVS, SFS, RNS, DAS, and DGs. The calculation is done by setting the standby system components to failure in the plant LRF cutsets. The LRF increases from 1.9E-8/year to 5.2E-6/year. This LRF frequency is still in the 10-6 range and is small.

Table 43-12 provides the top LRF cutsets for this sensitivity case. An examination of the top cutsets shows that they contain CCF of PMS software or cards in slow developing initiating events, such as TRANS and LSP. These LRF precursor sequences can be recovered from by credible operator actions. This considerably decreases the LRF. However, such recovery credit is not taken at this time.

43.7.3 Sensitivity to Standby Systems With Credit for Manual DAS

This sensitivity case is similar to the previous case reported above. A sensitivity study is performed to estimate the LRF increase when no credit is taken for nonsafety standby systems, but manual DAS is retained. This study removes (assumes to fail) the hydrogen ignitors in addition to the CVS, SFS, RNS, automatic DAS, and DGs. The calculation is done by setting the standby system components to failure in the plant LRF cutsets. The LRF increases from 1.9E-8/year to 3.9E-7/year. This LRF frequency is in the 10-7 range and is small. This case is intended to show the benefit of putting administrative controls on manual DAS. Table 43-13 provides the top LRF cutsets for this sensitivity case.

43.8 Conclusions and Insights

From the results of the containment event tree quantification and sensitivity analyses, the following conclusions and insights related to AP1000 LRF can be derived:

1. The containment effectiveness for AP1000 is over 90 percent, which provides an order of magnitude decrease from CDF to LRF. Since this results already includes CDF sequences that directly bypass the containment, the containment effectiveness for remaining sequences is actually much better. For example, for five (3BE, 3BL, 3BR, 3C, 3D) of the nine accident classes studied, the containment effectiveness ranges from 90 to 99.8 percent.

2. The containment effectiveness is lowest for the 3A accident class where the reactor coolant system (RCS) pressure is high after core damage. The post-core-damage depressurization for this class proves to be ineffective since failure of the automatic depressurization systems (ADS) by common cause failures leading to core damage also causes failure of post-core-damage depressurization.

3. Based on detailed analysis, the containment effectiveness for accident class 6, mainly steam generator tube rupture (SGTR) events, is 56.9 percent, due to those sequences where the RCS pressure is low after the postulated core damage. In such sequences, the fission products can be retained in the pressure vessel, shielded by the water in the faulted steam generator. A sensitivity analysis where all accident class 6 events are assigned to LRF shows that the plant containment effectiveness drops slightly to 89.7 percent (from 91.9 percent). Thus, the LRF results are not very sensitive to the treatment of the SGTR events for LRF.

4. A frequency of 1.0E-08/year has been assigned to the vessel failure initiating event (accident class 3C). In 90 percent of these events, the vessel is assumed to undergo failures that will be above the beltline: in which case the molten core could be cooled and containment would not be challenged. In the remaining 10 percent of the cases, the failure is assumed to be below the pressure vessel beltline, whereby the molten core would drop into the containment. In this case, it is conservatively assumed that the containment would fail. A sensitivity analysis is made whereby 100 percent of the failures would be below the beltline. The result shows that the containment effectiveness drops to 88.2 percent. This change is not significant, and the assumptions behind the case are very conservative.

5. The LRF results are sensitive to failure of hydrogen igniters. If no credit is taken for hydrogen igniters, the containment effectiveness drops to 74 percent.

6. However, LRF is not very sensitive to the reliability of hydrogen igniters; if IG reliability is assumed to be degraded (0.1) across the board for all accident classes, the containment effectiveness becomes 90.5 percent, which is an insignificant change from the base case.

7. For accident classes 3D and 1AP, if the large hydrogen releases through the in-containment refueling water storage tank (IRWST) is conservatively assumed to cause containment failure, the containment effectiveness drops to 84.5 percent. The LRF increases to 7.58 E-08/year. The increase is about a factor of 4 of the base. Such an increase is significant. This sensitivity analysis addresses the uncertainties in hydrogen mixing model for the case where the hydrogen is released into the IRWST and comes out from the IRWST vents above the operating deck.

8. The LRF is dominated (53.9 percent) by containment failures or bypasses due to SGTR, and unmitigated high-RCS-pressure core damage sequences, classified as BP. The remaining containment failures are dominated by an early containment failure due to reactor cavity flooding failure.

9. The LRF is not very sensitive to the reliability of PCS. If PCS reliability is assumed to be 0.001 across the board for all accident classes, the LRF becomes 1.97E-08, which is an insignificant change from the base case.

10. If no credit is taken for standby non-safety systems (the case for the RTNSS), the plant LRF becomes 5.2E-06/yr. This LRF frequency is still in the 10-6 range and is small. If credit for manual DAS is introduced in this case, the LRF becomes 3.9E-07/yr, which shows the benefit obtained from manual DAS.

Table 43-1

ACCIDENT CLASS FREQUENCIES

PDS	Frequency	Percentage	Description
1A	5.01E-09	2.1	High RCS Pressure (Transient or SLOCA)
1P	1.48E-09	0.6	High RCS Pressure (PRHR operating)
2E	8.06E-08	33.4	RCS Depressurized
2L	2.40E-08	9.9	RCS Depres. (Gravity Injection succ.; Sump Recirc. fails)
2R	4.63E-08	19.2	RCS Depressurized (CMT and ACC fail)
3A	4.43E-09	1.8	High RCS Pressure and ATWS
3C	1.00E-08	4.2	Vessel Failure
3D	5.97E-08	24.8	Partial RCS Depressurization
6	9.52E-09	4.0	Containment Bypass by SGTR or ISLOCA
CDF =	2.41E-07	100.0	

Table 43-2

BOOLEAN EXPRESSIONS TO CALCULATE Q1-Q29

1	1.00E-04	2	SYS-2E	SYS-CIC			
2	9.90E-05	3	SYS-2E	DEL-CIC	SYS-IWF		
3	9.70E-05	5	SYS-2E	DEL-CIC	DEL-IWF	DEL-PCT	SYS-VLH
4	1.00E-04	2	SYS-2L	SYS-CIC			
5	9.80E-05	4	SYS-2L	DEL-CIC	DEL-PCT	SYS-VLH	
6	1.00E-04	2	SYS-2R	SYS-CID			
7	9.80E-05	4	SYS-2R	DEL-CID	DEL-PCT	SYS-VLH	
8	1.00E-04	2	SYS-1A	SYS-ADTLT			
9	1.00E-06	3	SYS-1A	DEL-ADTLT	SYS-CIC		
10	9.80E-07	5	SYS-1A	DEL-ADTLT	DEL-CIC	DEL-PCT	SYS-VLH
11	1.00E-04	2	SYS-1P	SYS-ADTLT			
12	1.00E-06	3	SYS-1P	DEL-ADTLT	SYS-CIC		
13	9.80E-07	5	SYS-1P	DEL-ADTLT	DEL-CIC	DEL-PCT	SYS-VLH
14	1.00E-04	2	SYS-3A	SYS-ADALT			
15	1.00E-06	3	SYS-3A	DEL-ADALT	SYS-CID		
16	9.80E-07	5	SYS-3A	DEL-ADALT	DEL-CID	DEL-PCT	SYS-VLH
17	1.00E-04	2	SYS-3C	SYS-XCID			
18	9.80E-05	4	SYS-3C	DEL-XCID	DEL-PCT	SYS-VLH	
19	1.00E-04	2	SYS-3D	SYS-CID			
20	9.90E-05	3	SYS-3D	DEL-CID	SYS-IWF		
21	9.70E-05	5	SYS-3D	DEL-CID	DEL-IWF	DEL-PCT	SYS-VLH
22	9.80E-05	4	SYS-2E	DEL-CIC	DEL-IWF	SYS-PCT	
23	9.90E-05	3	SYS-2L	DEL-CIC	SYS-PCT		
24	9.90E-05	3	SYS-2R	DEL-CID	SYS-PCT		
25	9.90E-07	4	SYS-1A	DEL-ADTLT	DEL-CIC	SYS-PCT	
26	9.90E-07	4	SYS-1P	DEL-ADTLT	DEL-CIC	SYS-PCT	
27	9.90E-07	4	SYS-3A	DEL-ADALT	DEL-CID	SYS-PCT	
28	9.90E-05	3	SYS-3C	DEL-XCID	SYS-PCT		
29	9.80E-05	4	SYS-3D	DEL-CID	DEL-IWF	SYS-PCT	

Table 43-3 (Sheet 1 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
2E	8.06E-08		1.32E-10	Q1	2E/CIC		8.05E-08	P1	2E/CIC	4.08E-01	1A-DP
2L	2.40E-08		2.67E-09	Q2	2E/IWF		7.85E-08	P2	2E/CIC/IWF	4.10E-01	1P-DP
2R	4.63E-08		2.67E-09	Q3	2E/VLH		7.85E-08	P3	2E/CIC/IWF/PCT	9.21E-01	3A-DP
1A	5.01E-09		5.83E-10	Q4	2L/CIC		2.34E-08	P4	2L/CIC	1.64E-03	2E-IS
1P	1.48E-09		3.66E-11	Q5	2L/VLH		4.63E-08	P5	2R/CID	2.43E-02	2L-IS
3A	4.43E-09		7.67E-11	Q6	2R/CID		3.35E-09	P6	1A/ADTLT	1.66E-03	2R-IS
3C	1.00E-08		5.28E-11	Q7	2R/VLH		3.35E-09	P7	1A/ADTLT/CIC	1.55E-03	1A-IS
3D	5.97E-08		2.04E-09	Q8	1A/ADTLT		9.61E-10	P8	1P/ADTLT	1.52E-03	1P-IS
6	9.52E-09		5.20E-12	Q9	1A/CIC		9.61E-10	P9	1P/ADTLT/CIC	1.81E-02	3A-IS
			2.17E-11	Q10	1A/VLH		3.61E-10	P10	3A/ADALT	2.66E-03	3C-IS
CDF =	2.409E-07		6.05E-10	Q11	1P/ADTLT		3.61E-10	P11	3A/ADALT/CID	6.07E-03	3D-IS
			1.46E-12	Q12	1P/CIC		1.00E-08	P12	3C/XCID	3.32E-02	2E-IR
			1.04E-12	Q13	1P/VLH		5.97E-08	P13	3D/CID	3.45E-02	3D-IR
			4.08E-09	Q14	3A/ADALT		5.81E-08	P14	3D/CID/IWF	3.40E-02	2E-IG
			6.53E-12	Q15	3A/CID		5.81E-08	P15	3D/CID/IWF/PCT	1.56E-03	2L-IG
			7.58E-12	Q16	3A/VLH					1.14E-03	2R-IG
			2.66E-11	Q17	3C/XCID					6.49E-03	1A-IG
			1.15E-11	Q18	3C/VLH					1.08E-03	1P-IG

Table 43-3 (Sheet 2 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
			3.62E-10	Q19	3D/CID					2.10E-02	3A-IG
			2.06E-09	Q20	3D/IWF					1.15E-03	3C-IG
			1.50E-10	Q21	3D/VLH					2.59E-03	3D-IG
			1.35E-13	Q22	2E/PCT					1.72E-06	2E-PCT
			2.35E-14	Q23	2L/PCT					1.01E-06	2L-PCT
			5.21E-14	Q24	2R/PCT					1.12E-06	2R-PCT
			1.10E-14	Q25	1A/PCT					3.28E-06	1A-PCT
			0.00E+00	Q26	1P/PCT					0.00E+00	1P-PCT
			2.54E-14	Q27	3A/PCT					7.04E-05	3A-PCT
			1.16E-14	Q28	3C/PCT					1.16E-06	3C-PCT
			8.73E-14	Q29	3D/PCT					1.50E-06	3D-PCT
	2E	**2L**	**2R**	**1A**	**1P**	**3A**	**3C**	**3D**	**6**		
AC	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09		
DP	0.00E+00	0.00E+00	0.00E+00	4.08E-01	4.10E-01	9.21E-01	0.00E+00	0.00E+00	3.97E-01		
IS	1.64E-03	2.43E-02	1.66E-03	1.55E-03	1.52E-03	1.81E-02	2.66E-03	6.07E-03	2.43E-02		
IR	3.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.45E-02	3.32E-02		
RFL	2.67E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	1.00E+00		

Table 43-3 (Sheet 3 of 3)

CET NODE PROBABILITIES

PDS	Frequency		Probability	Symbol	Description		Probability	Symbol	Description	Failure Prob.	Node
VF	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	0.00E+00		
PC	1.72E-06	1.01E-06	1.12E-06	3.28E-06	0.00E+00	7.04E-05	1.16E-06	1.50E-06	1.01E-06		
VT	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00		
IF	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00		
IG	3.40E-02	1.56E-03	1.14E-03	6.49E-03	1.08E-03	2.10E-02	1.15E-03	2.59E-03	1.56E-03		
DF	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-02	0.00E+00	0.00E+00	1.70E-02	0.00E+00		
DTE	2.45E-01	5.00E-03	1.90E-01	0.00E+00	5.40E-02	0.00E+00	1.90E-01	1.15E-01	5.00E-03		
DFG	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
DTI	1.24E-01	1.30E-03	1.30E-01	0.00E+00	1.30E-01	0.00E+00	1.30E-01	1.30E-03	1.30E-03		
DTI-2	1.30E-03	(if RFL fails)									
DTE-2	0.117	(if RFL fails)									

Table 43-4

BOOLEAN EXPRESSIONS FOR P1-P15

1	9.90E-03	2	SYS-2E	DEL-CIC		
2	9.80E-03	3	SYS-2E	DEL-CIC	DEL-IWF	
3	9.70E-03	4	SYS-2E	DEL-CIC	DEL-IWF	DEL-PCT
4	9.90E-03	2	SYS-2L	DEL-CIC		
5	9.90E-03	2	SYS-2R	DEL-CID		
6	1.00E-04	2	SYS-1A	DEL-ADTLT		
7	9.90E-05	3	SYS-1A	DEL-ADTLT	DEL-CIC	
8	1.00E-04	2	SYS-1P	DEL-ADTLT		
9	9.90E-05	3	SYS-1P	DEL-ADTLT	DEL-CIC	
10	1.00E-04	2	SYS-3A	DEL-ADALT		
11	9.90E-05	3	SYS-3A	DEL-ADALT	DEL-CID	
12	9.90E-03	2	SYS-3C	DEL-XCID		
13	9.90E-03	2	SYS-3D	DEL-CID		
14	9.80E-03	3	SYS-3D	DEL-CID	DEL-IWF	
15	9.70E-03	4	SYS-3D	DEL-CID	DEL-IWF	DEL-PCT

Table 43-5 (Sheet 1 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
23	BP	3A	4.08E-09	20.9%	Containment Bypass
23	BP	6	3.78E-09	19.4%	Containment Bypass
21	CFE	2E	2.67E-09	13.7%	Sump Flooding Fails
21	CFE	3D	2.05E-09	10.5%	Sump Flooding Fails
23	BP	1A	2.04E-09	10.5%	Containment Bypass
10	CFE	3C	9.97E-10	5.1%	Vessel Failure
12	CFE	3D	9.71E-10	5.0%	Core Reflooding Fails; Diffusion Flame
23	BP	1P	6.05E-10	3.1%	Containment Bypass
22	CI	2L	5.83E-10	3.0%	Containment Isolation Fails
6	CFE	2E	4.75E-10	2.4%	Hydrogen Igniters Fail; Early DDT
22	CI	3D	3.62E-10	1.9%	Containment Isolation Fails
21	CFE	6	1.86E-10	1.0%	Sump Flooding Fails
4	CFI	2E	1.82E-10	0.9%	Hydrogen Igniters fails; Intermediate DDT
22	CI	6	1.40E-10	0.7%	Containment Isolation Fails
22	CI	2E	1.32E-10	0.7%	Containment Isolation Fails
16	CFE	2E	8.27E-11	0.4%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
22	CI	2R	7.67E-11	0.4%	Containment Isolation Fails
22	CI	3C	2.66E-11	0.1%	Containment Isolation Fails

Table 43-5 (Sheet 2 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
16	CFE	3D	1.70E-11	0.1%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
2	CFE	1P	1.48E-11	0.1%	Diffusion Flame
6	CFE	2R	1.00E-11	0.1%	Hydrogen Igniters Fail; Early DDT
22	CI	3A	6.33E-12	0.0%	Containment Isolation Fails
4	CFI	2R	5.55E-12	0.0%	Hydrogen Igniters Fails; Intermediate DDT
22	CI	1A	4.60E-12	0.0%	Containment Isolation Fails
6	CFE	3C	1.95E-12	0.0%	Hydrogen Igniters Fail; Early DDT
22	CI	1P	1.32E-12	0.0%	Containment Isolation Fails
4	CFI	3C	1.08E-12	0.0%	Hydrogen Igniters Fails; Intermediate DDT
14	CFI	2E	8.11E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters fails; Intermediate DDT
16	CFE	2L	1.83E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
14	CFI	3D	1.70E-13	0.0%	Core Reflooding Fails; Hydrogen Igniters fails; Intermediate DDT
4	CFI	1P	1.15E-13	0.0%	Hydrogen Igniters Fails; Intermediate DDT
9	CFL	2E	9.80E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	3D	8.60E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	2R	5.20E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
6	CFE	1P	5.05E-14	0.0%	Hydrogen Igniters Fail; Early DDT
14	CFI	2L	4.72E-14	0.0%	Core Reflooding Fails; Hydrogen Igniters Fails; Intermediate DDT

Table 43-5 (Sheet 3 of 3)

CONTRIBUTION OF PDS TO LRF

CET SEQ	REL CAT	PDS	FREQ	%	Sequence Description
16	CFE	6	4.23E-14	0.0%	Core Reflooding Fails; Hydrogen Igniters Fail; Early DDT
19	CFL	2E	3.57E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	3A	2.42E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	2L	2.35E-14	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
14	CFI	6	1.09E-14	0.0%	Core Reflooding Fails; Hydrogen Igniters fails; Intermediate DDT
9	CFL	3C	1.04E-14	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
9	CFL	1A	9.71E-15	0.0%	Passive Containment Cooling Fails; Venting Fails; Containment Fails
19	CFL	6	5.44E-15	0.0%	Core Reflooding Fails; Passive Containment Cooling Fails; Venting Fails; Containment Fails
		Sum	1.95E-08	100.0%	

Table 43-6 (Sheet 1 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP3A

Reduced Sum of Cutsets: 4.0770E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	3.01E-09	73.83	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
2	6.95E-10	17.05	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN06 (OPER. FAILS TO TRIP REACTOR	5.00E-01	ATW-MAN06C
3	1.58E-10	3.88	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C

Table 43-6 (Sheet 2 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
4	9.25E-11	2.27	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
5	5.71E-11	1.4	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
6	1.39E-11	0.34	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS

Table 43-6 (Sheet 3 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
7	1.00E-11	0.25	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
8	9.15E-12	0.22	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
9	4.96E-12	0.12	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 4 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
10	4.96E-12	0.12	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
11	4.86E-12	0.12	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
12	3.00E-12	0.07	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS

Table 43-6 (Sheet 5 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
13	2.43E-12	0.06	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
14	1.76E-12	0.04	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
15	1.74E-12	0.04	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 6 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
16	9.68E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA DAS	5.20E-02	ATW-MAN04
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
17	9.68E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA DAS	5.20E-02	ATW-MAN04
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
18	8.26E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 7 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
19	8.26E-13	0.02	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
20	5.68E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
21	5.68E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR

Table 43-6 (Sheet 8 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
22	5.25E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
23	5.25E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
24	4.24E-13	0.01	ATWS PRECURSOR WITH MFW AVAILA. INITIATING EVENT OCCURS	1.17E+00	IEV-ATW-T
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-03	ATW-MAN05
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 9 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
25	3.08E-13	0.01	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
26	2.88E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
27	2.88E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR

Table 43-6 (Sheet 10 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
28	2.82E-13	0.01	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
29	2.62E-13	0.01	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			FAILURE OF INPUT GROUP # (P##MOD3#)	5.02E-03	PMAMOD31
			FAILURE OF INPUT GROUP # (P##MOD3#)	5.02E-03	PMBMOD32
30	2.08E-13	0.01	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 11 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	1.86E-13	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
32	1.86E-13	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
33	1.53E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 12 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
34	1.53E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
35	1.36E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
36	1.34E-13	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO

Table 43-6 (Sheet 13 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
37	1.09E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
38	1.09E-13	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 14 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
39	1.07E-13	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
40	9.43E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM

Table 43-6 (Sheet 15 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	9.43E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
42	9.24E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
43	8.81E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			REACTOR TRIP BREAKERS CCF	8.10E-06	RCX-RB-FA
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO

Table 43-6 (Sheet 16 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
44	7.55E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
45	7.55E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
46	6.91E-14	0	PRZ SV FAILURE FOR LOSS OF MFW ATWS, NO UET	2.00E-03	OTH-PRES
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			CONTROL ROD MG SETS FAIL TO TRIP	1.75E-03	OTH-MGSET
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 17 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
47	6.31E-14	0	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			FIXED COMPONENT FAILS: CKT BKR, INVERTER, OR STATIC XFER	5.04E-04	ED3MOD01
			STATIC TRANSFER SWITCH FAILS TO TRANSFER OR BKR FAILS OPEN	2.19E-02	ED3MOD04
48	5.61E-14	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 002 FAILURE	5.23E-03	MSHTP002RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR

Table 43-6 (Sheet 18 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
49	5.61E-14	0	INADEQUATE PRS RELIEF FOR LOSS OF MFW ATWS, WITH UET	2.00E-03	OTH-PRESU
			ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			PMS REACTOR TRIP SYSTEM HARDWARE CCF	7.89E-05	CCX-PMS-HARDWARE
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			TURBINE IMPULSE CHAMBER PRESSURE TRANSMITTER 001 FAILURE	5.23E-03	MSHTP001RI
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
			COND. PROB. OF ATW-MAN01 (OPER. FAILS TO STEP-IN CONTROL ROD)	5.17E-01	ATW-MAN01C
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
50	5.36E-14	0	ATWS PRECURSOR WITH SI SIGNAL INITIATING EVENT OCCURS	1.48E-02	IEV-ATW-S
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 19 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP6

Reduced Sum of Cutsets: 3.7730E-09

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
1	7.59E-11	2.01	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
2	7.59E-11	2.01	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 20 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
3	6.39E-11	1.69	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
4	5.52E-11	1.46	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR ERROR TO CLOSE VALVES ON RUPTURED SG	1.34E-03	CIB-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
5	4.95E-10	13.12	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 21 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
6	4.27E-10	11.32	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
7	3.88E-10	10.28	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
8	3.34E-10	8.85	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
9	1.86E-11	0.49	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 22 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
10	1.86E-11	0.49	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
11	1.12E-11	0.3	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
12	9.43E-12	0.25	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 23 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
13	9.21E-12	0.24	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
14	7.76E-12	0.21	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
15	7.12E-11	1.89	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA

Table 43-6 (Sheet 24 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
16	5.40E-11	1.43	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
17	4.66E-11	1.24	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
18	3.59E-12	0.1	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V084 AND CV V085 TO OPEN	2.88E-02	CVMOD05
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 25 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
19	3.37E-12	0.09	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V081 FAILS TO CLOSE	2.71E-02	CVMOD07
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
20	2.45E-11	0.65	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
21	2.45E-11	0.65	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2

Table 43-6 (Sheet 26 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
22	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
23	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
24	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4

Table 43-6 (Sheet 27 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
25	1.96E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
26	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
27	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN

Table 43-6 (Sheet 28 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
28	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			UNAVAILABILITY OF BUS ECS ES 2 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS002TM
29	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS022TM
30	1.95E-11	0.52	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC2BS221TM

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DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
31	1.59E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V084 AND CV V085 TO OPEN	2.88E-02	CVMOD05
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	1.34E-03	LPM-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
32	1.51E-12	0.04	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 30 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
33	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
34	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COGNITIVE OPERATOR ERROR	1.84E-03	CIB-MAN00
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	5.00E-01	LPM-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
35	1.50E-12	0.04	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MECHANICAL FAILURE OF AOV V081 FAILS TO CLOSE	2.71E-02	CVMOD07
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO RECOG. THE NEED FOR RCS DEPRESS. DURING SLOCA	1.34E-03	LPM-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 31 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
36	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
37	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
38	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4

Table 43-6 (Sheet 32 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
39	1.47E-11	0.39	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
40	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
41	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDS1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDS1TM

Table 43-6 (Sheet 33 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
42	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDS1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDD1TM
43	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDD1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDS1TM
44	1.39E-11	0.37	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDDBSDD1TM
			BUS UNAVAILABLE DUE TO TEST OR CORRECTIVE MAINTENANCE	3.00E-04	IDBBSDD1TM

Table 43-6 (Sheet 34 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
45	1.30E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
46	1.27E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			MAIN GEN. BKR ES 01 FAILS TO OPEN	5.08E-03	ECOMOD01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS
47	1.26E-12	0.03	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			FAILURE TO ALIGN CVCS IN AUX. SPRAY MODE	3.10E-03	CVN-MAN00
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 35 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
48	1.25E-11	0.33	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
49	1.25E-11	0.33	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO RECLOSE (1 SV + PORV)	1.10E-02	OTH-SLSOV
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
50	1.13E-12	0.03	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFILL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	1.00E-01	PDS6-MANADS

Table 43-6 (Sheet 36 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 21CFE2E

Reduced Sum of Cutsets: 2.6710E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	6.48E-10	24.26	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
2	2.24E-10	8.39	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
3	1.73E-10	6.48	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
4	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
5	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 37 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
6	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
7	8.46E-11	3.17	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
8	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
9	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
10	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
11	7.38E-11	2.76	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 38 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
12	6.00E-11	2.25	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
13	6.00E-11	2.25	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
14	5.23E-11	1.96	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
15	2.94E-11	1.1	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
16	2.80E-11	1.05	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
17	2.56E-11	0.96	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 39 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
18	2.43E-11	0.91	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
19	2.16E-11	0.81	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
20	1.87E-11	0.7	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
21	1.74E-11	0.65	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			OPERATOR FAILS TO ALIGN AND ACTUATE THE RNS	2.90E-03	RHN-MAN01
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
22	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
23	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 40 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
24	1.62E-11	0.61	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS122TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
25	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
26	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
27	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
28	1.58E-11	0.59	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
29	1.54E-11	0.58	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			HARDWARE FAILURE OF VALVES ON DVI LINE A (V 015A & 017A)	5.07E-02	RNAMOD09
			HARDWARE FAILURE OF VALVES ON DVI LINE B (V 015B & 017B)	5.07E-02	RNBMOD10
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 41 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
30	1.52E-11	0.57	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			OPERATOR FAILS TO ALIGN AND ACTUATE THE RNS	2.90E-03	RHN-MAN01
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
31	1.41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			UNAVAILABILITY OF BUS ECS ES 1 DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS001TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
32	1.41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS012TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
33	1.41E-11	0.53	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			BUS UNAVAILABLE DUE TO UNSCHEDULED MAINTENANCE	2.70E-03	EC1BS122TM
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
34	1.34E-11	0.5	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			HARDWARE FAILURE OF VALVES ON DVI LINE A (V 015A & 017A)	5.07E-02	RNAMOD09
			HARDWARE FAILURE OF VALVES ON DVI LINE B (V 015B & 017B)	5.07E-02	RNBMOD10
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
35	1.12E-11	0.42	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 42 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
36	1.05E-11	0.39	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CHECK VALVE V013 FAILURE TO OPEN	1.75E-03	RNNCV013GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
37	9.16E-12	0.34	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CHECK VALVE V013 FAILURE TO OPEN	1.75E-03	RNNCV013GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
38	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
39	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
40	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 43 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	7.61E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			HARDWARE FAILS TO OPEN MOV V023/CB FTC/RELAY FTC	1.41E-02	RN23MOD5
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
42	7.13E-12	0.27	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
43	6.94E-12	0.26	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			PUMP 01A FAILS & ST CK V007A &C B FTC & RE FTC & CB ECS131 SP	3.40E-02	RNAMOD06
			PUMP 01B FAILS & ST CK V007B & C B FTC & RE FTC & CB ECS231 SP	3.40E-02	RNBMOD07
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
44	6.18E-12	0.23	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
45	6.05E-12	0.23	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			PUMP 01A FAILS & ST CK V007A &C B FTC & RE FTC & CB ECS131 SP	3.40E-02	RNAMOD06
			PUMP 01B FAILS & ST CK V007B & C B FTC & RE FTC & CB ECS231 SP	3.40E-02	RNBMOD07
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-6 (Sheet 44 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
46	5.51E-12	0.21	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
47	5.47E-12	0.2	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			CCF OF STOP CHECK VALVES V015A/B TO OPEN	4.90E-03	RNX-KV1-GO
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
48	5.41E-12	0.2	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 GRAVITY INJECTION SQUIB VALVES IN 1/1 LINES TO OPEN	5.80E-06	IWX-EV1-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
49	5.40E-12	0.2	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			CASK LOADING PIT UNAVAILABLE DUE TO FUEL UNLOADING OPERATIONS	1.00E-02	CLP-UNAVAILABLE
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
50	4.77E-12	0.18	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 45 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 21CFE3D

Reduced Sum of Cutsets: 2.059.00E-08

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	5.94E-10	28.85	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
2	4.65E-10	22.58	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
3	6.48E-11	3.15	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
4	5.56E-11	2.7	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
5	5.50E-11	2.67	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
6	5.50E-11	2.67	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-6 (Sheet 46 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
7	4.80E-11	2.33	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
8	4.36E-11	2.12	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
9	4.31E-11	2.09	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
10	4.25E-11	2.06	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
11	3.76E-11	1.83	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
12	2.80E-11	1.36	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO

Table 43-6 (Sheet 47 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
13	2.71E-11	1.32	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
14	2.45E-11	1.19	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
15	2.33E-11	1.13	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
16	2.16E-11	1.05	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
17	2.12E-11	1.03	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
18	1.89E-11	0.92	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 48 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
19	1.83E-11	0.89	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
20	1.47E-11	0.71	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
21	1.40E-11	0.68	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
22	1.21E-11	0.59	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
23	1.19E-11	0.58	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
24	1.14E-11	0.55	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 49 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
25	1.08E-11	0.52	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
26	1.02E-11	0.5	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
27	9.36E-12	0.45	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
28	9.31E-12	0.45	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
29	9.12E-12	0.44	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
30	8.03E-12	0.39	CMT LINE BREAK INITIATING EVENT OCCURS	9.31E-05	IEV-CMTLB
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-6 (Sheet 50 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	7.13E-12	0.35	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
32	7.05E-12	0.34	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
33	6.07E-12	0.29	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
34	6.00E-12	0.29	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
35	5.74E-12	0.28	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
36	5.51E-12	0.27	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 51 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
37	5.23E-12	0.25	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
38	4.95E-12	0.24	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
39	4.50E-12	0.22	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
40	3.88E-12	0.19	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			EITHER PRZR SV FAILS TO RECLOSE	1.00E-02	OTH-PRSOV
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
41	2.95E-12	0.14	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 52 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
42	2.61E-12	0.13	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC SOFTWARE	1.10E-05	CCX-IN-LOGIC-SW
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
43	2.61E-12	0.13	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF ACTUATION LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD2-SW
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
44	2.54E-12	0.12	SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
45	2.27E-12	0.11	LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CCF OF ESF INPUT LOGIC (HARDWARE)	1.03E-04	CCX-INPUT-LOGIC
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
46	2.02E-12	0.1	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF ESF INPUT LOGIC SOFTWARE	1.10E-05	CCX-IN-LOGIC-SW
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03
47	2.02E-12	0.1	SPURIOUS ADS INITIATING EVENT OCCURS	5.40E-05	IEV-SPADS
			CCF OF PMS ESF ACTUATION LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD2-SW
			FAILURE TO OPEN RECIRC MOVs	3.40E-03	REN-MAN03

Table 43-6 (Sheet 53 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
48	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			MECHANICAL FAILURE OF RNS MOV V055	1.41E-02	RN55MOD1
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
49	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILURE OF ISOLATION MOV 011	1.41E-02	RN11MOD3
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
50	1.83E-12	0.09	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			HARDWARE FAILS TO OPEN MOV V022/CB FTC/RELAY FTC	1.41E-02	RN22MOD4
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO

Table 43-6 (Sheet 54 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 23BP1A

Reduced Sum of Cutsets: 2.0420E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	5.12E-10	25.07	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
2	1.95E-10	9.55	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
3	1.68E-10	8.23	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
4	1.23E-10	6.02	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 55 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
5	7.03E-11	3.44	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
6	5.50E-11	2.69	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
7	5.50E-11	2.69	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
8	5.27E-11	2.58	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 56 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
9	4.66E-11	2.28	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
10	4.10E-11	2.01	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
11	4.02E-11	1.97	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
12	3.07E-11	1.5	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
13	2.67E-11	1.31	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 57 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
14	2.30E-11	1.13	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
15	2.00E-11	0.98	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
16	1.73E-11	0.85	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
17	1.56E-11	0.76	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS

Table 43-6 (Sheet 58 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
18	1.34E-11	0.66	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
19	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
20	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 59 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
21	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
22	1.31E-11	0.64	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
23	1.30E-11	0.64	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			STANDBY DG UNAVAILABLE DUE TO TEST AND MAINTENANCE	4.60E-02	ZO1DG001TM
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-6 (Sheet 60 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
24	1.17E-11	0.57	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS ACTUATION	1.16E-02	REC-MANDAS
25	1.13E-11	0.55	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			DUE TO FAILURE OF OPERATOR TO REFILL BASIN	4.00E-02	SWN-MAN03
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
26	1.02E-11	0.5	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			STANDBY DG UNAVAILABLE DUE TO TEST AND MAINTENANCE	4.60E-02	ZO1DG001TM
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-6 (Sheet 61 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
27	1.01E-11	0.49	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
28	8.83E-12	0.43	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			DUE TO FAILURE OF OPERATOR TO REFILL BASIN	4.00E-02	SWN-MAN03
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
29	8.02E-12	0.39	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
30	7.89E-12	0.39	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 62 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
31	7.50E-12	0.37	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
32	7.50E-12	0.37	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
33	6.59E-12	0.32	LOSS OF RSC FLOW INITIATING EVENT OCCURS	1.80E-02	IEV-LRCS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
34	6.28E-12	0.31	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 63 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
35	6.18E-12	0.3	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
36	5.92E-12	0.29	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
37	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01

Table 43-6 (Sheet 64 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
38	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
39	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
40	5.76E-12	0.28	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			FAILURE OF AIR COMPRESSOR TRANSMITTER	5.23E-03	CANTP011RI
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 65 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
41	5.69E-12	0.28	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			D/G FAILS TO START & RUN OR BKR 102 FAILS TO CLOSE	2.02E-02	ZO1MOD01
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
42	5.63E-12	0.28	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
43	5.63E-12	0.28	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 66 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
44	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
45	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF IRWST GUTTER DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA1
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

Table 43-6 (Sheet 67 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
46	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF PRHR DUE TO COMMON CAUSE FAILURE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
47	5.58E-12	0.27	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			MANUALLY REGULATE FLOW TO SG "A"	2.04E-01	REG-MAN00
			FAILURE OF PRHR DUE TO COMMON CAUSE OF AOVs	9.60E-05	PXX-AV-LA
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
48	4.64E-12	0.23	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07

Table 43-6 (Sheet 68 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
49	4.46E-12	0.22	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			EDS3 EA 1 DISTR. PNL FAILURE OR T&M	3.05E-04	ED3MOD07
			D/G FAILS TO START & RUN OR BKR 102 FAILS TO CLOSE	2.02E-02	ZO1MOD01
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
50	4.41E-12	0.22	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			UNAVAILABILITY GOAL FOR DAS	1.00E-02	DAS
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACTUATION)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01

Table 43-6 (Sheet 69 of 69)

DOMINANT CET SEQUENCES CONTRIBUTING TO LRF

Title: LRF Cutsets for 10CFE3C

Reduced Sum of Cutsets: 1.0000E-09

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	1.00E-09	100	REACTOR VESSEL RUPTURE INITIATING EVENT OCCURS	1.00E-08	IEV-RV-RP
			CFE - OCCURS	1.00E-01	CFE-OCCURS

Table 43-7 (Sheet 1 of 2)

SUMMARY OF RELEASE FREQUENCY CALCULATIONS

		2E	2L	2R	1A	1P	3A	3C	3D	6
	IC	7.70E-08	2.34E-08	4.62E-08	2.96E-09	8.55E-10	3.44E-10	8.97E-09	5.63E-08	5.41E-09
	CFE	3.22E-09	1.83E-13	1.00E-11	0.00E+00	1.48E-11	0.00E+00	9.99E-10	3.03E-09	1.86E-10
	CFI	1.82E-10	4.72E-14	5.55E-12	0.00E+00	1.15E-13	0.00E+00	1.08E-12	1.70E-13	1.09E-14
	CFV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	CFL	1.34E-13	2.35E-14	5.20E-14	9.71E-15	0.00E+00	2.42E-14	1.04E-14	8.60E-14	5.44E-15
	CI	1.32E-10	5.83E-10	7.67E-11	4.60E-12	1.32E-12	6.33E-12	2.66E-11	3.62E-10	1.40E-10
	BP	0.00E+00	0.00E+00	0.00E+00	2.04E-09	6.05E-10	4.08E-09	0.00E+00	0.00E+00	3.78E-09
	Total	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09
		2E	2L	2R	1A	1P	3A	3C	3D	6
1	IC	5.51E-08	0.000E+00	4.619E-08	2.941E-09	8.538E-10	3.364E-10	8.966E-09	0.000E+00	0.000E+00
2	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	1.477E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	IC	1.28E-09	0.000E+00	3.718E-11	1.921E-11	7.704E-13	7.209E-12	7.249E-12	0.000E+00	0.000E+00
4	CFI	1.82E-10	0.000E+00	5.555E-12	0.000E+00	1.151E-13	0.000E+00	1.083E-12	0.000E+00	0.000E+00
5	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	CFE	4.75E-10	0.000E+00	1.002E-11	0.000E+00	5.055E-14	0.000E+00	1.954E-12	0.000E+00	0.000E+00
7	CFV	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
9	CFL	9.80E-14	0.000E+00	5.200E-14	9.712E-15	0.000E+00	2.419E-14	1.037E-14	0.000E+00	0.000E+00

Table 43-7 (Sheet 2 of 2)

SUMMARY OF RELEASE FREQUENCY CALCULATIONS

		2E	2L	2R	1A	1P	3A	3C	3D	6
10	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.973E-10	0.000E+00	0.000E+00
11	IC	2.01E-08	2.333E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.612E-08	5.407E-09
12	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.706E-10	0.000E+00
13	IC	6.23E-10	3.630E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.309E-10	8.411E-12
14	CFI	8.11E-13	4.725E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.705E-13	1.095E-14
15	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
16	CFE	8.27E-11	1.826E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.704E-11	4.232E-14
17	CFV	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
18	CFI	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
19	CFL	3.57E-14	2.349E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.602E-14	5.443E-15
20	CFE	0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
21	CFE	2.67E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.046E-09	1.860E-10
22	CI	1.32E-10	5.826E-10	7.669E-11	4.602E-12	1.324E-12	6.328E-12	2.658E-11	3.622E-10	1.396E-10
23	BP	0.00E+00	0.000E+00	0.000E+00	2.042E-09	6.052E-10	4.077E-09	0.000E+00	0.000E+00	3.783E-09
	Total	8.06E-08	2.395E-08	4.632E-08	5.007E-09	1.476E-09	4.427E-09	1.000E-08	5.965E-08	9.524E-09

Table 43-8

LRF AND CONTAINMENT EFFECTIVENESS BY ACCIDENT CLASS

	2E	2L	2R	1A	1P	3A	3C	3D	6		TOTAL	%
CDF	8.06E-08	2.40E-08	4.63E-08	5.01E-09	1.48E-09	4.43E-09	1.00E-08	5.97E-08	9.52E-09		2.41E-07	100.0%
CFE	3.22E-09	1.83E-13	1.00E-11	0.00E+00	1.48E-11	0.00E+00	9.99E-10	3.03E-09	1.86E-10		7.47E-09	38.3%
CFI	1.82E-10	4.72E-14	5.55E-12	0.00E+00	1.15E-13	0.00E+00	1.08E-12	1.70E-13	1.09E-14		1.89E-10	1.0%
CFV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.0%
CFL	1.34E-13	2.35E-14	5.20E-14	9.71E-15	0.00E+00	2.42E-14	1.04E-14	8.60E-14	5.44E-15		3.45E-13	0.0%
CI	1.32E-10	5.83E-10	7.67E-11	4.60E-12	1.32E-12	6.33E-12	2.66E-11	3.62E-10	1.40E-10		1.33E-09	6.8%
BP	0.00E+00	0.00E+00	0.00E+00	2.04E-09	6.05E-10	4.08E-09	0.00E+00	0.00E+00	3.78E-09		1.05E-08	53.9%
LRF	3.54E-09	5.83E-10	9.23E-11	2.05E-09	6.21E-10	4.08E-09	1.03E-09	3.40E-09	4.11E-09		1.95E-08	100.0%
	18.2%	3.0%	0.5%	10.5%	3.2%	20.9%	5.3%	17.4%	21.1%			
CNTM-EFF	95.6%	97.6%	99.8%	59.1%	57.9%	7.8%	89.7%	94.3%	56.9%		91.9%	

Table 43-9

SUMMARY OF AP1000 LRF QUANTIFICATION FOR INTERNAL EVENTS AT-POWER

CDF			2.41E-07/year
LRF			1.95E-08/year
Containment Effectiveness			91.9%
Dominant Accident Classes			
6	4.11E-09	21.1%	Containment Bypass by SGTR or ISLOCA
3A	4.08E-09	20.9%	High RCS Pressure and ATWS
2E	3.54E-09	18.2%	RCS Depressurized
3D	3.40E-09	17.4%	Partial RCS Depressurization
1A	2.05E-09	10.5%	High RCS Pressure (Transient or SLOCA)
3C	1.03E-09	5.3%	Vessel Failure
1P	6.21E-10	3.2%	High RCS Pressure (PRHR operating)
2L	5.83E-10	3.0%	RCS Depres.(Gravity Injection succ.; Sump Recirc. fails)
2R	9.23E-11	0.5%	RCS Depressurized (CMT and ACC fail)
Total	1.95E-08	100%	
Dominant Release Categories			
BP	1.05E-08	53.9%	Containment Bypass
CFE	7.47E-09	38.3%	Early Containment Failure
CI	1.33E-09	6.8%	Containment Isolation Failure
Total	1.93E-08	99.0%	

Table 43-10

CET EVENT TREE NODE IMPORTANCES

CET NODE	LRF (per year)	Containment Failure Prob	Containment Effectiveness	Node Failed in Following PDS
BASE LRF	1.95E-08	8.1%	91.9%	N/A
DP RCS Depressurization	2.91E-08	12.1%	87.9%	1A, 1AP, 3A, and 6 set to 1.0.
IS Containment Isolation	2.41E-07	100.0%	0.0%	all PDS set to 1.0
IR Cavity Flooding	1.58E-07	65.6%	34.4%	3BE, 3D, 6 set to 1.0
RFL Core Reflooding	1.91E-08	7.9%	92.1%	3BE set to 1.0
VF Vessel Failure	2.85E-08	11.8%	88.2%	3C set to 1.0
PC PCS Failure	2.41E-07	100.0%	0.0%	all PDS set to 1.0
IG Hydrogen Igniter Failure	6.28E-08	26.0%	74.0%	all PDS set to 1.0
DF Diffusion Flame	1.41E-07	58.3%	41.7%	3D and 1AP set to 1.0; 3BE set to 0.8535 (85% of 3BE are SI-LB events where DF may exist. Diffusion flame does not apply to other PDS.
DTE Early DDT	2.16E-08	9.0%	91.0%	all PDS set to 1.0
DFG Hydrogen Deflagration	2.17E-08	9.0%	91.0%	all PDS set to 1.0
DTI Intermediate DDT	2.17E-08	9.0%	91.0%	all PDS set to 1.0

Table 43-11

CONTRIBUTION OF INITIATING EVENTS TO LARGE RELEASE

	Initiating Event Category	Percentage Contribution to LRF	LRF Contribution	Initiating Event Frequency
1	IEV-ATWS	17.11	3.27E-09	4.81E-01
2	IEV-SGTR	15.87	3.04E-09	3.88E-03
3	IEV-SPADS	13.14	2.51E-09	5.40E-05
4	IEV-SI-LB	9.82	1.88E-09	2.12E-04
5	IEV-TRANS	7.49	1.43E-09	1.40E+00
6	IEV-SLOCA	5.94	1.14E-09	5.00E-04
7	IEV-RV-RP	5.37	1.03E-09	1.00E-08
8	IEV-MLOCA	4.71	9.02E-10	4.36E-04
9	IEV-ATW-T	3.72	7.12E-10	1.17E+00
10	IEV-LCOND	2.73	5.22E-10	1.12E-01
11	IEV-LOSP	2.46	4.70E-10	1.20E-01
12	IEV-LMFW	1.98	3.80E-10	3.35E-01
13	IEV-LLOCA	1.65	3.16E-10	5.00E-06
14	IEV-RCSLK	1.53	2.93E-10	6.20E-03
15	IEV-SLB-V	1.22	2.33E-10	2.39E-03
16	IEV-LMFW1	1.11	2.12E-10	1.92E-01
17	IEV-CMTLB	1.03	1.98E-10	9.31E-05
18	IEV-LCCW	0.72	1.37E-10	1.44E-01
19	IEV-ATW-S	0.53	1.01E-10	1.48E-02
20	IEV-LCAS	0.52	1.00E-10	3.48E-02
21	IEV-POWEX	0.50	9.49E-11	4.50E-03
22	IEV-PRSTR	0.45	8.64E-11	1.34E-04
23	IEV-SLB-U	0.26	4.97E-11	3.72E-04
24	IEV-LRCS	0.08	1.58E-11	1.80E-02
25	IEV-SLB-D	0.05	9.07E-12	5.96E-04
26	IEV-ISLOC	0.00	4.74E-13	5.00E-11
	Totals	100.00	1.91E-08	2.38E+00

Table 43-12 (Sheet 1 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
1	1.68E-06	32.33	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
2	9.24E-07	17.78	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
3	7.24E-07	13.93	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
4	4.02E-07	7.74	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
5	2.30E-07	4.43	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
6	1.73E-07	3.33	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
7	1.34E-07	2.58	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW

Table 43-12 (Sheet 2 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
8	1.01E-07	1.94	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
9	7.44E-08	1.43	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
10	6.82E-08	1.31	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
11	6.01E-08	1.16	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFIL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
12	5.34E-08	1.03	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
13	4.27E-08	0.82	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-12 (Sheet 3 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
14	4.07E-08	0.78	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFIL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			COND. PROB. OF AND-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	AND-MAN01C
			LATE ADS RECOVERY BY OPERATOR ACTION	1.00E-01	PDS6-MANADS
15	3.34E-08	0.64	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
16	3.00E-08	0.58	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
17	2.63E-08	0.51	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
18	2.59E-08	0.5	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
19	2.16E-08	0.42	LOSS OF RSC FLOW INITIATING EVENT OCCURS	1.80E-02	IEV-LRCS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW

Table 43-12 (Sheet 4 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
20	2.06E-08	0.4	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
21	2.03E-08	0.39	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
22	1.08E-08	0.21	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSU	4.78E-04	CCX-TRNSM
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			LATE ADS ACTUATION BY OPERATOR ACTION	5.00E-02	AND-REC01
23	1.08E-08	0.21	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSU	4.78E-04	CCX-TRNSM
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO RECOGNIZE NEED FOR RCS DEPR. AFTER CORE DAMAGE	5.00E-02	LPM-REC01
24	9.14E-09	0.18	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG

Table 43-12 (Sheet 5 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
25	7.44E-09	0.14	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
26	7.36E-09	0.14	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSU	4.78E-04	CCX-TRNSM
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
27	6.56E-09	0.13	STEAM LINE BREAK DOWNSTREAM OF MSIV INITIATING EVENT OCCURS	5.96E-04	IEV-SLB-D
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
28	6.22E-09	0.12	CONTAINMENT FAILURE DUE TO DIFFUSION FLAME	1.70E-02	OTH-DF
			RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
29	6.15E-09	0.12	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			CCF OF RTD LEVEL TRANSMITTERS	3.84E-05	CMX-VS-FA
30	6.00E-09	0.12	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-12 (Sheet 6 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
31	5.77E-09	0.11	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSU	4.78E-04	CCX-TRNSM
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
32	5.71E-09	0.11	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
33	5.50E-09	0.11	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
34	5.40E-09	0.1	CORE POWER EXCURSION INITIATING EVENT OCCURS	4.50E-03	IEV-POWEX
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
35	5.23E-09	0.1	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
36	5.14E-09	0.1	STEAM LINE BREAK DOWNSTREAM OF MSIV INITIATING EVENT OCCURS	5.96E-04	IEV-SLB-D
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-12 (Sheet 7 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
37	4.95E-09	0.1	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFIL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			COND. PROB. OF AND-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	AND-MAN01C
			LATE ADS RECOVERY BY OPERATOR ACTION	1.00E-01	PDS6-MANADS
38	4.92E-09	0.09	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAK	4.20E-04	RPX-CB-GO
			OPER. FAILS TO FULFIL MANUAL ACTUATION OF ADS	3.02E-03	AND-MAN01
39	4.80E-09	0.09	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
40	4.66E-09	0.09	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
41	4.31E-09	0.08	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
42	3.83E-09	0.07	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (1 SV)	1.00E-02	OTH-SLSOV2
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW

Table 43-12 (Sheet 8 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
43	3.76E-09	0.07	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
44	3.49E-09	0.07	SUCCESS OF CORE REFLOODING	7.33E-01	SUC-RFL
			NO CONTAINMENT FAILURE FROM HYDROGEN DETONATION	7.55E-01	SUC-DTE
			CONTAINMENT FAILURE DUE TO HYDROGEN DEFLAG.-TO-DETON. TRANSITION	1.24E-01	OTH-DTI-1
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
45	3.39E-09	0.07	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
46	3.16E-09	0.06	CONTAINMENT FAILURE FROM DIFFUSION FLAME	1.70E-02	OTH-DF
			RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
47	3.00E-09	0.06	LOSS OF COMPRESSED AIR INITIATING EVENT OCCURS	3.48E-02	IEV-LCAS
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (1 SV)	1.00E-02	OTH-SLSOV2
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM

Table 43-12 (Sheet 9 of 9)

LRF SENSITIVITY CASE – NON CREDIT FOR STANDBY NON-SAFETY SYSTEMS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Basic Event Identifier
48	2.96E-09	0.06	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
49	2.87E-09	0.06	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
50	2.69E-09	0.05	SUCCESS OF CORE REFLOODING	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO

Table 43-13 (Sheet 1 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
1	7.44E-08	19.12	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
2	2.06E-08	5.29	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFILL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAKERS	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			COND. PROB. OF AND-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	AND-MAN01C
			LATE ADS RECOVERY BY OPERATOR ACTION	1.00E-01	PDS6-MANADS
3	1.95E-08	5.01	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
4	1.68E-08	4.32	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS

Table 43-13 (Sheet 2 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
5	1.58E-08	4.06	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
6	1.07E-08	2.75	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
7	9.24E-09	2.37	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF PMS ESF OUTPUT LOGIC SOFTWARE	1.10E-05	CCX-PMXMOD1-SW
8	9.14E-09	2.35	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG

