

ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Wednesday, December 10, 2008 5:30 PM
To: Getachew Tesfaye
Cc: John Rycyna; DELANO Karen V (AREVA NP INC); Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 6, Supplement 3, FSAR Ch 19 (Part 2 of 3)
Attachments: RAI 06 Supplement 3 Response US EPR DC (Part 2 of 3).pdf

Getachew,
Attached is "RAI 6 Supplement 3 Response US EPR DC.pdf (Part 2 of 3).pdf," Response to RAI 6, Question 19-124.

(Russ Wells on behalf of)

Ronda Pederson

ronda.pederson@areva.com

Licensing Manager, U.S. EPR Design Certification
New Plants Deployment

AREVA NP, Inc.

An AREVA and Siemens company

3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

Cell: 434-841-8788

From: WELLS Russell D (AREVA NP INC)
Sent: Wednesday, December 10, 2008 5:14 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 6, Supplement 3, FSAR Ch 19 (Part 1 of 3)

Getachew,

AREVA NP Inc. provided responses to 24 of the 44 questions of RAI No. 6 on July 7, 2008. A Supplement 1 response to RAI No. 6 was sent on August 8, 2008 to address an additional 19 of the 44 questions. A Supplement 2 response to RAI No. 6 was sent on October 8, 2008 to address the single remaining question.

Attached please find Supplement 3 to AREVA NP's response to RAI No. 6. The attached file, "RAI 6 Supplement 3 Response US EPR DC.pdf" provides revised technically correct and complete responses to two RAI No. 6, Questions 19-84 and 19-124. These responses supersede the previously submitted responses, as described in the response document.

The following table provides the page(s) in the response document, "RAI 6 Supplement 3 Response US EPR DC.pdf" containing the response to the one question.

Question #	Start Page	End Page
RAI 6 —19-84	2	63
RAI 6 —19-124	64	299

This concludes the formal AREVA NP response to RAI 6, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson

ronda.pederson@areva.com

Licensing Manager, U.S. EPR Design Certification

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From: Pederson Ronda M (AREVA NP INC)

Sent: Wednesday, October 08, 2008 9:11 AM

To: 'Getachew Tesfaye'

Cc: DUNCAN Leslie E (AREVA NP INC); DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); NOXON David B (AREVA NP INC)

Subject: Response to U.S. EPR Design Certification Application RAI No. 6, FSAR Ch. 19, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 22 of the 43 questions of RAI No. 6 on July 7, 2008. AREVA NP's Supplement 1 response to RAI No. 6 was sent on August 8, 2008 to address an additional 19 of the 43 questions. Attached please find AREVA NP's second supplemental response to the subject request for additional information (RAI). The attached file, "RAI 6 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining one question, as committed in the August 8, 2008 submittal.

The following table provides the page(s) in the response document, "RAI 6 Supplement 2 Response US EPR DC.pdf" containing the response to the one question.

Question #	Start Page	End Page
RAI 6 —19-117	2	3

Sincerely,

Ronda Pederson

ronda.pederson@areva.com

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New Plants Deployment

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3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, August 08, 2008 6:38 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; DELANO Karen V (AREVA NP INC)
Subject: RE: Response to U.S. EPR Design Certification Application RAI No. 6, FSAR Ch. 19

Getachew,

The proprietary and non-proprietary versions of the technically correct and complete responses to the 19 of the remaining 20 questions of RAI 6, are submitted via AREVA NP Inc. letter, "Response to U.S. EPR Design Certification Application RAI No. 6, Supplement 1," NRC 08:056, dated August 8, 2008. An affidavit to support withholding of information from public disclosure, per 10CFR2.390(b), is provided as an enclosure to that letter.

A complete answer is not provided to RAI 6, Question 117b. A technically correct and complete response to this question will be provided by November 7, 2008.