Table 43-13 (Sheet 3 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
9	8.40E-09	2.16	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
10	7.24E-09	1.86	LOSS OF OFFSITE POWER INITIATING EVENT OCCURS	1.20E-01	IEV-LOSP
			FAILURE TO RECOVER OFFSITE AC POWER IN 30 MINUTES	7.00E-01	OTH-R05
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
			CCF OF EPO BOARDS IN PMS	8.62E-06	CCX-EP-SAM
11	6.22E-09	1.6	CONTAINMENT FAILURE DUE TO DIFFUSION FLAME	1.70E-02	OTH-DF
			RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
12	6.00E-09	1.54	SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP

Table 43-13 (Sheet 4 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
13	5.49E-09	1.41	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01
14	5.49E-09	1.41	TRANSIENT WITH MFW INITIATING EVENT OCCURS	1.40E+00	IEV-TRANS
			CCF NON-SAFETY TRANSMITTERS INTERFACING SYSTEM PRESSURE	4.78E-04	CCX-TRNSM
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01
15	5.23E-09	1.34	MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF STRAINERS IN IRWST TANK	1.20E-05	IWX-FL-GP
16	4.66E-09	1.2	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS

Table 43-13 (Sheet 5 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
17	4.02E-09	1.03	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
18	3.49E-09	0.9	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			NO CONTAINMENT FAILURE FROM HYDROGEN DETONATION	7.55E-01	SUC-DTE
			OTH-DTI-1	1.24E-01	OTH-DTI-1
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG
19	3.39E-09	0.87	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
20	3.16E-09	0.81	CONTAINMENT FAILURE DUE TO DIFFUSION FLAME	1.70E-02	OTH-DF
			RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA

Table 43-13 (Sheet 6 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
21	3.04E-09	0.78	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFIL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 AOVS TO OPEN	6.20E-05	CCX-AV-LA
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			PDS6-MANADS	1.00E-01	PDS6-MANADS
22	3.01E-09	0.77	ATWS PRECURSOR WITH NO MFW INITIATING EVENT OCCURS	4.81E-01	IEV-ATWS
			OPERATOR FAILS TO MANUALLY TRIP REACTOR VIA PMS	5.20E-02	ATW-MAN03
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COMMON CAUSE FAILURE OF PZR LEVEL SENSORS	4.78E-04	CCX-XMTR195
			COND. PROB. OF ATW-MAN04 (OPER. FAILS TO TRIP REACTOR)	5.26E-01	ATW-MAN04C
23	2.96E-09	0.76	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2

Table 43-13 (Sheet 7 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
24	2.69E-09	0.69	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
25	2.67E-09	0.69	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
26	2.50E-09	0.64	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			OPERATOR FAILS TO FULFIL MANUAL ACTUATION OF ADS	5.00E-01	ADF-MAN01
			COMMON CAUSE FAILURE OF 4 CHECK VALVES TO OPEN	5.10E-05	CMX-CV-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			COND. PROB. OF ADN-MAN01(OPER. FAILS TO ACT. ADS)	5.00E-01	ADN-MAN01C
			LATE ADS RECOVERY BY OPERATOR ACTION	1.00E-01	PDS6-MANADS
27	2.49E-09	0.64	STEAM GENERATOR TUBE RUPTURE INITIATING EVENT OCCURS	3.88E-03	IEV-SGTR
			COMMON CAUSE FAILURE TO OPEN OF 4.16 KVAC CIRCUIT BREAKERS	4.20E-04	RPX-CB-GO
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			OPER. FAILS TO FULFIL MANUAL ACTUATION OF ADS	3.02E-03	ADN-MAN01

Table 43-13 (Sheet 8 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
28	2.35E-09	0.6	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF 4 GRAVITY INJECTION CVs	3.00E-05	IWX-CV-AO
29	2.33E-09	0.6	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA
30	2.30E-09	0.59	LOSS OF MFW TO ONE SG INITIATING EVENT OCCURS	1.92E-01	IEV-LMFW1
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
31	2.04E-09	0.52	CORE REFLOODING IS SUCCESSFUL	7.33E-01	SUC-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	2.45E-01	OTH-DTE
			MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			CCF OF 4 GRAVITY INJECTION & 2 RECIRCULATION SQUIB VALVES	2.60E-05	IWX-EV-SA

Table 43-13 (Sheet 9 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
32	2.00E-09	0.51	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
33	1.73E-09	0.44	LOSS OF CCW/SW INITIATING EVENT OCCURS	1.44E-01	IEV-LCCW
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
34	1.73E-09	0.44	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			SMALL LOCA INITIATING EVENT OCCURS	5.00E-04	IEV-SLOCA
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
35	1.71E-09	0.44	SUC-CFE	9.00E-01	SUC-CFE
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.90E-01	OTH-DTE-2R
			REACTOR VESSEL RUPTURE INITIATING EVENT OCCURS	1.00E-08	IEV-RV-RP
36	1.66E-09	0.43	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.90E-01	OTH-DTE-2R
			LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CHECK VALVE 028A FAILS TO OPEN	1.75E-03	ACACV028GO

Table 43-13 (Sheet 10 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob	Percent	Basic Event Name	Event Prob.	Identifier
37	1.66E-09	0.43	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.90E-01	OTH-DTE-2R
			LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CHECK VALVE 029B FAILS TO OPEN	1.75E-03	ACBCV029GO
38	1.66E-09	0.43	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.90E-01	OTH-DTE-2R
			LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CHECK VALVE 028B FAILS TO OPEN	1.75E-03	ACBCV028GO
39	1.66E-09	0.43	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.90E-01	OTH-DTE-2R
			LARGE LOCA INITIATING EVENT OCCURS	5.00E-06	IEV-LLOCA
			CHECK VALVE 029A FAILS TO OPEN	1.75E-03	ACACV029GO
40	1.61E-09	0.41	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
			CCF OF RECIRC MOVs TO OPEN	4.40E-03	IWX-MV-GO
41	1.59E-09	0.41	CORE REFLOODING FAILS	2.67E-01	OTH-RFL
			CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.17E-01	OTH-DTE-4
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			IWRST DISCHARGE LINE "A" STRAINER PLUGGED	2.40E-04	IWA-PLUG

Table 43-13 (Sheet 11 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
42	1.56E-09	0.4	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS ACT.	1.16E-02	REC-MANDAS
43	1.50E-09	0.39	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			MEDIUM LOCA INITIATING EVENT OCCURS	4.36E-04	IEV-MLOCA
			DUE TO CCF OF 4TH STAGE ADS SQUIB VALVES TO OPERATE	3.00E-05	ADX-EV-SA
44	1.48E-09	0.38	RCS LEAK INITIATING EVENT OCCURS	6.20E-03	IEV-RCSLK
			MAIN GEN. BKR ES 01 FAILS TO OPEN [# 12]	5.08E-03	EC0MOD01
			COMMON CAUSE FAILURE OF THE BATTERIES IDSA-DB-1A/1B	4.70E-05	CCX-BY-PN
45	1.44E-09	0.37	CONTAINMENT FAILS DUE HYDROGEN DETONATION	1.15E-01	OTH-DTE-3D
			SAFETY INJECTION LINE BREAK INITIATING EVENT OCCURS	2.12E-04	IEV-SI-LB
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
46	1.41E-09	0.36	MAIN STEAM LINE STUCK-OPEN SV INITIATING EVENT OCCURS	2.39E-03	IEV-SLB-V
			CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2

Table 43-13 (Sheet 12 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
47	1.39E-09	0.36	CONSEQUENTIAL SGTR OCCURS	1.00E-02	OTH-SGTR
			LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			ANY SECOND. SIDE RELIEF VALVE FAILS TO CLOSE (2 SV + PORV)	2.10E-02	OTH-SLSOV1
			CCF OF 2 SQUIB VALVES TO OPERATE	5.90E-05	ADX-EV-SA2
48	1.34E-09	0.34	LOSS OF CONDENSER INITIATING EVENT OCCURS	1.12E-01	IEV-LCOND
			SOFTWARE CCF OF ALL CARDS	1.20E-06	CCX-SFTW
			FAILURE OF MANUAL DAS REACTOR TRIP HARDWARE	1.00E-02	MDAS
49	1.31E-09	0.34	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	ADN-REC01

Table 43-13 (Sheet 13 of 13)

LRF CUTSETS FOR THE CASE – SENSITIVITY TO STANDBY SYSTEMS WITH CREDIT FOR MANUAL DAS

Number	Cutset Prob.	Percent	Basic Event Name	Event Prob.	Identifier
50	1.31E-09	0.34	LOSS OF MAIN FEEDWATER INITIATING EVENT OCCURS	3.35E-01	IEV-LMFW
			CCF OF SAFETY PT LT CONTINUOUSLY INTERFACING HIGH PRESSURE	4.78E-04	CCX-XMTR
			COND. PROB. OF REC-MANDAS (FAILURE OF MANUAL DAS ACT.)	5.06E-01	REC-MANDASC
			CCF OF 4 COMBINATIONS OF 3 STAGES #2 AND #3 MOVS	3.24E-04	ADX-MV3-GO
			OPERATOR FAILS TO ACTUATE ADS AFTER CORE DAMAGE	5.00E-02	LPM-REC01

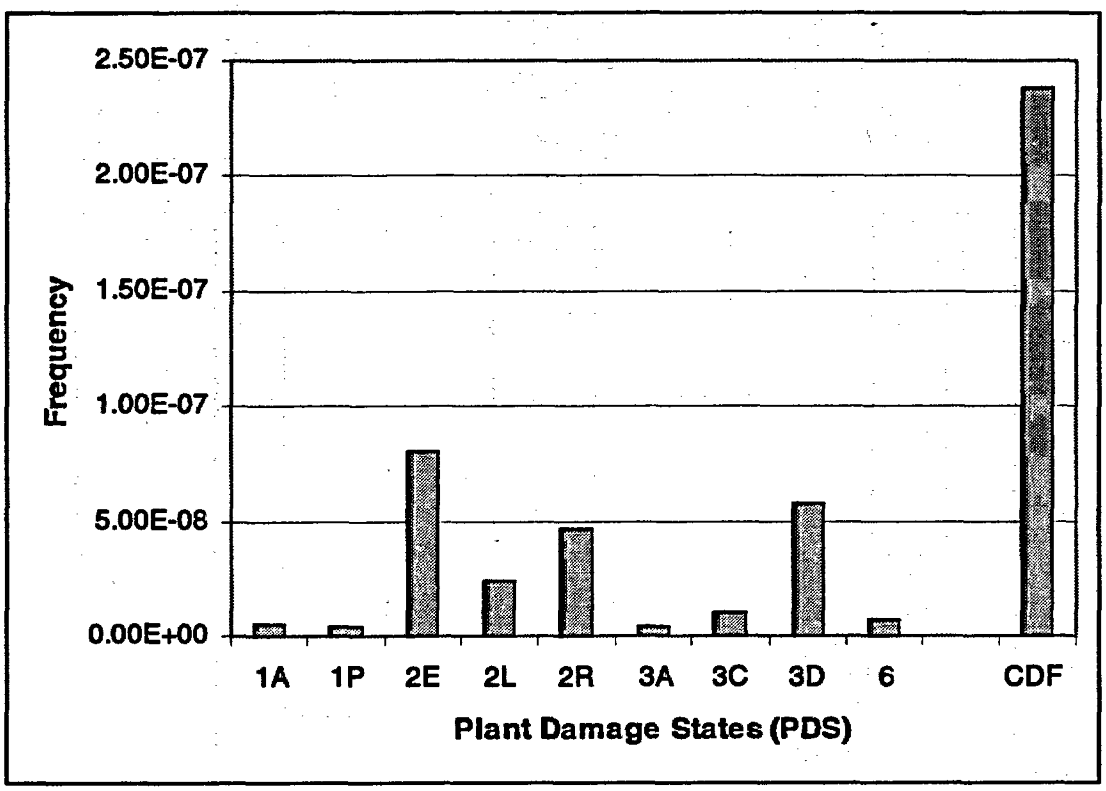


Figure 43-1

Plant Damage State Contributions to CDF

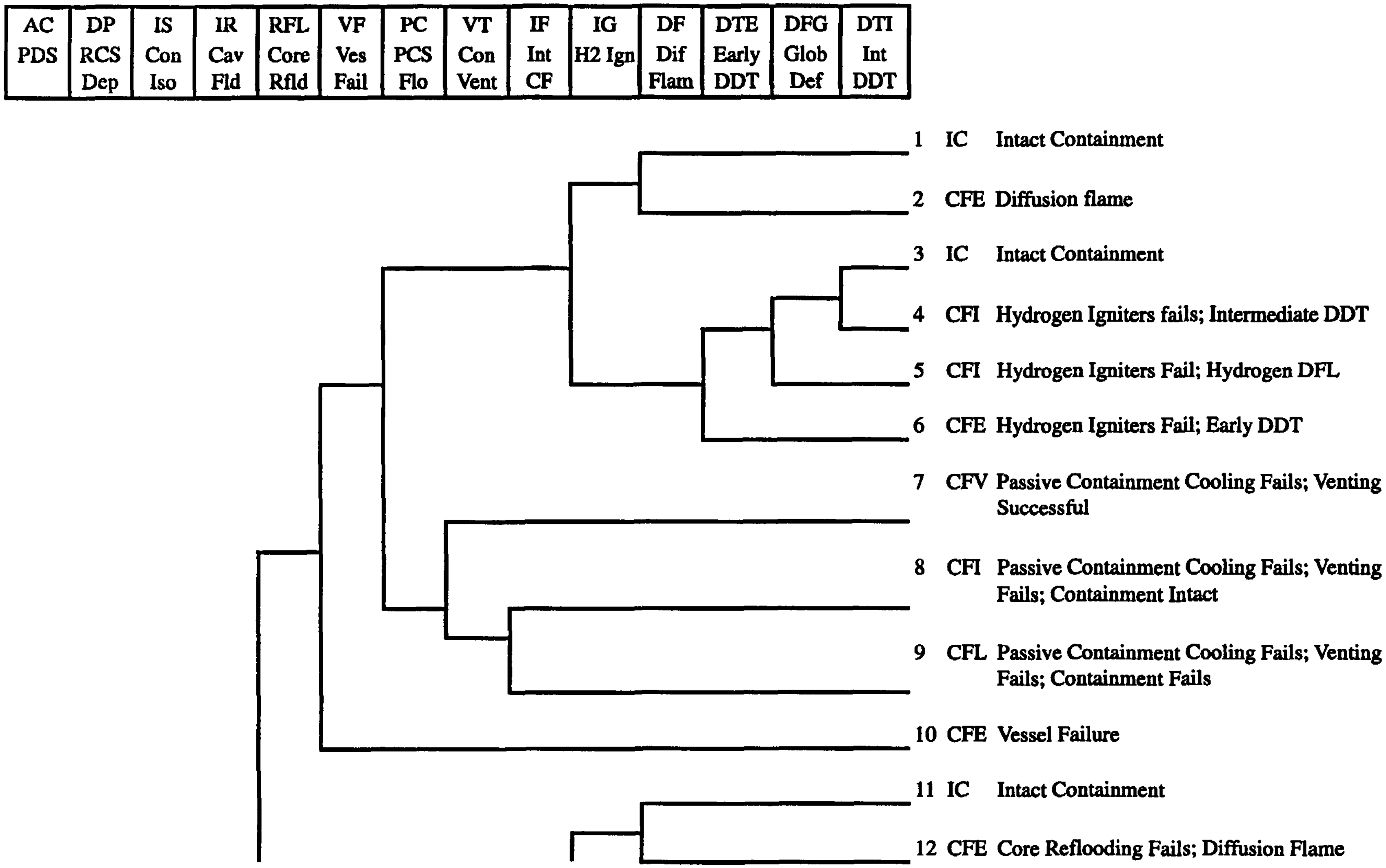


Figure 43-2 (Sheet 1 of 3)

Containment Event Tree – CET

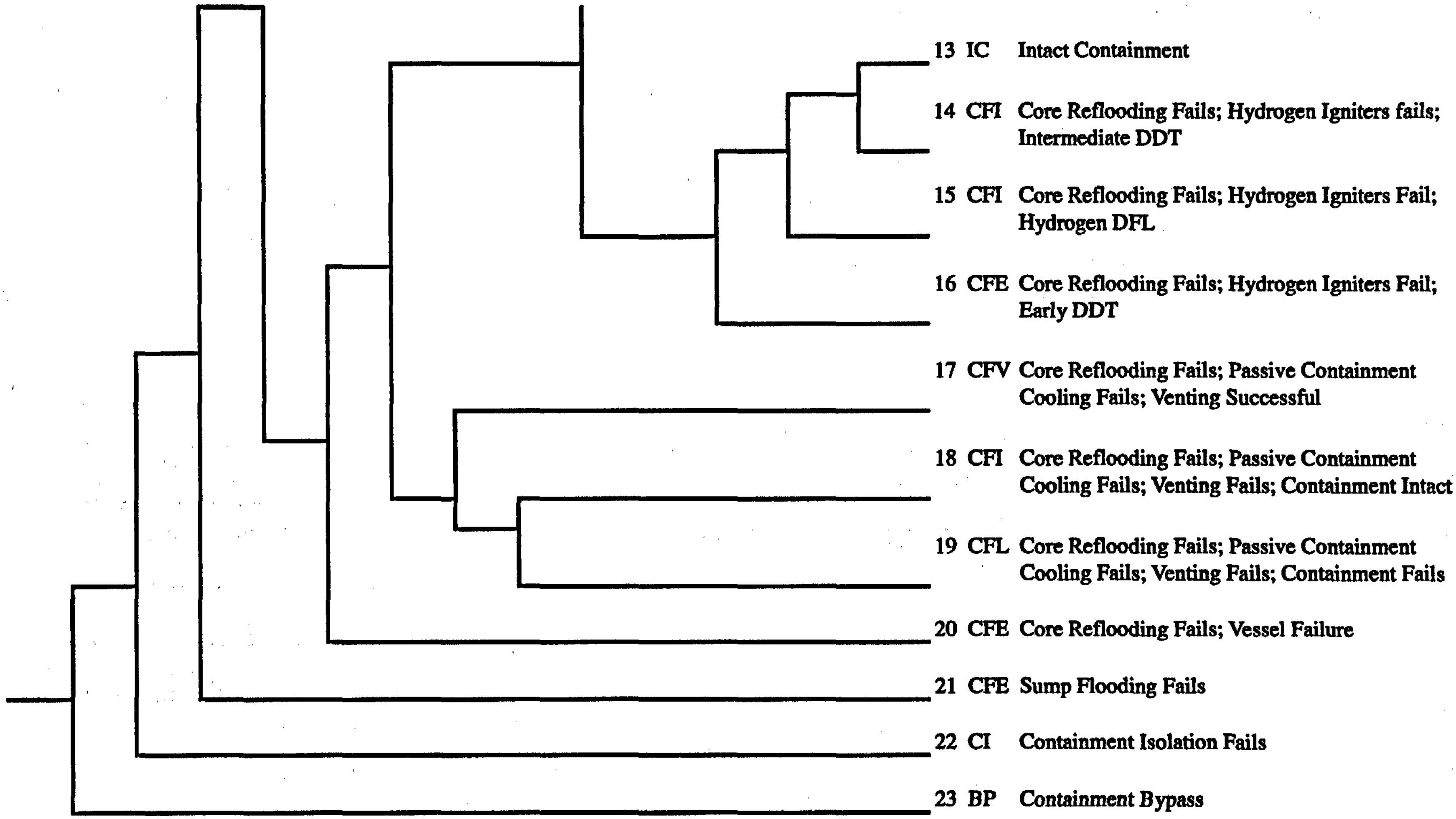
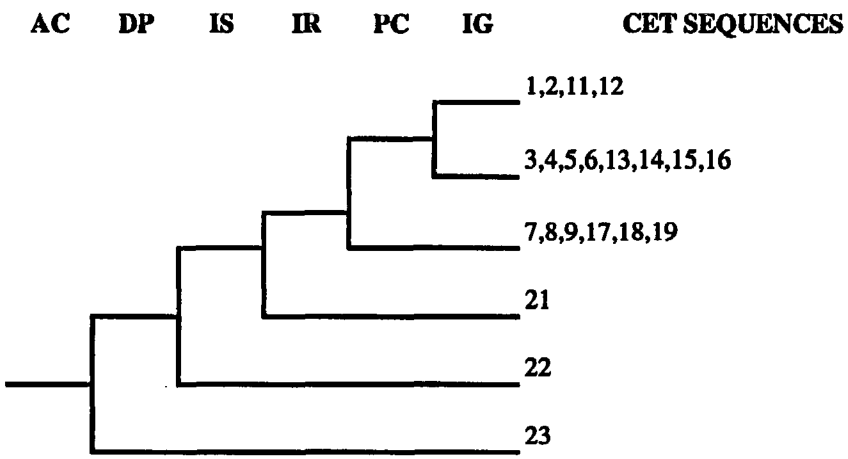


Figure 43-2 (Sheet 2 of 3)

Containment Event Tree – CET



CET sequences 10 and 20 not shown above contain success of IS, and IR nodes, but do not involve the PC and IG nodes.

Figure 43-2 (Sheet 3 of 3)

Containment Event Tree – CET

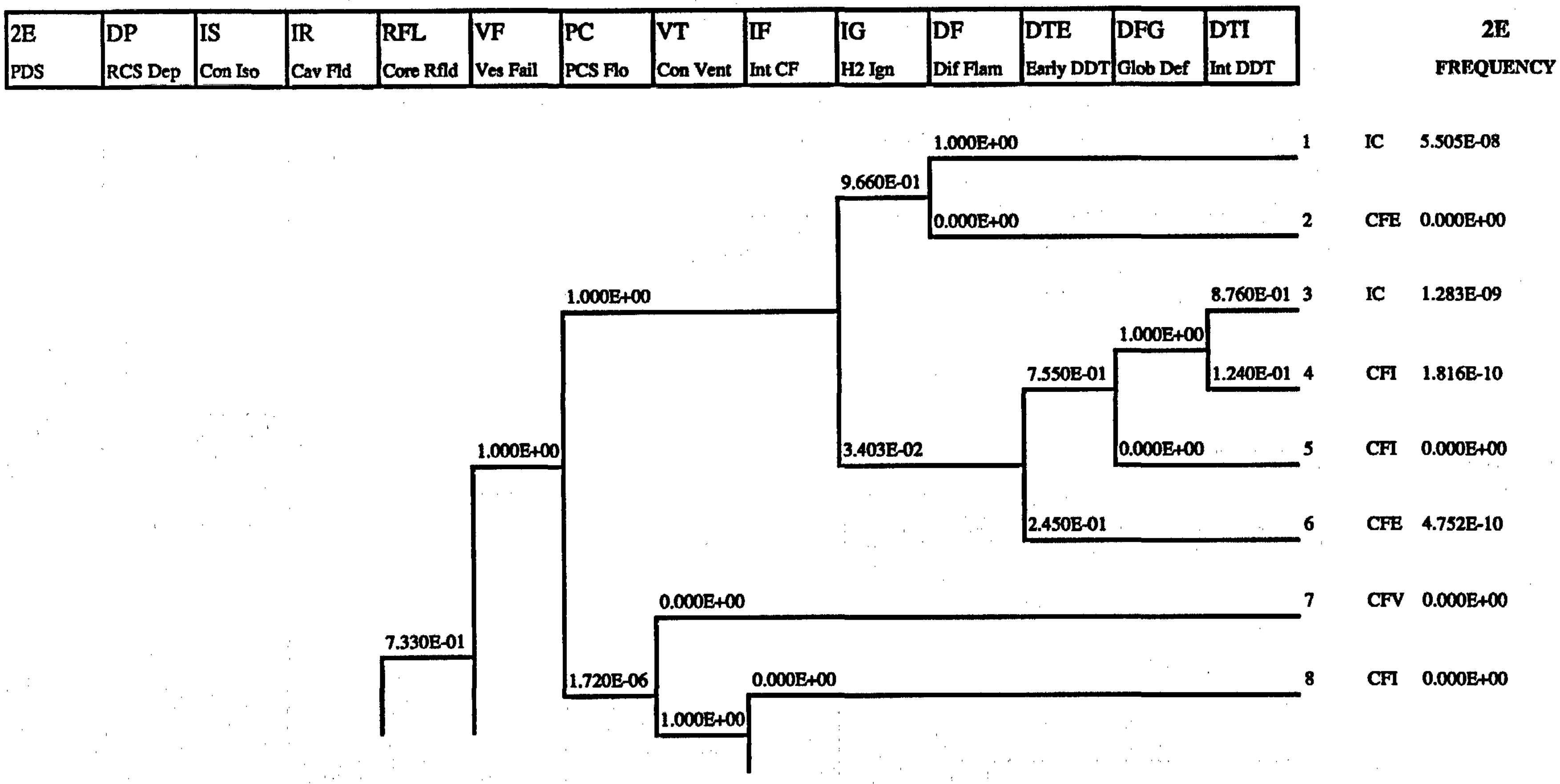


Figure 43-3 (Sheet 1 of 3)

3BE CET

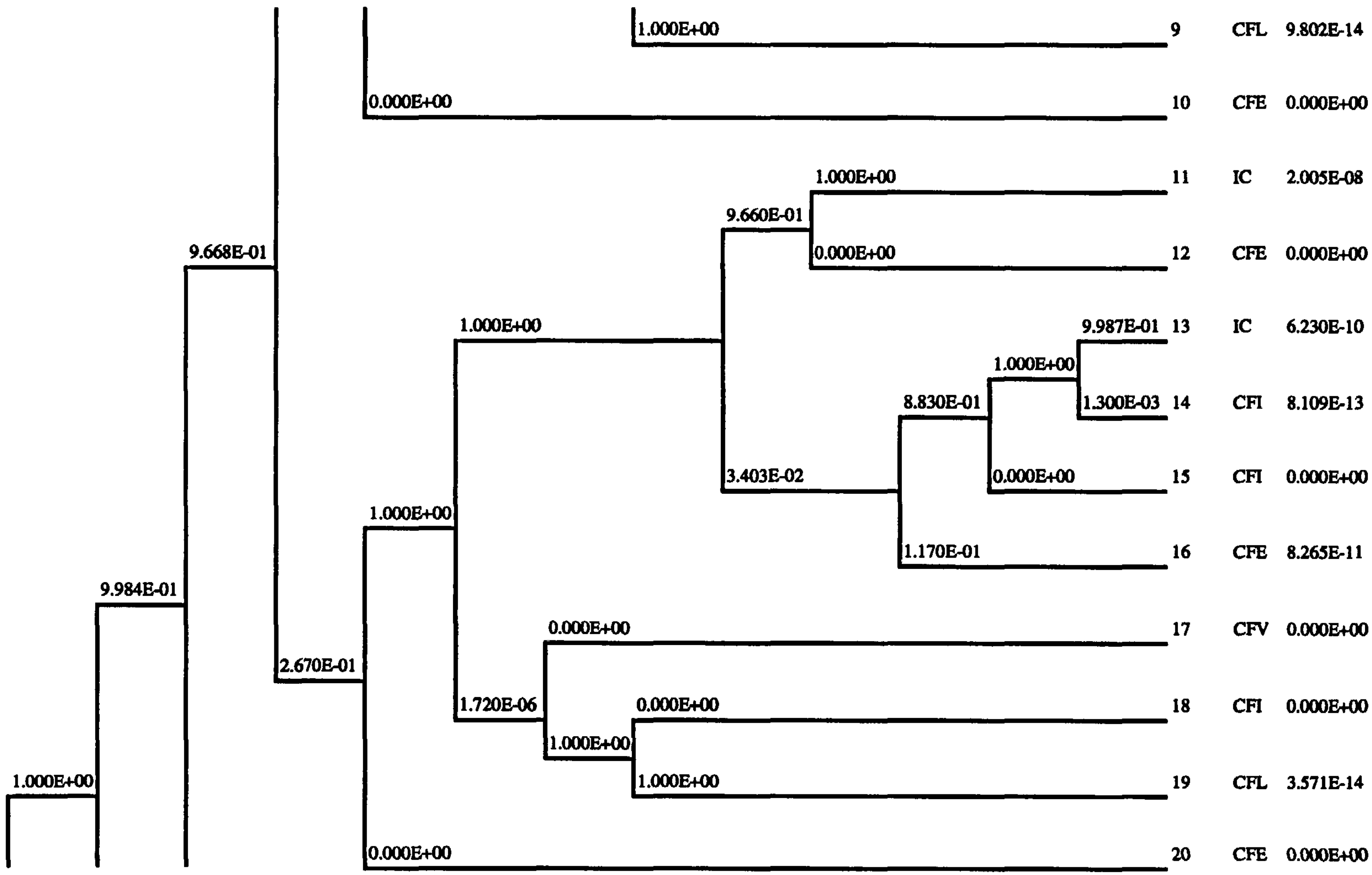
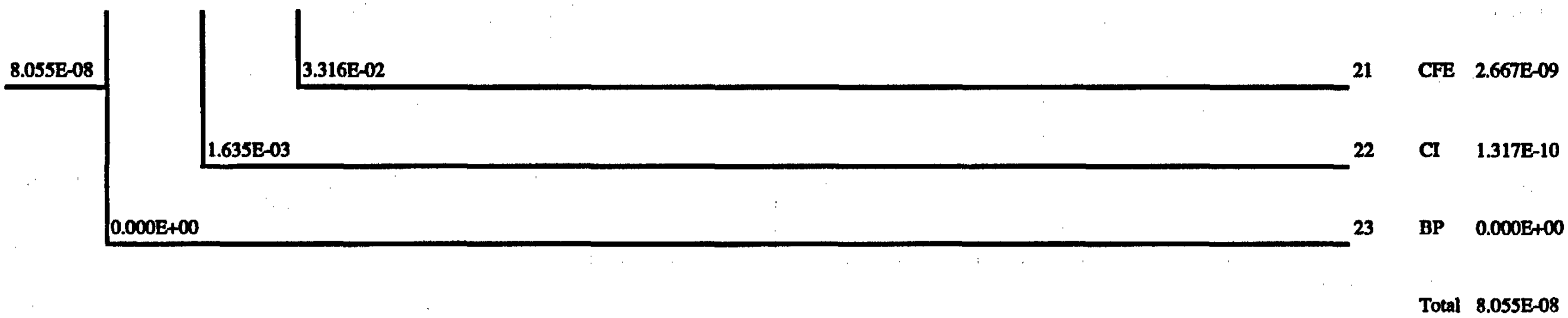


Figure 43-3 (Sheet 2 of 3)

3BE CET



Fail	2E Success	
8.055E-08		AC
0.000E+00	1.000E+00	DP
1.635E-03	9.984E-01	IS
3.316E-02	9.668E-01	IR
2.670E-01	7.330E-01	RFL
0.000E+00	1.000E+00	VF
1.720E-06	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
3.403E-02	9.660E-01	IG
0.000E+00	1.000E+00	DF
2.450E-01	7.550E-01	DTE
0.000E+00	1.000E+00	DFG
1.240E-01	8.760E-01	DTI
1.300E-03	9.987E-01	DTI-2
1.170E-01	8.830E-01	DTE-2

2E Rel. Cat.	Freq.	%
IC	7.701E-08	95.61%
CFE	3.225E-09	4.00%
CFI	1.824E-10	0.23%
CFV	0.000E+00	0.00%
CFL	1.337E-13	0.00%
CI	1.317E-10	0.16%
BP	0.000E+00	0.00%
Total	8.055E-08	100.00%

Figure 43-3 (Sheet 3 of 3)

3BE CET

2L PDS	DP RCS Dep	IS Con Iso	IR Cav Fld	RFL Core Rfld	VF Ves Fail	PC PCS Flo	VT Con Vent	IF Int CF	IG H2 Ign	DF Dif Flam	DTE Early DDT	DFG Glob Def	DTI Int DDT	2L FREQUENCY

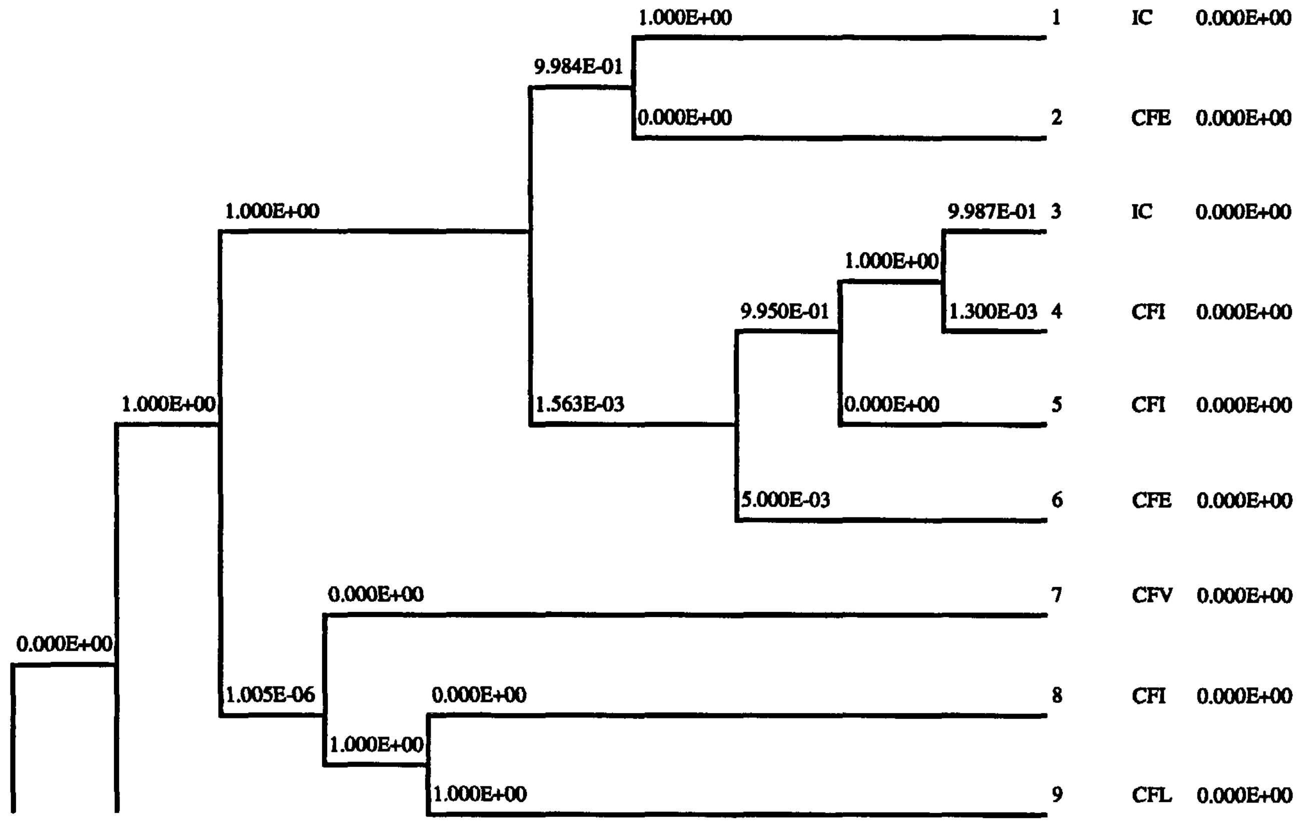


Figure 43-4 (Sheet 1 of 3)

3BL CET

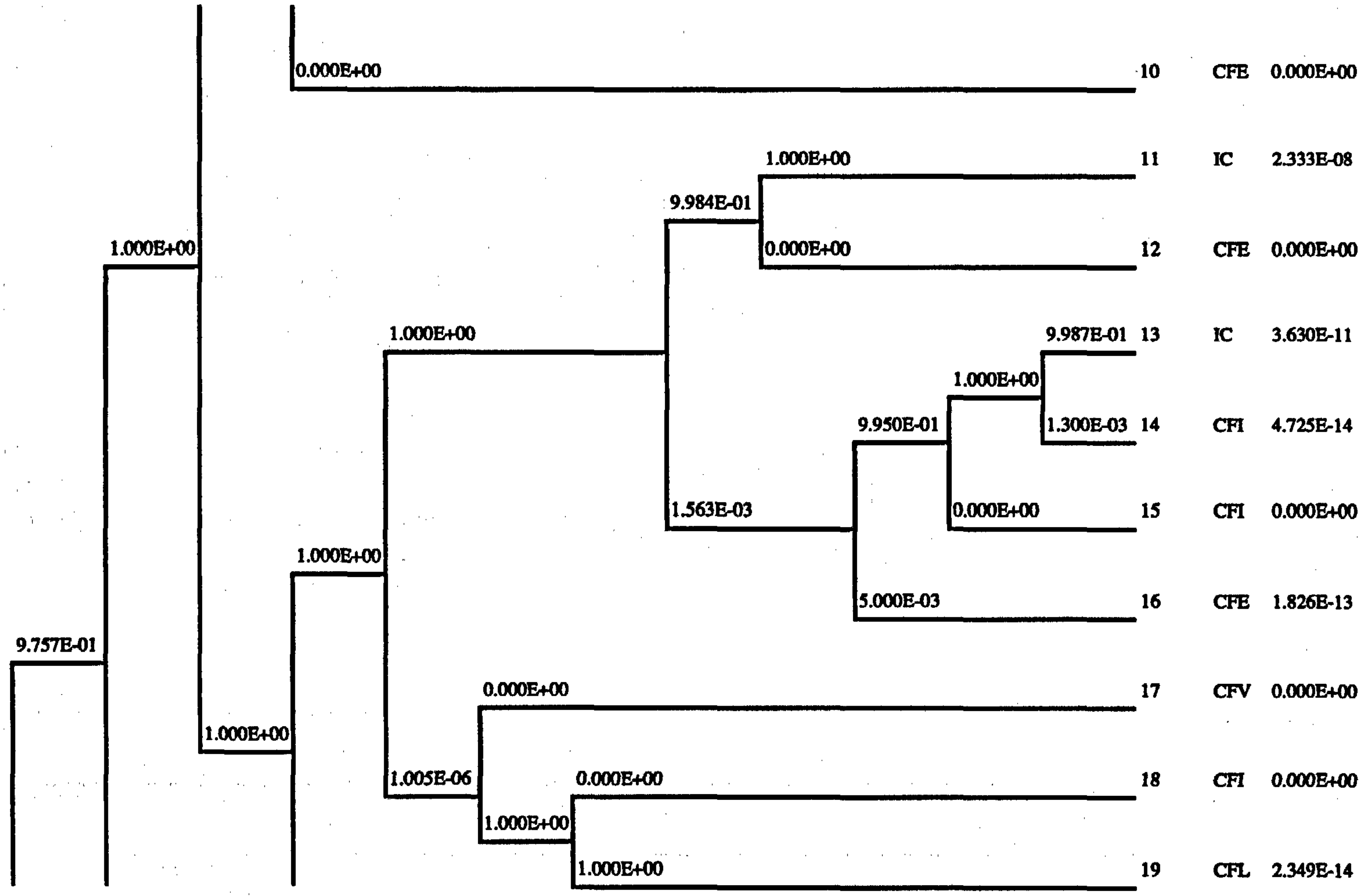
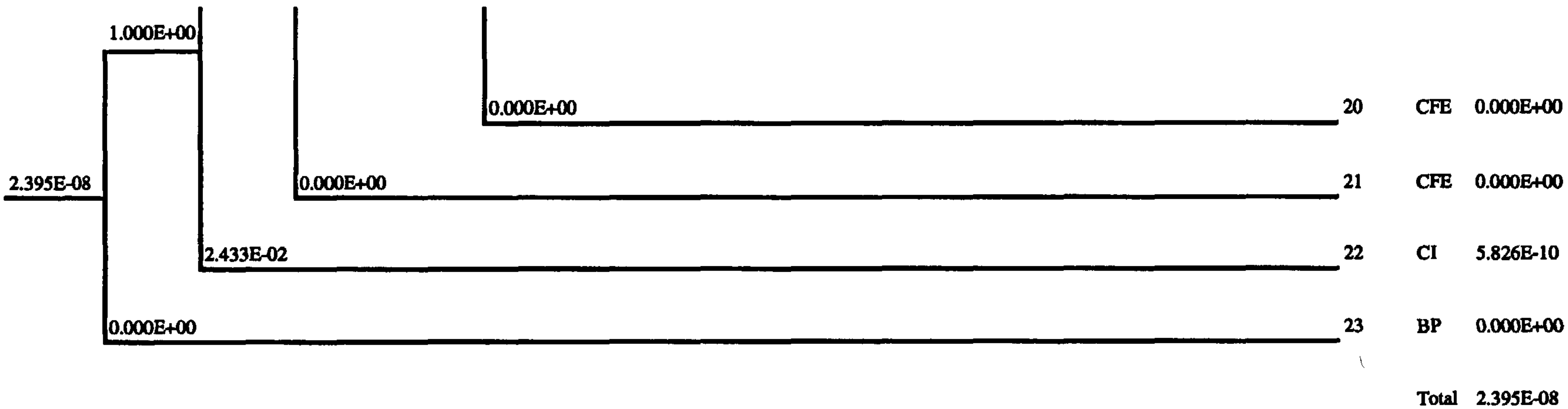


Figure 43-4 (Sheet 2 of 3)

3BL CET



2L Fail	Success	
2.395E-08		AC
0.000E+00	1.000E+00	DP
2.433E-02	9.757E-01	IS
0.000E+00	1.000E+00	IR
1.000E+00	0.000E+00	RFL
0.000E+00	1.000E+00	VF
1.005E-06	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
1.563E-03	9.984E-01	IG
0.000E+00	1.000E+00	DF
5.000E-03	9.950E-01	DTE
0.000E+00	1.000E+00	DFG
1.300E-03	9.987E-01	DTI

2L Rel. Cat.	Freq.	%
IC	2.337E-08	97.57%
CFE	1.826E-13	0.00%
CFI	4.725E-14	0.00%
CFV	0.000E+00	0.00%
CFL	2.349E-14	0.00%
CI	5.826E-10	2.43%
BP	0.000E+00	0.00%
Total	2.395E-08	100.00%

Figure 43-4 (Sheet 3 of 3)

3BL CET

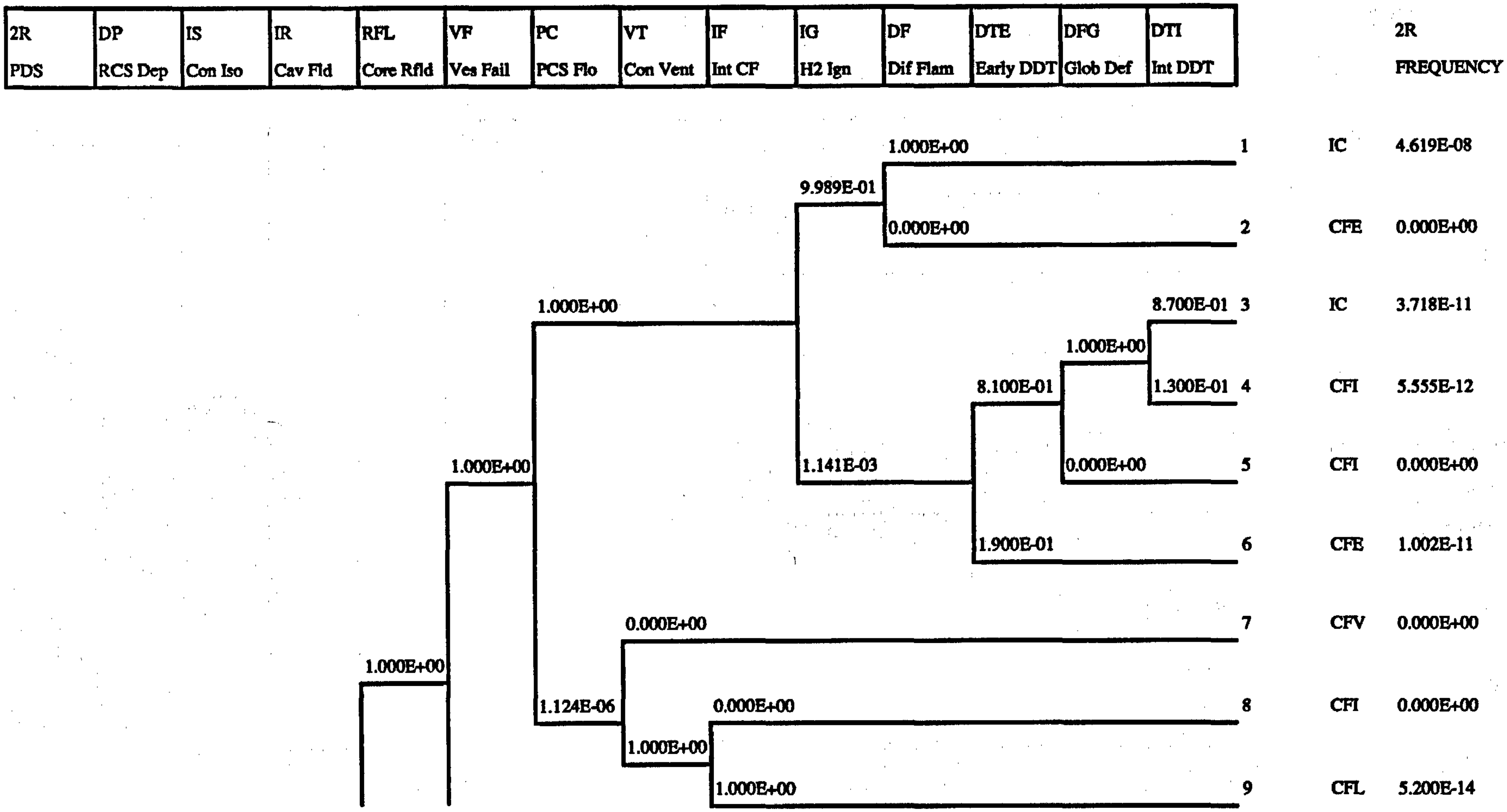


Figure 43-5 (Sheet 1 of 3)

3BR CET

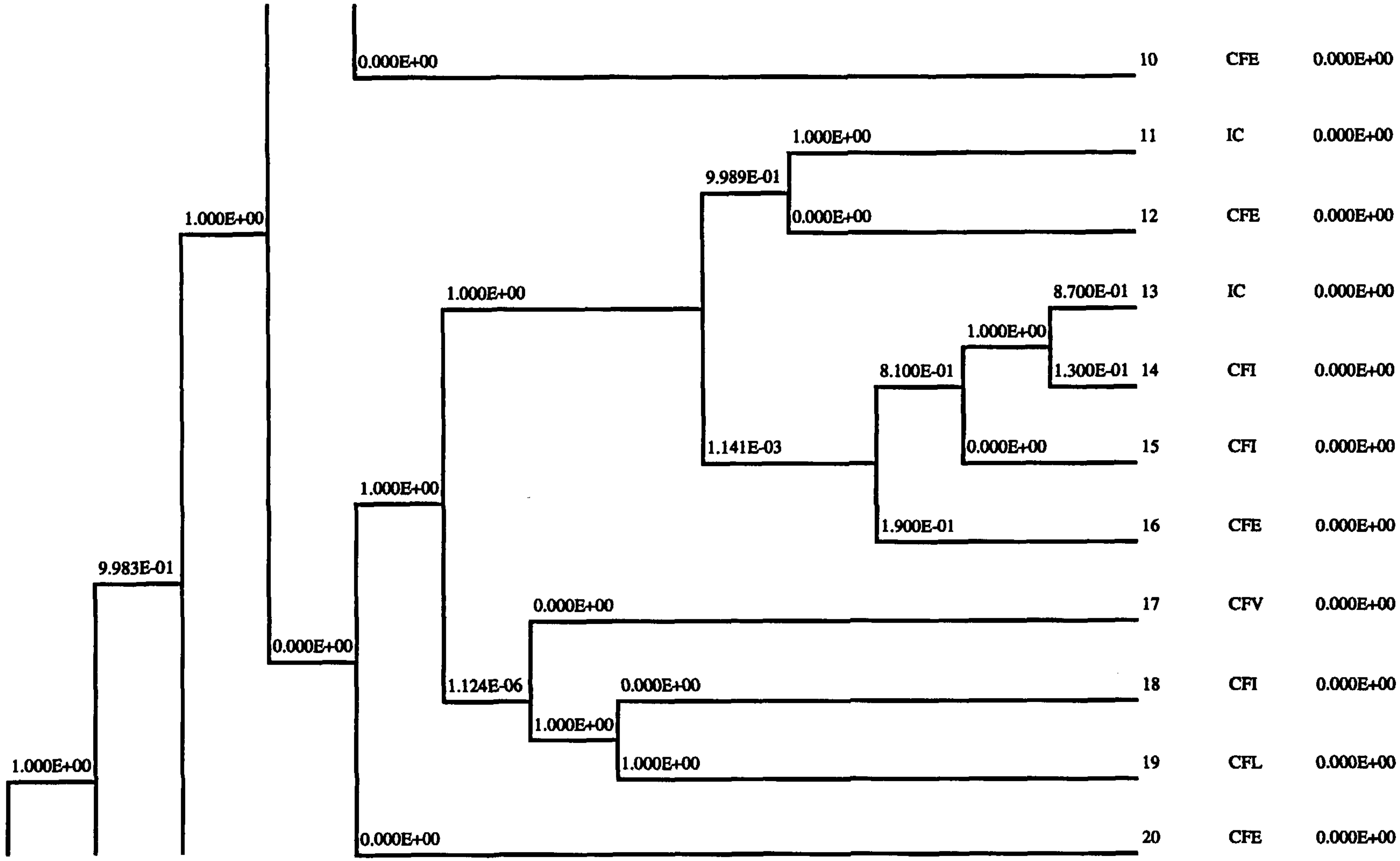
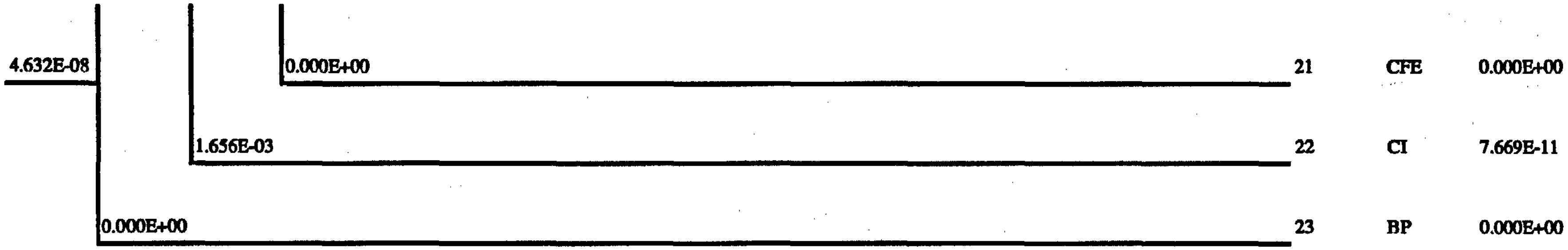


Figure 43-5 (Sheet 2 of 3)

3BR CET



Total 4.632E-08

2R Fail	2R Success	
4.632E-08		AC
0.000E+00	1.000E+00	DP
1.656E-03	9.983E-01	IS
0.000E+00	1.000E+00	IR
0.000E+00	1.000E+00	RFL
0.000E+00	1.000E+00	VF
1.124E-06	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
1.141E-03	9.989E-01	IG
0.000E+00	1.000E+00	DF
1.900E-01	8.100E-01	DTE
0.000E+00	1.000E+00	DFG
1.300E-01	8.700E-01	DTI

2R Rel. Cat.	Freq.	%
IC	4.623E-08	99.80%
CFE	1.002E-11	0.02%
CFI	5.555E-12	0.01%
CFV	0.000E+00	0.00%
CFL	5.200E-14	0.00%
CI	7.669E-11	0.17%
BP	0.000E+00	0.00%
Total	4.632E-08	100.00%

Figure 43-5 (Sheet 3 of 3)

3BR CET

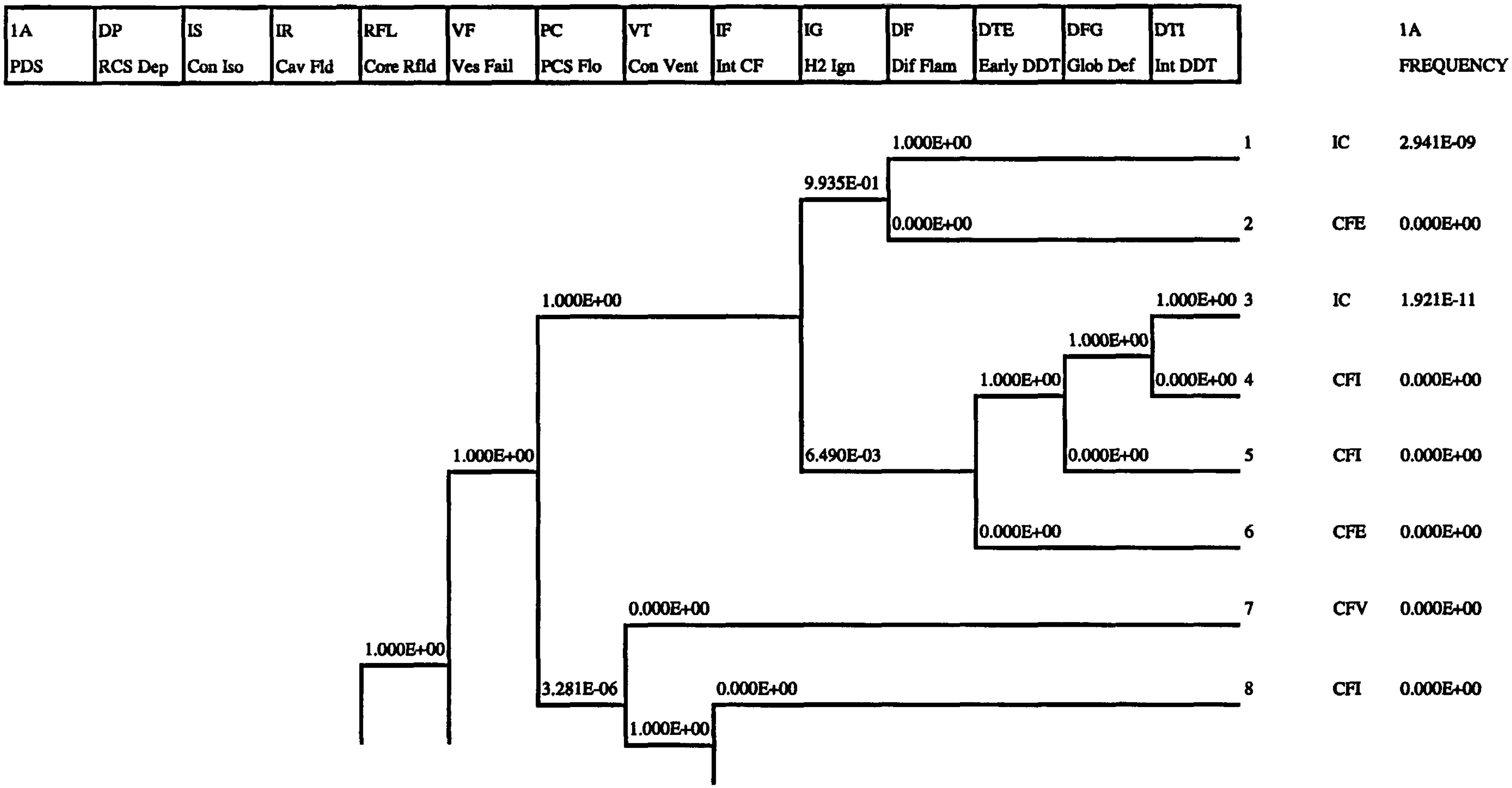


Figure 43-6 (Sheet 1 of 3)

1A CET

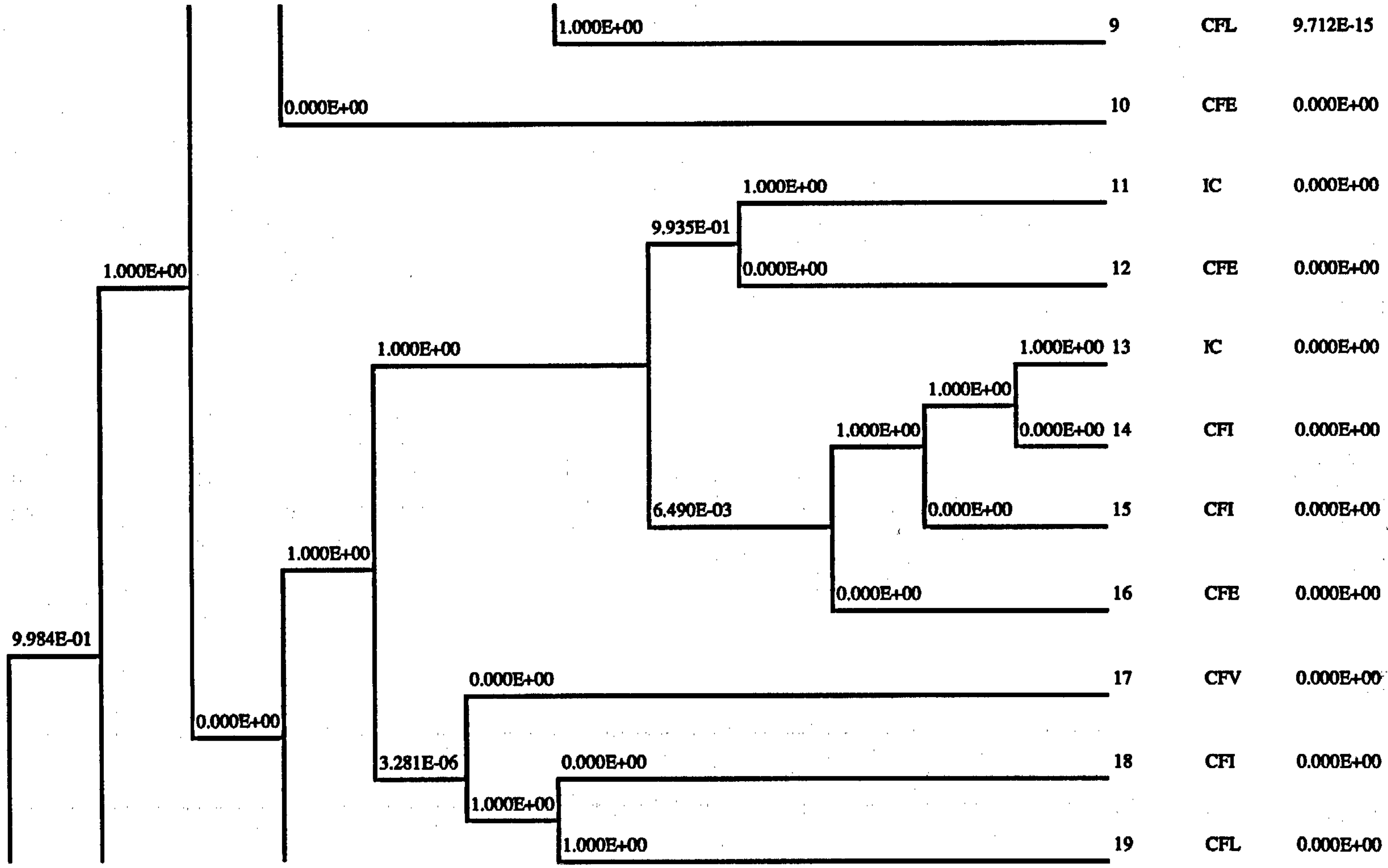
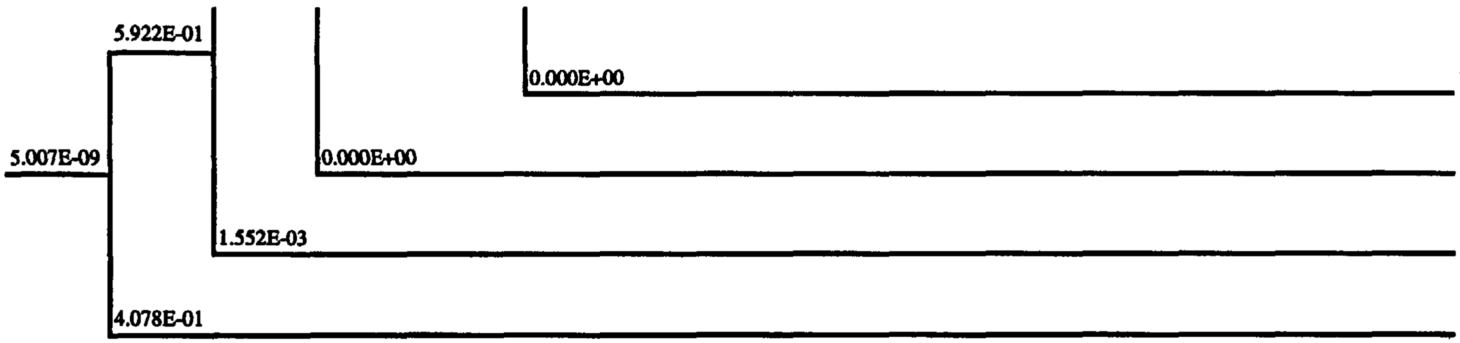


Figure 43-6 (Sheet 2 of 3)

1A CET



20	CFE	0.000E+00
21	CFE	0.000E+00
22	CI	4.602E-12
23	BP	2.042E-09
	Total	5.007E-09

1A Fail	1A Success	
5.007E-09		AC
4.078E-01	5.922E-01	DP
1.552E-03	9.984E-01	IS
0.000E+00	1.000E+00	IR
0.000E+00	1.000E+00	RFL
0.000E+00	1.000E+00	VF
3.281E-06	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
6.490E-03	9.935E-01	IG
0.000E+00	1.000E+00	DF
0.000E+00	1.000E+00	DTE
0.000E+00	1.000E+00	DFG
0.000E+00	1.000E+00	DTI

1A Rel. Cat.	Freq.	%
IC	2.960E-09	59.13%
CFE	0.000E+00	0.00%
CFI	0.000E+00	0.00%
CFV	0.000E+00	0.00%
CFL	9.712E-15	0.00%
CI	4.602E-12	0.09%
BP	2.042E-09	40.78%
Total	5.007E-09	100.00%

Figure 43-6 (Sheet 3 of 3)

1A CET

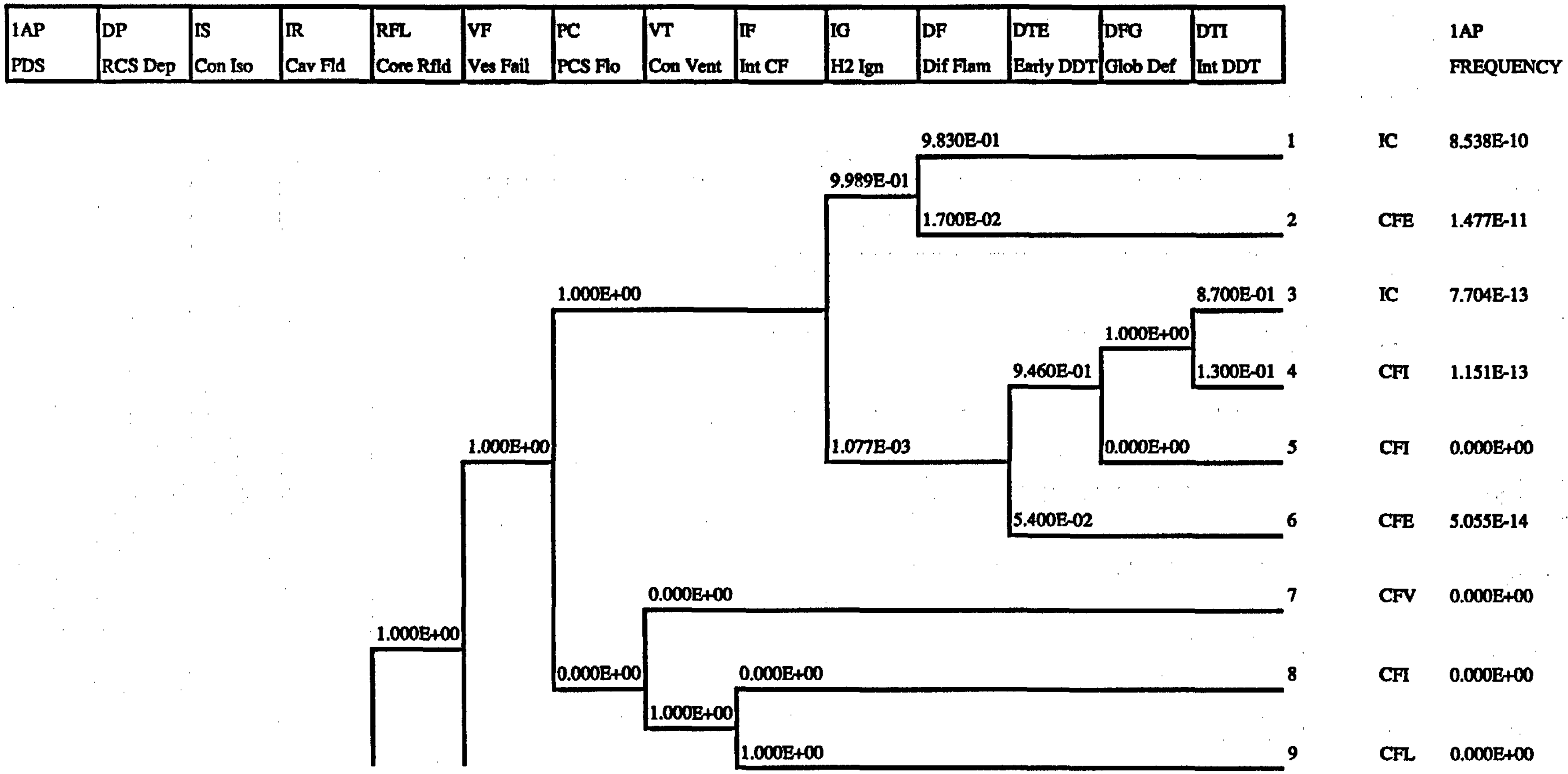


Figure 43-7 (Sheet 1 of 3)

1AP CET

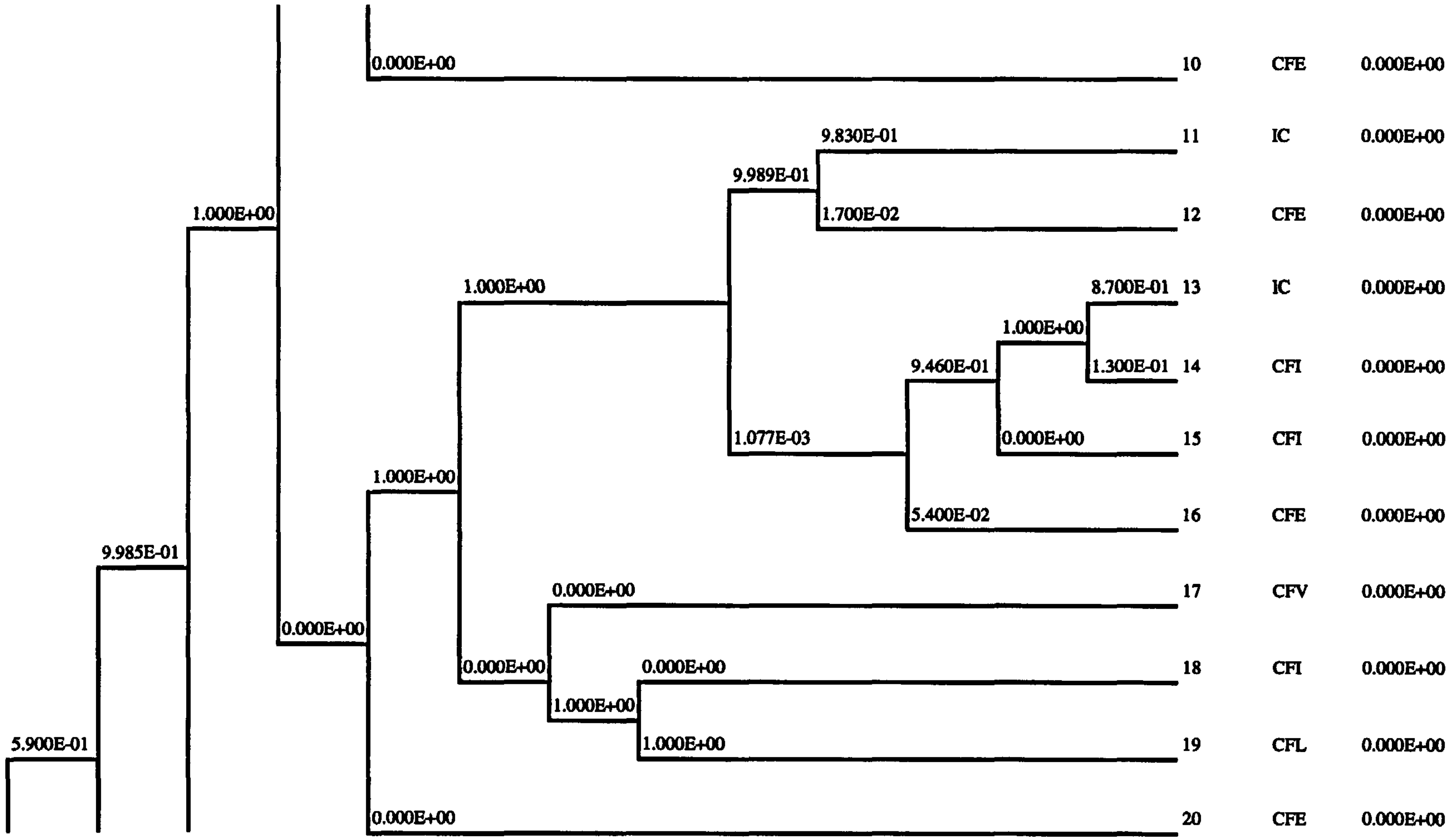
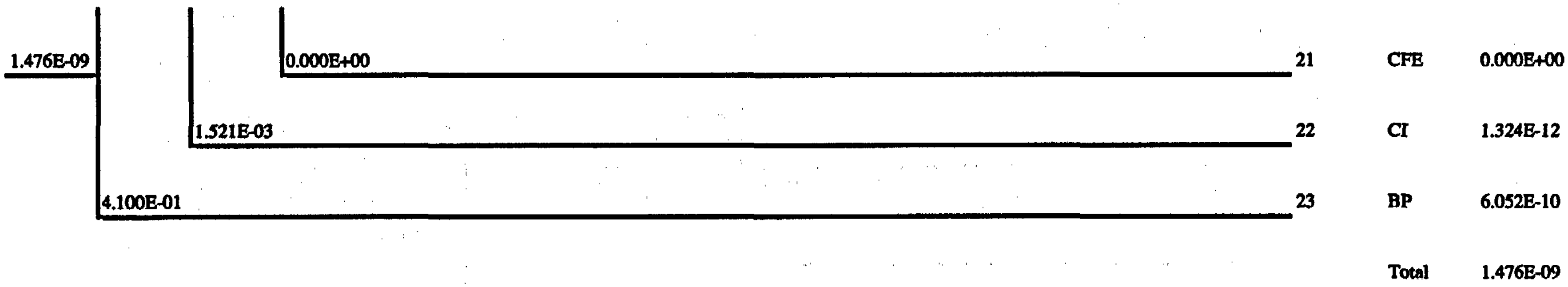


Figure 43-7 (Sheet 2 of 3)

1AP CET



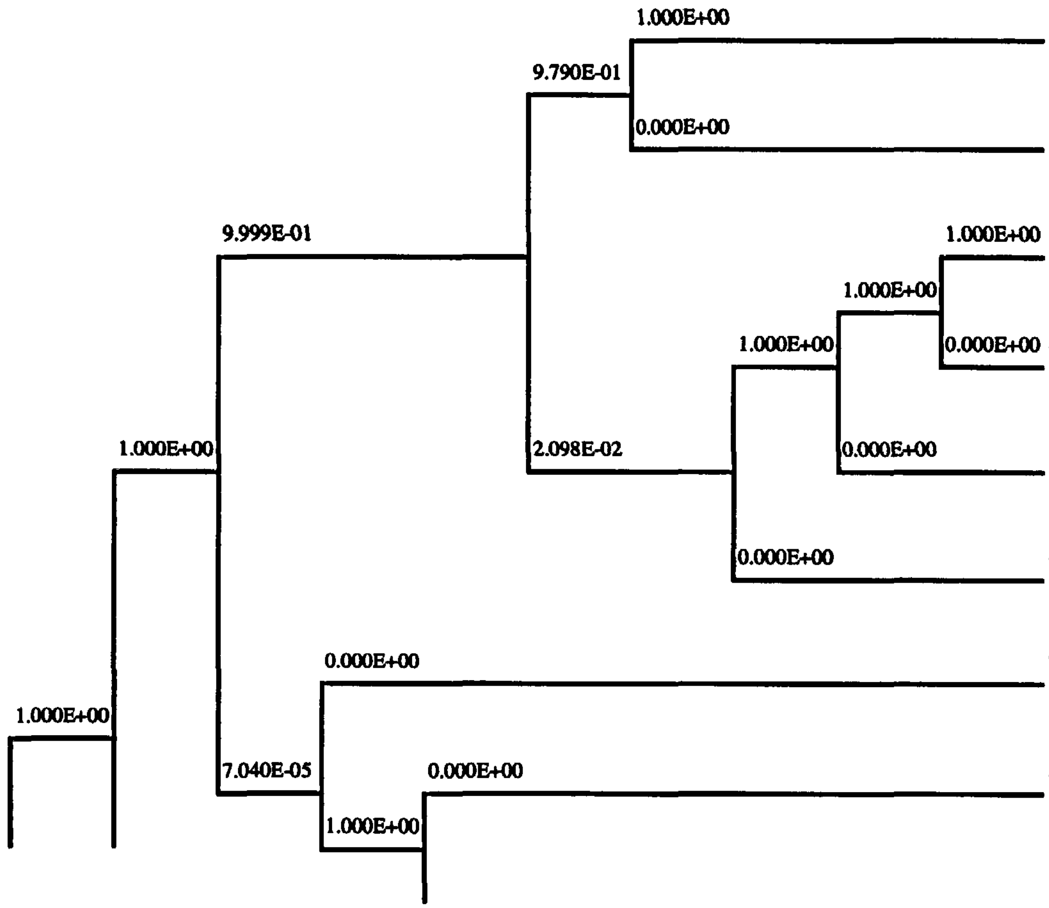
Fail	1AP Success	
1.476E-09		AC
4.100E-01	5.900E-01	DP
1.521E-03	9.985E-01	IS
0.000E+00	1.000E+00	IR
0.000E+00	1.000E+00	RFL
0.000E+00	1.000E+00	VF
0.000E+00	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
1.077E-03	9.989E-01	IG
1.700E-02	9.830E-01	DF
5.400E-02	9.460E-01	DTE
0.000E+00	1.000E+00	DFG
1.300E-01	8.700E-01	DTI

1AP Rel. Cat.	Freq.	%
IC	8.545E-10	57.90%
CFE	1.482E-11	1.00%
CFI	1.151E-13	0.01%
CFV	0.000E+00	0.00%
CFL	0.000E+00	0.00%
CI	1.324E-12	0.09%
BP	6.052E-10	41.00%
Total	1.476E-09	100.00%

Figure 43-7 (Sheet 3 of 3)

1AP CET

3A	DP	IS	IR	RFL	VF	PC	VT	IF	IG	DF	DTE	DFG	DTI
PDS	RCS Dep	Con Iso	Cav Fld	Core Rfld	Ves Fail	PCS Flo	Con Vent	Int CF	H2 Ign	Dif Flam	Early DDT	Glob Def	Int DDT



#	3A	FREQUENCY
1	IC	3.364E-10
2	CFE	0.000E+00
3	IC	7.209E-12
4	CFI	0.000E+00
5	CFI	0.000E+00
6	CFE	0.000E+00
7	CFV	0.000E+00
8	CFI	0.000E+00

Figure 43-8 (Sheet 1 of 3)

3A CET

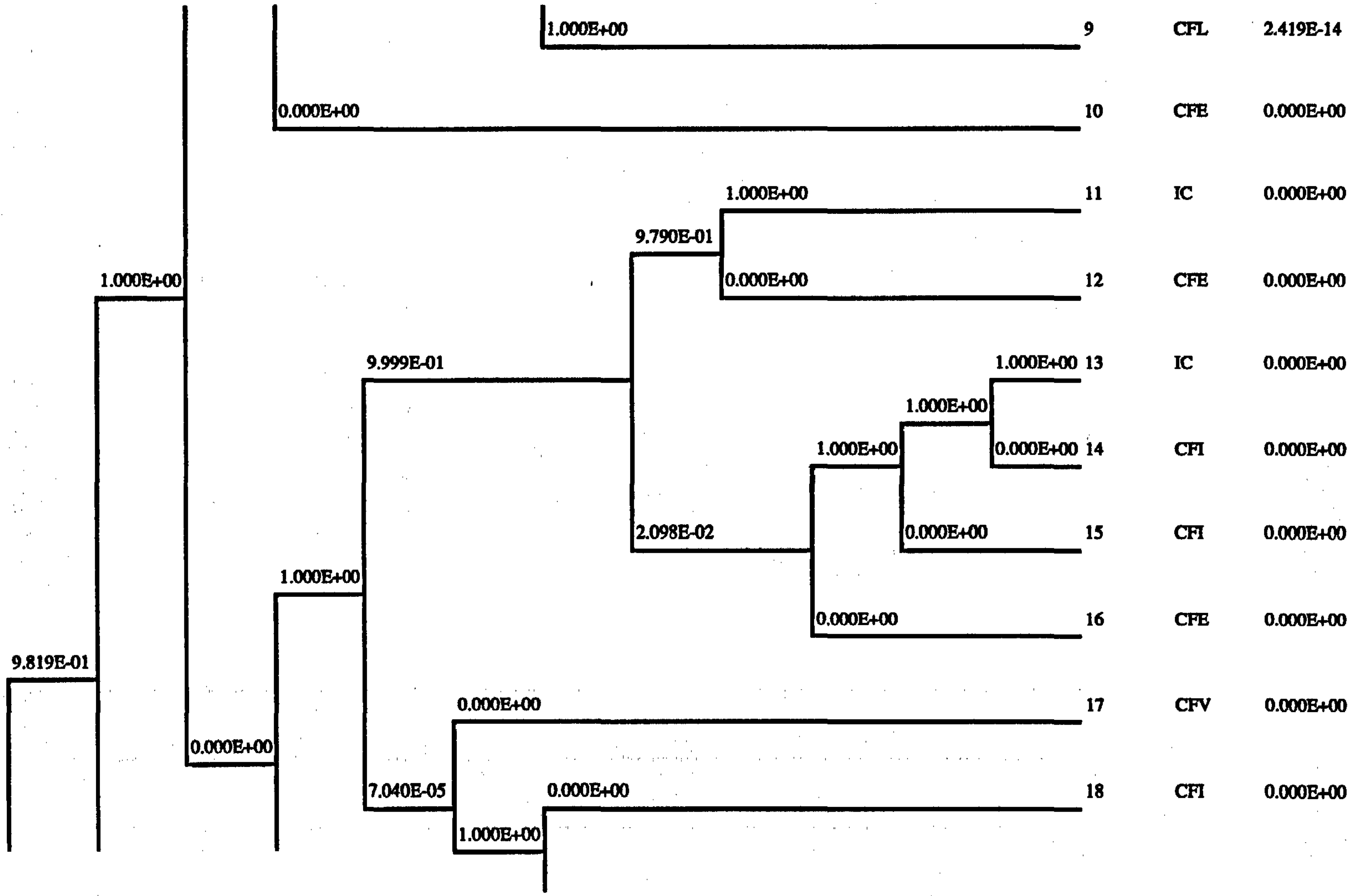
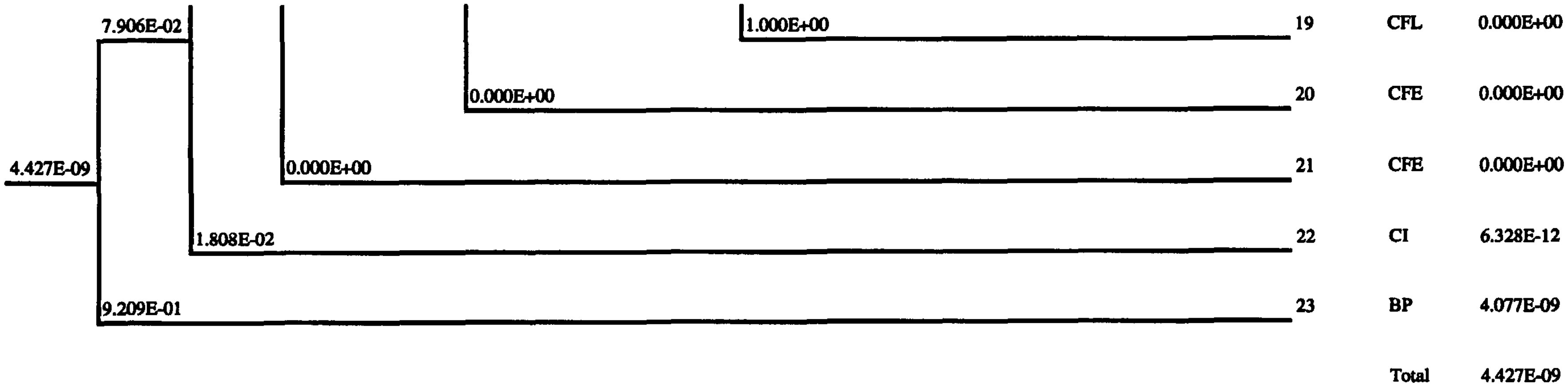


Figure 43-8 (Sheet 2 of 3)

3A CET



	3A	
Fail	Success	
4.427E-09		AC
9.209E-01	7.906E-02	DP
1.808E-02	9.819E-01	IS
0.000E+00	1.000E+00	IR
0.000E+00	1.000E+00	RFL
0.000E+00	1.000E+00	VF
7.040E-05	9.999E-01	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
2.098E-02	9.790E-01	IG
0.000E+00	1.000E+00	DF
0.000E+00	1.000E+00	DTE
0.000E+00	1.000E+00	DFG
0.000E+00	1.000E+00	DTI

3A		
Rel. Cat.	Freq.	%
IC	3.436E-10	7.76%
CFE	0.000E+00	0.00%
CFI	0.000E+00	0.00%
CFV	0.000E+00	0.00%
CFL	2.419E-14	0.00%
CI	6.328E-12	0.14%
BP	4.077E-09	92.09%
Total	4.427E-09	100.00%

Figure 43-8 (Sheet 3 of 3)

3A CET

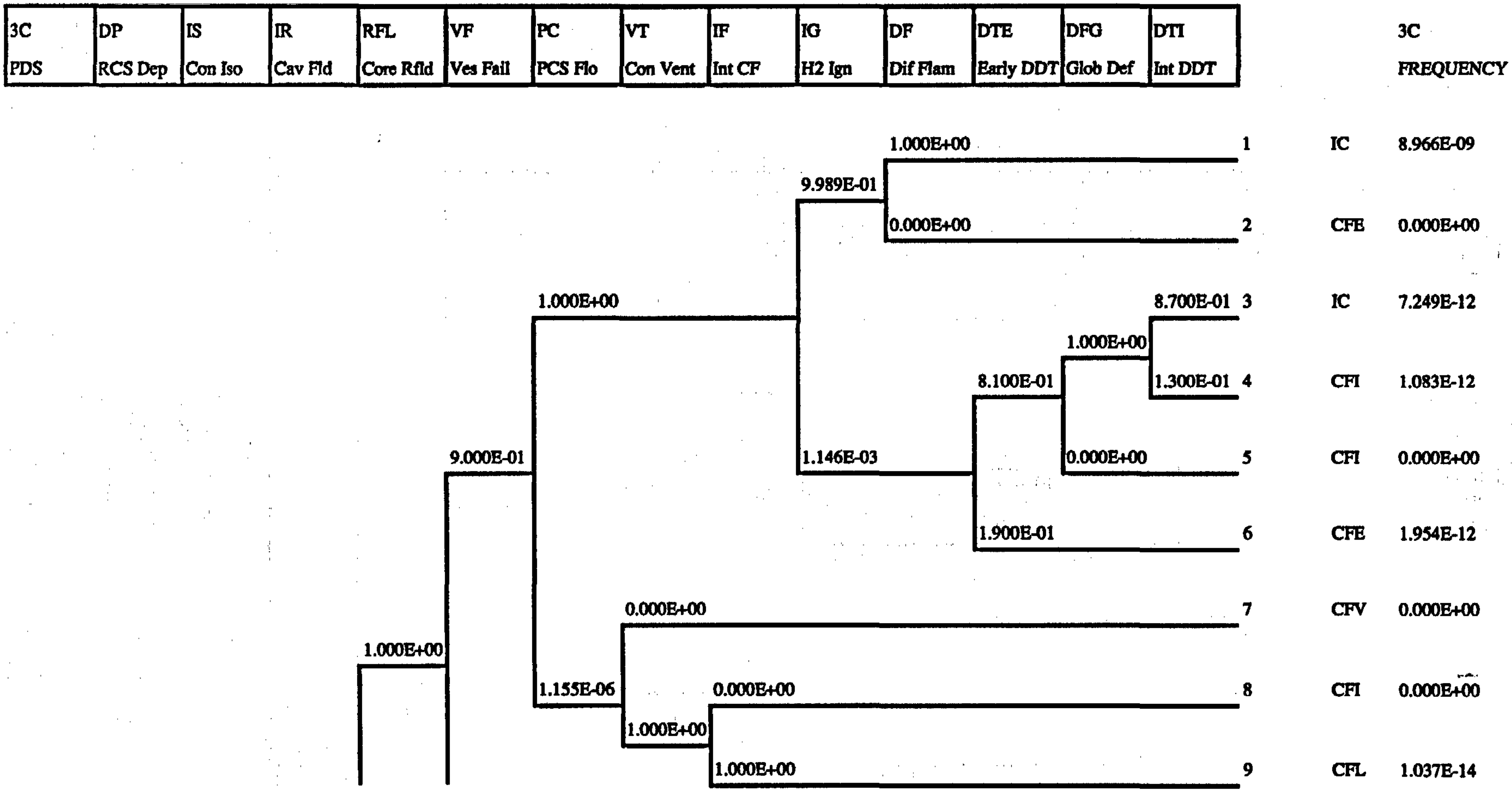


Figure 43-9 (Sheet 1 of 3)

3C CET

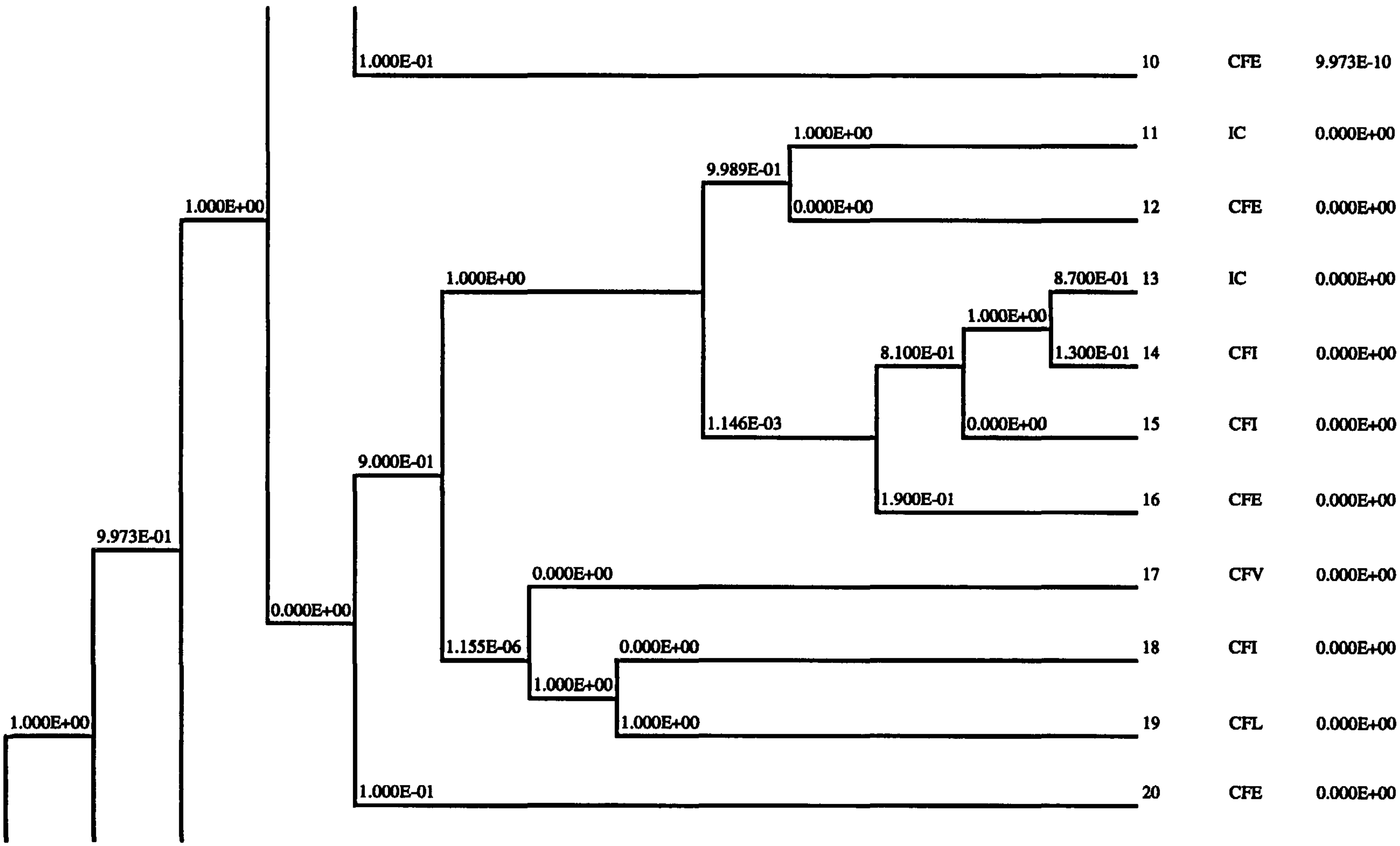
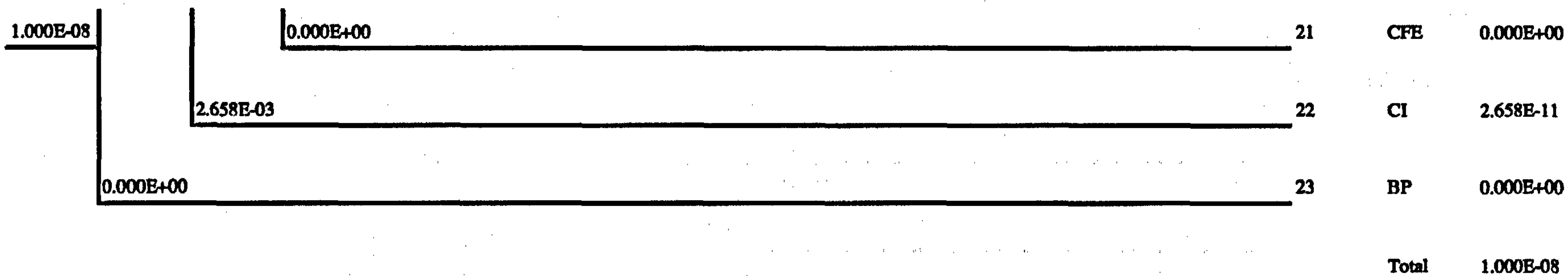


Figure 43-9 (Sheet 2 of 3)

3C CET



Fail	3C Success		3C Rel. Cat.	Freq.	%
1.000E-08		AC	IC	8.973E-09	89.73%
0.000E+00	1.000E+00	DP	CFE	9.993E-10	9.99%
2.658E-03	9.973E-01	IS	CFI	1.083E-12	0.01%
0.000E+00	1.000E+00	IR	CFV	0.000E+00	0.00%
0.000E+00	1.000E+00	RFL	CFL	1.037E-14	0.00%
1.000E-01	9.000E-01	VF	CI	2.658E-11	0.27%
1.155E-06	1.000E+00	PC	BP	0.000E+00	0.00%
1.000E+00	0.000E+00	VT			
1.000E+00	0.000E+00	IF	Total	1.000E-08	100.00%
1.146E-03	9.989E-01	IG			
0.000E+00	1.000E+00	DF			
1.900E-01	8.100E-01	DTE			
0.000E+00	1.000E+00	DFG			

Figure 43-9 (Sheet 3 of 3)

3C CET

3D PDS	DP RCS Dep	IS Con Iso	IR Cav Fld	RFL Core Rfld	VF Ves Fail	PC PCS Flo	VT Con Vent	IF Int CF	IG H2 Ign	DF Dif Flam	DTE Early DDT	DFG Glob Def	DTI Int DDT		3D FREQUENCY

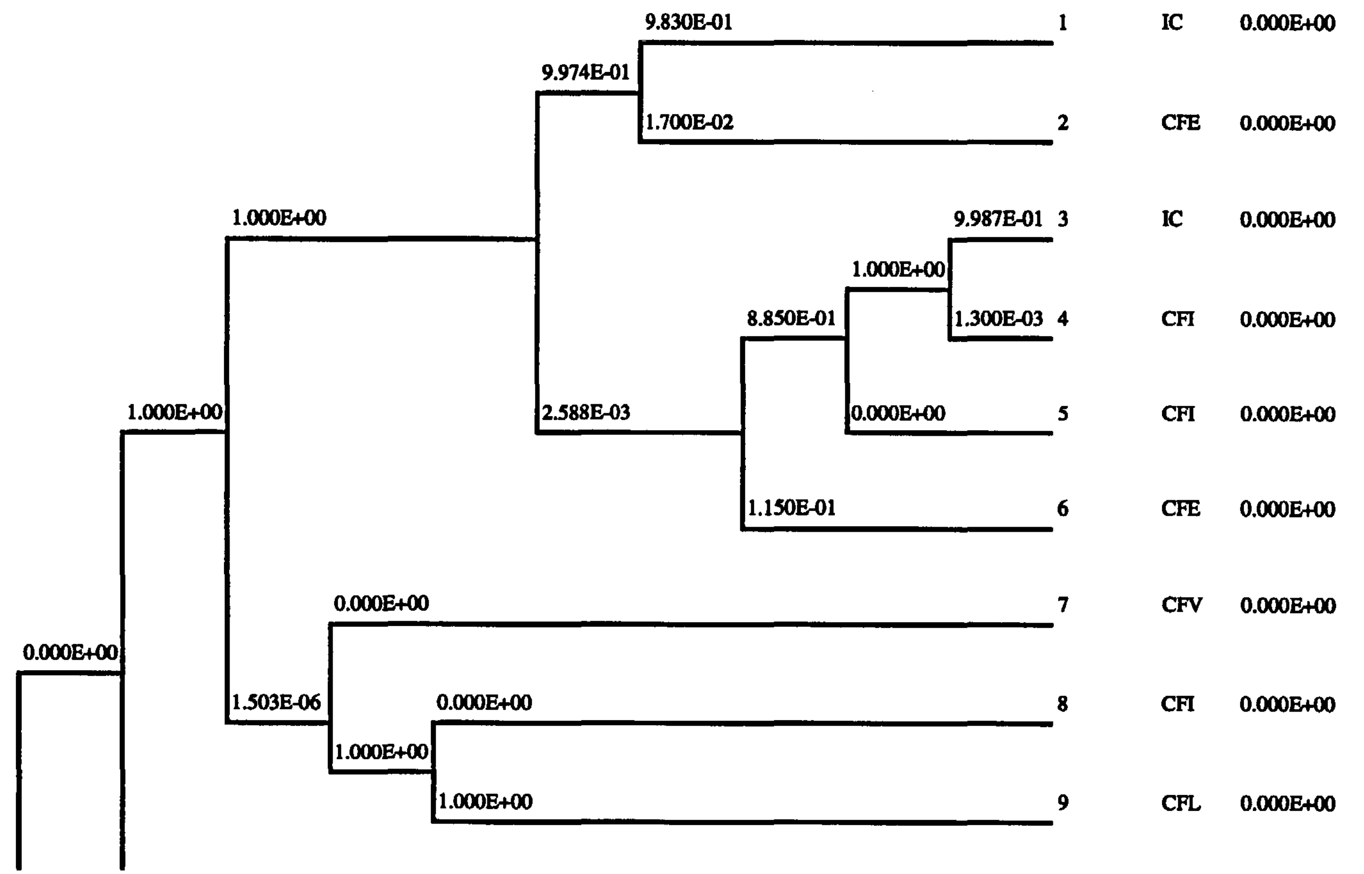


Figure 43-10 (Sheet 1 of 3)

3D CET

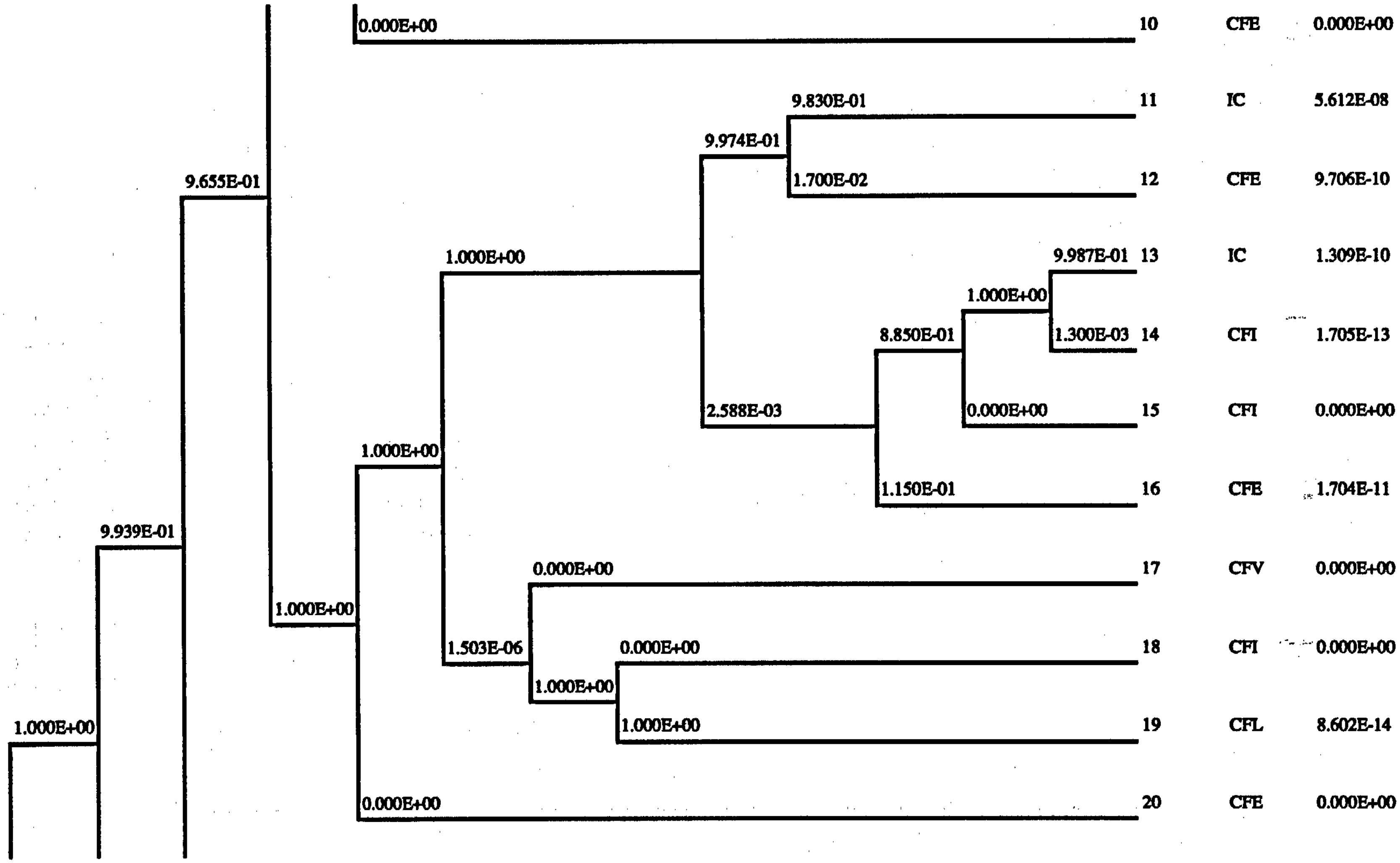
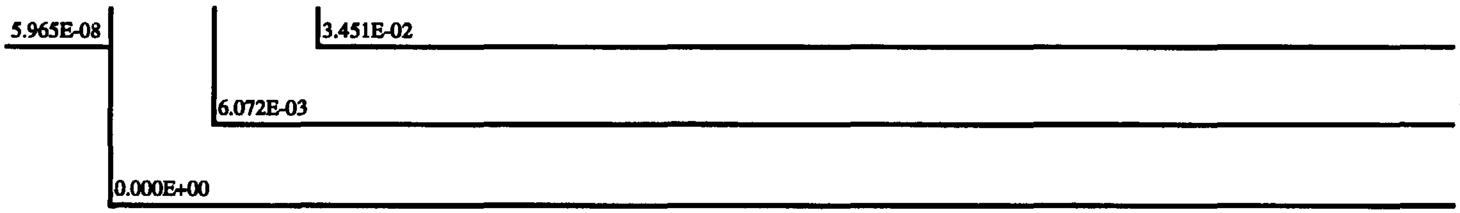


Figure 43-10 (Sheet 2 of 3)

3D CET



21	CFE	2.046E-09
22	CI	3.622E-10
23	BP	0.000E+00
	Total	5.965E-08

Fail	3D Success	
5.965E-08		AC
0.000E+00	1.000E+00	DP
6.072E-03	9.939E-01	IS
3.451E-02	9.655E-01	IR
1.000E+00	0.000E+00	RFL
0.000E+00	1.000E+00	VF
1.503E-06	1.000E+00	PC
1.000E+00	0.000E+00	VT
1.000E+00	0.000E+00	IF
2.588E-03	9.974E-01	IG
1.700E-02	9.830E-01	DF
1.150E-01	8.850E-01	DTE
0.000E+00	1.000E+00	DFG
1.300E-03	9.987E-01	DTI

3D Rel. Cat.	Freq.	%
IC	5.625E-08	94.31%
CFE	3.034E-09	5.09%
CFI	1.705E-13	0.00%
CFV	0.000E+00	0.00%
CFL	8.602E-14	0.00%
CI	3.622E-10	0.61%
BP	0.000E+00	0.00%
Total	5.965E-08	100.00%

Figure 43-10 (Sheet 3 of 3)

3D CET

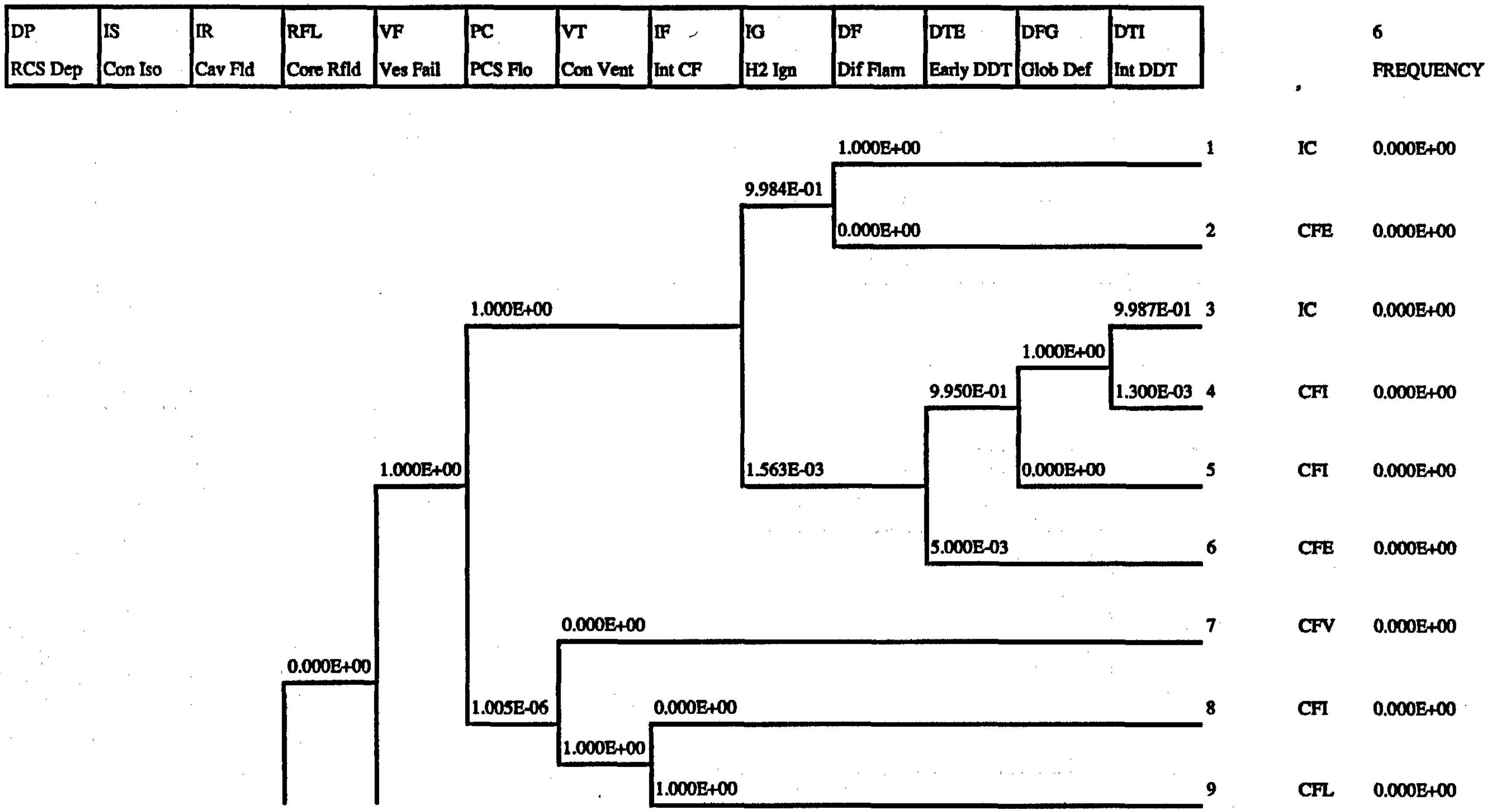


Figure 43-11 (Sheet 1 of 3)

6 CET

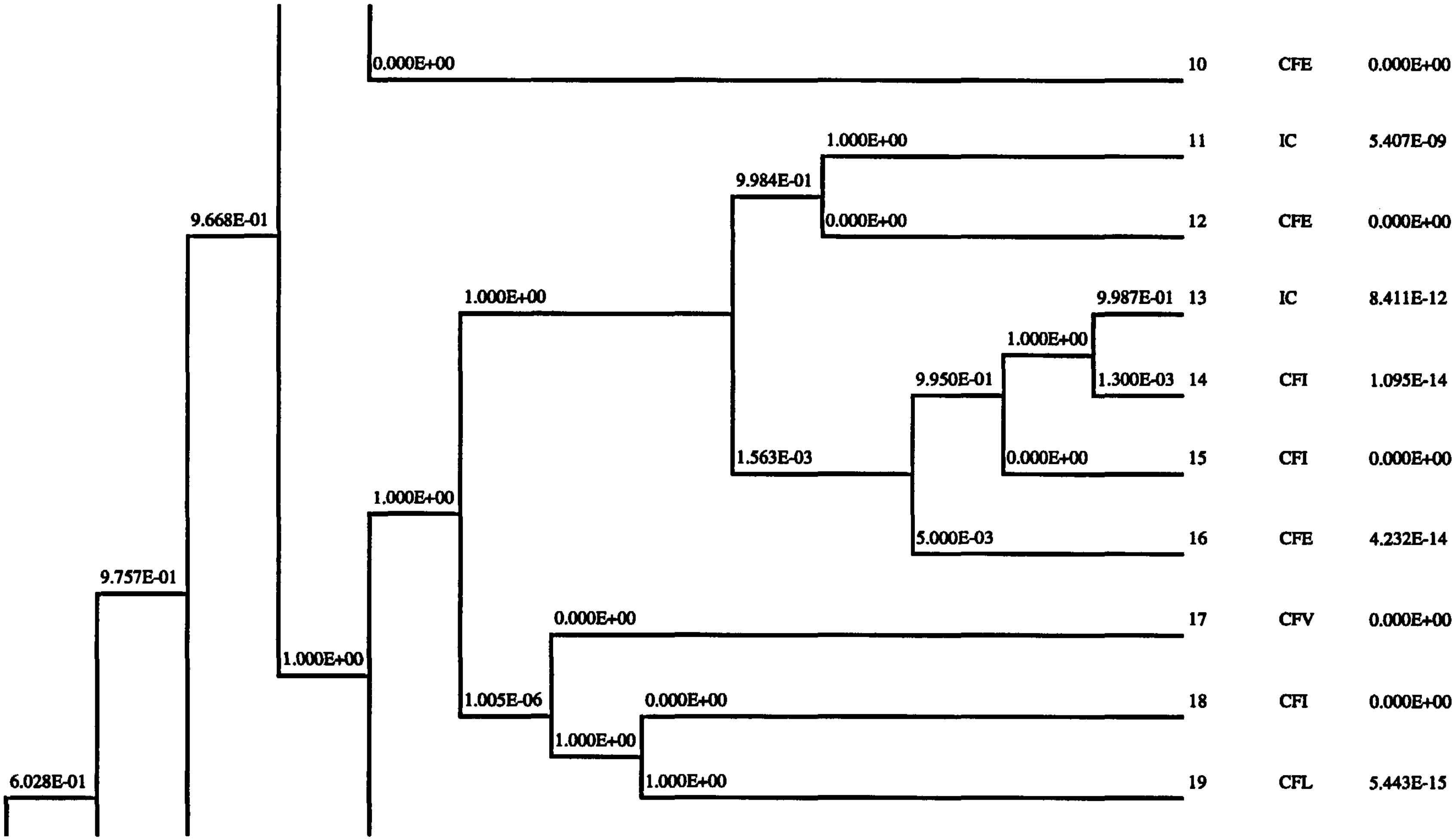
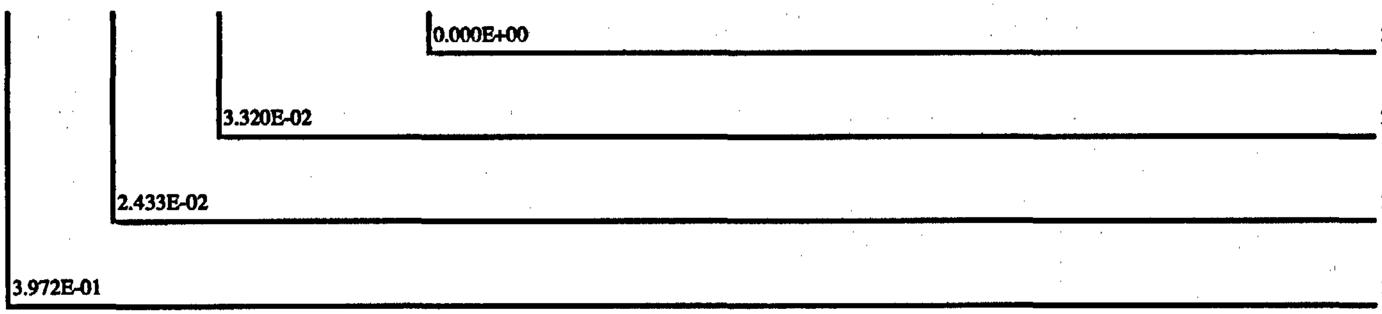


Figure 43-11 (Sheet 2 of 3)

6 CET



20	CFE	0.000E+00
21	CFE	1.860E-10
22	CI	1.396E-10
23	BP	3.783E-09
	Total	9.524E-09

6

Success	
	AC
6.028E-01	DP
9.757E-01	IS
9.668E-01	IR
0.000E+00	RFL
1.000E+00	VF
1.000E+00	PC
0.000E+00	VT
0.000E+00	IF
9.984E-01	IG
1.000E+00	DF
9.950E-01	DTE
1.000E+00	DFG
9.987E-01	DTI

6

Rel. Cat.	Freq.	%
IC	5.415E-09	56.86%
CFE	1.860E-10	1.95%
CFI	1.095E-14	0.00%
CFV	0.000E+00	0.00%
CFL	5.443E-15	0.00%
CI	1.396E-10	1.47%
BP	3.783E-09	39.72%
Total	9.524E-09	100.00%

Figure 43-11 (Sheet 3 of 3)

6 CET

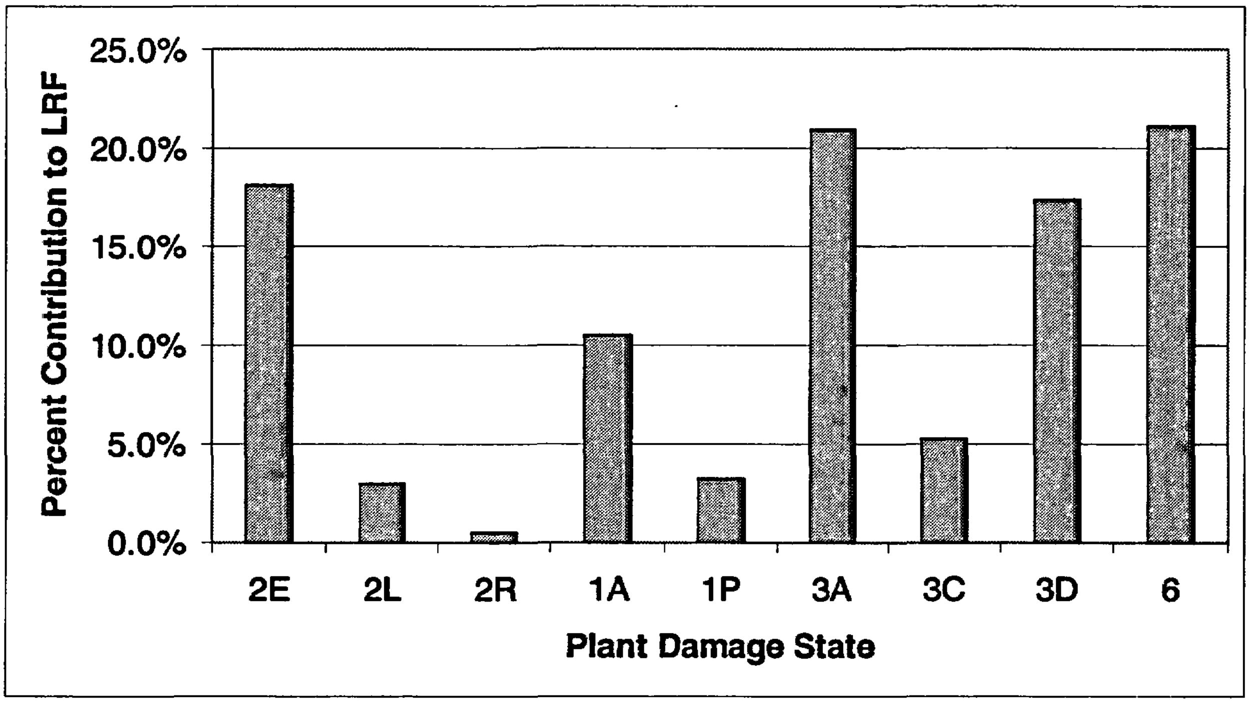


Figure 43-12

Contribution of PDS to LRF

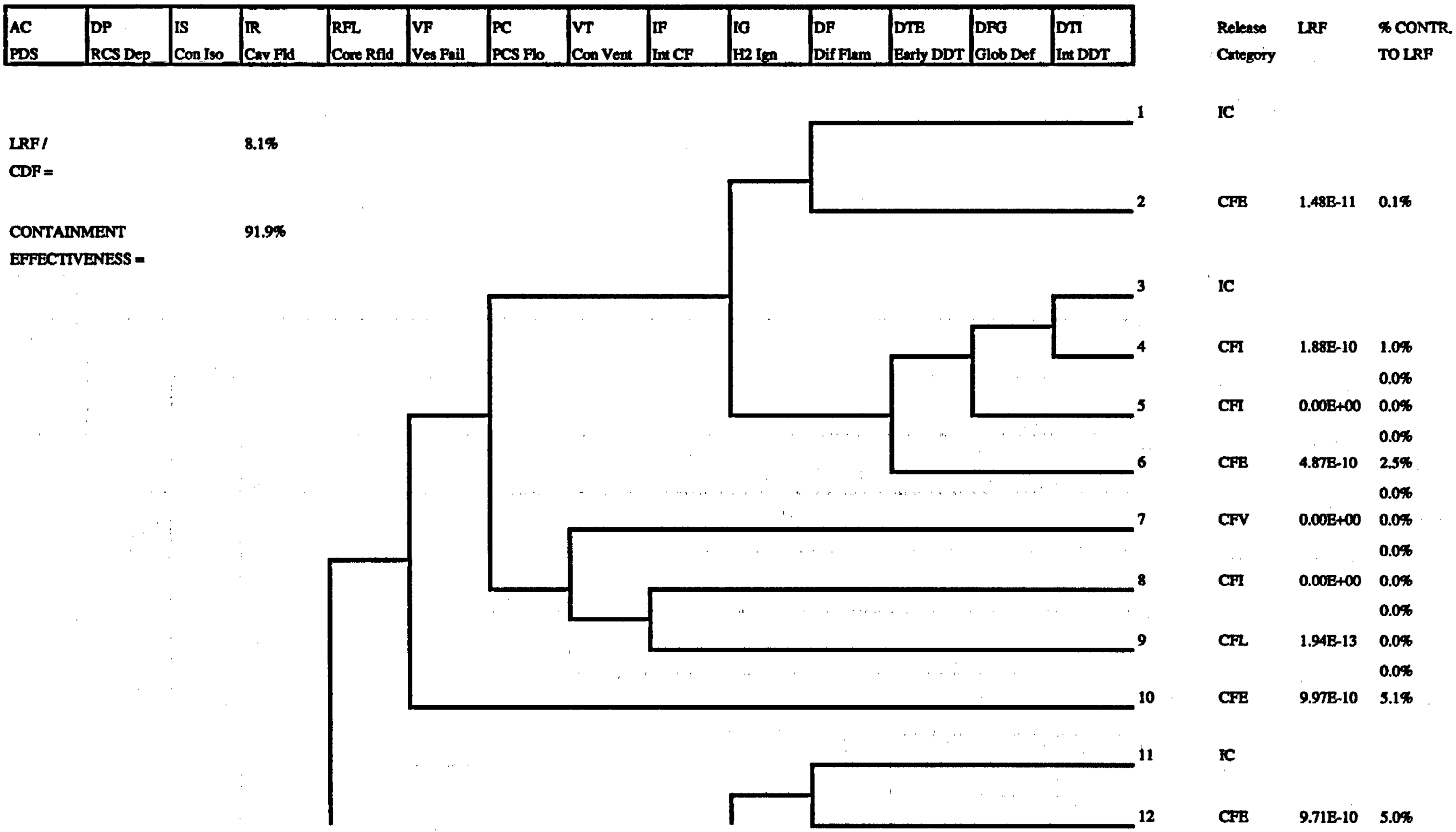
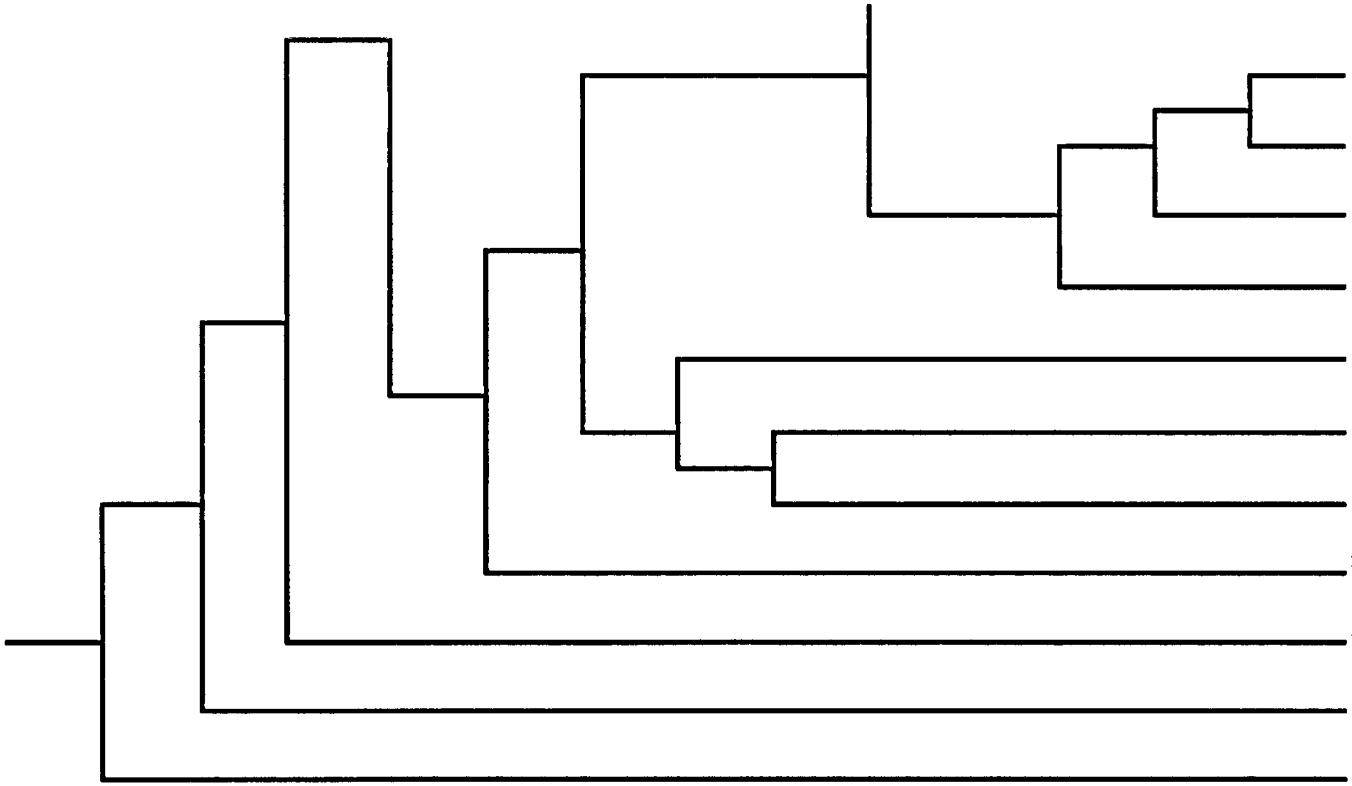


Figure 43-13 (Sheet 1 of 2)

Summary of CET Quantification



13	IC		
14	CFI	1.04E-12	0.0%
15	CFI	0.00E+00	0.0%
16	CFE	9.99E-11	0.5%
17	CFV	0.00E+00	0.0%
18	CFI	0.00E+00	0.0%
19	CFL	1.51E-13	0.0%
20	CFE	0.00E+00	0.0%
21	CFE	4.90E-09	25.1%
22	CI	1.33E-09	6.8%
23	BP	1.05E-08	53.9%
	Total	1.95E-08	100.0%

Figure 43-13 (Sheet 2 of 2)

Summary of CET Quantification

ATTACHMENT 43A

PDS CALCULATIONS

This attachment contains the results of the plant damage state frequency calculations for AP1000 PRA at-power events.

The 190 *.wlk files for the dominant accident sequences were generated when the CDF analysis of Chapter 33 was performed. These files are listed in Table 43A-1. Then, WLINK code is used to collect the CDF cutsets from accident sequences into PDS files. The input files for this purpose are named X.in, where X stands for the 2 or 1 character symbol for a PDS given above. The results of the PDS quantification are summarized in Table 43A-2.

Table 43A-1 (Sheet 1 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
1	6.88E-08	2esil-07.wlk	1.00E-15	120	189
2	4.26E-08	2rllo-09.wlk	1.00E-15	12	207
3	2.13E-08	3dsad-08.wlk	1.00E-15	1280	222
4	1.98E-08	3dsil-08.wlk	1.00E-15	208	189
5	1.00E-08	3crvr-02.wlk	1.00E-14	1	1
6	8.44E-09	2lslo-05.wlk	1.00E-15	38	314
7	7.35E-09	2lmlo-05.wlk	1.00E-15	38	308
8	5.11E-09	3dslo-12.wlk	1.00E-15	1487	314
9	4.46E-09	3dmlo-12.wlk	1.00E-15	1340	308
10	3.72E-09	2rsad-09.wlk	1.00E-15	23	222
11	3.67E-09	2esad-07.wlk	1.00E-15	46	222
12	3.57E-09	2lsil-03.wlk	1.00E-15	38	189
13	3.56E-09	6esgt-41.wlk	1.00E-14	330	244
14	3.31E-09	3aatw-23.wlk	1.00E-14	31	46
15	3.30E-09	2eslo-09.wlk	1.00E-15	1099	314
16	2.88E-09	2emlo-09.wlk	1.00E-15	1074	308
17	2.19E-09	6esgt-13.wlk	1.00E-14	39	244
18	1.97E-09	3dllo-08.wlk	1.00E-15	992	207
19	1.57E-09	2lcmt-05.wlk	1.00E-15	38	278
20	1.41E-09	1atra-17.wlk	2.13E-14	407	181
21	1.29E-09	3dsil-16.wlk	1.00E-15	343	189
22	1.13E-09	6lsgtc05.wlk	1.23E-13	140	153
23	9.98E-10	3dsil-17.wlk	1.00E-15	279	189
24	9.71E-10	6esgtc12.wlk	1.23E-13	498	153
25	9.51E-10	3dcmt-12.wlk	1.00E-15	868	278
26	9.45E-10	1pmlo-28.wlk	1.00E-15	299	308
27	9.11E-10	2lsad-03.wlk	1.00E-15	35	222
28	8.95E-10	1atra-32.wlk	2.13E-14	44	181
29	7.60E-10	2lmloc05.wlk	1.00E-14	45	205
30	7.45E-10	1pslo-39.wlk	1.00E-15	277	314
31	7.13E-10	3drcs-12.wlk	1.00E-13	693	148
32	7.10E-10	3aatt-26.wlk	1.00E-14	6	19
33	6.15E-10	2ecmt-09.wlk	1.00E-15	595	278
34	5.40E-10	2lsil-14.wlk	1.00E-15	692	189
35	4.96E-10	6esgtc09.wlk	1.23E-13	361	153
36	4.80E-10	1alca-16.wlk	1.18E-15	410	173

Table 43A-1 (Sheet 2 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
37	4.61E-10	3dmloc12.wlk	1.00E-14	376	205
38	4.60E-10	1pmlo-13.wlk	1.00E-15	30	308
39	4.48E-10	1almf-16.wlk	4.72E-15	632	206
40	4.45E-10	1pslo-13.wlk	1.00E-15	30	314
41	4.37E-10	1pcmt-28.wlk	1.00E-15	207	278
42	4.31E-10	6lsgt-05.wlk	1.00E-14	156	244
43	4.23E-10	2lrcs-05.wlk	1.00E-13	263	148
44	3.79E-10	2ercs-09.wlk	1.00E-13	527	148
45	3.40E-10	2ello-07.wlk	1.00E-15	20	207
46	3.40E-10	1aslvc30.wlk	1.00E-13	114	69
47	2.97E-10	2emloc09.wlk	1.00E-14	223	205
48	2.75E-10	6esgt-12.wlk	1.00E-14	948	244
49	2.67E-10	3dprss12.wlk	1.00E-13	146	101
50	2.16E-10	1almf-31.wlk	4.72E-15	51	206
51	1.95E-10	1alml-17.wlk	1.00E-15	484	203
52	1.87E-10	3aatw-49.wlk	1.00E-14	41	46
53	1.67E-10	1prcs-13.wlk	1.00E-13	21	148
54	1.59E-10	1aslv-30.wlk	1.00E-15	87	108
55	1.58E-10	6esgt-09.wlk	1.00E-14	725	244
56	1.48E-10	1alsp-32.wlk	9.31E-14	95	72
57	1.47E-10	1alco-16.wlk	7.66E-15	466	163
58	1.43E-10	1alcc-13.wlk	1.00E-14	277	122
59	1.41E-10	1dtra-16.wlk	2.13E-14	283	181
60	1.24E-10	2etra-13.wlk	2.13E-14	282	181
61	1.23E-10	1alml-32.wlk	1.00E-15	67	203
62	1.00E-10	3aats-38.wlk	1.00E-14	14	27
63	9.82E-11	1pcmt-13.wlk	1.00E-15	30	278
64	9.60E-11	6esgt-39.wlk	1.00E-14	306	244
65	9.25E-11	2eprss09.wlk	1.00E-13	101	101
66	9.19E-11	1alcc-23.wlk	1.00E-14	15	122
67	8.90E-11	1pmloc28.wlk	1.00E-14	38	205
68	8.43E-11	2lllo-03.wlk	1.00E-15	17	207
69	8.14E-11	2lprss05.wlk	1.00E-13	62	101
70	8.02E-11	3aatw-24.wlk	1.00E-14	38	46
71	7.20E-11	1alco-31.wlk	7.66E-15	21	163
72	7.02E-11	1aslvc45.wlk	1.00E-13	63	69

Table 43A-1 (Sheet 3 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
73	6.91E-11	2ltra-09.wlk	2.13E-14	148	181
74	6.03E-11	1pprss13.wlk	1.00E-13	6	101
75	5.00E-11	6eisl-02.wlk	1.00E-14	1	1
76	4.75E-11	1pmloc13.wlk	1.00E-14	31	205
77	4.17E-11	6esgtc41.wlk	1.23E-13	8	153
78	4.09E-11	6esgtc13.wlk	1.23E-13	54	153
79	3.50E-11	1dlmf-15.wlk	4.72E-15	372	206
80	3.29E-11	1pslo-26.wlk	1.00E-15	16	314
81	3.12E-11	3aatw-48.wlk	1.00E-14	14	46
82	3.09E-11	2elmf-12.wlk	4.72E-15	414	206
83	2.84E-11	2elcc-11.wlk	1.00E-14	167	122
84	2.71E-11	6esgt-56.wlk	1.00E-14	8	244
85	2.62E-11	1aslv-45.wlk	1.00E-15	10	108
86	2.46E-11	2llca-08.wlk	1.18E-15	98	173
87	2.45E-11	1aslu-30.wlk	1.00E-15	22	67
88	2.14E-11	2llmf-08.wlk	4.72E-15	240	206
89	2.11E-11	1dlcc-12.wlk	1.00E-14	126	122
90	2.03E-11	6lsgt-08.wlk	1.00E-14	62	244
91	1.98E-11	2rmlo-23.wlk	1.00E-15	276	308
92	1.97E-11	1prcs-39.wlk	1.00E-13	11	148
93	1.96E-11	1dlml-16.wlk	1.00E-15	456	203
94	1.92E-11	2elsp-13.wlk	9.31E-14	88	72
95	1.81E-11	1alrc-17.wlk	1.00E-15	290	132
96	1.73E-11	2elml-13.wlk	1.00E-15	492	203
97	1.70E-11	2ltra-25.wlk	2.13E-14	58	181
98	1.59E-11	6esgt-26.wlk	1.00E-14	118	244
99	1.56E-11	2llsp-09.wlk	9.31E-14	31	72
100	1.44E-11	2lslvc22.wlk	1.00E-13	12	69
101	1.43E-11	1alca-31.wlk	1.18E-15	30	173
102	1.40E-11	1bsbo-44.wlk	9.31E-14	52	72
103	1.14E-11	6esgt-36.wlk	1.00E-14	192	244
104	1.14E-11	1alrc-32.wlk	1.00E-15	10	132
105	1.08E-11	1dlco-15.wlk	7.66E-15	104	163
106	9.70E-12	2llml-09.wlk	1.00E-15	272	203
107	9.38E-12	2elco-12.wlk	7.66E-15	90	163
108	9.33E-12	2elca-12.wlk	1.18E-15	392	173

Table 43A-1 (Sheet 4 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
109	9.16E-12	2rcmt-23.wlk	1.00E-15	159	278
110	9.15E-12	1dlsp-16.wlk	9.31E-14	38	72
111	8.16E-12	2lslv-22.wlk	1.00E-15	44	108
112	7.52E-12	2lslo-08.wlk	1.00E-15	380	314
113	7.47E-12	4esbo-43.wlk	9.31E-14	30	72
114	6.73E-12	2llcc-07.wlk	1.00E-14	62	122
115	6.68E-12	2llco-08.wlk	7.66E-15	100	163
116	6.55E-12	2lmlo-08.wlk	1.00E-15	366	308
117	6.54E-12	1dsld-46.wlk	1.00E-15	10	17
118	6.50E-12	1dlca-15.wlk	1.18E-15	310	173
119	5.68E-12	3aats-52.wlk	1.00E-14	10	27
120	4.37E-12	1apow-17.wlk	1.00E-15	125	86
121	4.14E-12	6esgt-35.wlk	1.00E-14	77	244
122	4.08E-12	5eslu-91.wlk	1.00E-15	10	67
123	4.08E-12	2llmf-24.wlk	4.72E-15	62	206
124	3.49E-12	1pslo-54.wlk	1.00E-15	8	314
125	3.42E-12	1dslvc29.wlk	1.00E-13	22	69
126	3.31E-12	6esgtc26.wlk	1.23E-13	6	153
127	3.12E-12	2lsil-06.wlk	1.00E-15	276	189
128	3.01E-12	2eslv-26.wlk	1.00E-15	198	108
129	2.87E-12	1apow-32.wlk	1.00E-15	15	86
130	2.52E-12	6lsgt-31.wlk	1.00E-14	68	244
131	2.52E-12	2llm1-25.wlk	1.00E-15	166	203
132	2.44E-12	3aatt-14.wlk	1.00E-14	2	19
133	2.27E-12	1prcs-54.wlk	1.00E-13	1	148
134	2.08E-12	3aats-13.wlk	1.00E-14	6	27
135	2.06E-12	1dslv-29.wlk	1.00E-15	160	108
136	1.95E-12	1alsp-17.wlk	9.31E-14	12	72
137	1.73E-12	3aats-39.wlk	1.00E-14	12	27
138	1.73E-12	1dlrc-16.wlk	1.00E-15	120	132
139	1.71E-12	2rmloc23.wlk	1.00E-14	15	205
140	1.50E-12	2elrc-13.wlk	1.00E-15	92	132
141	1.49E-12	2lrcs-08.wlk	1.00E-13	6	148
142	1.30E-12	2lcmt-08.wlk	1.00E-15	174	278
143	1.26E-12	2lslu-22.wlk	1.00E-15	20	67
144	1.17E-12	2llco-24.wlk	7.66E-15	18	163

Table 43A-1 (Sheet 5 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
145	1.14E-12	6esgtc36.wlk	1.23E-13	3	153
146	1.05E-12	2llca-24.wlk	1.18E-15	62	173
147	8.96E-13	2eslvc26.wlk	1.00E-13	8	69
148	8.49E-13	2llrc-09.wlk	1.00E-15	70	132
149	8.02E-13	1pprss54.wlk	1.00E-13	2	101
150	7.98E-13	4lsbo-39.wlk	9.31E-14	4	72
151	6.33E-13	3aats-14.wlk	1.00E-14	2	27
152	5.80E-13	1prcs-26.wlk	1.00E-13	4	148
153	5.78E-13	6esgt-25.wlk	1.00E-14	16	244
154	5.11E-13	6lsgt-18.wlk	1.00E-14	18	244
155	4.79E-13	1dlcc-22.wlk	1.00E-14	3	122
156	4.48E-13	2lsad-06.wlk	1.00E-15	95	222
157	4.29E-13	2eslu-26.wlk	1.00E-15	78	67
158	3.87E-13	1dpow-16.wlk	1.00E-15	20	86
159	3.48E-13	3dats-37.wlk	1.00E-14	9	27
160	3.36E-13	2epow-13.wlk	1.00E-15	22	86
161	3.01E-13	2lmloc08.wlk	1.00E-14	18	205
162	2.94E-13	1dslu-29.wlk	1.00E-15	54	67
163	2.74E-13	6esgt-22.wlk	1.00E-14	12	244
164	2.48E-13	2ltra-22.wlk	2.13E-14	3	181
165	2.08E-13	3aatt-25.wlk	1.00E-14	4	19
166	2.03E-13	3dlccm12.wlk	1.00E-14	12	10
167	1.94E-13	2lpow-09.wlk	1.00E-15	30	86
168	1.77E-13	1asld-31.wlk	1.00E-15	18	17
169	1.20E-13	3aatw-22.wlk	1.00E-14	6	46
170	1.08E-13	2llspm05.wlk	1.00E-14	4	9
171	8.17E-14	3datw-11.wlk	1.00E-14	4	46
172	5.94E-14	2llmf-21.wlk	4.72E-15	3	206
173	4.86E-14	5eslu-76.wlk	1.00E-15	12	67
174	4.52E-14	6esgt-51.wlk	1.00E-14	1	244
175	4.49E-14	2elccm09.wlk	1.00E-14	4	10
176	4.32E-14	3datw-12.wlk	1.00E-14	2	46
177	4.09E-14	2lpow-25.wlk	1.00E-15	3	86
178	3.71E-14	2rlca-26.wlk	1.18E-15	6	173
179	3.40E-14	2llm1-22.wlk	1.00E-15	3	203
180	1.77E-14	2lllo-06.wlk	1.00E-15	10	207

Table 43A-1 (Sheet 6 of 6)

AP1000 PRA DOMINANT CDF SEQUENCES FOR AT-POWER EVENTS

	Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
181	1.67E-14	3aatt-13.wlk	1.00E-14	1	19
182	1.64E-14	2llca-21.wlk	1.18E-15	6	173
183	1.63E-14	3dcmt-26.wlk	1.00E-15	1	278
184	1.38E-14	3aats-26.wlk	1.00E-14	1	27
185	1.24E-14	3dats-12.wlk	1.00E-14	1	27
186	1.22E-14	2rlm1-27.wlk	1.00E-15	9	203
187	9.77E-15	2lslv-40.wlk	1.00E-15	2	108
188	9.10E-15	1dlm1-30.wlk	1.00E-15	7	203
189	7.88E-15	2rslo-49.wlk	1.00E-15	3	314
190	1.11E-15	1aslv-17.wlk	1.00E-15	1	108
	2.41E-07	Sum			30337

Table 43A-2

AP1000 PRA PDS FREQUENCIES FOR AT-POWER EVENTS

Frequency	Sequence ID	Cutoff Prob	Basic Ev.	Cutsets
5.01E-09	1a.wlk	1.00E-14	2749	193
1.48E-09	1p.wlk	1.00E-14	270	86
8.06E-08	2e.wlk	1.00E-14	3294	262
2.40E-08	2l.wlk	1.00E-14	2066	241
4.63E-08	2r.wlk	1.00E-14	180	51
4.43E-09	3a.wlk	1.00E-14	188	52
1.00E-08	3c.wlk	1.00E-14	1	1
5.97E-08	3d.wlk	1.00E-14	6448	393
9.52E-09	6.wlk	1.00E-14	4147	278
2.41E-07	Sum			1557

Note:
The four 1p sequences for MLO and CMT-LB events are grouped with 3d since RCS is expected to be at least partially depressurized by the nature of the initiating event.

ATTACHMENT 43B

DP NODE PROBABILITY FOR PDS

An examination of PDS 6 core damage cutsets show that passive residual heat removal (PRHR) is available in most of the dominant cutsets. In these event sequences (cutsets), the RCS pressure will drop and the RCS loss through the break will diminish, such that operators will have a long time period (on the order of hours) to actuate the ADS, if they failed to actuate it initially. In that case, even if core damage were postulated very conservatively, the fission product release would be mostly contained, or attenuated in the water inventory of the faulted steam generator.

The following process is performed to calculate the failure of the DP node in the CET event tree for PDS 6:

1. The 6L accident sequences are removed from the calculation since ADS is successful in these sequences. What is left is labeled as 6e.* (such as 6e.in, 6e.wlk files)

2. SGTR event tree sequences 9, 35, and 36 that show up in the PDS 6 event sequence list are removed since ADS is successful. The ISLOCA contribution is also removed. The remaining sequences are subject to DP node failure. They are stored in file 6f.in and quantified to calculate their failure frequency.

3. The sequences where PRHR failed are removed from the list, leaving the following sequences in file 6sprhr.in. The removed sequences are stored in 6fprhr.in.

   6ESGT-12
   6ESGT-13
   6ESGT-39
   6ESGT-41
   6ESGTC12
   6ESGTC13
   6ESGTC36
   6ESGTC41

4. The 6sprhr sequences are quantified. The dominant cutsets are examined. Those cutsets where ADS failed due to operator action failure human error probability are deemed to be recoverable due to availability of long time periods; a screening human error probability (HEP) of 0.1 is used (1-HEP = 0.90). The calculations are shown in Table 44B-1. The cutsets are shown in their standard output format, with the first column added to collect "recoverable" frequencies.

   Recoverable frequency = (1-HEP) * failure frequency = 0.90 * failure frequency.

Result

The failure probability of the DP node is calculated to be 0.397 for PDS 6 (see Table 43B-1).

Table 43B-1 (Sheet 1 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

6spds.wlk		**Calculation of Failure Probability of DP for PDS 6**							
	6.wlk	278	4147	9.52E-09					
	6e.wlk	240	3703	7.94E-09					
	6f.wlk	222	2345	7.22E-09					
	6fprhr.wlk	89	161	4.72E-11					
	6sprhr.wlk	199	2186	7.18E-09					
	Failure Probability of DP for PDS 6			=	CDF(6f.wlk)-Recoverable Sum)/CDF(6.wlk)				
				=	3.97E-01				
Recoverable									
6.82E-10	1	7.58E-10	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	REC-MANDASC	LPM-MAN01C	
6.82E-10	2	7.58E-10	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	REC-MANDASC	ADN-MAN01C	
5.75E-10	3	6.39E-10	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01C
4.97E-10	4	5.52E-10	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01C	
	5	4.95E-10	3	IEV-SGTR	CCX-PMXMOD1-SW	REC-MANDAS			
	6	4.27E-10	3	IEV-SGTR	CCX-PMXMOD1-SW	MDAS			
	7	3.88E-10	3	IEV-SGTR	CCX-EP-SAM	REC-MANDAS			
	8	3.34E-10	3	IEV-SGTR	CCX-EP-SAM	MDAS			
1.67E-10	9	1.86E-10	5	IEV-SGTR	CIB-MAN00	REC-MANDASC	CCX-INPUT-LOGIC	ADN-MAN01C	

Table 43B-1 (Sheet 2 of 7)

CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

1.67E-10	10	1.86E-10	5	IEV-SGTR	CIB-MAN00	REC-MANDASC	CCX-INPUT-LOGIC	LPM-MAN01C	
1.01E-10	11	1.12E-10	5	IEV-SGTR	CIB-MAN00	CCX-AV-LA	REC-MANDASC	ADN-MAN01C	
8.51E-11	12	9.46E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01C
8.32E-11	13	9.24E-11	5	IEV-SGTR	CIB-MAN00	CMX-CV-GO	REC-MANDASC	ADN-MAN01C	
6.96E-11	14	7.73E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01C
	15	7.12E-11	3	IEV-SGTR	CCX-XMTR	CMX-VS-FA			
	16	5.40E-11	3	IEV-SGTR	CCX-SFTW	REC-MANDAS			
	17	4.66E-11	3	IEV-SGTR	CCX-SFTW	MDAS			
3.23E-11	18	3.59E-11	6	IEV-SGTR	CVMOD05	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01
3.04E-11	19	3.38E-11	6	IEV-SGTR	CVMOD07	ADF-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01
	20	2.45E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	ADX-EV-SA2	
	21	2.45E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	ADX-EV-SA2	
	22	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN55MOD1	
	23	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN11MOD3	
	24	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN22MOD4	
	25	1.96E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RN23MOD5	
	26	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	CCX-BY-PN	
	27	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	CCX-BY-PN	
	28	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS002TM	
	29	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS022TM	
	30	1.95E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	CCX-BY-PN	EC2BS221TM	
1.43E-11	31	1.59E-11	6	IEV-SGTR	CVMOD05	ADF-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01
1.36E-11	32	1.51E-11	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC	ADN-MAN01
1.35E-11	33	1.50E-11	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	MDAS	ADN-MAN01C	
1.35E-11	34	1.50E-11	5	IEV-SGTR	CIB-MAN00	RPX-CB-GO	MDAS	LPM-MAN01C	

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CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

1.35E-11	35	1.50E-11	6	IEV-SGTR	CVMOD07	ADF-MAN01	RPX-CB-GO	REC-MANDASC	LPM-MAN01
	36	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN55MOD1
	37	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN11MOD3
	38	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN22MOD4
	39	1.47E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RN23MOD5
	40	1.39E-11	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	CLP-UNAVAILABLE	
	41	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDS1TM	IDBBSDS1TM	
	42	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDS1TM	IDBBSDD1TM	
	43	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDD1TM	IDBBSDS1TM	
	44	1.39E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	IDDBSDD1TM	IDBBSDD1TM	
1.17E-11	45	1.30E-11	5	IEV-SGTR	CANTP011RI	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
1.14E-11	46	1.27E-11	5	IEV-SGTR	EC0MOD01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
1.13E-11	47	1.26E-11	6	IEV-SGTR	CVN-MAN00	ADF-MAN01	RPX-CB-GO	MDAS	ADN-MAN01C
	48	1.25E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS001TM	ADX-EV-SA	
	49	1.25E-11	5	OTH-SGTR	IEV-TRANS	OTH-SLSOV	EC1BS012TM	ADX-EV-SA	
1.02E-11	50	1.13E-11	7	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC ADN-MAN01
	51	1.12E-11	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA2	
	52	1.12E-11	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA2	
9.81E-12	53	1.09E-11	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	MDAS	LPM-MAN01C	
	54	1.04E-11	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	CLP-UNAVAILABLE
	55	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN55MOD1		
	56	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN11MOD3		
	57	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN22MOD4		
	58	1.01E-11	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RN23MOD5		

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CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

	59	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN55MOD1	
	60	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN11MOD3	
	61	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN22MOD4	
	62	9.95E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RN23MOD5	
	63	8.93E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	CCX-BY-PN	
	64	8.93E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	CCX-BY-PN	
6.98E-12	65	7.76E-12	5	IEV-SLB-V	OTH-SGTR	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
6.71E-12	66	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB063GO	REC-MANDASC	ADN-MAN01	
6.71E-12	67	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB061GO	REC-MANDASC	ADN-MAN01	
6.71E-12	68	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB053GO	REC-MANDASC	ADN-MAN01	
6.71E-12	69	7.46E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB051GO	REC-MANDASC	ADN-MAN01	
6.71E-12	70	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB063GO	REC-MANDASC	ADN-MAN01	
6.71E-12	71	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB061GO	REC-MANDASC	ADN-MAN01	
6.71E-12	72	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB053GO	REC-MANDASC	ADN-MAN01	
6.71E-12	73	7.46E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB051GO	REC-MANDASC	ADN-MAN01	
	74	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN55MOD1
	75	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN11MOD3
	76	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN22MOD4
	77	7.46E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	RN23MOD5
	78	7.14E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	CLP-UNAVAILABLE		
	79	7.06E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	CLP-UNAVAILABLE	
	80	6.80E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RNX-KV1-GO	
6.05E-12	81	6.72E-12	5	IEV-SGTR	EC1BS001TM	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
6.05E-12	82	6.72E-12	5	IEV-SGTR	EC1BS012TM	RPX-CB-GO	REC-MANDASC	ADN-MAN01	

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CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

6.05E-12	83	6.72E-12	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	RPX-CB-GO	REC-MANDASC	LPM-MAN01
	84	6.42E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA2	
	85	6.42E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA2	
	86	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN55MOD1		
	87	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN11MOD3		
	88	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN22MOD4		
	89	5.94E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	RN23MOD5		
5.18E-12	90	5.76E-12	5	IEV-SGTR	CANTP011RI	RPX-CB-GO	REC-MANDASC	LPM-MAN01	
5.18E-12	91	5.76E-12	5	IEV-SGTR	MSX-AV2-FA	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
	92	5.70E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA	
	93	5.70E-12	5	OTH-SGTR	IEV-LMFW	OTH-SLSOV1	EC1BS012TM	ADX-EV-SA	
5.07E-12	94	5.63E-12	5	IEV-SGTR	EC0MOD01	RPX-CB-GO	REC-MANDASC	LPM-MAN01	
	95	5.29E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA	CLP-UNAVAILABLE
4.75E-12	96	5.28E-12	6	IEV-SGTR	CVMOD05	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01
	97	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN55MOD1		
	98	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN11MOD3		
	99	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN22MOD4		
	100	5.12E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	RN23MOD5		
	101	5.12E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	CCX-BY-PN	
	102	5.12E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS012TM	CCX-BY-PN	
	103	5.10E-12	6	OTH-SGTR	IEV-LOSP	OTH-R05	OTH-SLSOV1	ADX-EV-SA2	RNX-KV1-GO
4.47E-12	104	4.97E-12	6	IEV-SGTR	CVMOD07	ADF-MAN01	CCX-AV-LA	REC-MANDASC	ADN-MAN01

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CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

3.92E-12	105	4.35E-12	6	IEV-SGTR	CVMOD05	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01
	106	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN55MOD1		
	107	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN11MOD3		
	108	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN22MOD4		
	109	4.33E-12	4	IEV-SGTR	CIB-MAN01	ADX-EV-SA2	RN23MOD5		
	110	4.21E-12	4	IEV-SGTR	CIB-MAN00	ADX-EV-SA2	CLP-UNAVAILABLE		
3.69E-12	111	4.10E-12	6	IEV-SGTR	CVMOD07	ADF-MAN01	CMX-CV-GO	REC-MANDASC	ADN-MAN01
	112	4.02E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RHN-MAN01	
	113	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS001TM	
	114	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS012TM	
	115	3.75E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	EC1BS122TM	
3.31E-12	116	3.68E-12	5	IEV-SGTR	CIB-MAN00	MDAS	CCX-INPUT-LOGIC	ADN-MAN01C	
	117	3.63E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA	CLP-UNAVAILABLE		
	118	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDS1TM	IDBBSDS1TM	
	119	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDS1TM	IDBBSDD1TM	
	120	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDD1TM	IDBBSDS1TM	
	121	3.63E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	IDDBSDD1TM	IDBBSDD1TM	
	122	3.57E-12	6	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA2	RNAMOD09	RNBMOD10
	123	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN55MOD1		
	124	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN11MOD3		
	125	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN22MOD4		
	126	3.52E-12	4	IEV-SGTR	SGBAV040LA	ADX-EV-SA2	RN23MOD5		
	127	3.50E-12	4	IEV-SLB-V	OTH-SGTR	ADX-EV-SA2	RNX-KV1-GO		
	128	3.46E-12	5	OTH-SGTR	IEV-LCOND	OTH-SLSOV1	ADX-EV-SA	RNX-KV1-GO	

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CALCULATION OF FAILURE PROBABILITY OF DP FOR PDS 6

	129	3.34E-12	4	IEV-SGTR	EC1BS001TM	OTH-SLSOV3	ADX-EV-SA2		
	130	3.34E-12	4	IEV-SGTR	EC1BS012TM	OTH-SLSOV3	ADX-EV-SA2		
3.01E-12	131	3.34E-12	5	IEV-SGTR	CIB-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
2.99E-12	132	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB063GO	REC-MANDASC	LPM-MAN01	
2.99E-12	133	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB061GO	REC-MANDASC	LPM-MAN01	
2.99E-12	134	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB053GO	REC-MANDASC	LPM-MAN01	
2.99E-12	135	3.32E-12	5	IEV-SGTR	IDBBSDS1TM	RC1CB051GO	REC-MANDASC	LPM-MAN01	
2.99E-12	136	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB063GO	REC-MANDASC	LPM-MAN01	
2.99E-12	137	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB061GO	REC-MANDASC	LPM-MAN01	
2.99E-12	138	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB053GO	REC-MANDASC	LPM-MAN01	
2.99E-12	139	3.32E-12	5	IEV-SGTR	IDBBSDD1TM	RC1CB051GO	REC-MANDASC	LPM-MAN01	
2.96E-12	140	3.29E-12	5	IEV-SGTR	DUMP-MAN01	RPX-CB-GO	REC-MANDASC	ADN-MAN01	
	141	3.27E-12	5	OTH-SGTR	IEV-LMFW1	OTH-SLSOV1	EC1BS001TM	ADX-EV-SA	
3.44E-09	Sum								

ATTACHMENT 43C

EVALUATION OF OPERATOR ACTIONS

The operator actions pertinent to the CET event tree nodes are listed in Table 43C-1. A comparison with the operator actions modeled in the AP600 PRA indicates that all but one operator action still have the same performance shaping factors and time windows except one, REN-MAN03.

The REN-MAN03 time window is estimated to be shorter for the AP1000 design since higher water levels are needed in the reactor cavity, thus a longer flooding time. To compensate for the shorter time window, the action to open valves has been moved to the first step of Emergency Response Guideline (ERG) AFR.C-1. With this revision it is estimated that the A600 HEP of 3.4E-03 for this operator action is maintained for AP1000. However, two sensitivity analyses are made to study the effect of this operator action HEP being higher, namely 3.4E-02 or 0.1. The operator action affects the IWF fault tree cutsets, and thus the probabilities q2 and q20 calculated for use in the CET. The calculations are stored in sec-44iwf folder.

The results are summarized in the following table:

REN-MAN03 HEP =	3.4E-03	3.4E-02	0.1
Q2	2.671E-09	5.088E-09	1.029E-08
Q20	2.059E-09	3.851E-09	7.712E-09
LRF	1.95E-08	2.62E-08	3.5E-08
Ceff	91.9%	89.1	85.5%

If the REN-MAN03 failure probability was two orders of magnitude higher than the base case, the plant LRF would have been doubled, which shows that the results are somewhat sensitive to this operator action.

Table 43C-1

EVALUATION OF CET-RELATED OPERATOR ACTIONS

SUMMARY OF OPERATOR ACTIONS FOR CONTAINMENT EVENT TREE NODES

Top Event	Description of Operator Error	Event ID	Cue(s)	Time Window	AP600 Tw/Ta/Stress	AP600 HEP/Cond HEP	AP1000 HEP	Comments
DP	Failure to recognize need for post-core-uncovery RCS depress during small LOCA or transient with loss of PRHR	LPM-REC01	core-exit T/C > 1200°F (ERG AFR.C-1)	30 minutes	20/15/H	1.34E-03/ 5.0E-02	1.34E-03/ 5.0E-02	
	Failure to complete ADS as recovery from failure of automatic actuation or manual actuation after core damage	ADN-REC01	core-exit T/C > 1200°F (ERG AFR.C-1)	30 minutes	5/3/H	3.02E-03/ 5.0E-02	3.02E-03/ 5.0E-02	
IS	Failure to recognize need and failure to isolate the containment, given core damage following an accident	CIC-MAN01	high containment pressure, or temperature, or radiation (ERG E-0)	50 minutes	60/30/H	5.71E-03/ N/A	5.71E-03/ N/A	
IR	Failure to recognize need and failure to open recirculation valves to flood reactor cavity after core damage	REN-MAN03	core-exit temperature > 1200°F (ERG AFR.C-1)	5 minutes	20/10/H	3.4E-03/0.15	3.4E-03/0.15	See sensitivity analyses
PC	Failure to recognize need and failure to open PCS water valves to drain cooling water on containment shell	PCN-MAN01	high containment pressure (ERG E-0)	18 hours	300/120/H	1.48E-04/ N/A	1.48E-04/ N/A	
VNT	Failure to recognize need and failure to open containment vent to reduce containment pressure	VNT-MAN01	high containment pressure (SAMG)	60 minutes	N/A		1.0	Not credited
IG	Failure to recognize need and failure to actuate hydrogen control system, given core damage following an accident	VLN-MAN01	core-exit T/C > 1200°F (ERG AFR.C-1)	15 minutes	15/10/H	1.28E-03/0.5	1.28E-03/0.5	
DP	Failure to perform ADS as recovery from failure of automatic actuation or manual actuation in later phases of SGTR event	PDS6-MANADS	Late Recovery	Hours available	0.1		0.1	Screening valve

ATTACHMENT 43D

EFFECT OF "PRE-EXISTING CONTAINMENT OPENING" ON LRF

This discussion is included in the AP1000 PRA documentation to include the effect of pre-existing containment opening on the plant LRF.

The contribution of containment isolation failure to AP1000 PRA base case LRF is captured under the accident class CI, as summarized in Table 43-8 of the AP1000 PRA. The frequency of the accident class CI is 1.33E-09/year.

Three fault trees, CIC, CID, and XCID are used in the modeling of containment failure. The system failure probabilities obtained from these fault trees are 1.77E-03, 1.77E-03, and 2.76E-03, respectively. These fault tree models do not account for the pre-existing containment opening with a failure probability of 1.2E-04. If these scenarios were to be included in the model, the system failure probability would increase by at most 7.3 percent (1.0 - (1.77E-03+1.2E-04)/1.77E-03). This increase will be used to estimate the corresponding increase in LRF.

A 7.3 percent increase in the CI accident class LRF of 1.33E-09 would raise it to 1.43E-09/year. The plant LRF would change from 1.95E-08/year to 1.96E-08/year. This change is small.

ATTACHMENT 43E

EFFECT OF CONTAINMENT AIR-COOLING FAILURE ON PLANT RISK

This attachment discusses the effect of containment air-cooling failure on plant risk given the success criteria that air cooling alone is sufficient to prevent containment failure for accidents studied in the base AP1000 PRA model.

When PCS is modeled by fault trees to be used in the at-power CDF event trees (under the event tree top event CHR), to identify and collect the late containment failure (LCF) end states for sequences, it includes only water cooling function. This function serves both as short-term and long-term (24-72 hours) cooling. The objective of introducing LCF end state was to collect those success sequences where only air cooling by PCS is sufficient to avoid core damage, and both the water cooling by PCS and normal RHR are unavailable. This collection is stored under the LCF end state with a frequency of 6.92E-08/year, which is not a CDF end state, but represents the uncertainty in the sufficiency of containment cooling solely by PCS air cooling.

Failure of air cooling is less likely than the mechanical and actuation failure modes already accounted for in the PCS water cooling fault tree models. Thus, this failure mode is not assigned a failure probability. Moreover, other supplies of water are expected to be available from the fire protection system, demineralized water system, ancillary water system, and temporary sources (fire trucks or water buffaloes) that can be brought online by the operators to avoid dependence on air only cooling.

In the context of AP1000 PRA Chapter 6, the following success criteria are in effect for containment cooling:

Containment cooling either by

1. "Water cooling mode" of PCS

   or

2. Decay heat removal mode of normal RHR

   or

3. "Air cooling mode" of PCS

is sufficient to prevent core damage during the mission time specified for CDF event trees. The probability of failure of all three of these functions for an otherwise "success" sequence is small. Thus, this containment cooling function is not queried in the CDF event trees for CDF.

If these LCF sequences were to lead to core damage, then the same sequences would also lead to a late LRF consequence. The frequency of additional late LRF (it is also CDF) introduced by failure of air cooling on top of failure of water cooling and normal RHR

cooling (for otherwise success end states) is estimated below for different values of air-cooling reliability.

The table below shows the relation between assuming different values for air-cooling failure probability, and the resulting increase in plant CDF/LRF:

Air-Cooling Failure Probability	Current LCF with Air-Cooling Success	Increase in LRF (also CDF) if LCF and Failure of Air Cooling Occurs	Comparative Increase in Base LRF	Risk Significance
0.0001	6.92E-08	6.92E-12	Very Small	Insignificant
0.001	6.92E-08	6.92E-11	Very Small	Insignificant
0.01	6.92E-08	6.92E-10	3.5%	Insignificant

From this table, it is shown that with any reasonable value for the air-cooling failure probability, the increase in LRF is not risk significant, and the increase of CDF is even less significant.

CHAPTER 45

FISSION-PRODUCT SOURCE TERMS

This chapter discusses the fission-product source terms that are used in the offsite dose analysis (Chapter 49) for each of the release categories, or end states, of the containment event tree, as discussed in Chapter 35. The source terms are taken from the MAAP4 analyses results presented in Chapter 34. They are used as the input to the offsite dose analysis presented in Chapter 49.

45.1 Summary of AP1000 Release Categories

The release categories group similar fission-product source terms from the Level 2 analysis to bound the offsite consequences and reduce the number of sequences to be analyzed. The AP1000 prevents large releases with design features of the containment that provide redundant, diverse mitigation of challenging phenomena in the unlikely event of a severe accident. These features include the reactor coolant automatic depressurization system (ADS), the ability to flood the reactor vessel cavity, hydrogen igniters in the large dry containment, and the passive containment cooling system (PCS). The design features act to maintain reactor coolant system (RCS) integrity, prevent containment overpressurization from hydrogen detonation or deflagration, and remove heat from the containment. The mitigation features maintain the potential for fission-product release from the AP1000 containment very low.

Given a severe accident, a release of fission products occurs through normal containment leakage, a breach of the containment or a bypass of the containment.

A large pre-existing opening, or containment isolation failure, produces containment leakage beyond the design basis. The failure of a large purge line isolation valve is assumed for containment isolation failure.

A breach of the containment shell is assumed to occur based on the containment pressure and the conditional containment failure probability discussed in Chapter 42. The containment is also assumed to fail if hydrogen detonation occurs.

Containment bypass in the AP1000 is typically caused by steam generator tube rupture initiated events that progress to severe accident or by steam generator tube ruptures induced by high pressure and temperature core damage events.

The containment release categories are described in Section 35.6. For each of these categories, the release fractions are determined over a 72-hour period following the onset of core damage. For all containment failure release categories, the release is assumed to be directly from the containment to the environment at ground level. For the intact containment (IC) category, a decontamination factor (DF) of three is applied (Reference 45-2) due to deposition in the auxiliary building.

For each of the release categories, a representative source term is used to complete the Level 3 analysis. This representative source term was identified as the bounding release for the accident sequences in the specific release category.

The release fractions at 24 and 72 hours for each fission-product group are presented in Tables 45-1 and 45-2, respectively.

45.2 Release Category Source Terms

45.2.1 Release Category IC

Release Category IC represents the release of fission products from an intact containment during a severe accident. Normal containment leakage accounts for the fission-product releases to the environment. The likely normal leakage release pathway is via containment penetration leakage into the auxiliary building.

The fission product release fractions from an accident class 3BE sequence with cavity flooding, hydrogen control, and passive containment cooling are used to represent the IC release. A decontamination factor of 3 is applied to the aerosol-release fractions to model deposition in the auxiliary building. A direct release sensitivity analysis to the decontamination factor is discussed in section 45.3.

The source term releases for Release Category IC are presented in Figures 45-1 through 45-12.

45.2.2 Release Category BP

Release category BP represents containment bypass releases to the environment. Fission products are released from the reactor coolant system via failed steam generator tubes to the secondary system and to the environment through a stuck-open safety valve. Release category BP contributes to the large, early release frequency (LERF) of the AP1000. The fission product release fractions from a steam generator tube initiated core damage sequence in accident class 1A are used to represent the BP release.

The source term releases for Release Category BP are presented in Figures 45-13 through 45-24.

45.2.3 Release Category CI

Release category CI represents fission product releases to the environment from an unisolated containment. Fission products are released from the reactor coolant system to the containment; however, the containment is not isolated from the environment from the beginning of the accident. Release category CI contributes to the LERF of the AP1000.

The fission product release fractions from an accident class 3C sequence with the failure of containment isolation are used to represent the CI release category.

The source term releases for Release Category CI are presented in Figures 45-25 through 45-36.

45.2.4 Release Category CFE

Release category CFE represents fission product releases to the environment from containment failure induced by severe accident phenomena that may occur during the core melting and

relocation phase of the accident sequence. Fission products are released from the reactor coolant system to the containment. Before significant deposition of the aerosol fission products, the containment fails due to a high-energy event (i.e. hydrogen combustion or steam explosion). Release category CFE contributes to the LERF of the AP1000.

The fission product release fractions from an accident class 3D sequence with early containment failure induced by hydrogen detonation were used to represent release category CFE.

The source term releases for Release Category CFE are presented in Figures 45-37 through 45-48.

45.2.5 Release Category CFI

Release category CFI represents fission product releases to the environment from containment failure that may occur after the melting and relocation phenomena and within 24 hours after the onset of core damage. Fission products are released from the reactor coolant system to the containment. The containment atmosphere is well-mixed and significant aerosol deposition has begun when the containment fails due to severe accident phenomena (i.e. hydrogen combustion or long-term containment pressurization from decay heat). Release category CFI contributes to the large release frequency of the AP1000, but is not an early release contributing to LERF.

The fission product release fractions from an accident class 3BE sequence with intermediate containment failure induced by hydrogen detonation were used to represent release category CFI.

The source term releases for Release Category CFI are presented in Figures 45-49 through 45-60.

45.2.6 Release Category CFL

Release category CFL represents fission product releases to the environment from containment failure that may occur after 24 hours. Fission products are released from the reactor coolant system to the containment. The containment atmosphere is pressurized with steam from decay heat. Significant aerosol deposition occurs over the long term of the accident. Containment fails from overpressure due to loss of containment cooling. Release category CFL contributes to large release frequency, but is not an early release contributing to LERF.

The fission product releases from an accident class 3BE sequence and containment failure induced by long-term containment pressurization is used to represent release category CFL.

The source term releases for Release Category CFL are presented in Figures 45-61 through 45-72.

45.2.7 Release Category CFV

Release category CFV represents fission product releases to the environment from containment venting, which occurs after 24 hours. Fission products are released to the containment. The

containment atmosphere is pressurized with steam from decay heat. Significant aerosol deposition occurs over the long term of the accident. The operator vents the containment at a pressure well below the failure pressure of the containment. No filtering is assumed. Release category CFV contributes to large release frequency, but is not an early release contributing to LERF.

Release category CFV did not exist for the AP600 PRA (Reference 45-1). The failure frequency for successful operator venting in the containment event tree analysis is unity. Therefore, the frequency of CFV in the AP1000 PRA is zero occurrences per reactor year. No source term is calculated for this release category.

45.3 Direct-Release Sensitivity Case

For release category IC, the leakage from the containment is assumed to pass through the middle annulus of the auxiliary building. This room has restricted leakage to the environment. Thus, the fission products have long residence times. Significant deposition occurs in the middle annulus, attenuating the release of fission products to the environment. A decontamination factor of three is credited for the aerosol fission products because of this deposition.

To account for uncertainty in the probability of the fission products bypassing the middle annulus decontamination effect, the release is assumed, in the IC direct-release sensitivity case, to be released directly to the environment at the design leak rate.

The source term releases for the Direct Release Sensitivity Case are presented in Figures 45-73 through 45-84.

45.4 Summary

The AP1000 release categories and associated source terms over the first 24 and 72 hours after core damage are summarized in Tables 45-1 and 45-2, respectively.

A fission-product release source term (direct) is also developed to address the sensitivity assuming that the IC source term from the containment is released directly to the environment with no holdup or decontamination in the auxiliary building. The sensitivity release fractions also represent source terms for consequence analysis, as discussed in Chapter 49.

45.5 References

45-1 GW-GL-022, AP600 Probabilistic Risk Assessment, August 1998.

45-2 EPRI Letter to James Wilson, USNRC, dated April 30, 1993, attachment titled, "Passive ALWR Secondary Building Mixing and Leak Rate Monitoring."

Table 45-1

ENVIRONMENTAL RELEASE FRACTIONS AT 24 HOURS AFTER CORE DAMAGE PER RELEASE CATEGORY

Release Cat.	Environmental Release Fractions at 24 Hours After Core Damage											
	Xe, Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2
IC	1.0E-3	1.2E-5	9.5E-6	1.1E-5	1.3E-5	1.1E-5	1.2E-5	1.3E-6	1.5E-6	1.3E-5	0.0E0	0.0E0
BP	1.0E-0	3.2E-1	2.5E-1	3.6E-3	4.5E-2	2.1E-1	8.9E-3	1.3E-4	8.0E-4	2.2E-1	0.0E0	0.0E0
CI	6.4E-1	4.6E-2	2.1E-2	2.0E-2	4.0E-2	1.8E-2	3.2E-2	2.4E-4	7.4E-4	2.7E-2	0.0E0	0.0E0
CFE	8.1E-1	5.7E-2	3.2E-2	3.5E-3	1.4E-2	5.5E-2	5.3E-3	6.5E-5	2.5E-4	2.3E-2	0.0E0	0.0E0
CFI	8.0E-1	3.3E-3	5.0E-3	2.2E-2	9.3E-3	3.3E-3	1.7E-2	8.3E-3	1.1E-2	7.2E-3	0.0E0	0.0E0
CFL	1.3E-3	1.2E-5	8.5E-6	1.7E-5	1.7E-5	1.1E-5	1.7E-5	8.5E-6	9.0E-6	1.7E-5	0.0E0	0.0E0
DIRECT	3.0E-3	3.6E-5	2.9E-5	3.3E-5	3.9E-5	3.3E-5	2.8E-5	3.9E-6	4.5E-6	3.9E-5	0.0E0	0.0E0

Table 45-2

ENVIRONMENTAL RELEASE FRACTIONS AT 72 HOURS AFTER CORE DAMAGE PER RELEASE CATEGORY

Release Cat.	Environmental Release Fractions at 72 Hours After Core Damage											
	Xe, Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2
IC	2.6E-3	1.2E-5	9.5E-6	1.1E-5	1.3E-5	1.1E-5	1.2E-5	1.4E-6	1.5E-6	1.3E-5	0.0E0	0.0E0
BP	1.0E-0	4.5E-1	2.6E-1	3.6E-3	4.5E-2	2.5E-1	8.9E-3	1.3E-4	8.0E-4	2.7E-1	0.0E0	0.0E0
CI	7.8E-1	4.6E-2	2.1E-2	2.0E-2	4.0E-2	1.8E-2	2.2E-2	2.4E-4	7.4E-4	2.9E-2	0.0E0	0.0E0
CFE	9.6E-1	5.7E-2	3.2E-2	3.5E-3	1.4E-2	5.5E-2	5.3E-3	6.5E-5	2.5E-4	2.3E-2	0.0E0	0.0E0
CFI	9.2E-1	3.3E-3	5.0E-3	2.2E-2	9.3E-3	3.3E-3	1.7E-2	1.9E-2	2.1E-2	7.3E-3	0.0E0	0.0E0
CFL	9.8E-1	3.3E-5	8.6E-6	2.8E-3	1.4E-3	2.2E-5	2.6E-3	1.4E-1	1.3E-1	6.2E-4	0.0E0	0.0E0
DIRECT	7.8E-3	3.6E-5	2.9E-5	3.3E-5	3.9E-5	3.3E-5	3.6E-5	4.2E-6	4.5E-6	3.9E-5	0.0E0	0.0E0

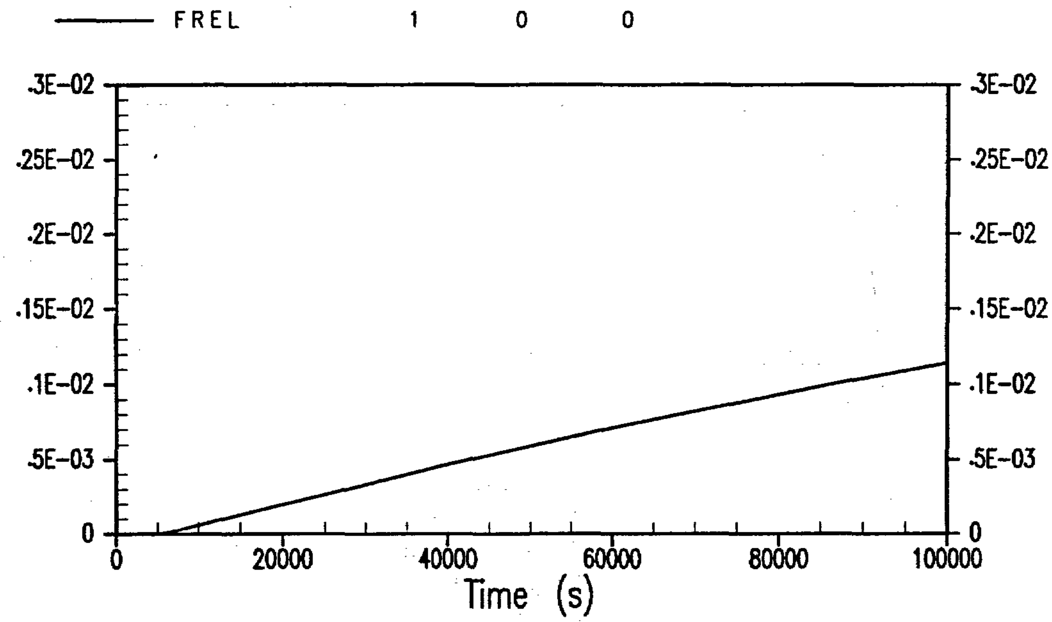

Figure 45-1

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Noble Gases

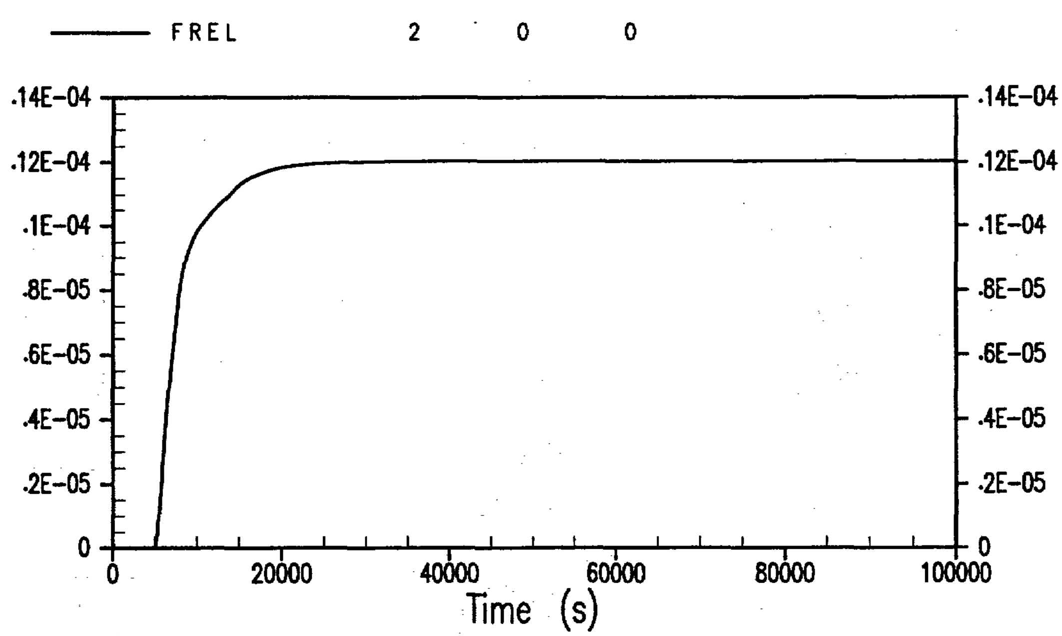

Figure 45-2

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Iodide

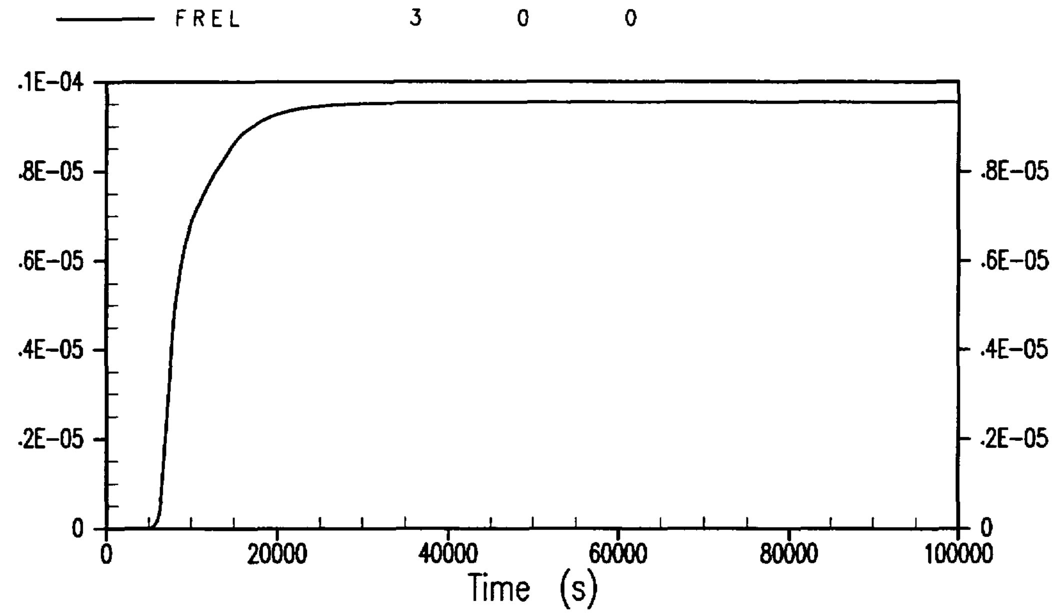

Figure 45-3

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium Dioxide

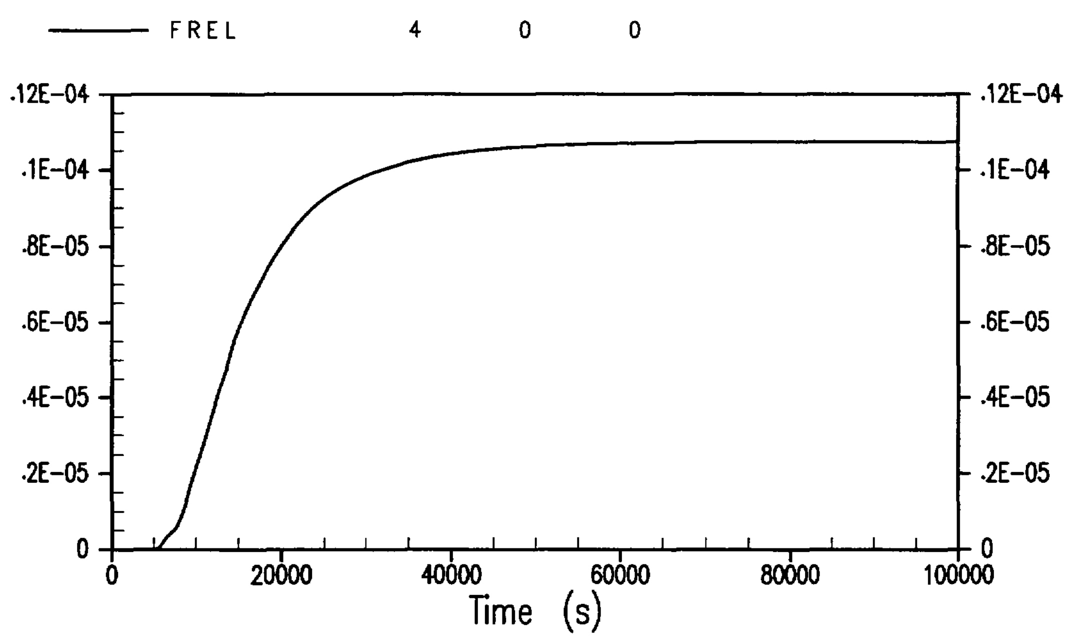

Figure 45-4

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Strontium Oxide

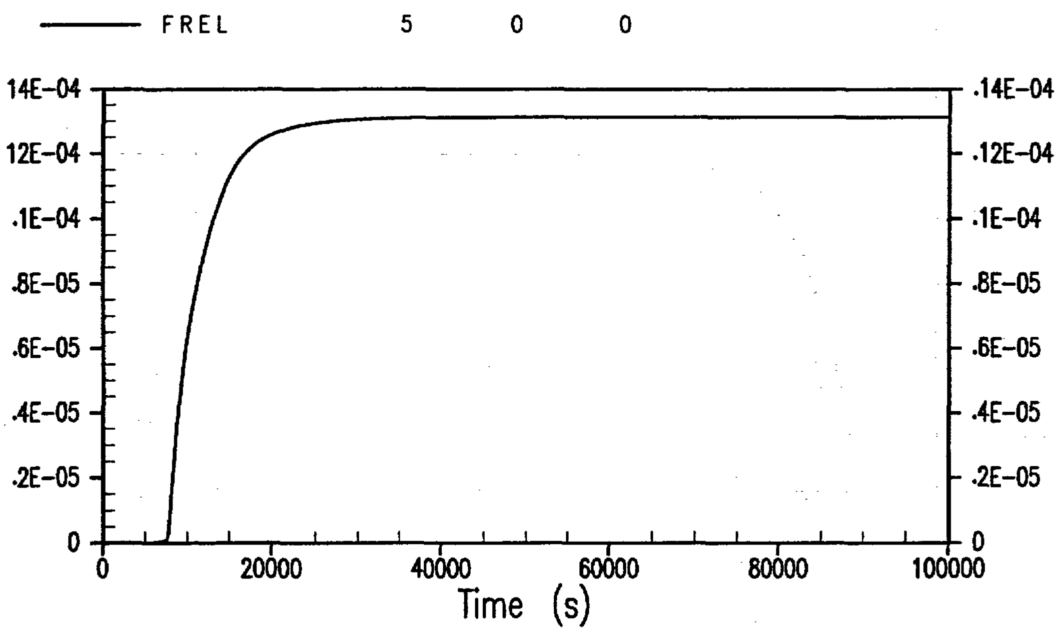

Figure 45-5

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Molybdenum Dioxide

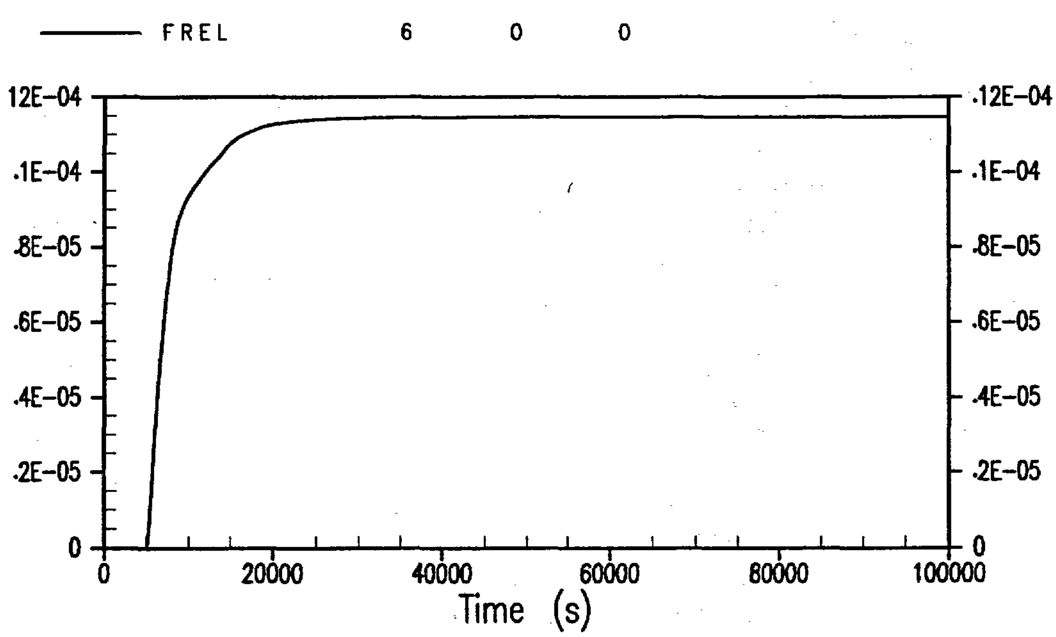

Figure 45-6

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Hydroxide

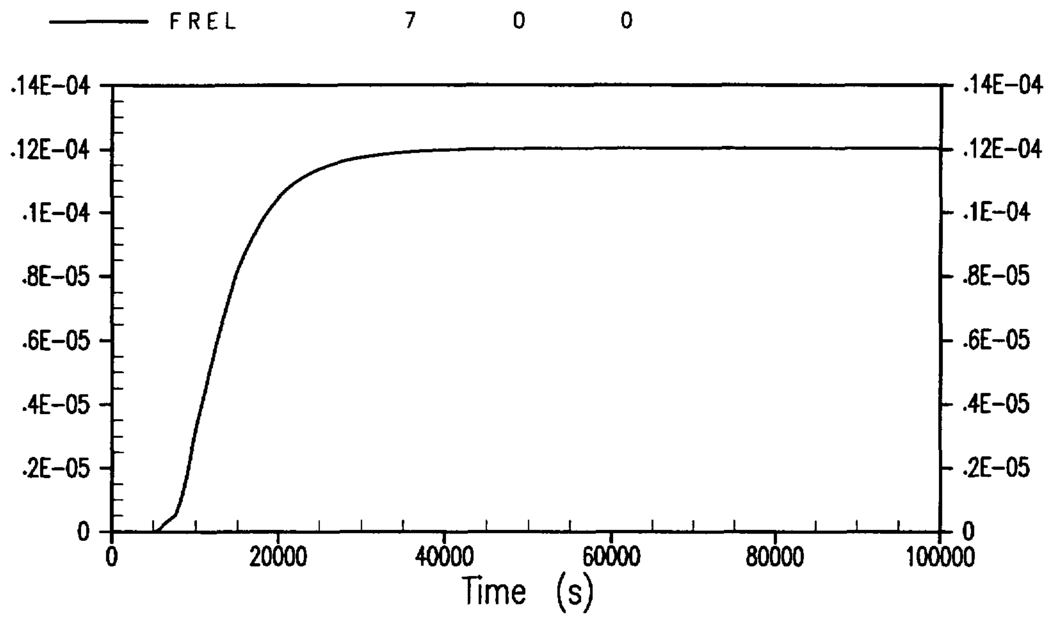

Figure 45-7

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Barium Oxide

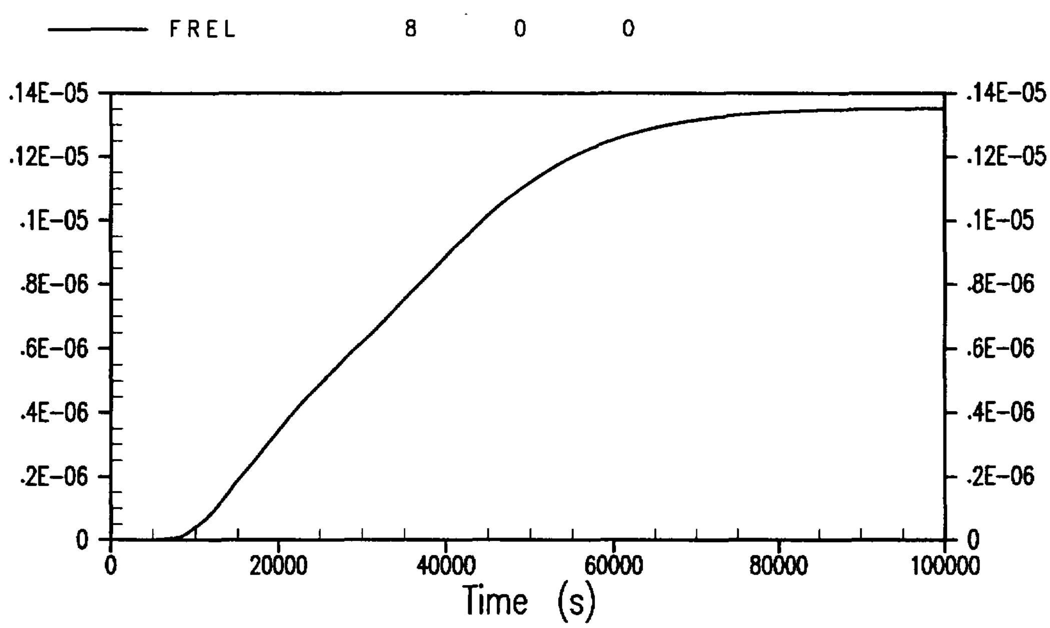

Figure 45-8

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Dilanthanum Trioxide

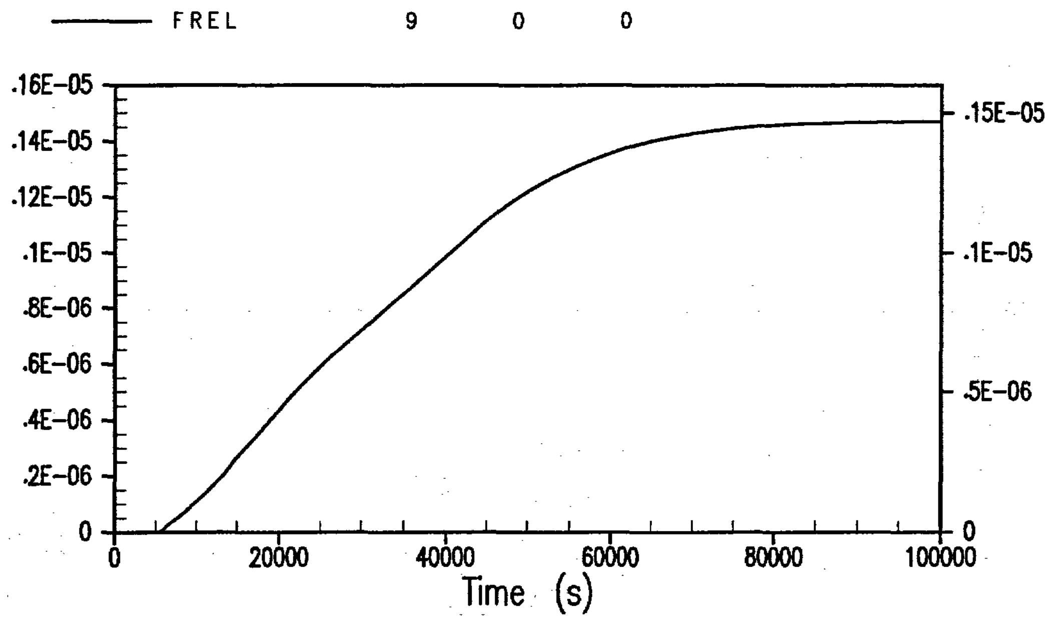

Figure 45-9

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Cerium Dioxide

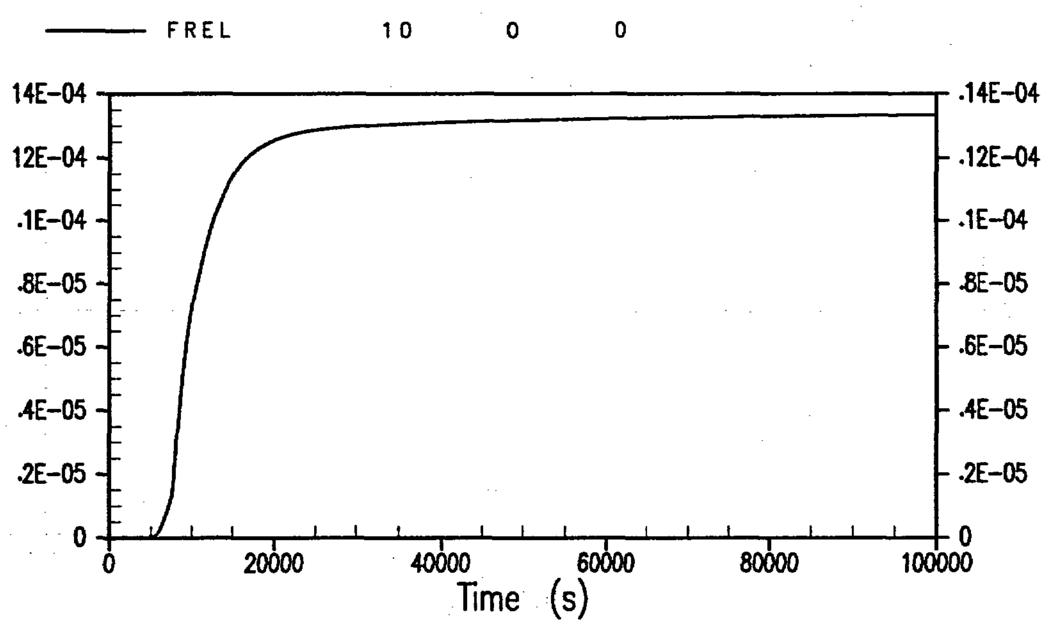

Figure 45-10

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tin

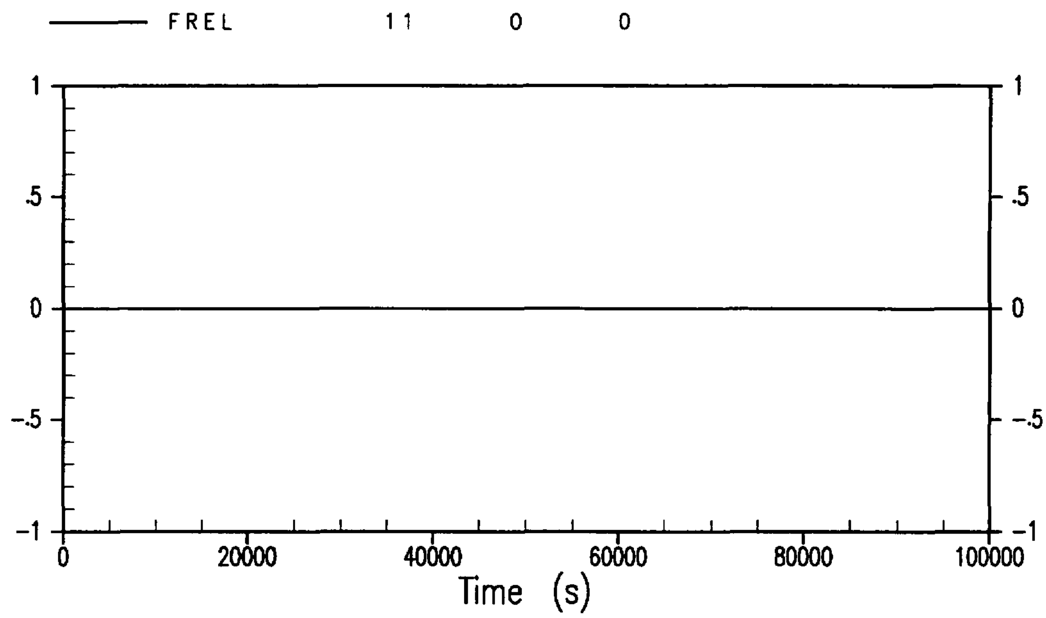

Figure 45-11

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium

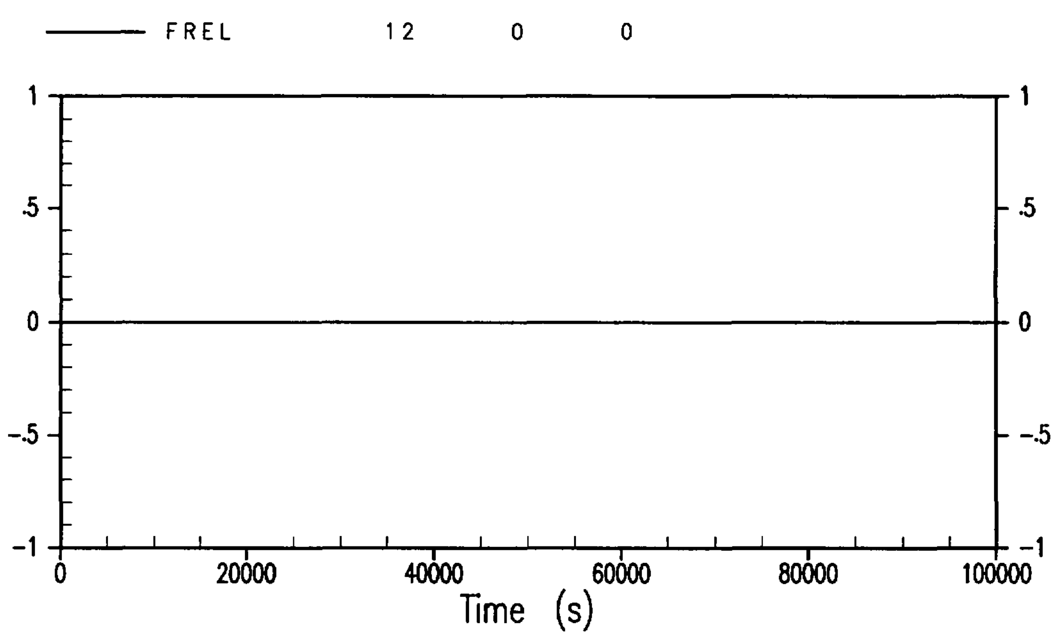

Figure 45-12

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection: Release Fraction of Uranium Dioxide

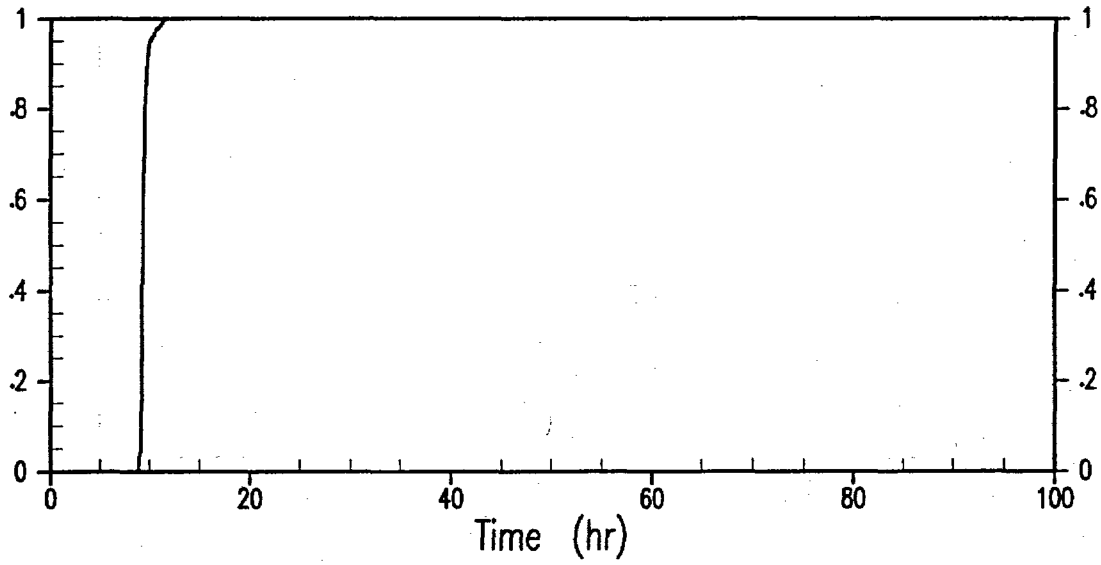

Figure 45-13

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Noble Gases

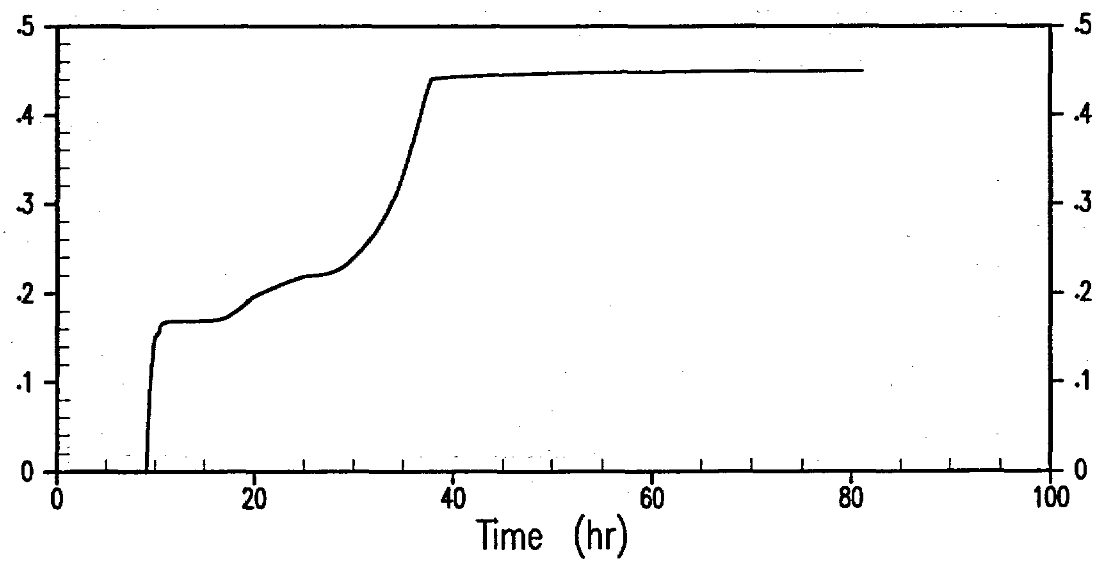

Figure 45-14

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Cesium Iodide

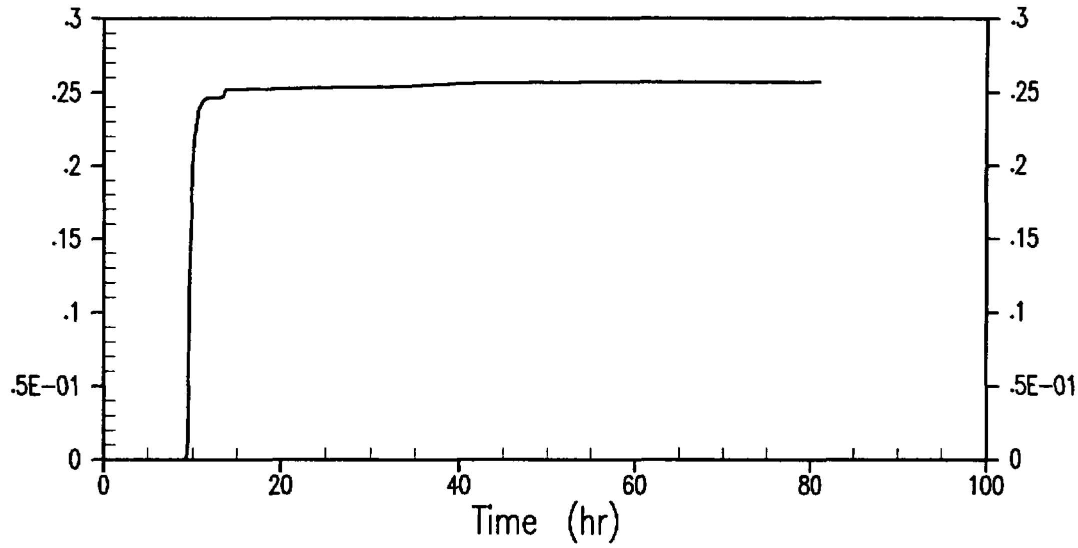

Figure 45-15

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Tellurium Dioxide

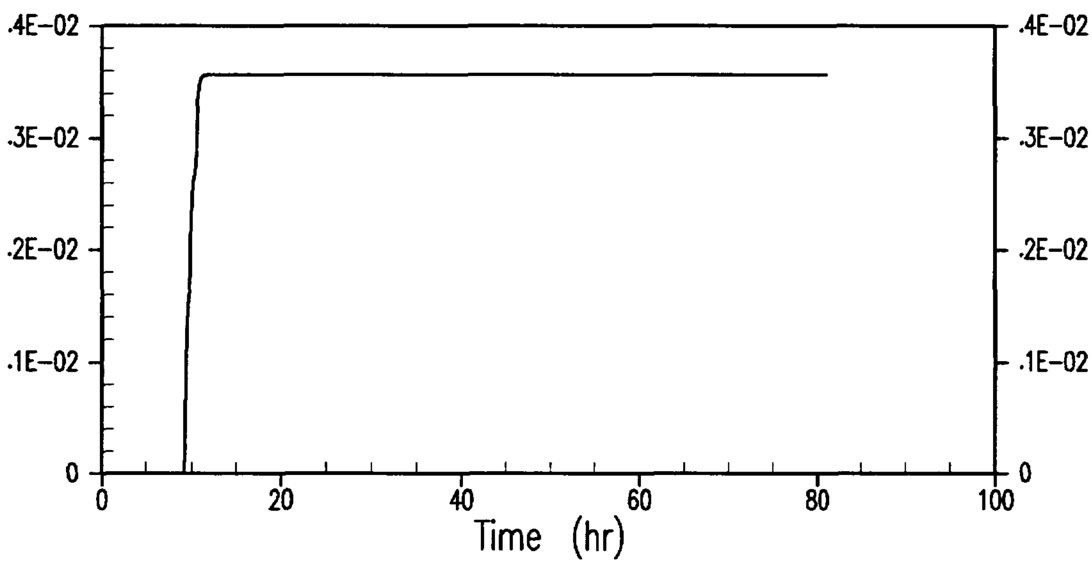

Figure 45-16

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Strontium Oxide

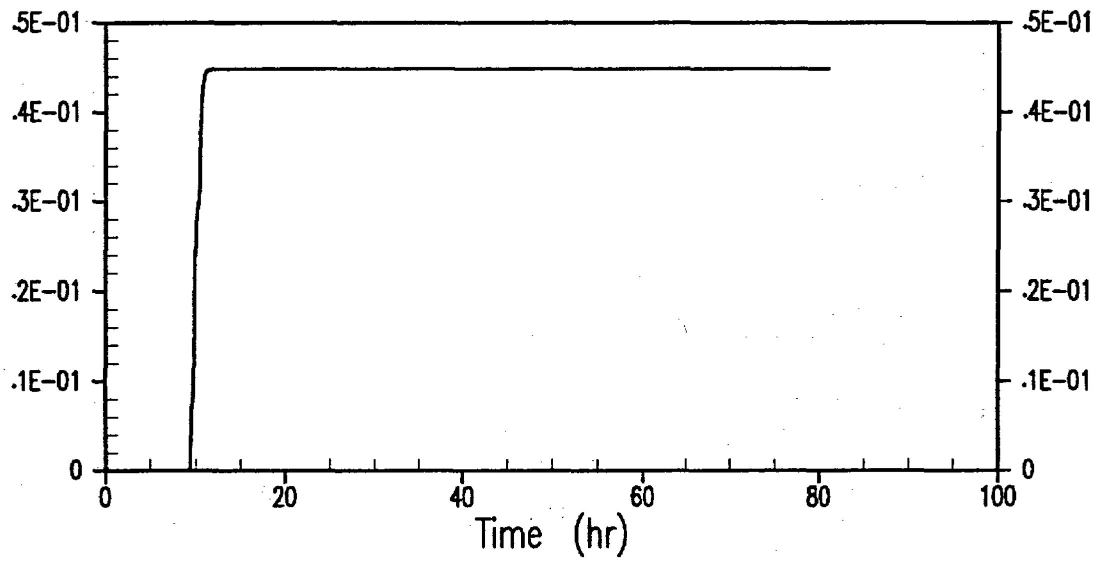

Figure 45-17

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Molybdenum Dioxide

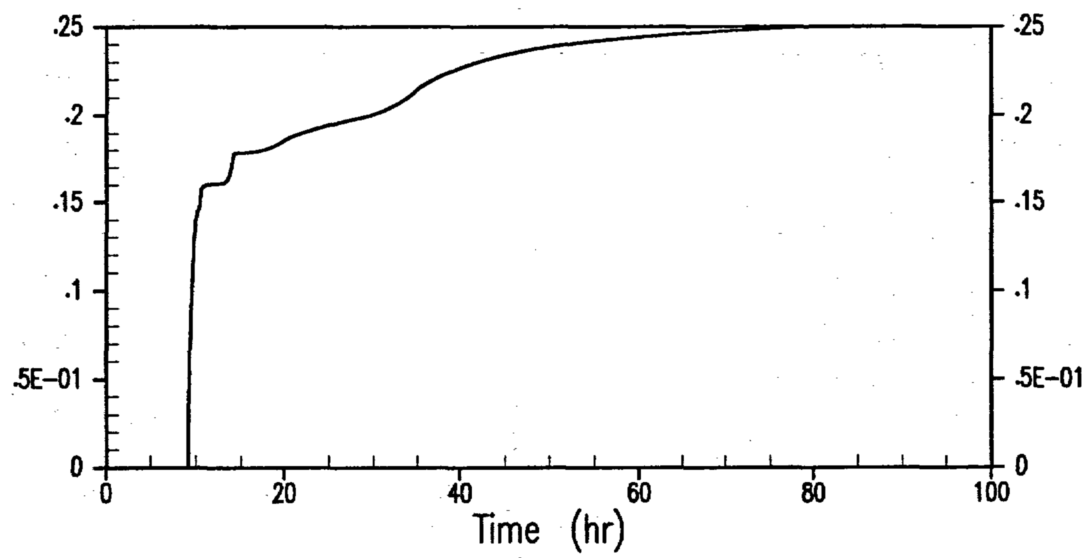

Figure 45-18

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Cesium Hydroxide

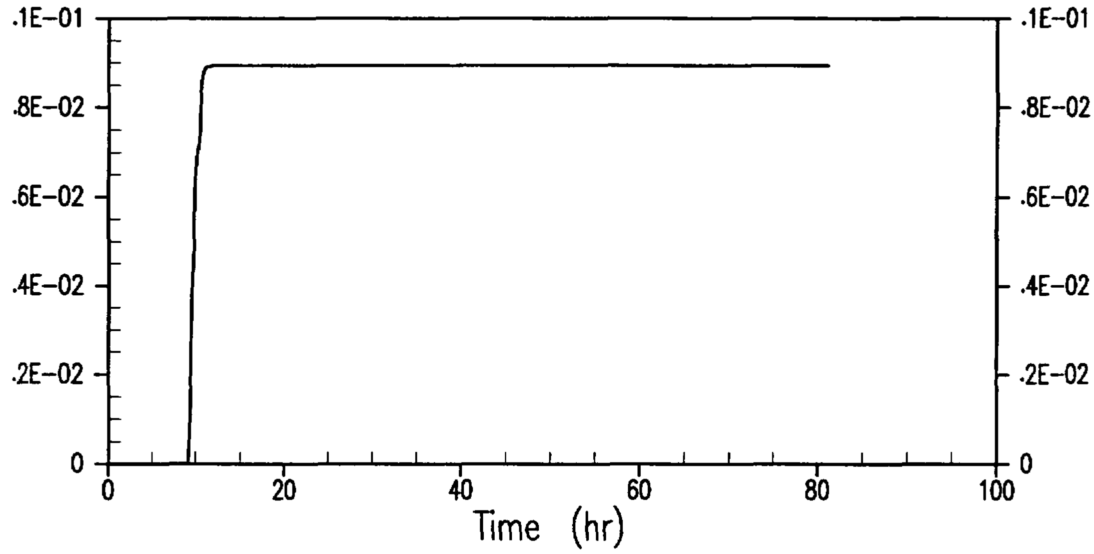

Figure 45-19

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Barium Oxide

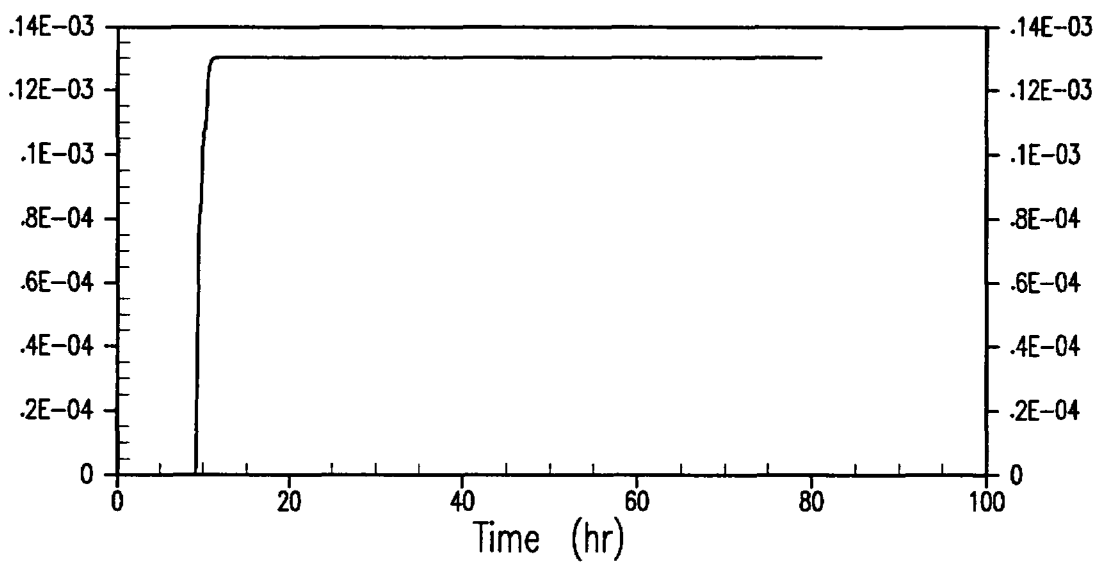

Figure 45-20

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Dilanthanum Trioxide

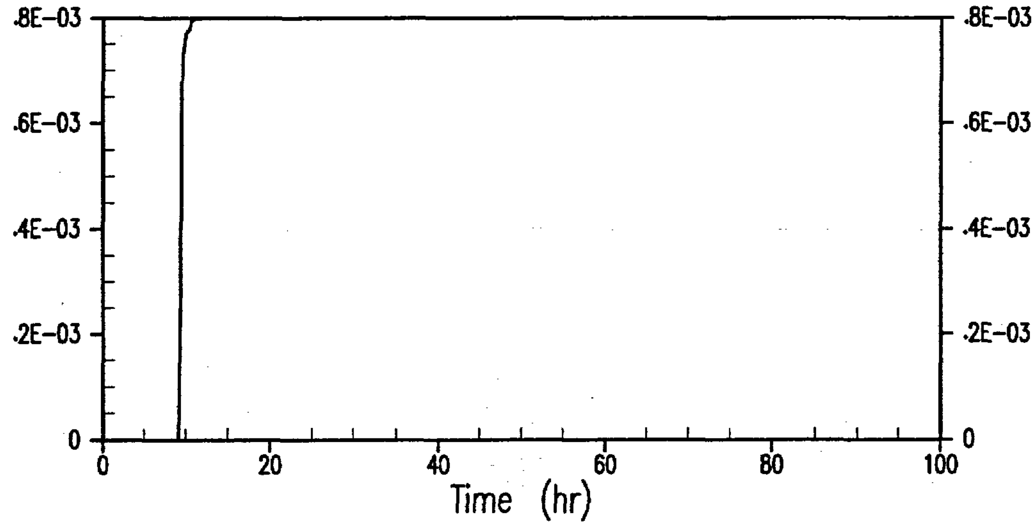

Figure 45-21

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Cerium Dioxide

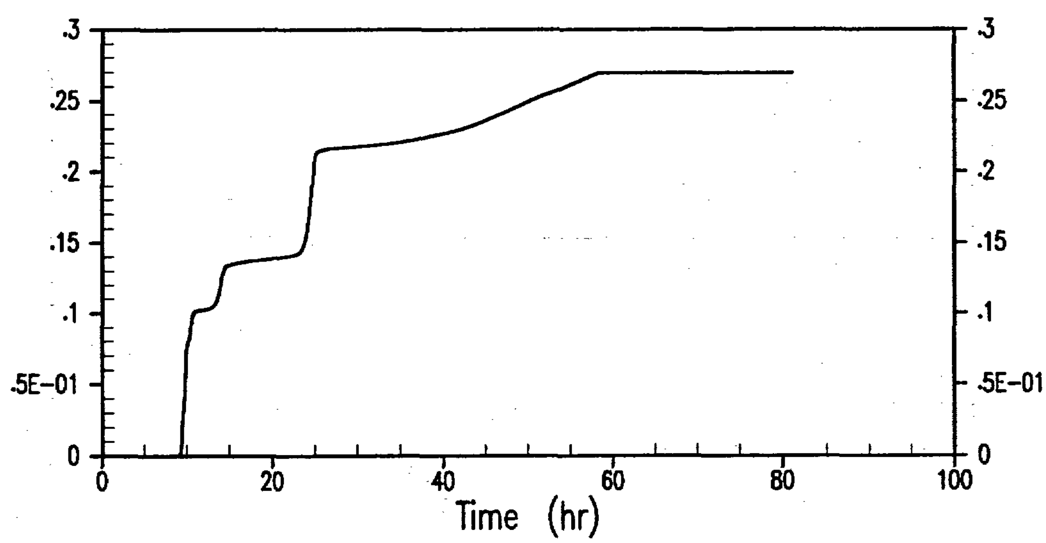

Figure 45-22

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Tin

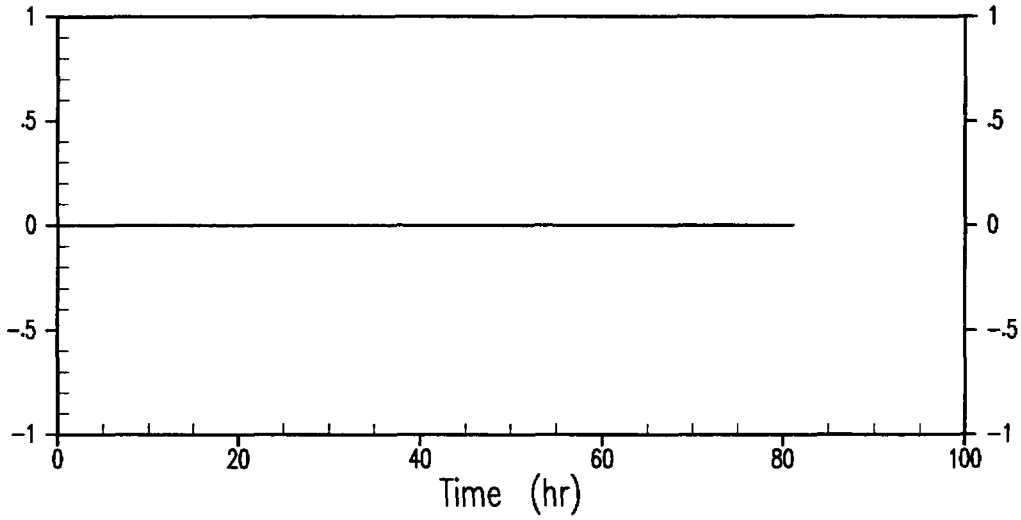

Figure 45-23

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Tellurium

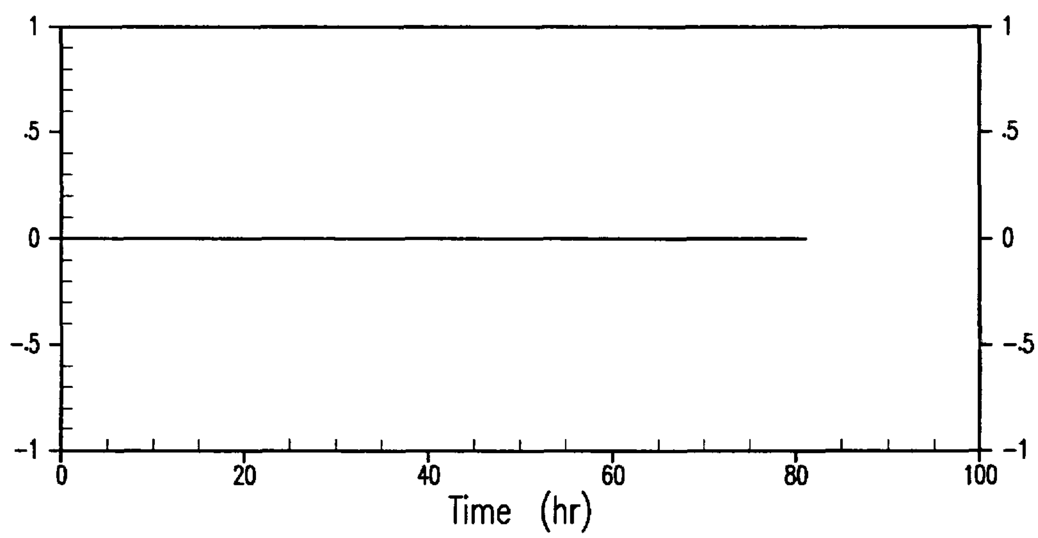

Figure 45-24

Release Category BP, Case 6E-1 – SGTR with Stuck Open SG Safety Valve: Release Fraction of Uranium Dioxide

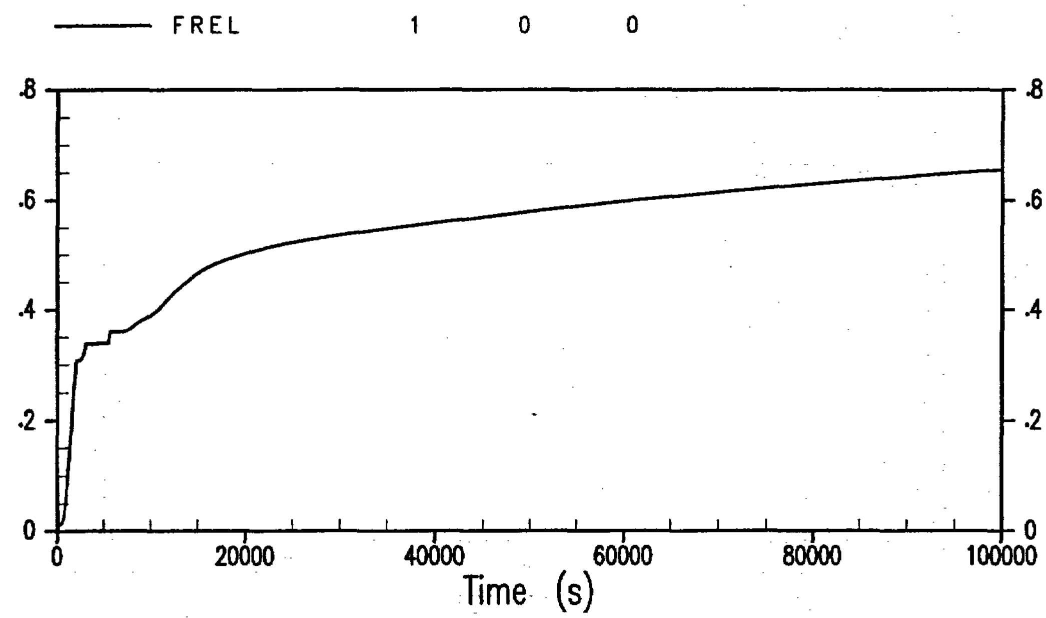

Figure 45-25

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Noble Gases

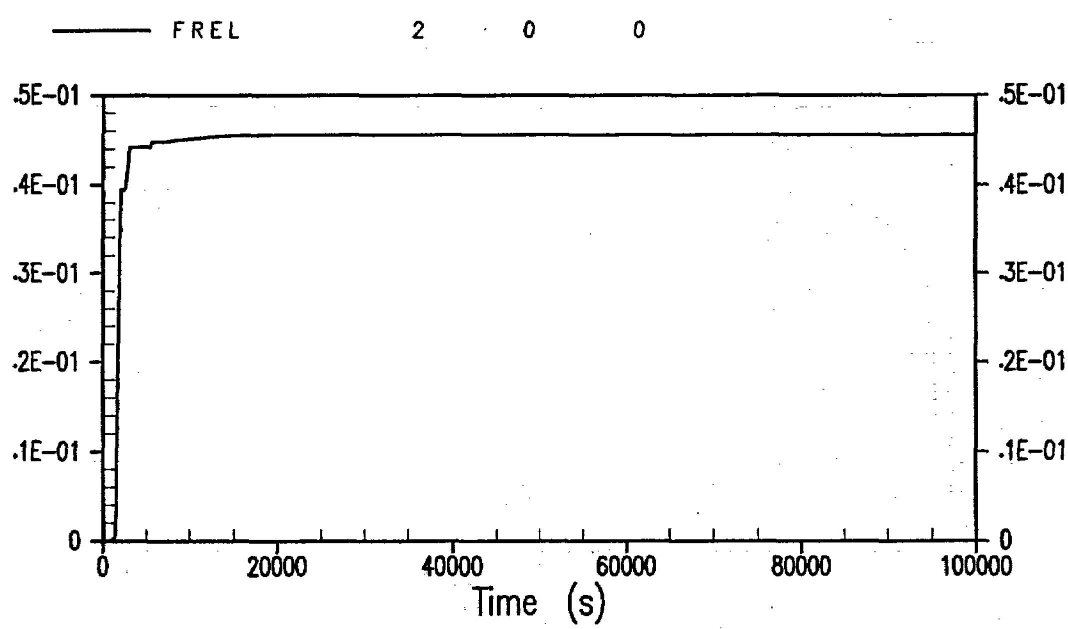

Figure 45-26

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cesium Iodide

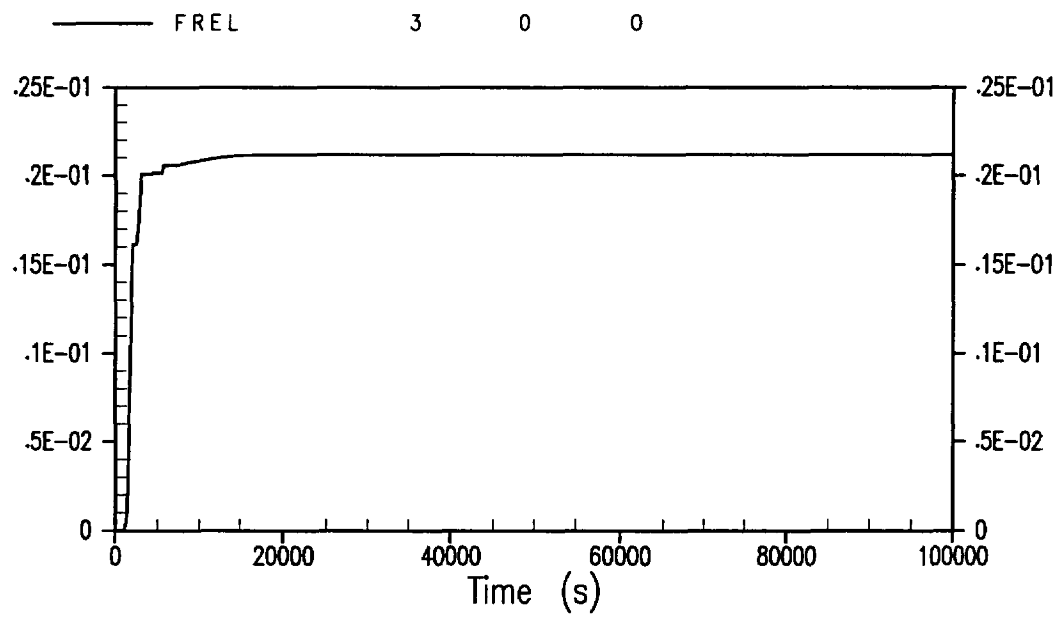

Figure 45-27

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tellurium Dioxide

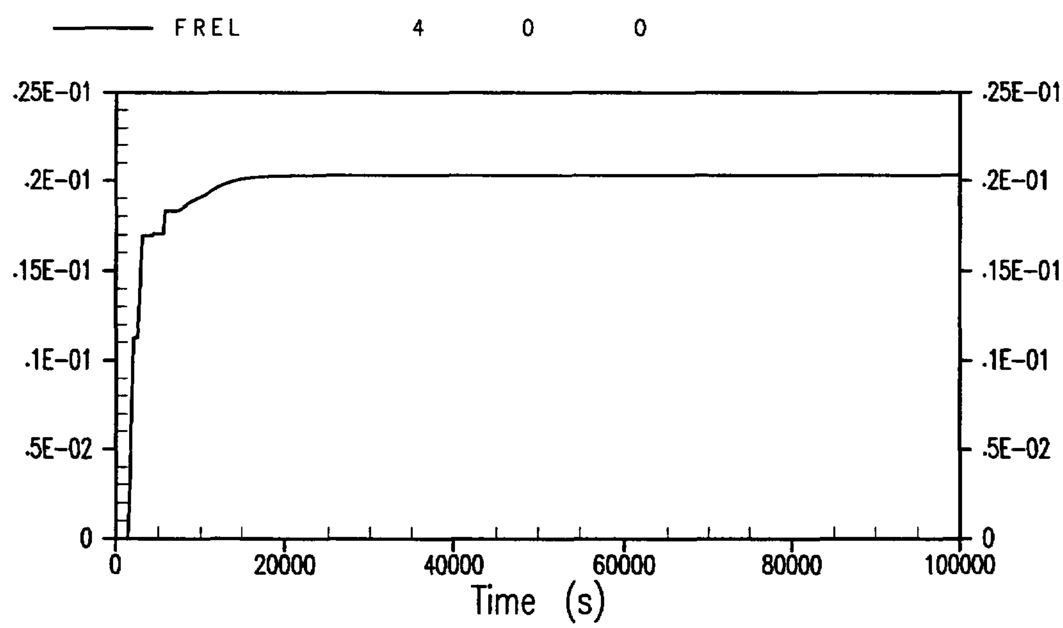

Figure 45-28

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Strontium Oxide

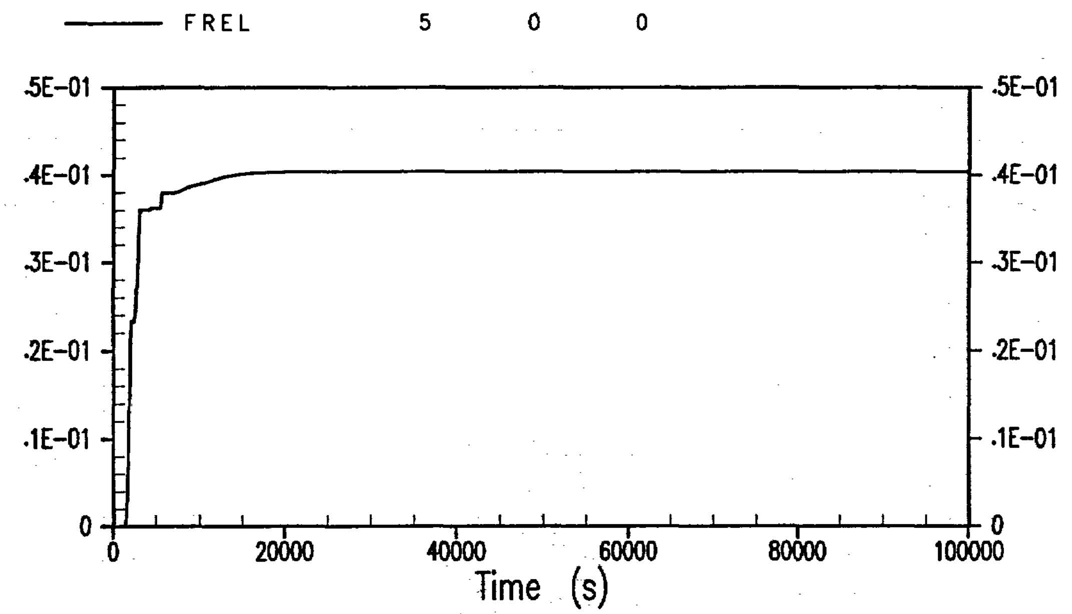

Figure 45-29

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Molybdenum Dioxide

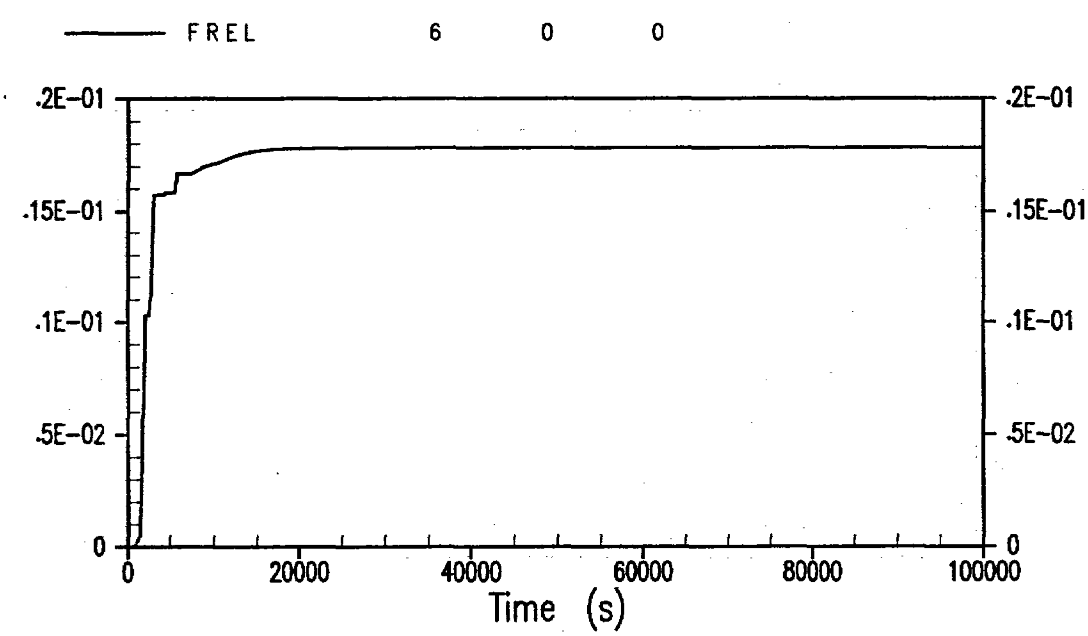

Figure 45-30

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cesium Hydroxide

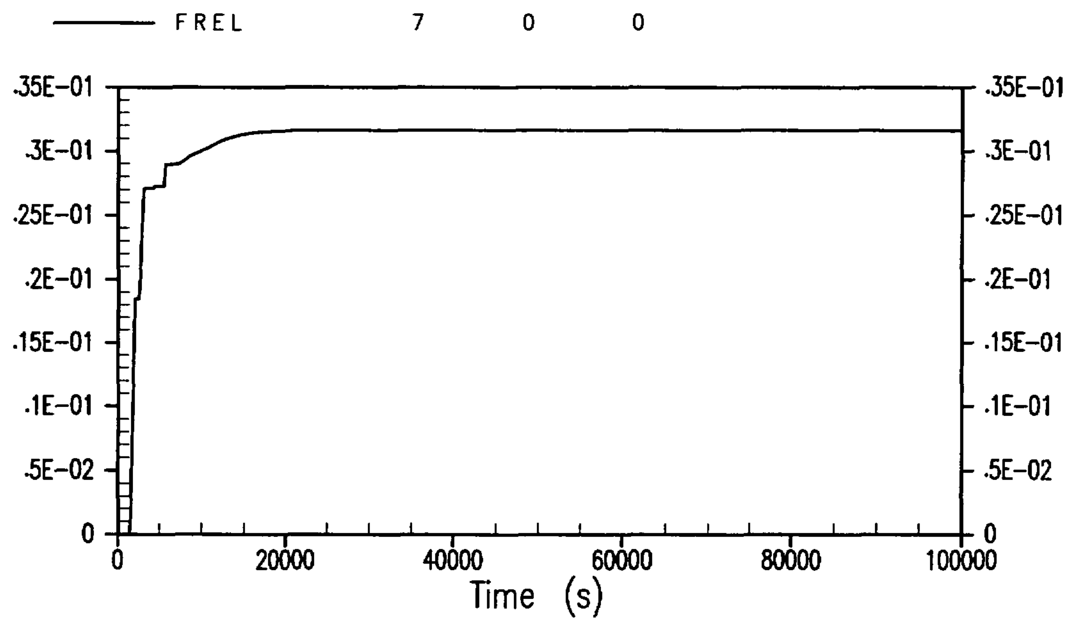

Figure 45-31

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Barium Oxide

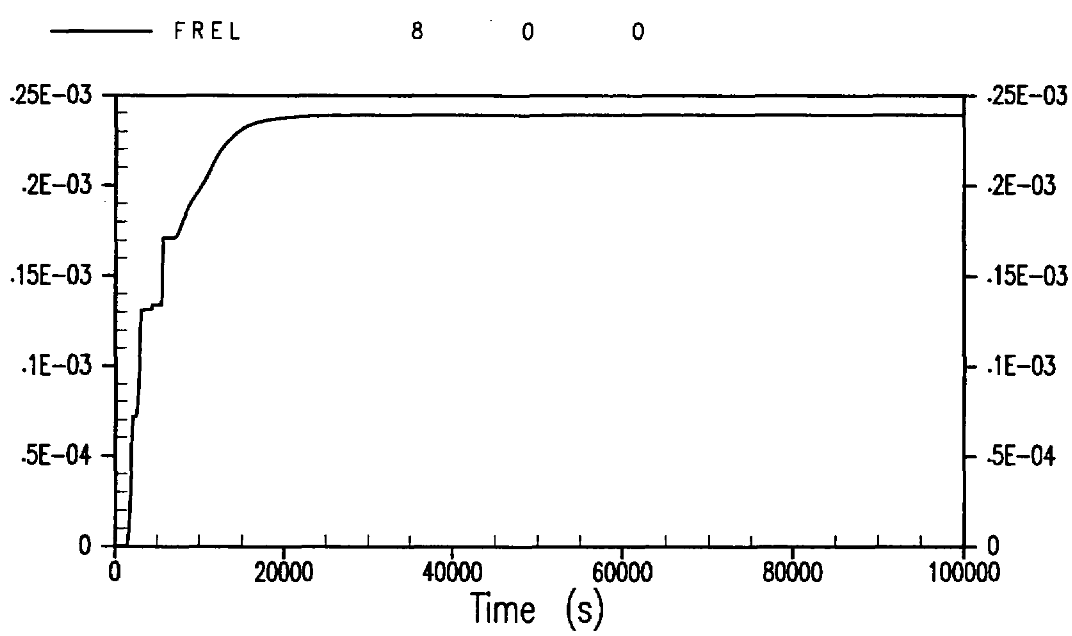

Figure 45-32

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Dilanthanum Trioxide

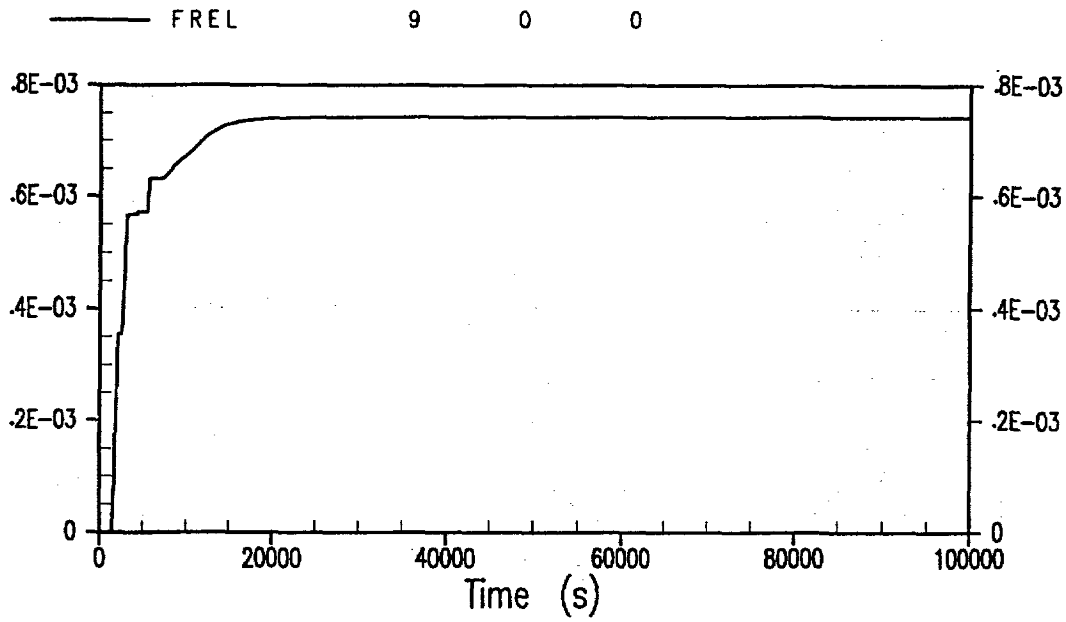

Figure 45-33

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Cerium Dioxide

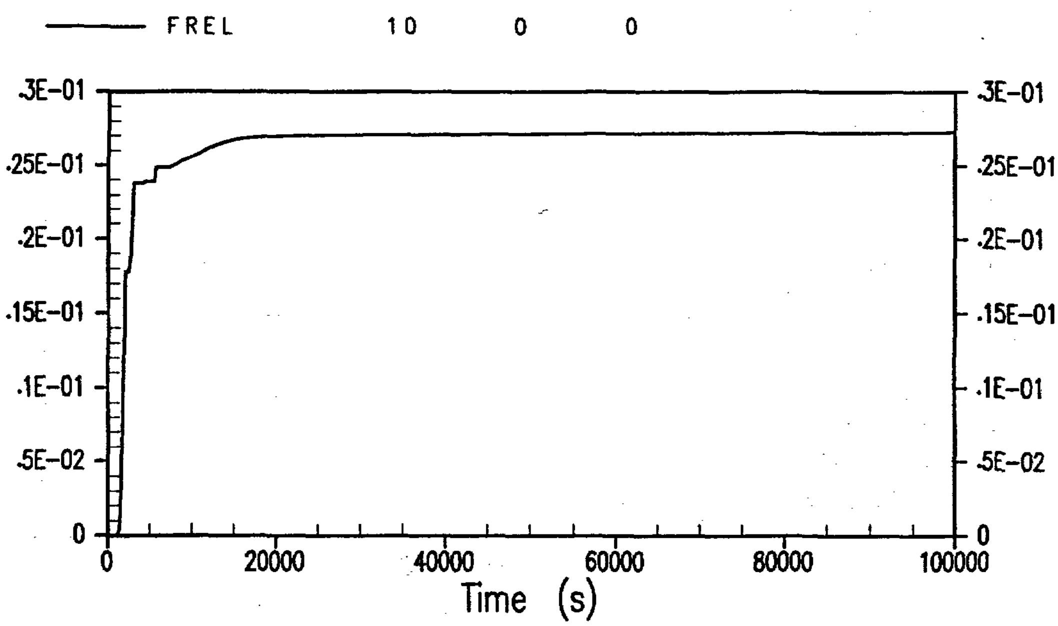

Figure 45-34

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tin

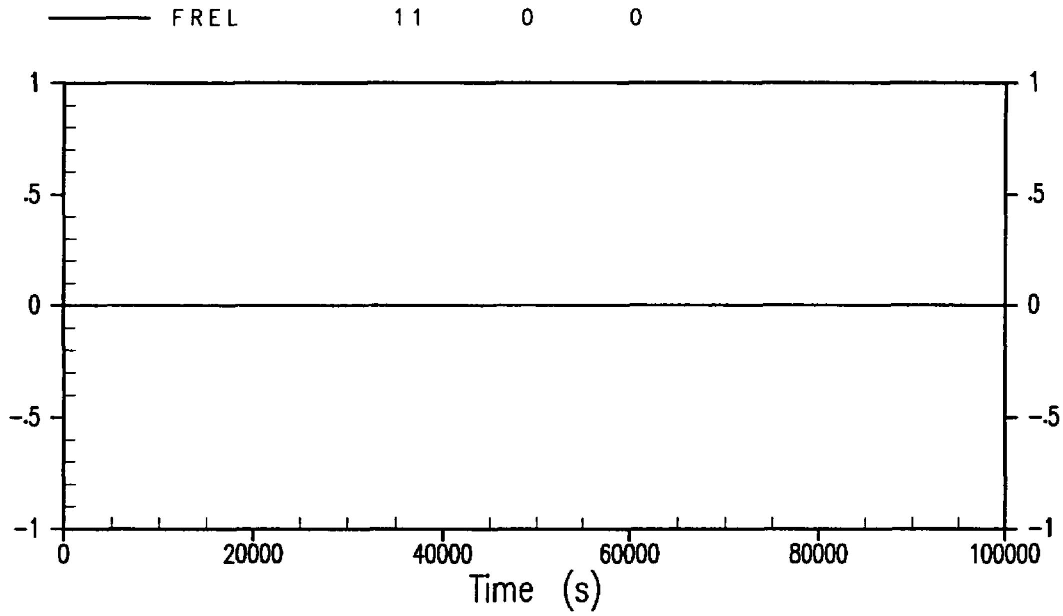

Figure 45-35

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Tellurium

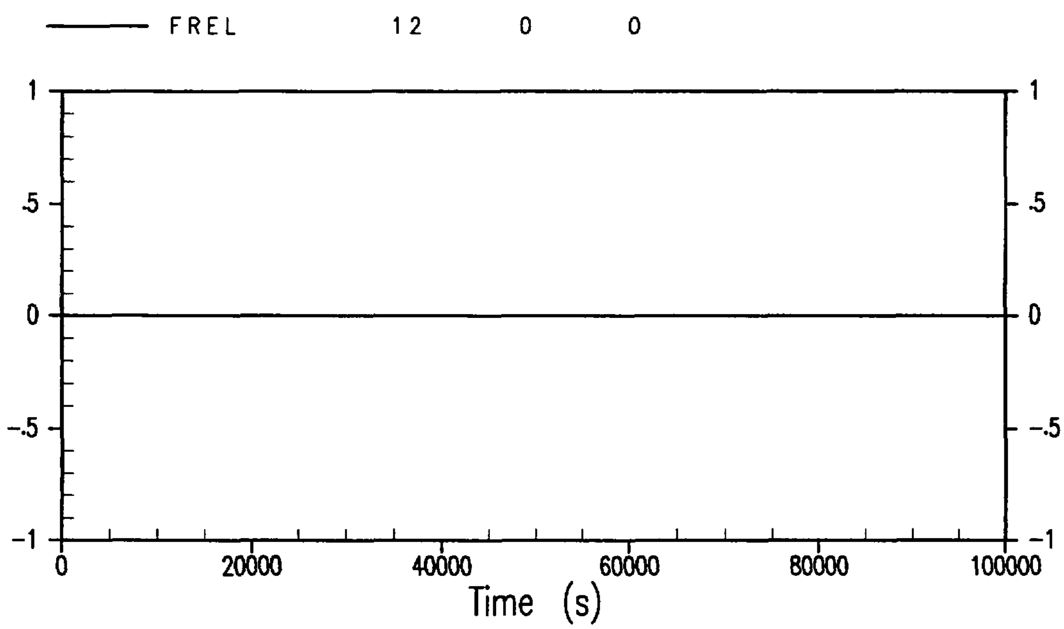

Figure 45-36

Release Category CI, Case 3C-2 – Vessel Rupture with Containment Failure: Release Fraction of Uranium Dioxide

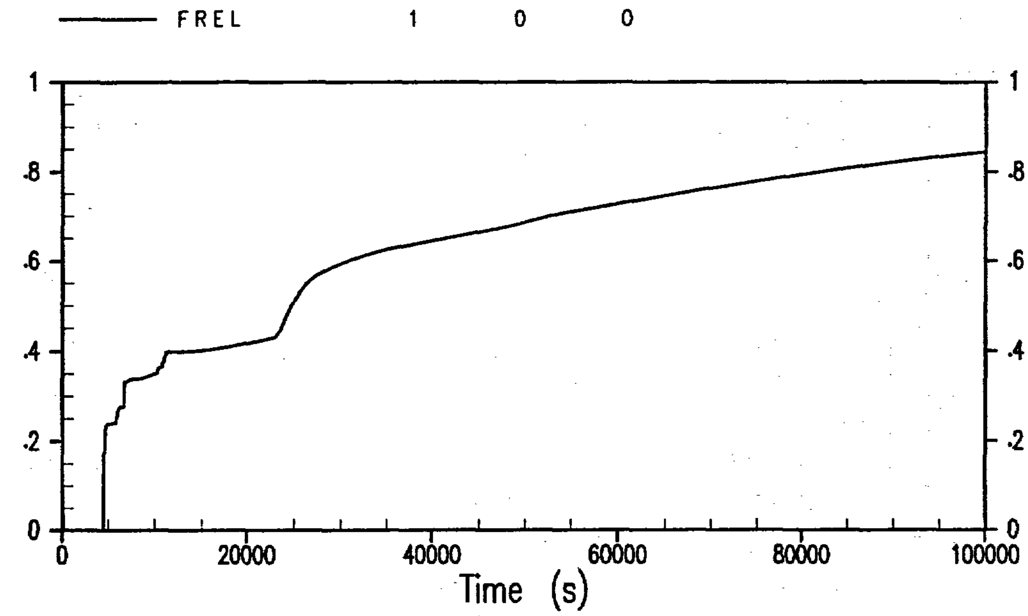

Figure 45-37

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Noble Gases

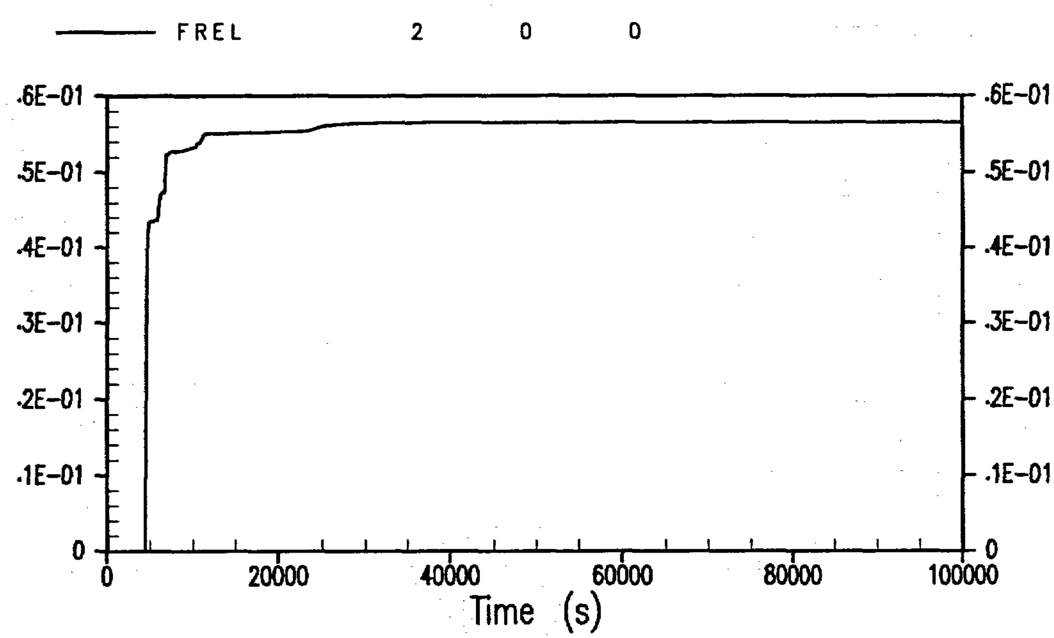

Figure 45-38

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cesium Iodide

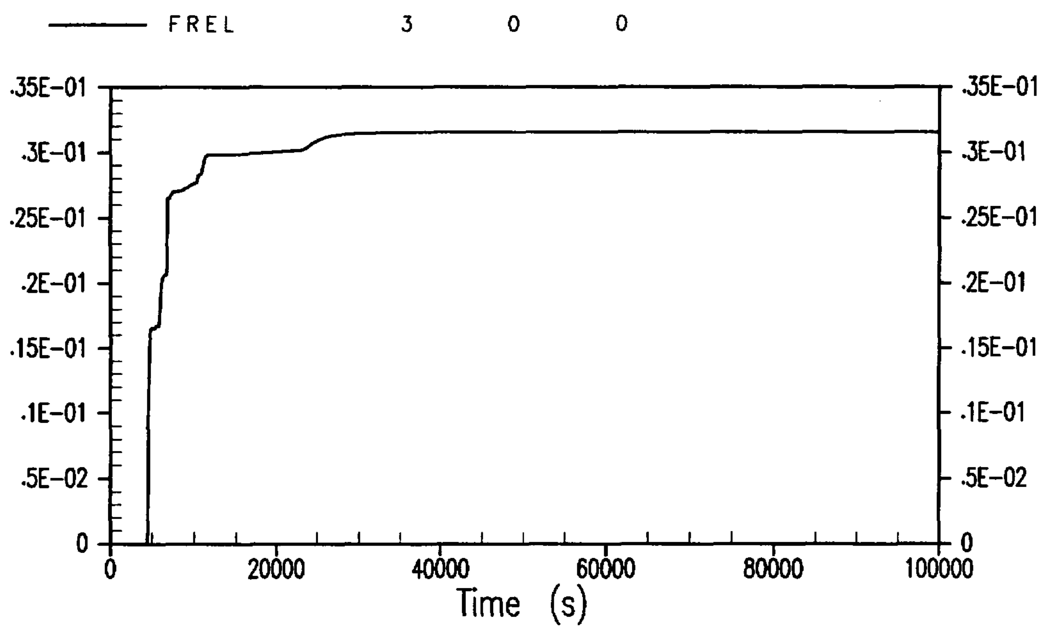

Figure 45-39

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tellurium Dioxide

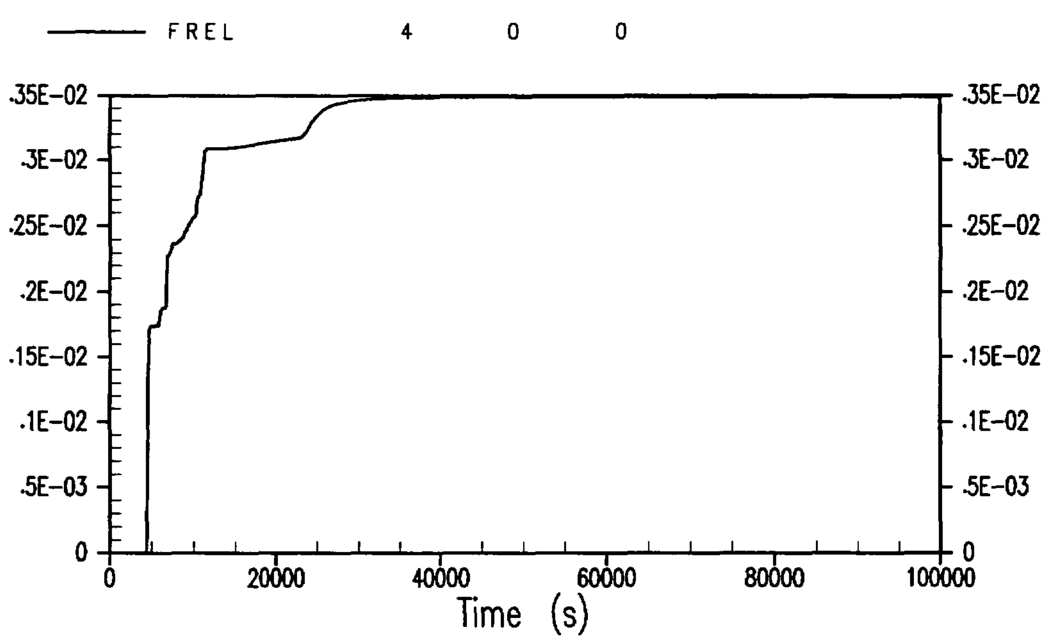

Figure 45-40

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Strontium Oxide

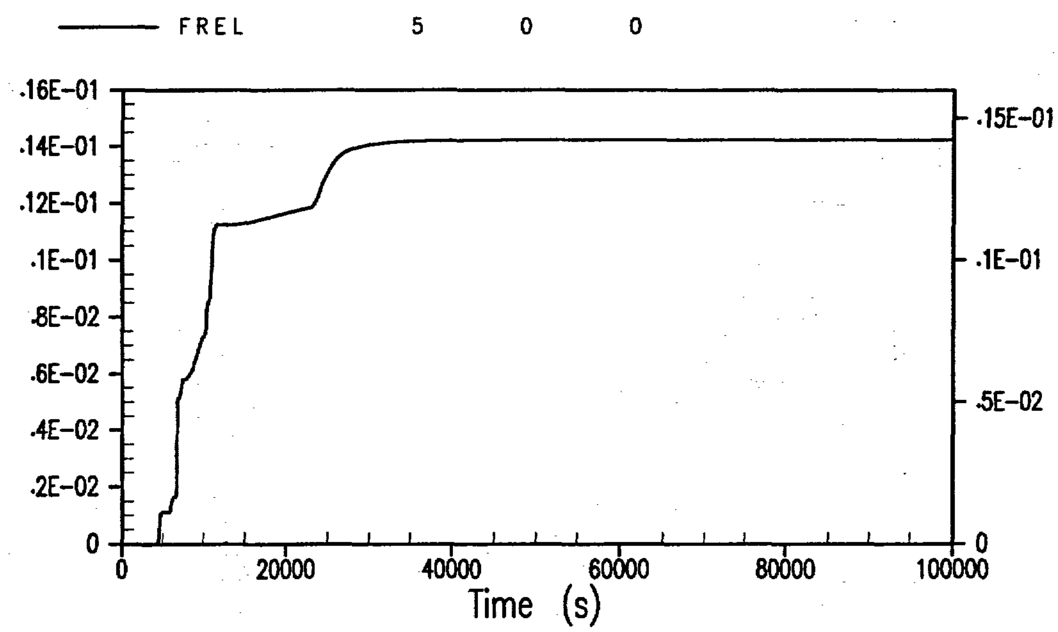

Figure 45-41

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Molybdenum Dioxide

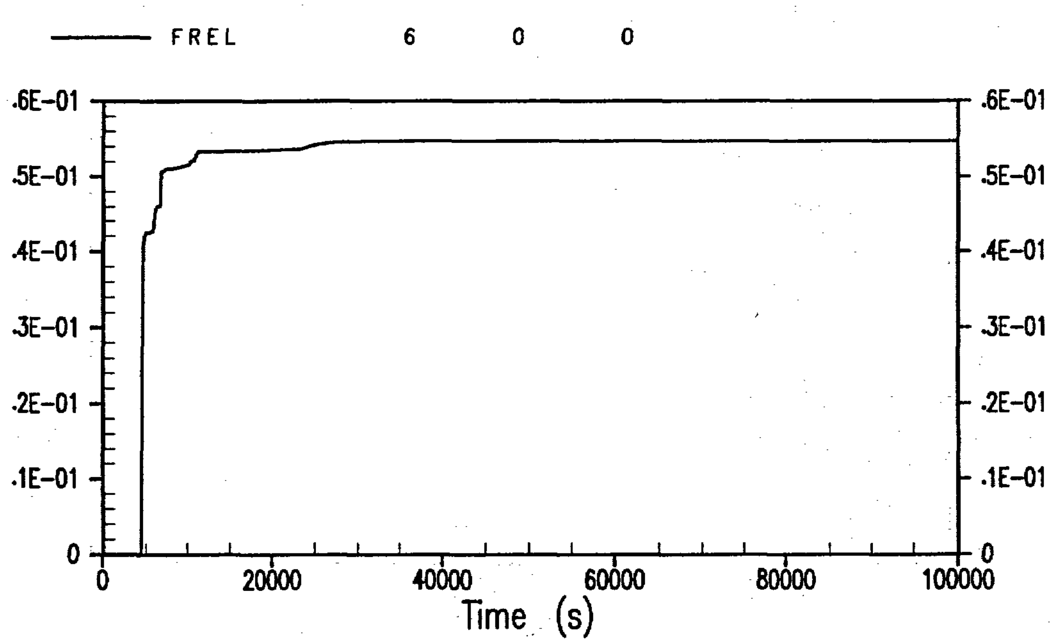

Figure 45-42

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cesium Hydroxide

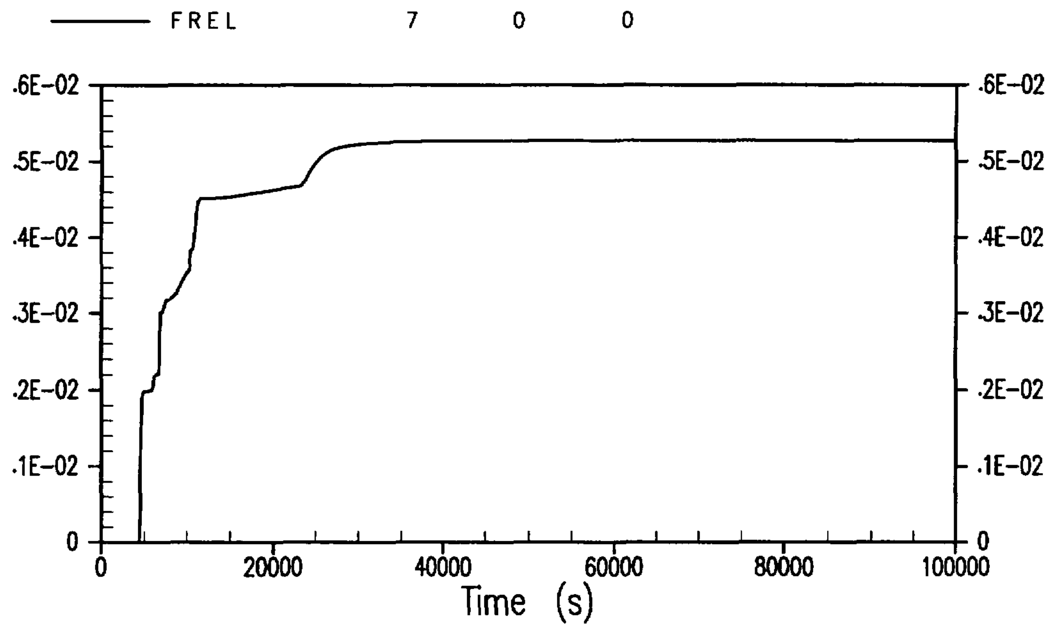

Figure 45-43

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Barium Oxide

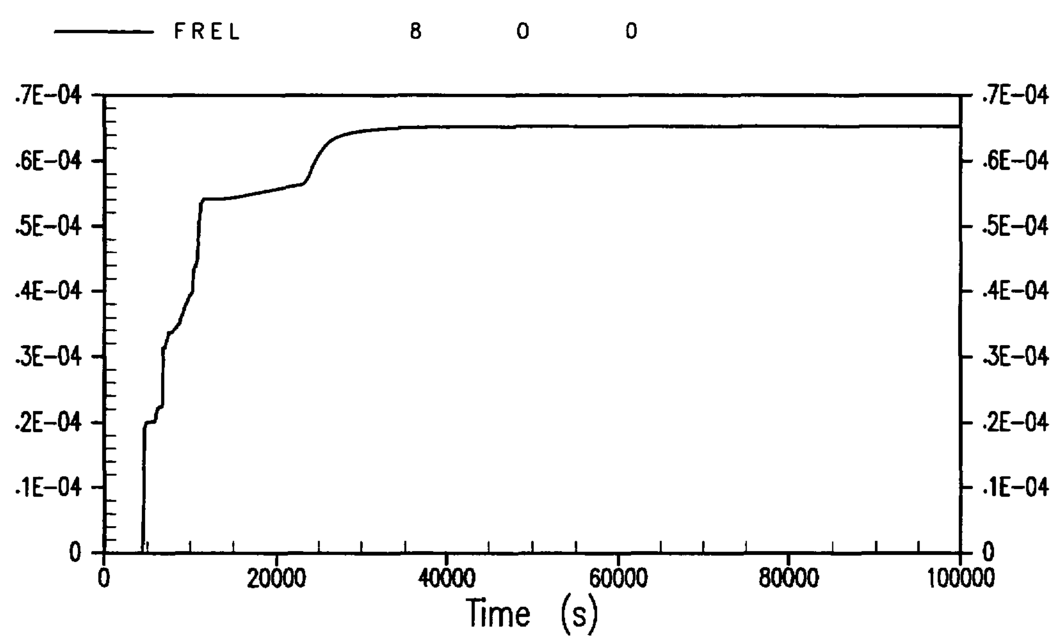

Figure 45-44

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Dilanthanum Trioxide

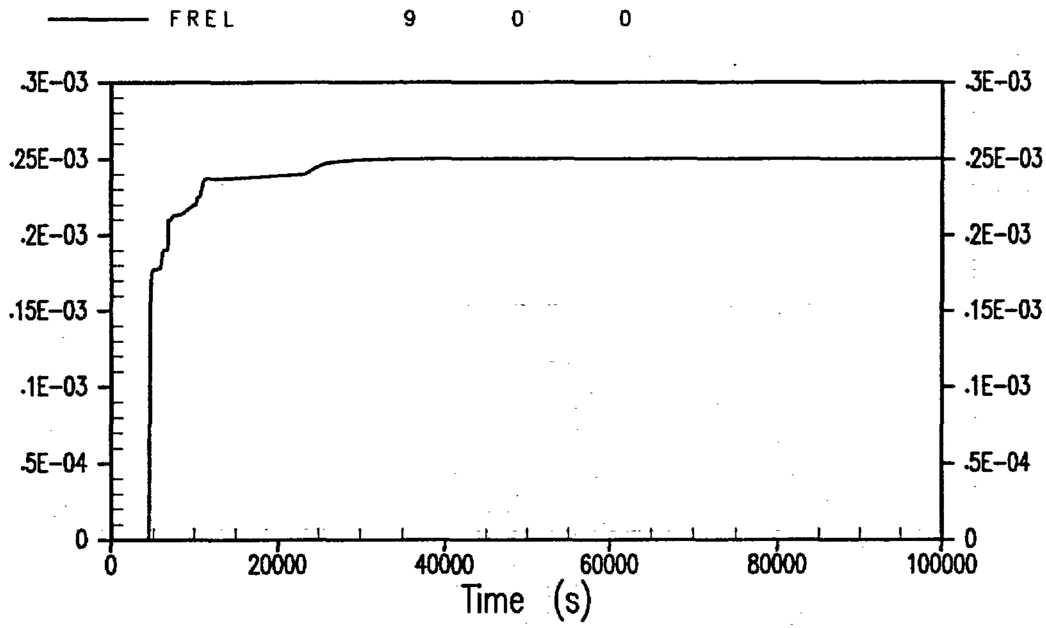

Figure 45-45

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Cerium Dioxide

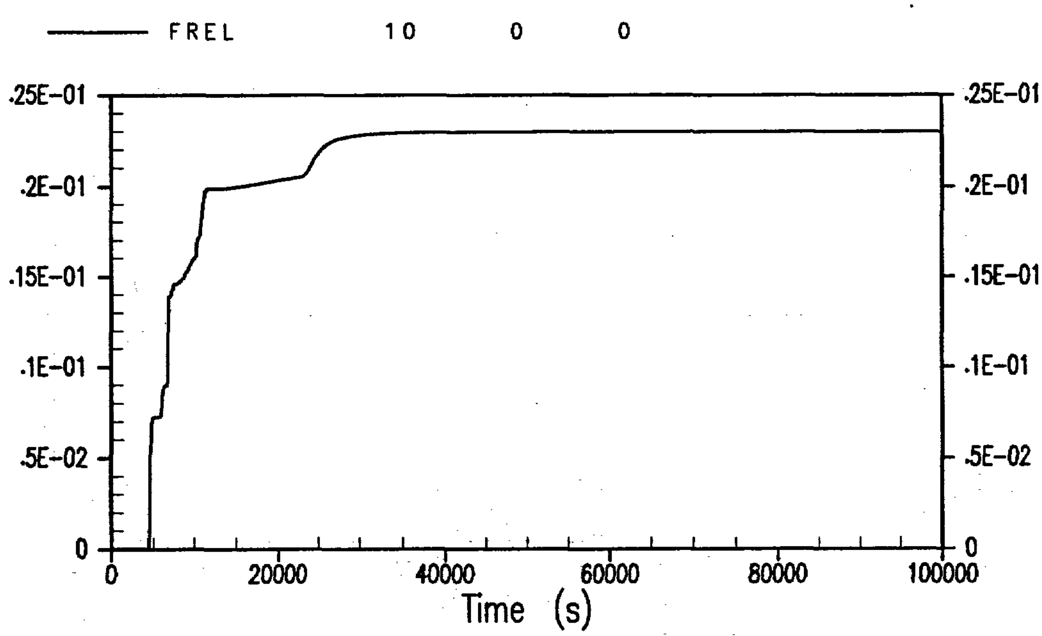

Figure 45-46

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tin

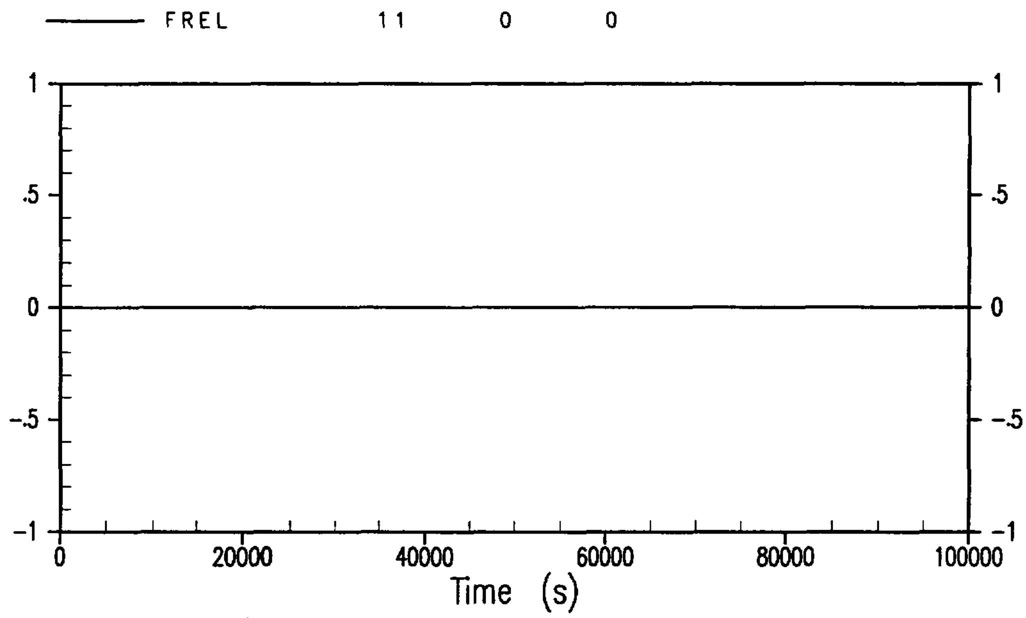

Figure 45-47

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Tellurium

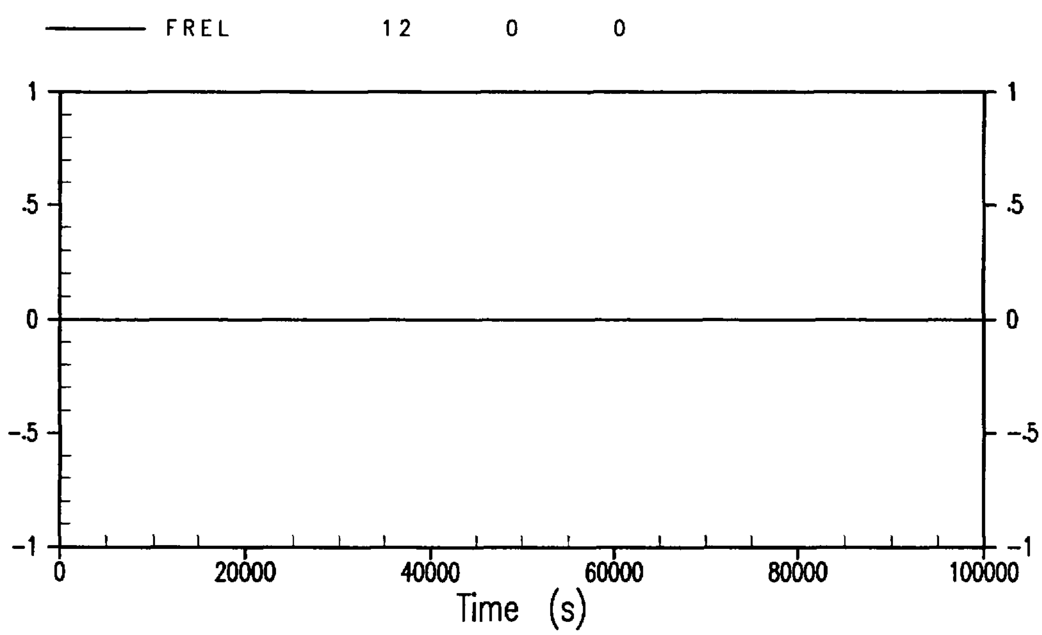

Figure 45-48

Release Category CFE, Case 3D-4 – Spurious ADS-2, Failed CMTs, Diffusion Flame: Release Fraction of Uranium Dioxide

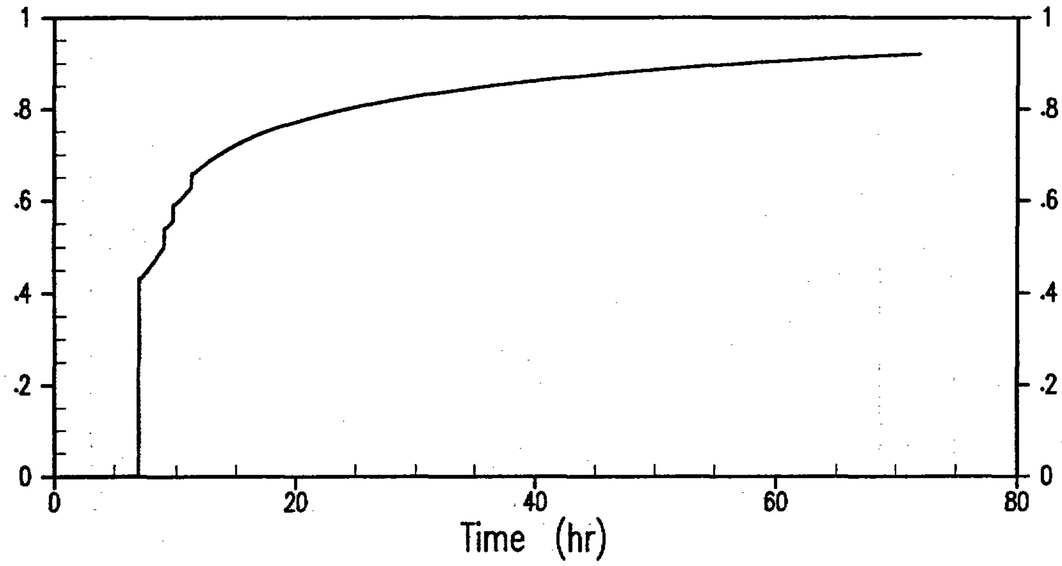

Figure 45-49

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Noble Gases

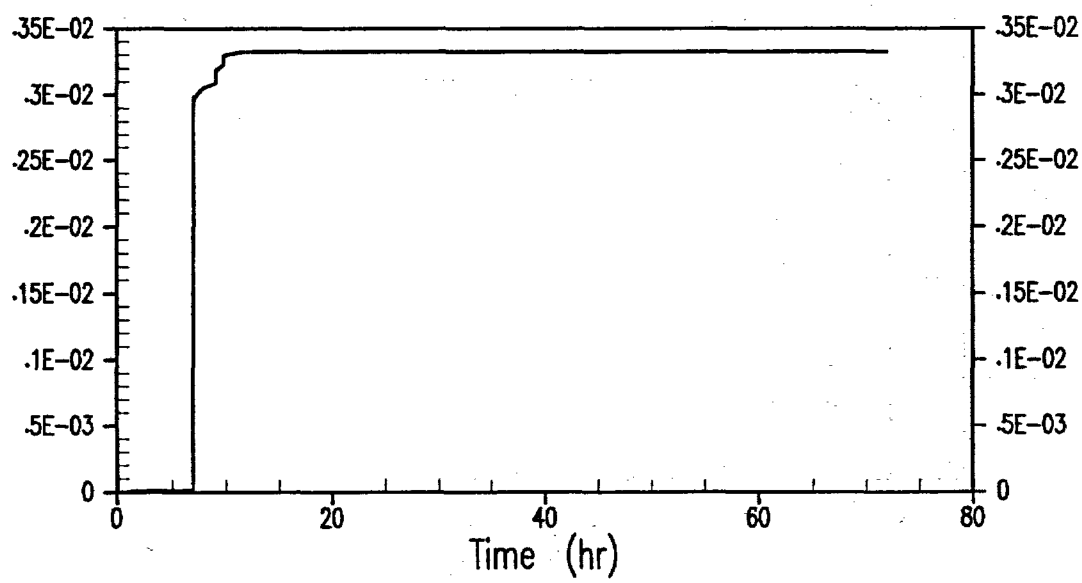

Figure 45-50

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cesium Iodide

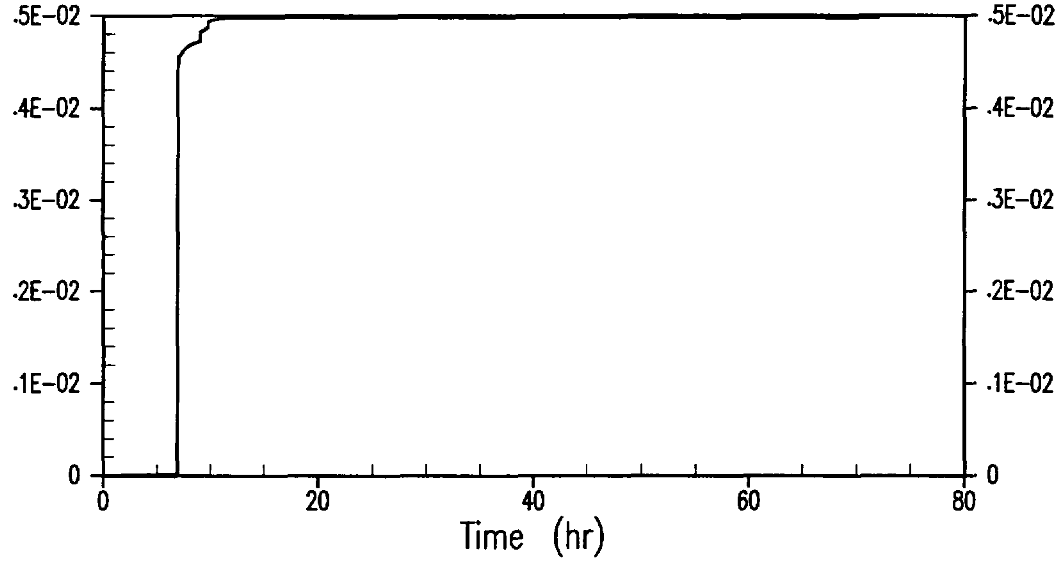

Figure 45-51

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tellurium Dioxide

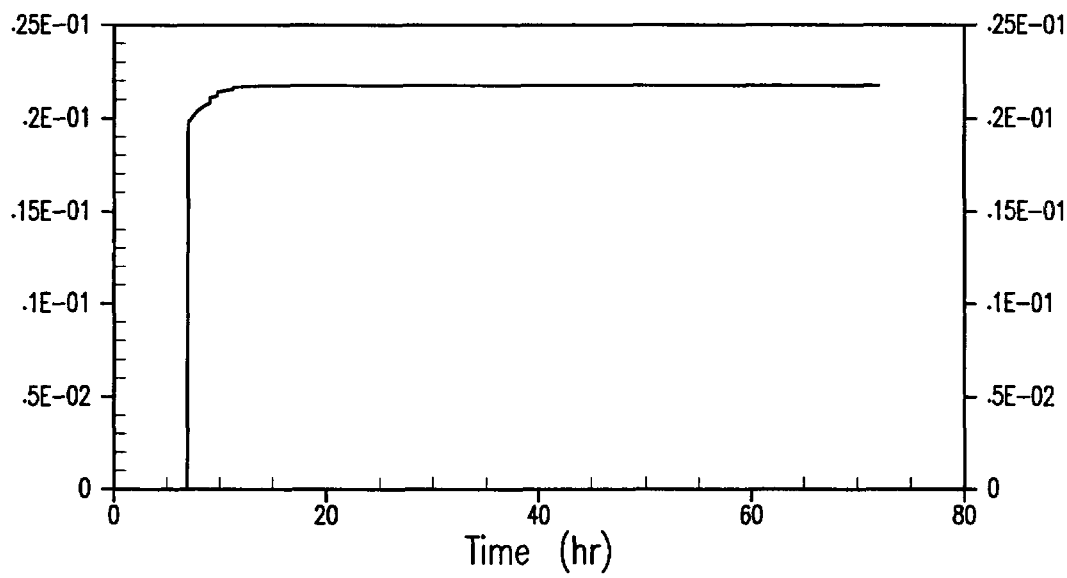

Figure 45-52

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Strontium Oxide

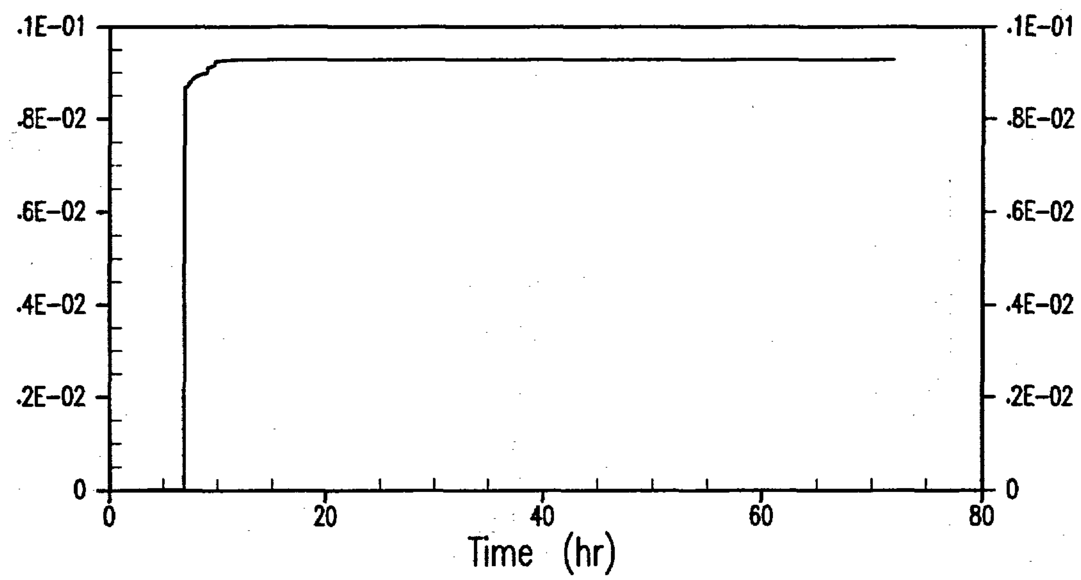

Figure 45-53

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Molybdenum Dioxide

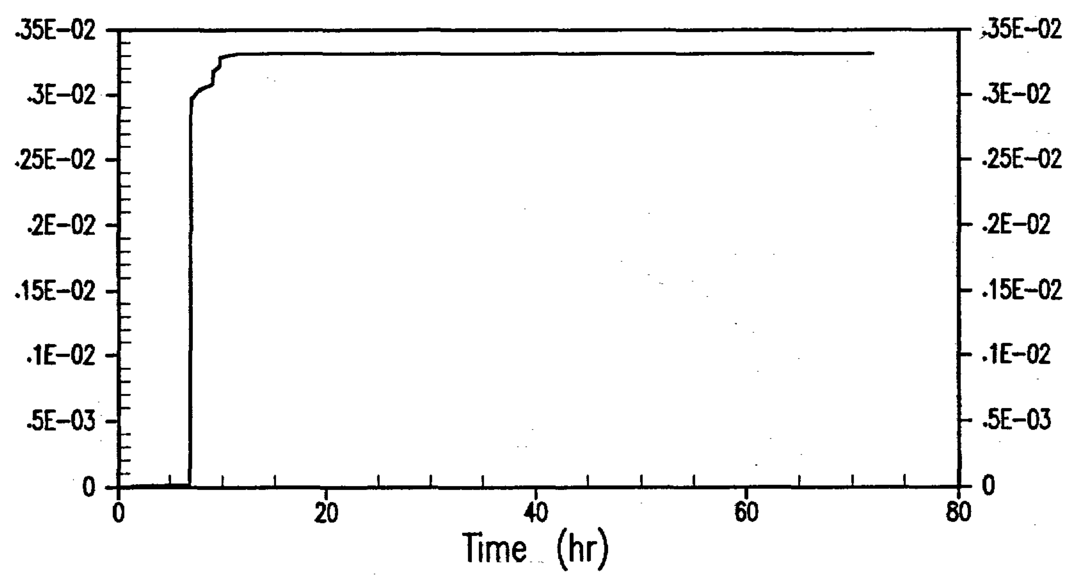

Figure 45-54

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cesium Hydroxide

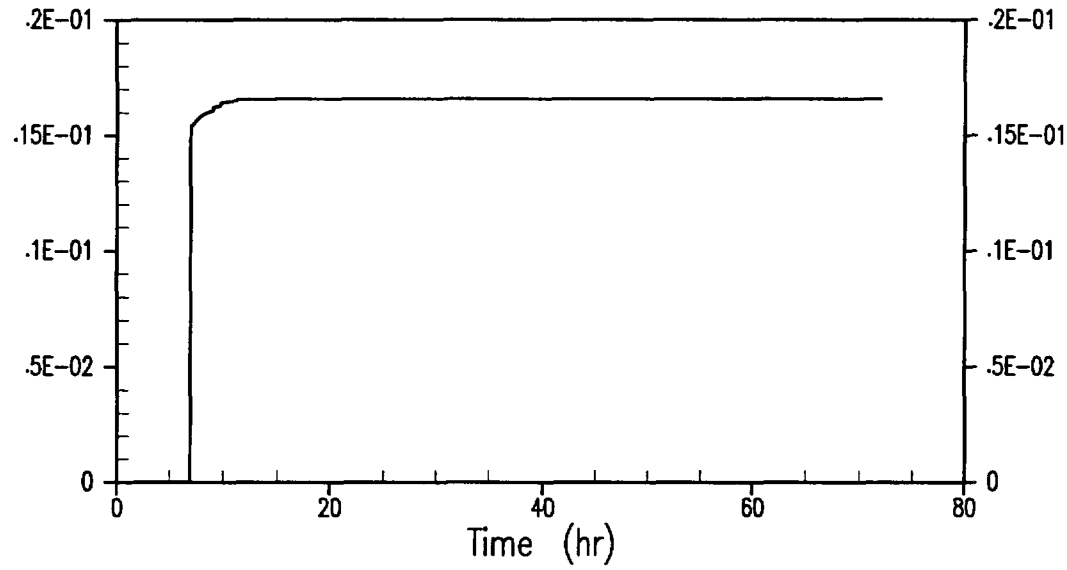

Figure 45-55

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Barium Oxide

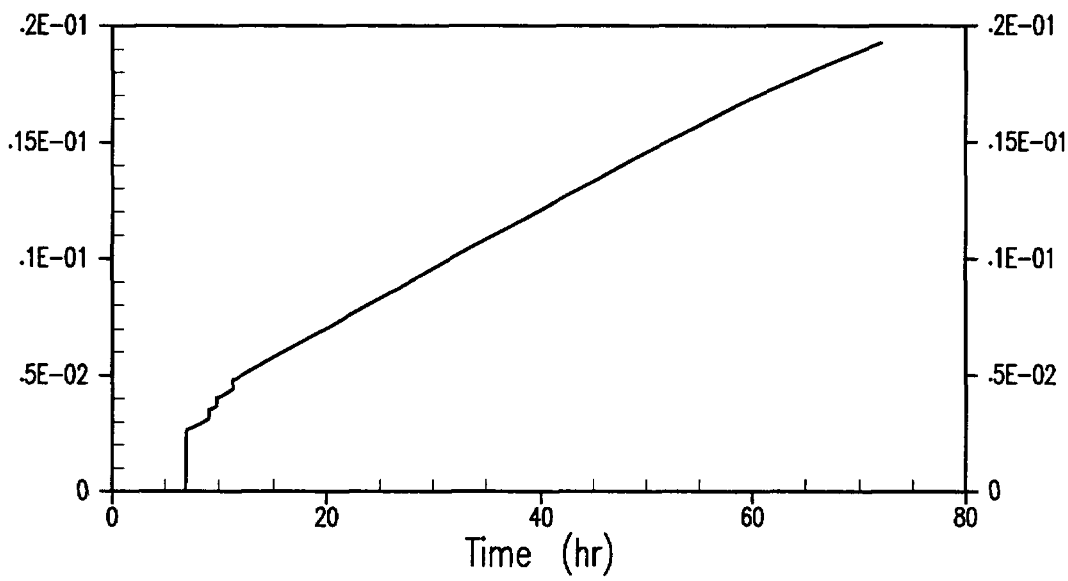

Figure 45-56

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Dilanthanum Trioxide

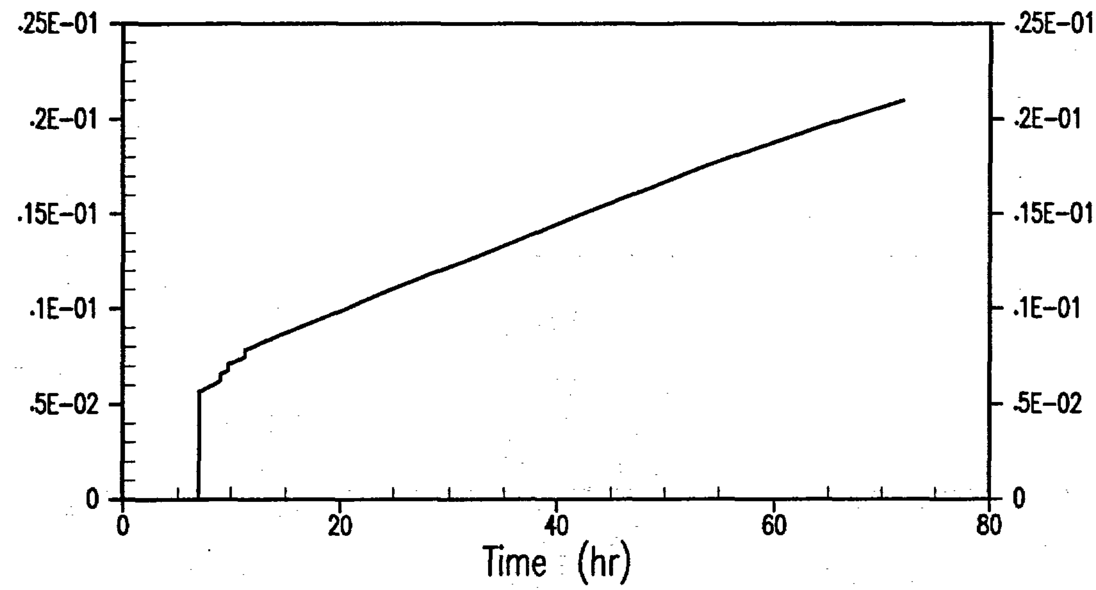

Figure 45-57

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Cerium Dioxide

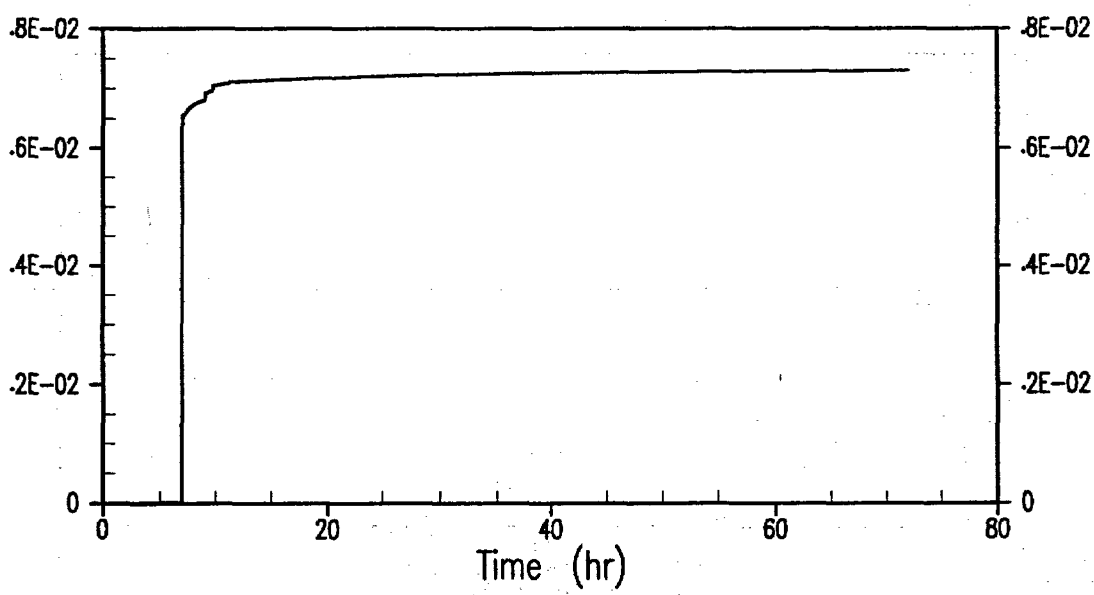

Figure 45-58

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tin

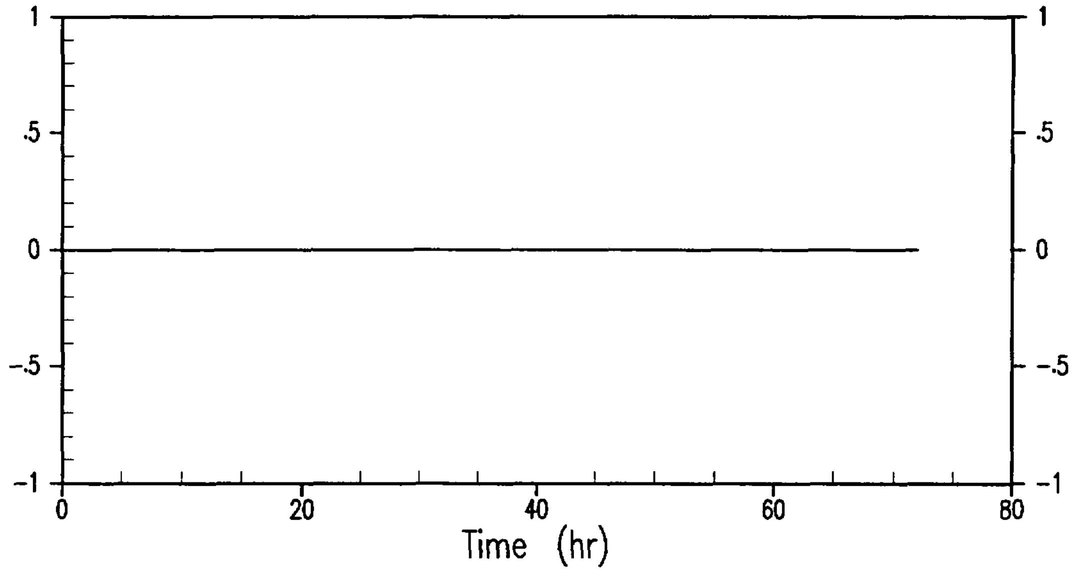

Figure 45-59

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Tellurium

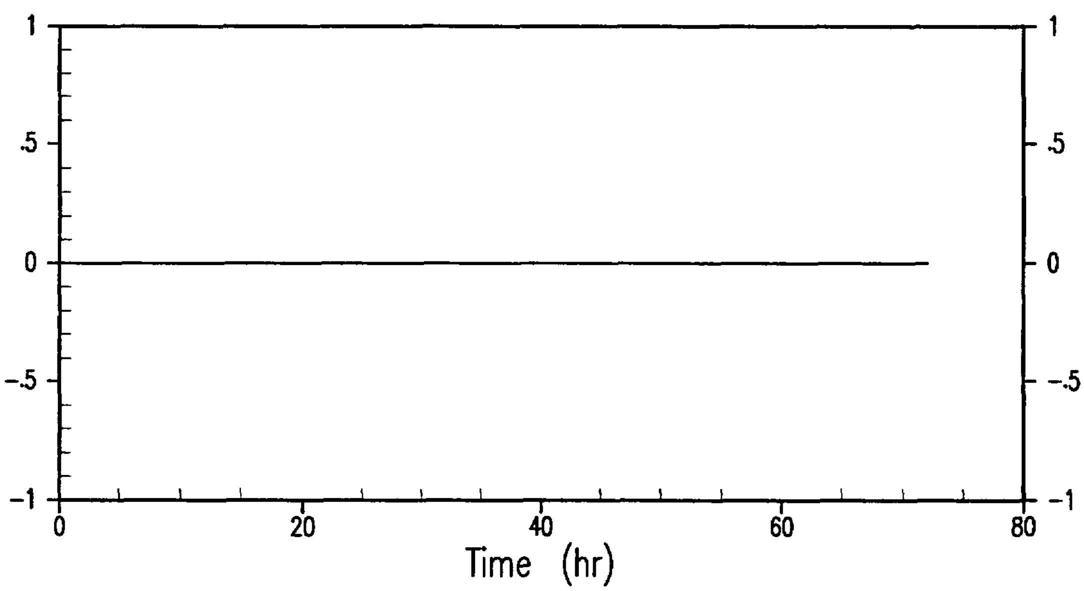

Figure 45-60

Release Category CFI, Case 3BE-3 – DVI Line Break, Failed Gravity Injection, No PXS Flooding: Release Fraction of Uranium Dioxide

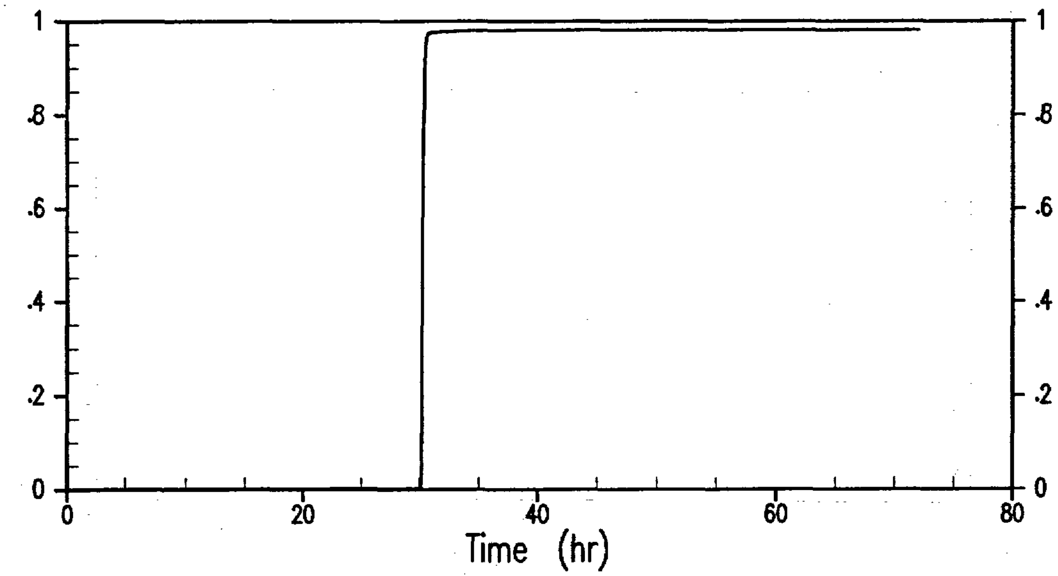

Figure 45-61

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Noble Gases

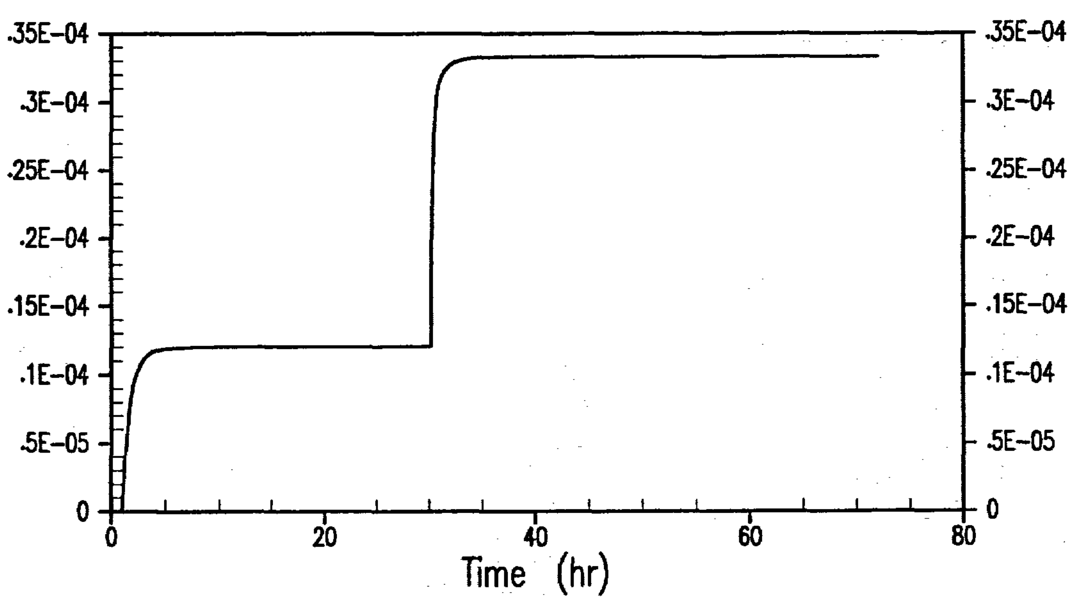

Figure 45-62

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Iodide

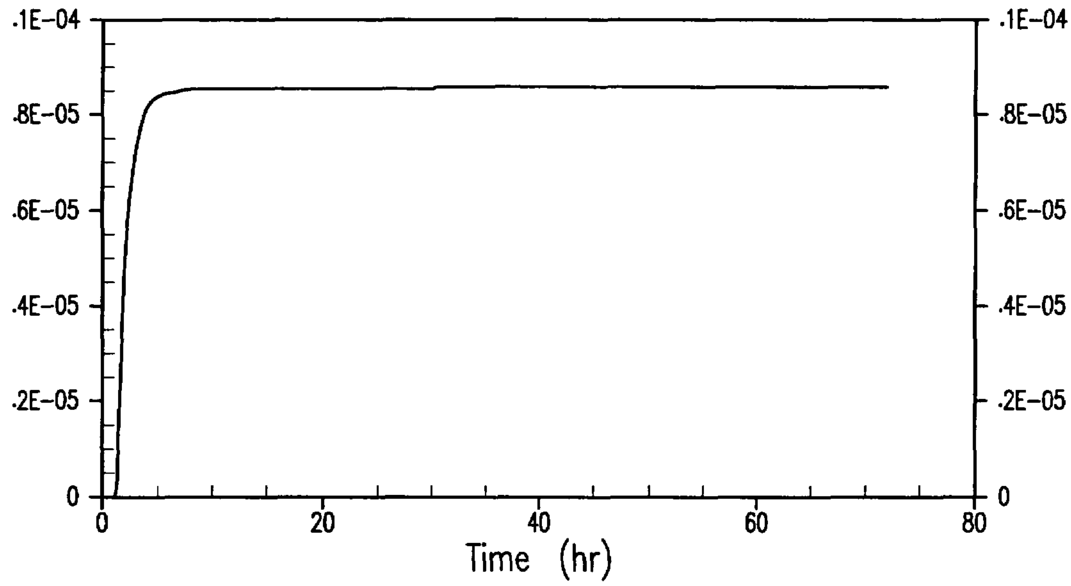

Figure 45-63

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium Dioxide

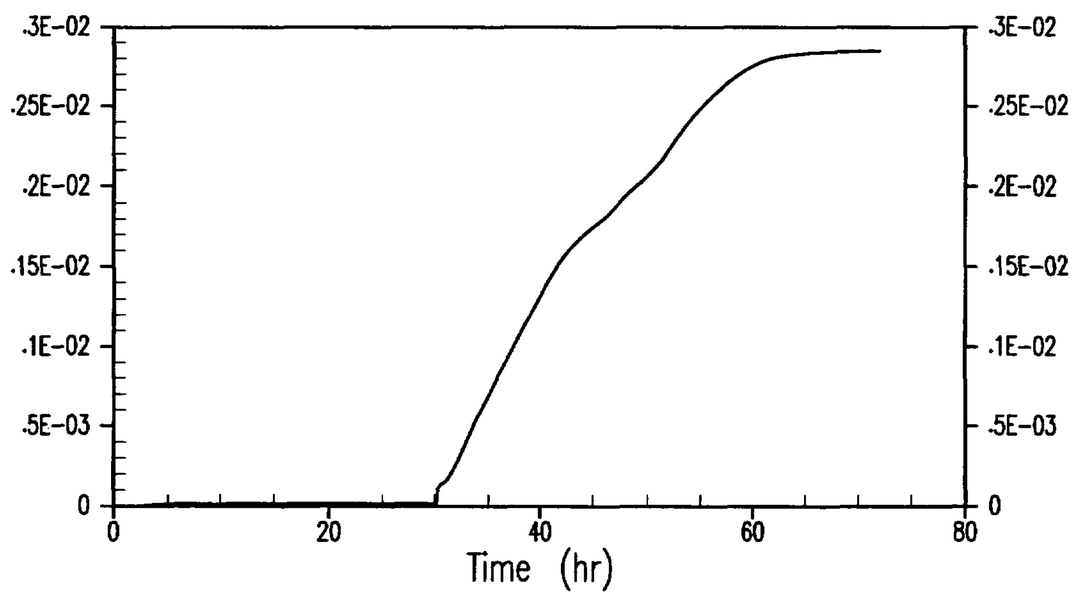

Figure 45-64

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Strontium Oxide

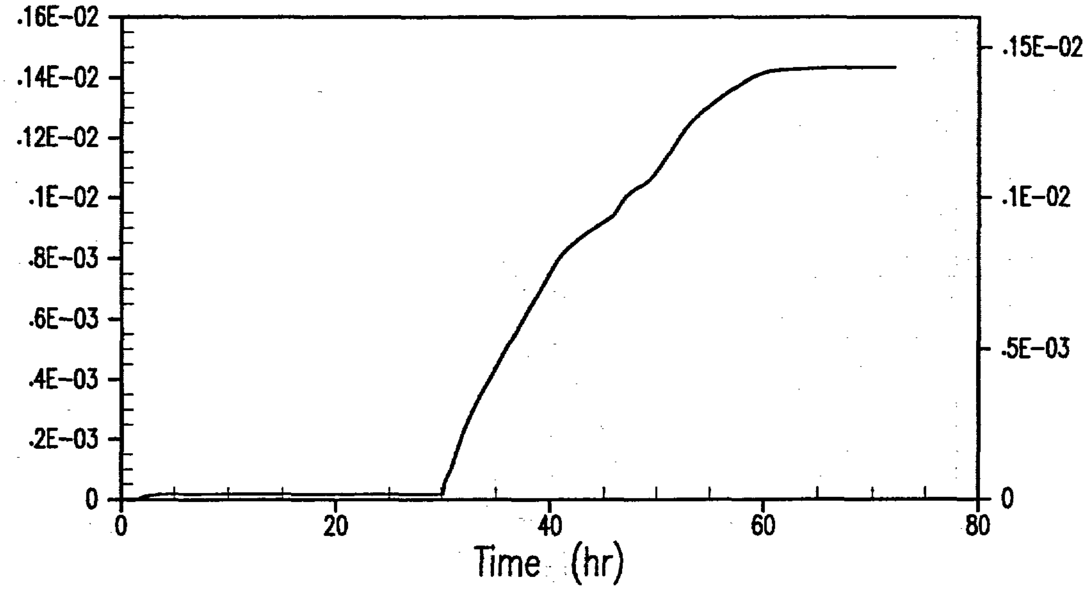

Figure 45-65

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Molybdenum Dioxide

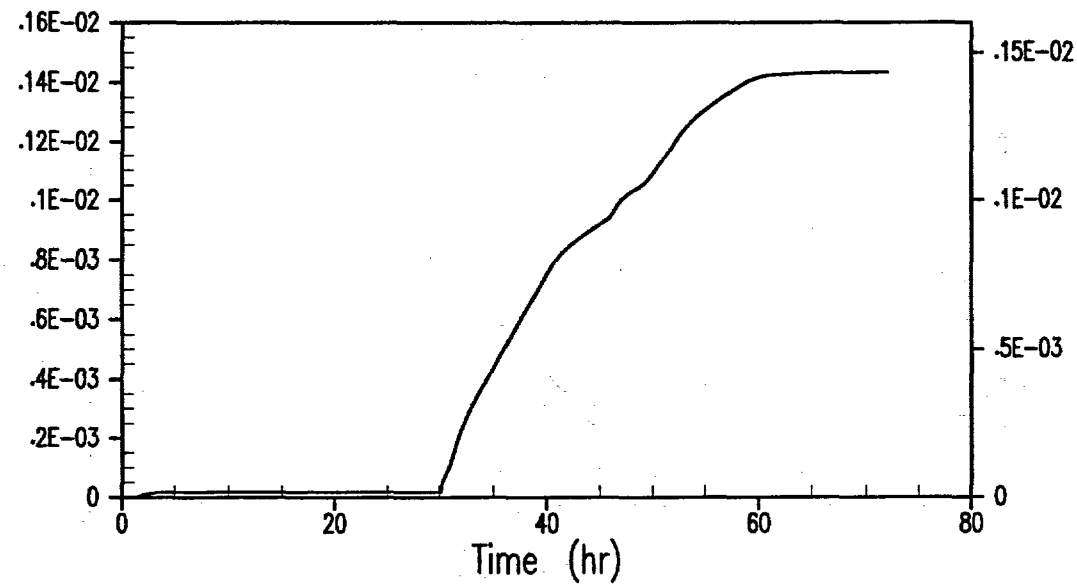

Figure 45-66

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cesium Hydroxide

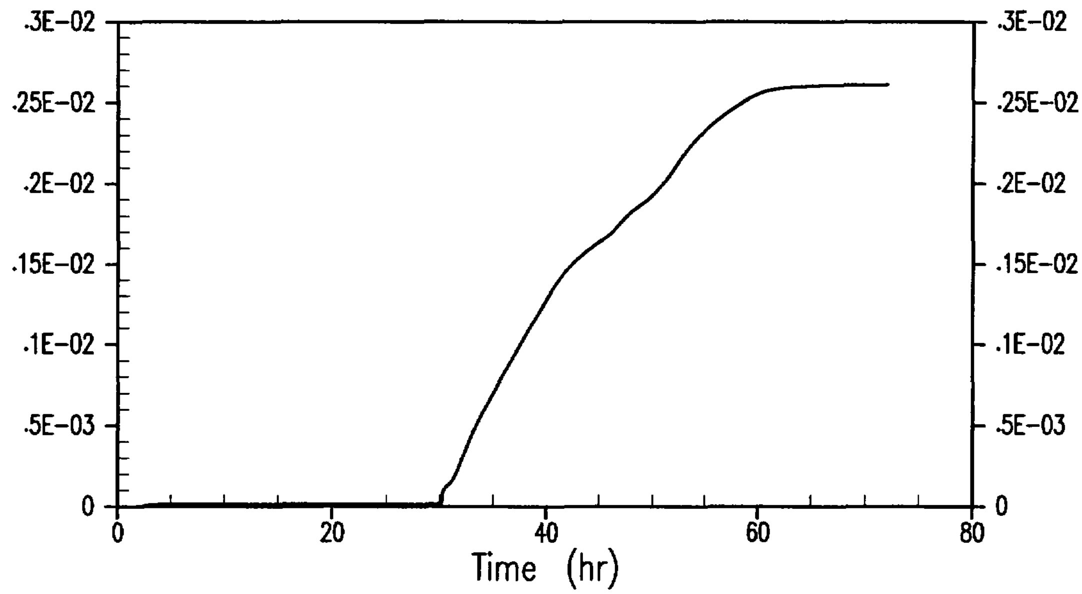

Figure 45-67

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Barium Oxide

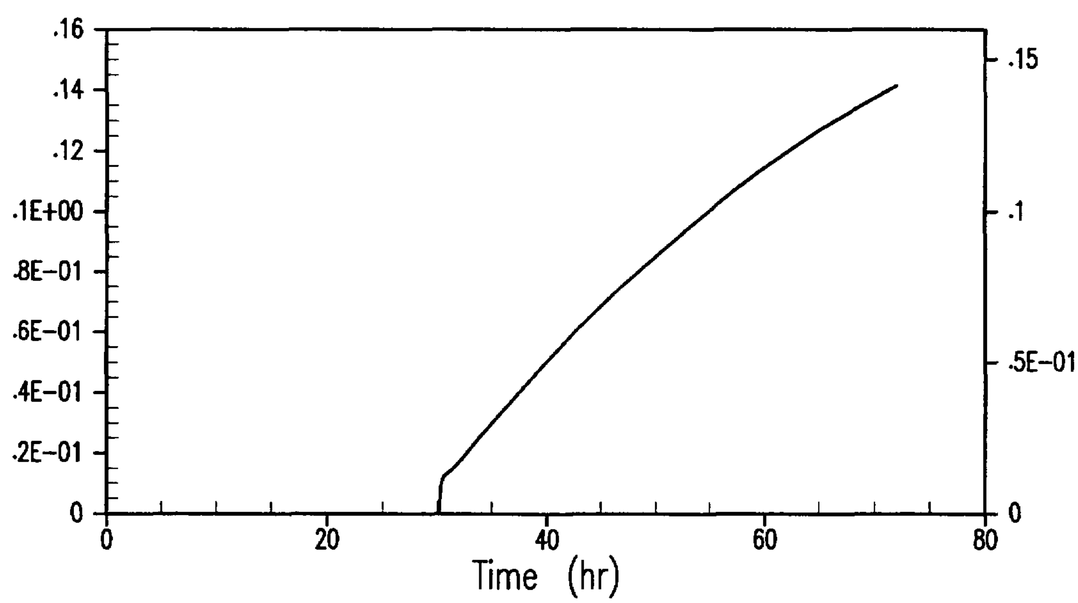

Figure 45-68

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Dilanthanum Trioxide

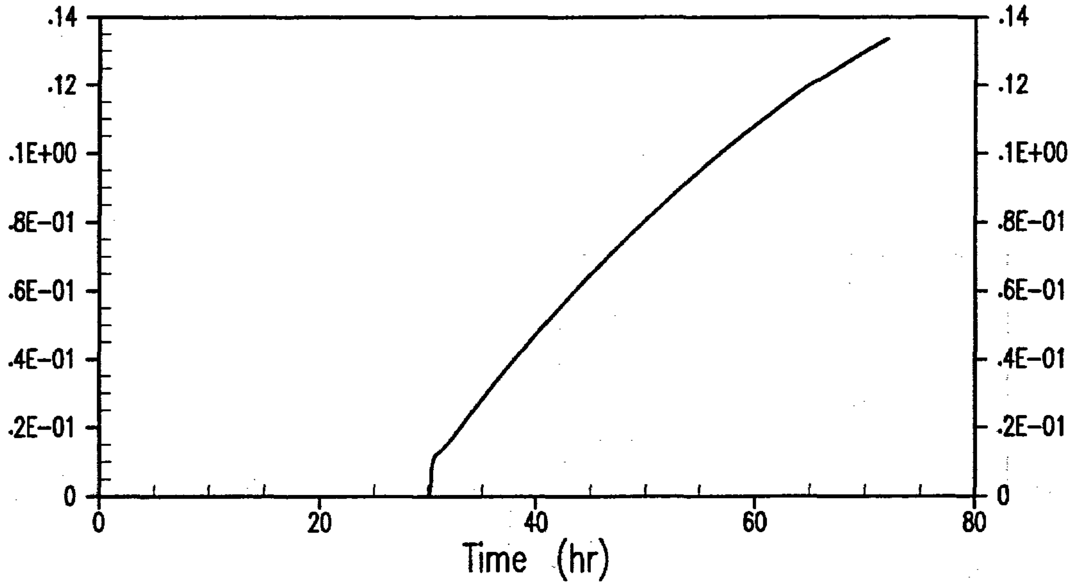

Figure 45-69

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Cerium Dioxide

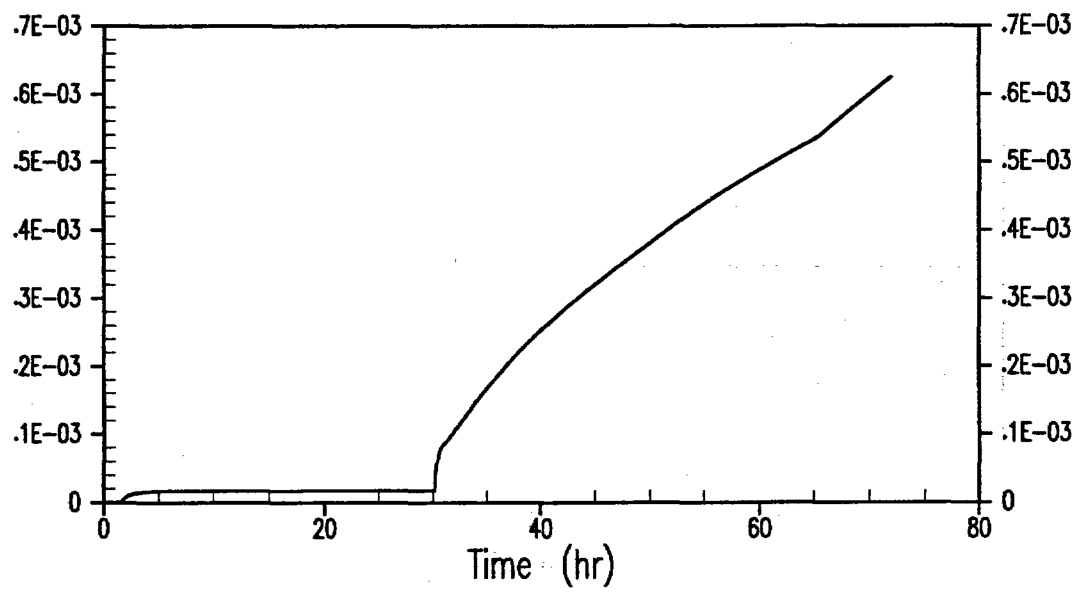

Figure 45-70

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tin

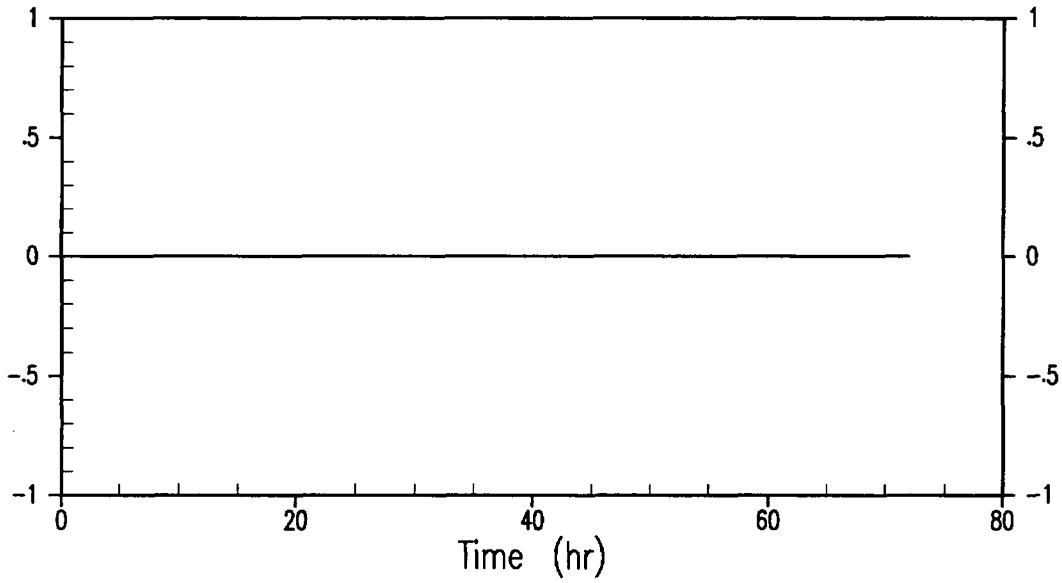

Figure 45-71

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Tellurium

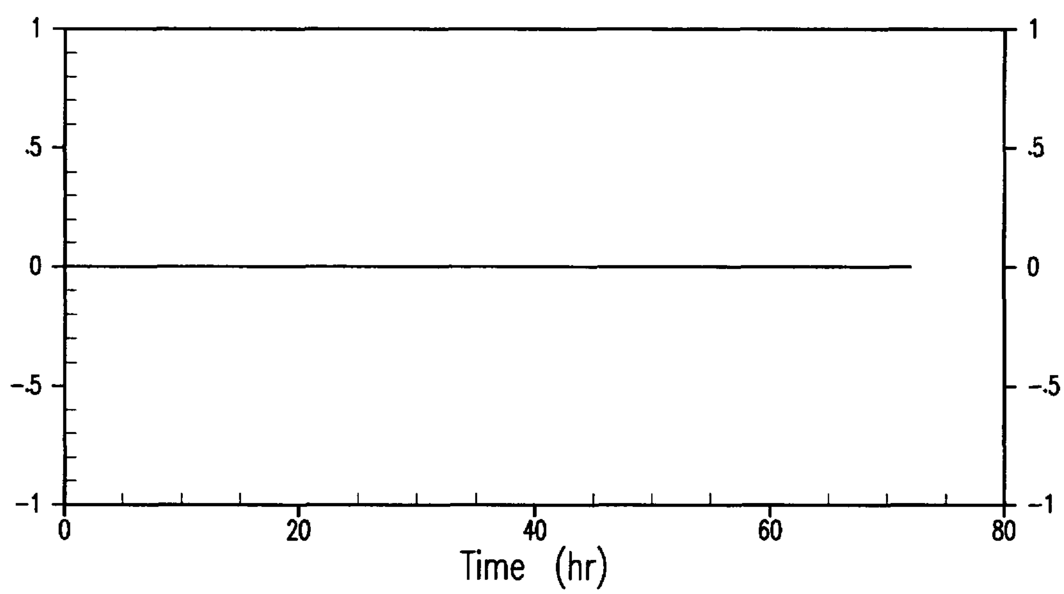

Figure 45-72

Release Category CFL, Case 3BE-7 – SBLOCA with Failed Gravity Injection: Release Fraction of Uranium Dioxide

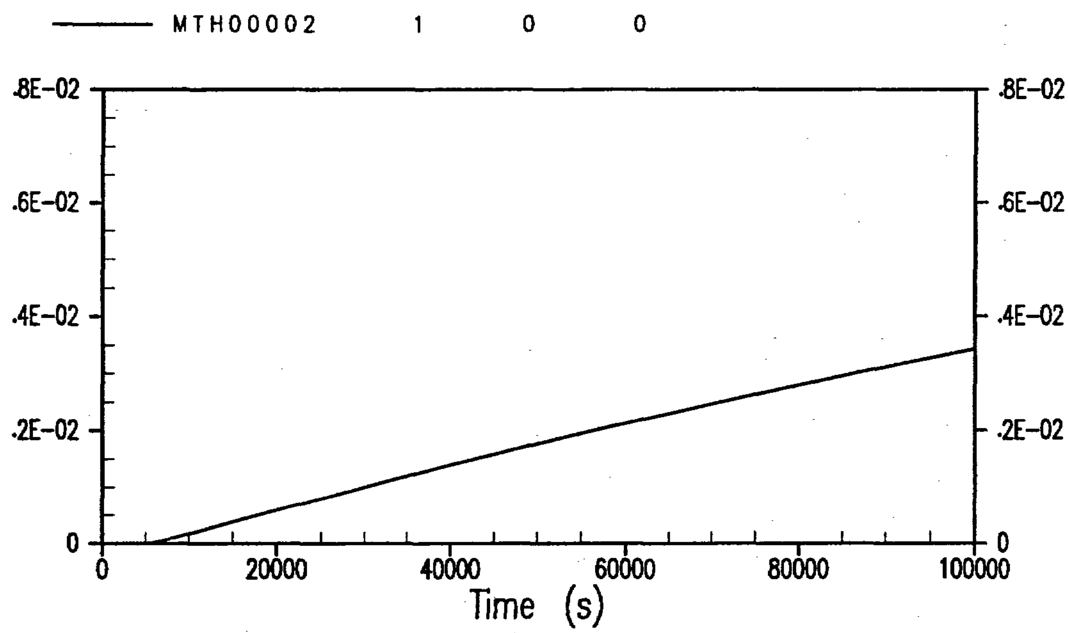

Figure 45-73

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Noble Gases

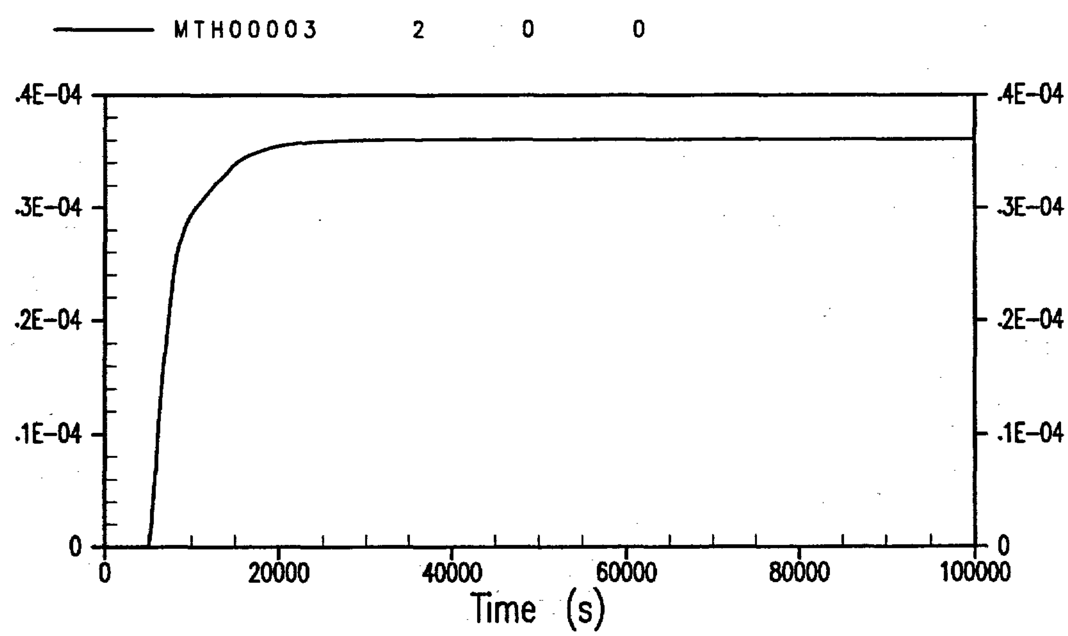

Figure 45-74

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cesium Iodide

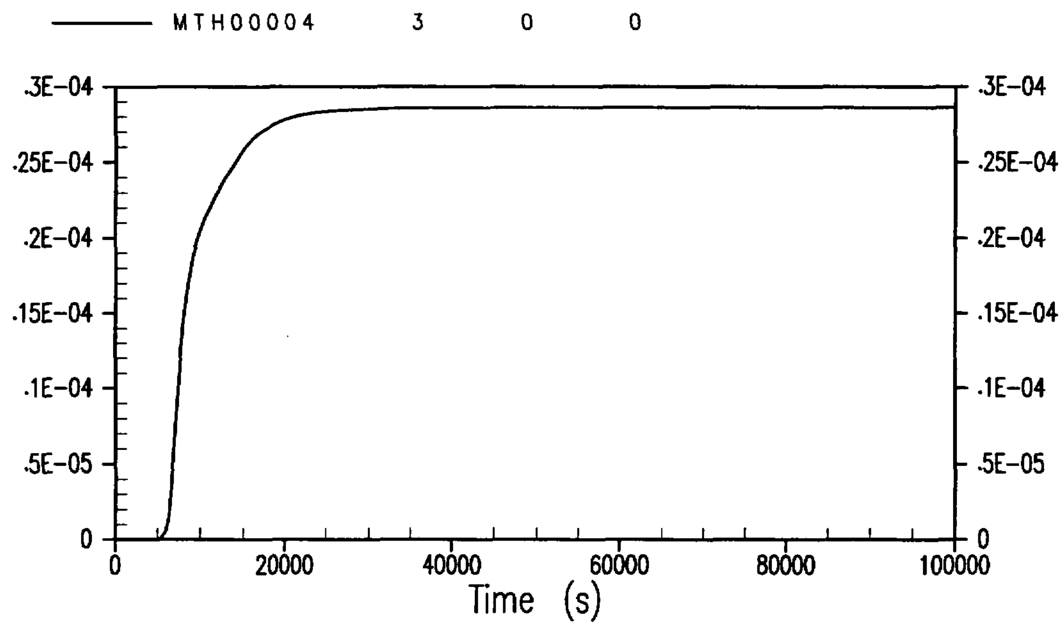

Figure 45-75

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tellurium Dioxide

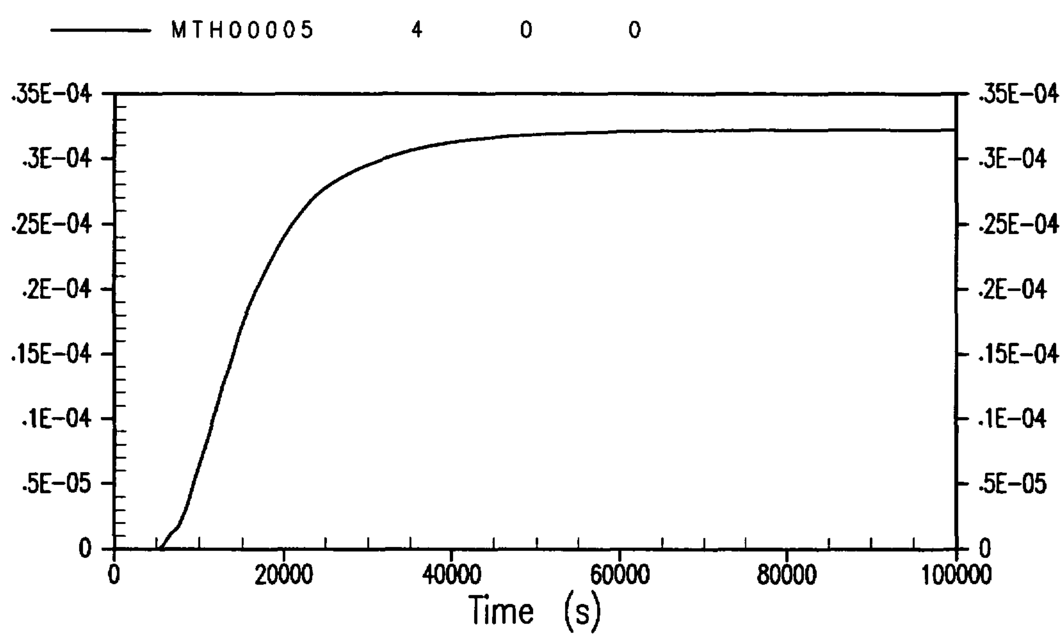

Figure 45-76

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Strontium Oxide

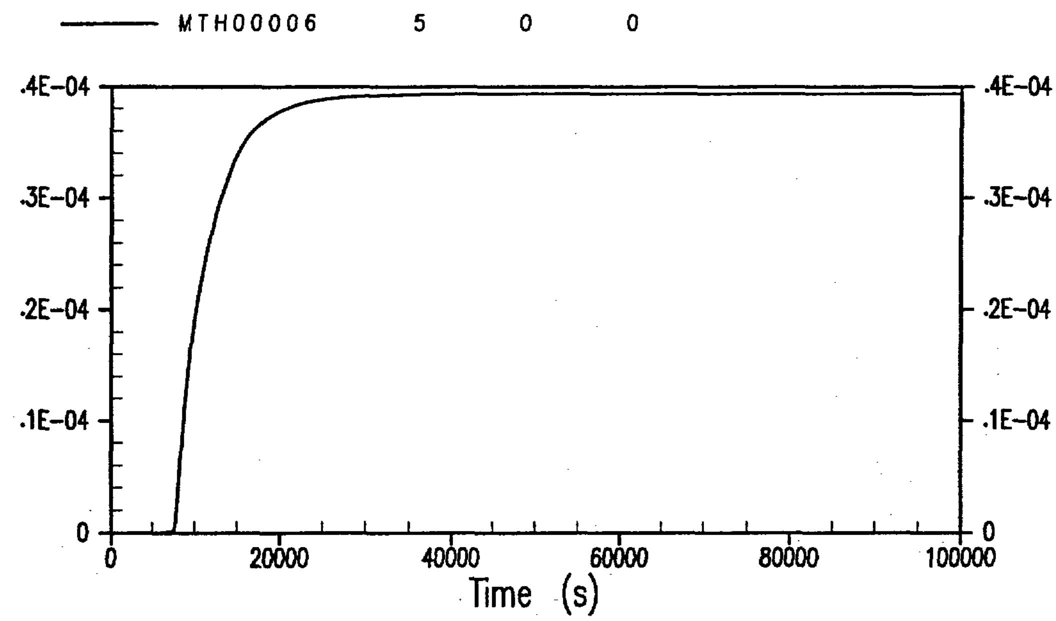

Figure 45-77

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Molybdenum Dioxide

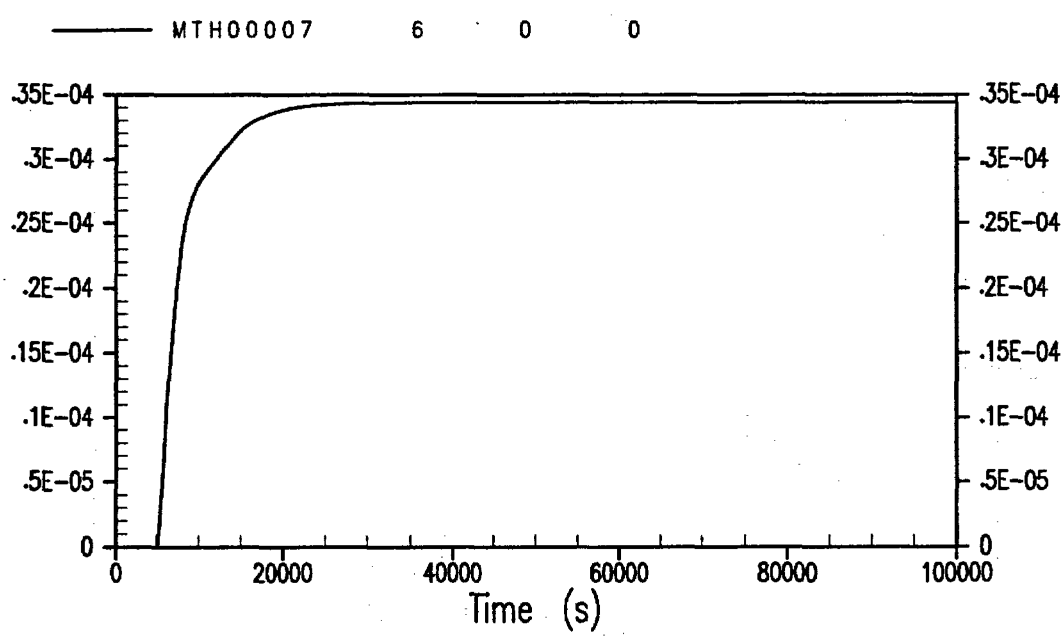

Figure 45-78

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cesium Hydroxide

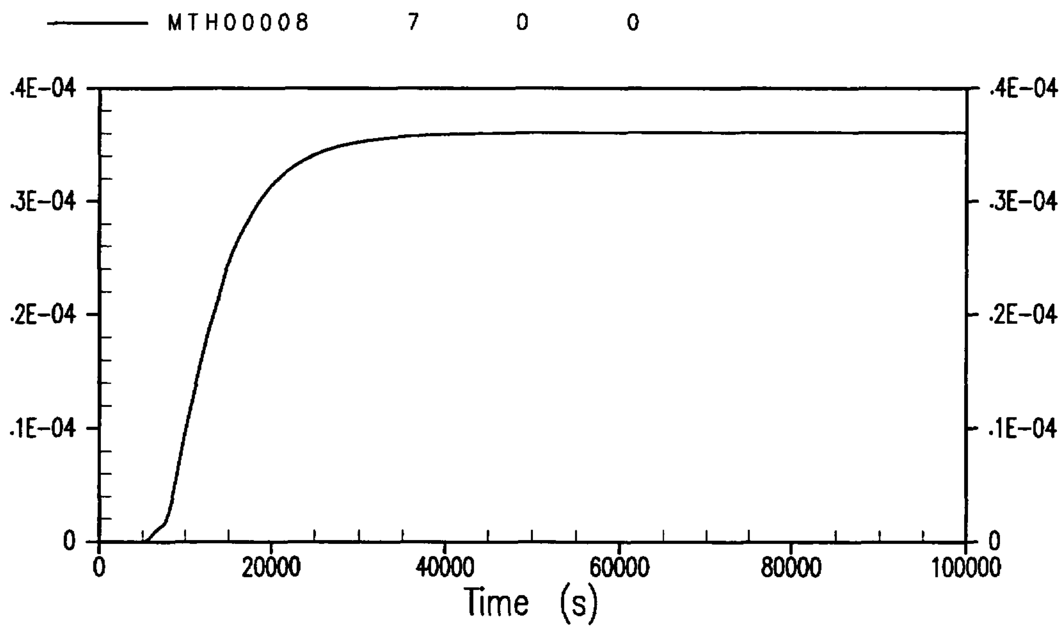

Figure 45-79

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Barium Oxide

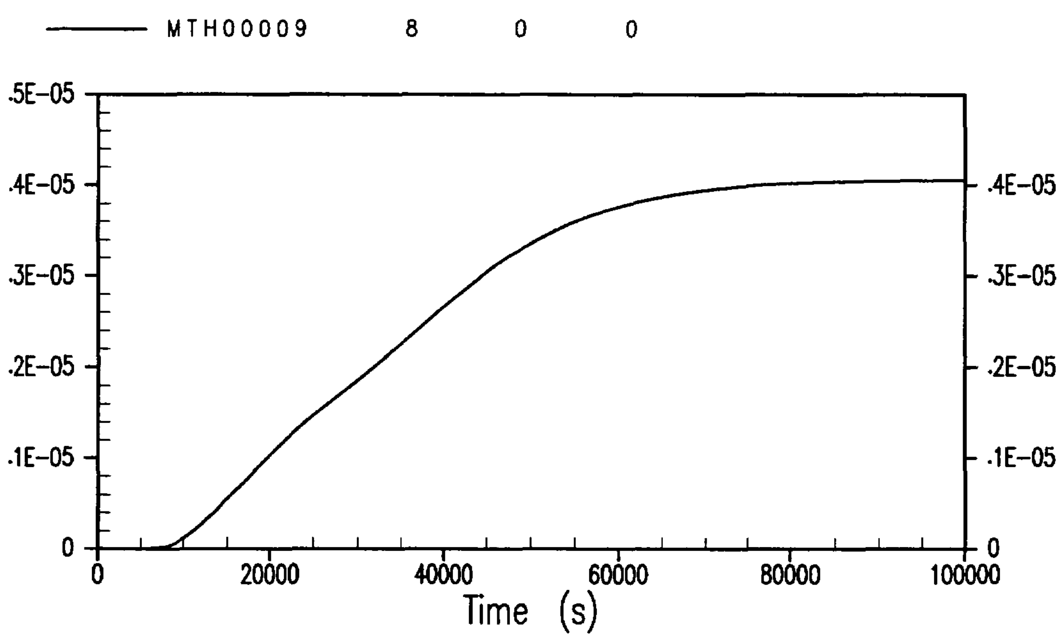

Figure 45-80

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Dilanthanum Trioxide

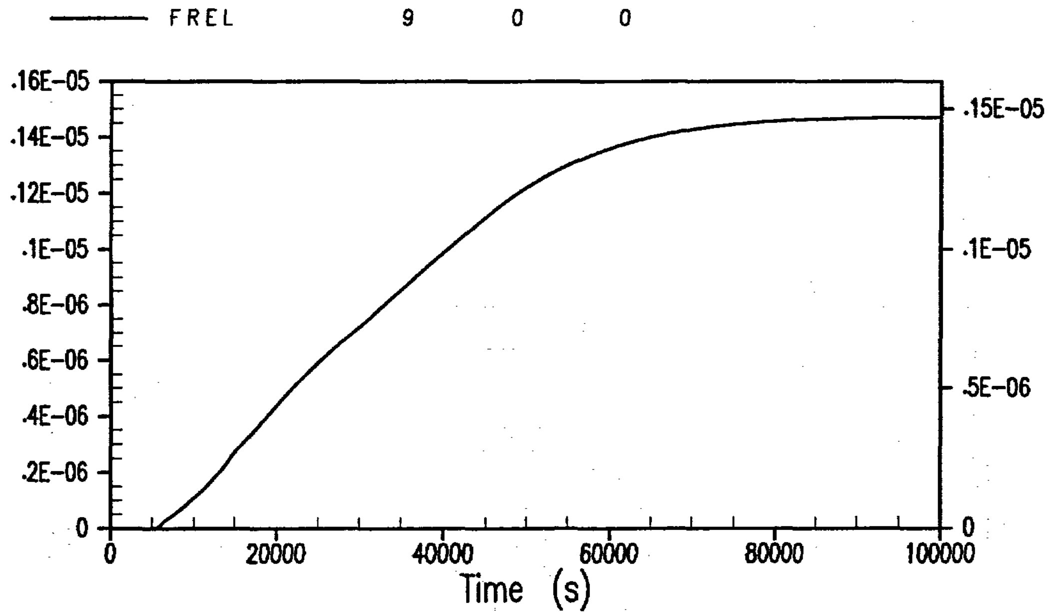

Figure 45-81

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Cerium Dioxide

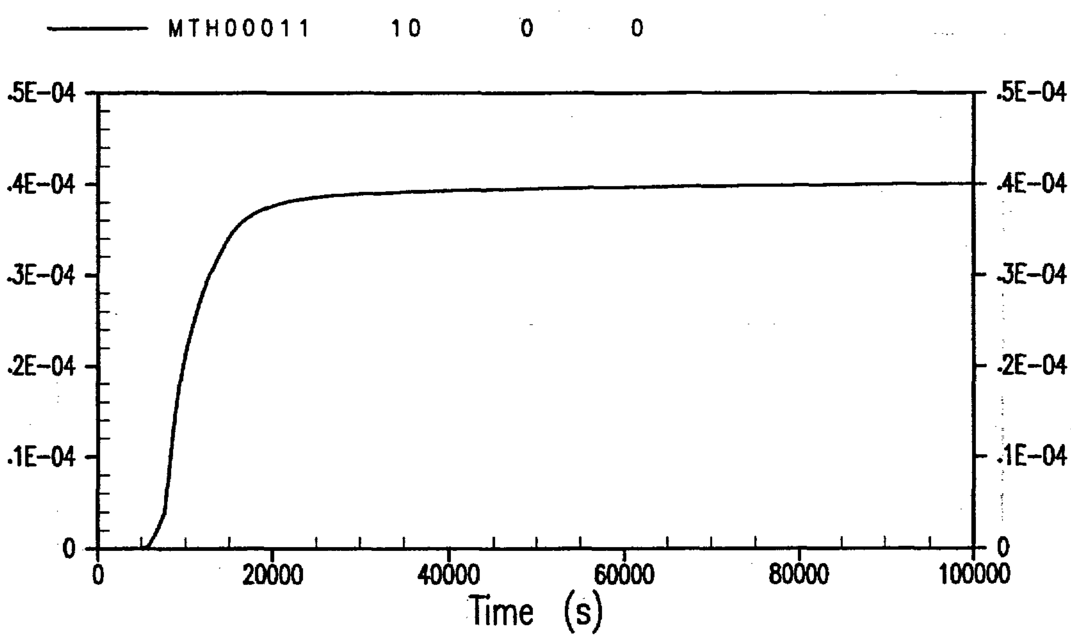

Figure 45-82

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tin

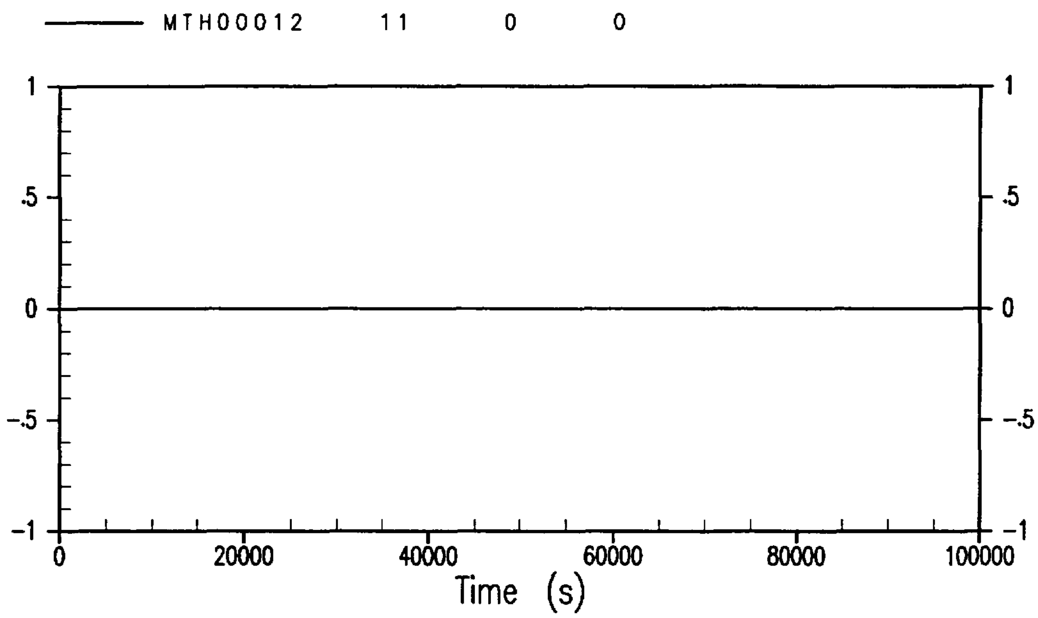

Figure 45-83

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Tellurium

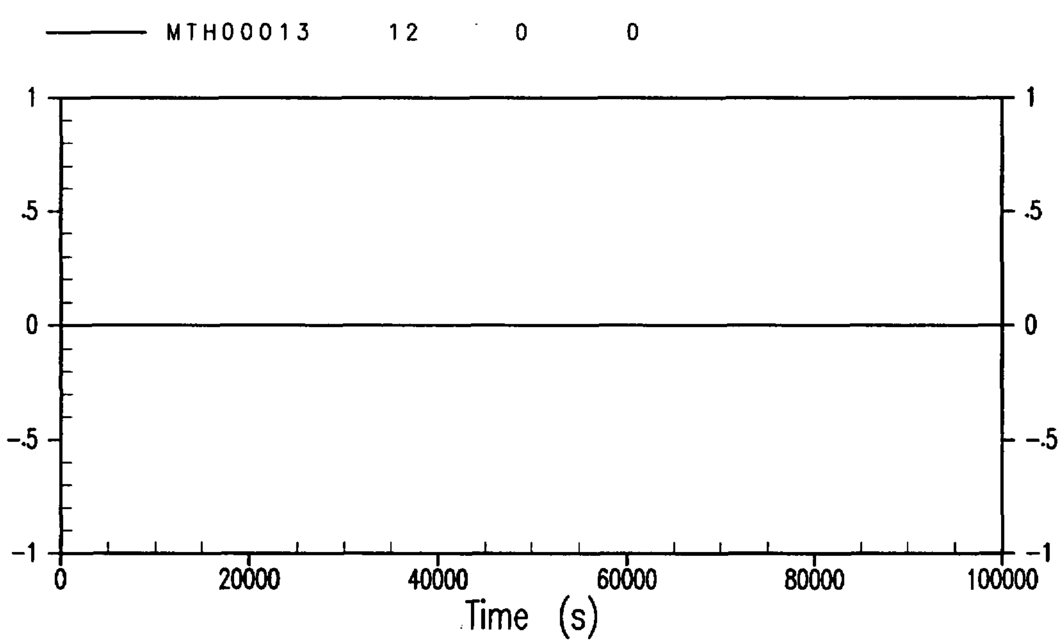

Figure 45-84

Release Category IC, Case 3BE-5 – SBLOCA with Failed Gravity Injection Direct-Release Sensitivity: Release Fraction of Uranium Dioxide

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REVISION 1 CHANGE ROADMAP

Section	Page No.	Type of Change[1]
AP1000 Document Cover Sheet		Editorial
Probabilistic Risk Assessment, Title Page		Editorial
T of C	i through c	Editorial
Revision 1 Change Roadmap	ci through civ	Editorial
1	1-6	Editorial
3	3-4	Editorial
Attachment 4B	4B-24	720.027
Attachment 4B	4B-74	Editorial
6	6-9	720.025 (720.029)
6	6-12	720.025 (720.029) Editorial
6	6-16	Editorial
6	6-17	720.026
6	6-19 through 6-53	720.023 (720.024) (720.097)
6	6-62	720.031
6	6-69	720.025 (720.029)
6	6-71	720.025 (720.029)
8	8-23 and 8-25	Editorial
12	12-6	720.033
12	12-30	720.033
26	26-11 and 26-12	Editorial
28	28-10 and 28-11	Editorial
29	29-17	720.033
29	29-21	720.033

REVISION 1 CHANGE ROADMAP (Cont.)

Section	Page No.	Type of Change[1]
30	30-35 and 30-36	720.068
30	30-66 and 30-67	720.068
30	30-110	Editorial
34	34-1	720.042
34	34-4 and 34-5	720.042
34	34-6 and 34-7	720.042 Editorial
34	34-8 through 34-243	720.042
35	35-28	720.043
39	39-4	720.073 Editorial
39	39-5	720.088 (720.048, 720.074, 720.083, 720.089)
39	39-6	720.088 720.073 (720.048, 720.074, 720.083, and 720.089)
39	39-12	Editorial
39	39-19	Editorial
39	39-20	720.073
39	39-21	Editorial 720.088
Attachment 39A	39A-1 through 39A-40	720.088 (720.048, 720.074, 720.083, and 720.089)
41	41-6	720.042
41	41-15	720.093
41	41-20	720.054
41	41-31	Editorial
Attachment 41A	41A-1 through 41A-228	720.042
Attachment 41B	41B-1 through 41B-11	720.093
43	43-126 and 43-127	Editorial
Attachment 43C	43C-1 and 43C-2	720.043
44	44-7	Editorial

REVISION 1 CHANGE ROADMAP (Cont.)

Section	Page No.	Type of Change[(1)]
45	45-1 through 45-3	470.013 (470.012)
45	45-4	470.013 (470.012) Editorial
45	45-5 through 45-48	470.013 (470.012)
49	49-1	720.056
49	49-4 through 49-6	720.056
49	49-9 through 49-49	720.056
50	50-14	720.034
55	55-5	DSER OI 19A.2-5 (R1)
55	55-7	DSER OI 19A.2-4 (R1) DSER OI 19A.2-5 (R1) DSER OI 19A.2-6 (R1)
55	55-20	DSER OI 19A.2-6 (R1)
57	57-1 through 57-109	Letter DCP/NRC1515
Attachment 57A	57A-1 through 57A-37	Letter DCP/NRC1515
Attachment 57B	57B-1 through 57B-6	Letter DCP/NRC1515
Attachment 57C	57C-1 through 57C-80	Letter DCP/NRC1515
Attachment 57D	57D-1 through 57D-7	Letter DCP/NRC1515
59	59-20 and 59-21	Editorial
59	59-23 through 59-25	Letter DCP/NRC1515
59	59-26	720.056
59	59-28	Editorial
59	59-29 through 59-32	720.038
59	59-34 through 59-38	720.038
59	59-72	Editorial
59	59-73	Technical
59	59-83	Editorial
59	59-75 through 59-96	720.038
59	59-97	720.038 720.066
59	59-98	720.038
59	59-100	Technical

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Appendix B	B-6	720.058
Appendix B	B-13	720.076
Appendix D	D-14 and D-15	720.078
Appendix D	D-31	720.078
Appendix D	D-35 and D-36	Technical
Appendix D	D-37 through D-58	720.078

1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number. RAI number in parenthesis contains a reference to RAI response listed above.

REVISION 2 CHANGE ROADMAP

Section	Page No.	Type of Change[1]
AP1000 Document Cover Sheet		Editorial
Probabilistic Risk Assessment, Title Page		Editorial
T of C	i through c	Editorial
Revision 2 Change Roadmap	cv through cvii	Editorial
6	6-17	720.026 (R1)
6	6-28	720.024 (R1)
6	6-32 and 6-33	720.024 (R1)
6	6-37 through 6-39	720.024 (R1)
6	6-41	720.024 (R1)
6	6-50 through 6-53	720.024 (R1)
6	6-69	720.029 (R1)
24	24-17	720.046 (R1)
24	24-22 and 24-23	720.046 (R1)
24	24-27	720.046 (R1)
30	30-26a through 30-28	720.029 (R1)
35	35-28	720.043 (R1)
43	43-9 and 43-9a	720.039 (R2)
43	43-9b	Editorial
43	43-10a	720.039 (R2)
43	43-10b	Editorial
43	43-93a through 43-93w	720.039 (R2)
43	93-93x	Editorial
Attachment 43C	43C-2	720.043 (R1)
50	50-1	
50	50-1a and 50-1b	Editorial
50	50-14	720.039 (R2)
50	50-14a	720.039 (R2)
50	50-14b	Editorial
54	54-1 through 54-131	720.038 (R2)

REVISION 2 CHANGE ROADMAP (Cont.)

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56	56-9	Editorial
56	56-17 and 56-18	Editorial
56	56-20	Editorial
56	56-36 and 56-37	Editorial
56	56-38	Editorial 720.038 (R1)
56	56-38a through 56-38k	720.038 (R1)
56	56-381	Editorial
56	56-47 through 56-49	Editorial
56	56-51	Editorial
56	56-54 and 56-55	720.038 (R1)
57	57-14 and 57-15	280.011 (R1)
57	57-15a and 57-15b	Editorial
59	59-23 and 59-23a	720.038 (R1)
59	59-23b	Editorial
59	59-34	720.038 (R1)
59	59-72	720.038 (R1)
Appendix A	A-12	Editorial
Appendix A	A-24 through A-26	440.014 (R1)
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Appendix A	A-26b	Editorial
Appendix A	A-27	720.012 (R1)
Appendix A	A-31	720.012 (R1)
Appendix A	A-33	720.010 (R1)
Appendix A	A-33a and A-33b	Editorial
Appendix A	A-44	Editorial
Appendix A	A-57 through A-61	720.012 (R1)
Appendix A	A-63	720.012 (R1)
Appendix A	A-66	720.012 (R1)
Appendix A	A-103a through A-103b	440.014 (R1)
Appendix A	A-103c and A-103d	720.012 (R1)
Appendix A	A-151 and A-152	720.013 (R1)
Appendix A	A-165 and A-166	720.013 (R1)

REVISION 2 CHANGE ROADMAP (Cont.)

Section	Page No.	Type of Change[1]
Appendix D	D-13 and D-14	720.080 (R1)
Appendix D	D-35 and D-36	720.080 (R1)

1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number.

REVISION 3 CHANGE ROADMAP

Section	Page No.	Type of Change[1]
AP1000 Document Cover Sheet		Editorial
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Revision 3 Change Roadmap	cx	Editorial
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57	57-1 and 57-2	Editorial
57	57-4	Editorial
57	57-11 and 57-12	Editorial
57	57-17	Editorial
57	57-22 and 57-23	Editorial
57	57-30 through 57-39	720.038 (R1)
57	57-40	720.038 (R1) Editorial
57	57-41 and 57-42	720.038 (R1)
57	57-78	Editorial
57	57-117 through 57-124	720.038 (R1)
Appendix A	A-23 through A-25	720.009 (R2)
Appendix A	A-105 through A-111	720.009 (R2)

1. Changes incorporated as a result of Westinghouse responses to NRC Request for Additional Information (RAI) identified by RAI number.

REVISION 4 CHANGE ROADMAP

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34	34-4	Editorial
34	34-16	DSER OI 19.1.10.3-1 (R1)
34	34-19 through 34-21	DSER OI 19.1.10.3-1 (R1)
34	34-50 and 34-51	DSER OI 19.1.10.3-1 (R1)
34	34-247 through 34-264	DSER OI 19.1.10.3-1 (R1)
42	42-3	DSER OI 19.2.6-1 (R1)
42	42-6	DSER OI 19.2.6-3
42	42-7 and 42-8	Editorial
43	43-10	Editorial
43	43-13	Editorial
Attachment 43D	43D-1	DSER OI 19.1.3.2-1
Attachment 43E	43E-1 and 43E-2	DSER OI 19.1.3.2-2
45	45-2	DSER OI 19.1.10.3-1 (R1)
45	45-5 and 45-6	DSER OI 19.1.10.3-1 (R1)
45	45-13 through 45-18	DSER OI 19.1.10.3-1 (R1)
45	45-31 through 45-42	DSER OI 19.1.10.3-1 (R1)
Attachment 45A	45A-1 through 45A-24	Deleted per DSER OI 19.1.10.3-1 (R1)
49	49-6	DSER OI 19.1.10.3-1 (R1)
49	49-9 through 49-49	DSER OI 19.1.10.3-1 (R1)
50	50-1	Editorial
54	54-9	DSER OI 19.1.10.2-3
54	54-12	DSER OI 19.1.10.2-3
54	54-13	Editorial
54	54-22 through 54-71	Editorial
54	54-76 through 54-80	DSER OI 19.1.10.2-5 Editorial

REVISION 4 CHANGE ROADMAP (Cont.)

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54	54-83 through 54-110	DSER OI 19.1.10.2-5 Editorial
54	54-112 through 54-118	DSER OI 19.1.10.2-5 Editorial
54	54-121 through 54-137	DSER OI 19.1.10.2-3
55	55-5	DSER OI 19A.2-5 (R1)
55	55-7	DSER OI 19A.2-4 (R1) DSER OI 19A.2-5 (R1) DSER OI 19A.2-6 (R1) Editorial
55	55-16 through 55-18	Editorial
55	55-20	DSER OI 19A.2-6 (R1)
55	55-25 through 55-29	Editorial
56	56-46	DSER OI 19.3.10-1
59	59-26	DSER OI 19.1.10.3-1 (R1)
59	59-37	DSER OI 19A.3-2 (R1)
59	59-45 through 59-70	Editorial
59	59-73	DSER OI 19.1.10.3-1 (R1)
59	59-74	Editorial
59	59-100	DSER OI 19.1.10.3-1 (R1)

1. Changes incorporated as a result of Draft Safety Evaluation Report (DSER) Open Item (OI) Response identified by DSER OI number.