Sincerely,

Ronda Pederson

ronda.pederson@areva.com

Licensing Manager, U.S. EPR Design Certification

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3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

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From: Pederson Ronda M (AREVA NP INC)
Sent: Monday, July 07, 2008 7:21 PM
To: Getachew Tesfaye
Cc: 'John Rycyna'; BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 6, FSAR Ch. 19

Getachew,

The proprietary and non-proprietary versions of the technically correct and complete responses to 23 of the 43 questions of RAI 6, along with partial responses to two questions, are submitted via AREVA NP Inc. letter, "Response to U.S. EPR Design Certification Application RAI No. 6," NRC 08:060, dated July 7, 2008. An affidavit to support withholding of information from public disclosure, per 10CFR2.390(b), is provided as an enclosure to that letter.

Complete answers are not provided for 20 of the questions. The schedule for technically correct and complete response for these questions is provided below.

Question #	Response Date
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RAI 6 Question 19-79	August 8, 2008
RAI 6 Question 19-84	August 8, 2008
RAI 6 Question 19-86a - ISLOCA MAAP Results	August 8, 2008
RAI 6 Question 19-87	August 8, 2008
RAI 6 Question 19-89	August 8, 2008
RAI 6 Question 19-90	August 8, 2008
RAI 6 Question 19-91	August 8, 2008
RAI 6 Question 19-92	August 8, 2008
RAI 6 Question 19-93	August 8, 2008
RAI 6 Question 19-101	August 8, 2008
RAI 6 Question 19-105	August 8, 2008
RAI 6 Question 19-106	August 8, 2008
RAI 6 Question 19-114	August 8, 2008
RAI 6 Question 19-115	August 8, 2008
RAI 6 Question 19-117	August 8, 2008
RAI 6 Question 19-118	August 8, 2008
RAI 6 Question 19-119	August 8, 2008
RAI 6 Question 19-120b	August 8, 2008
RAI 6 Question 19-121	August 8, 2008
RAI 6 Question 19-124	August 8, 2008

Sincerely,

Ronda Pederson

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Licensing Manager, U.S. EPR Design Certification

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]

Sent: Thursday, June 05, 2008 7:17 AM

To: ZZ-DL-A-USEPR-DL

Cc: John Rycyna; Joseph Colaccino; Hossein Hamzehee; Lynn Mrowca; Edward Fuller; Hanh Phan; Theresa Clark; Jim Xu; Peter Hearn

Subject: U.S. EPR Design Certification Application RAI No. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 14, 2008, and discussed with your staff on May 21 and 28, 2008. The staff agreed to delete draft RAI Questions 19-100, 19-102, and 19-108 as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Getachew Tesfaye
Office of New Reactors
U.S. Nuclear Regulatory Commission
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 26

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41D58397)

Subject: Response to U.S. EPR Design Certification Application RAI No. 6, Supplement 3, FSAR Ch 19 (Part 2 of 3)
Sent Date: 12/10/2008 5:30:16 PM
Received Date: 12/10/2008 5:30:36 PM
From: WELLS Russell D (AREVA NP INC)

Created By: Russell.Wells@areva.com

Recipients:

"John Rycyna" <John.Rycyna@nrc.gov>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"Pederson Ronda M (AREVA NP INC)" <Ronda.Pederson@areva.com>
Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	8401	12/10/2008 5:30:36 PM
RAI 06 Supplement 3 Response US EPR DC (Part 2 of 3).pdf		3775630

Options

Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Question 19-124:

Please provide examples of several typical MAAP-calculated results for risk-dominant U.S. EPR accident scenarios, including the time evolution of:

- RCS Pressure
- Hydrogen produced in-vessel
- Hydrogen mass inside containment (mass and concentration)
- Hydrogen consumed by PARs
- Oxygen (mass and concentration) inside containment
- Steam (mass and concentration) inside containment
- Other non-condensable gases (mass and concentration) inside containment
- Level of water inside IRWST
- Level of water on the spreading floor, the melt discharge channel, the reactor pit, and other applicable elevations inside containment (showing water drainage into the IRWST)
- Core debris mass inside various containment regions (i.e., reactor pit, discharge channel and the spreading floor)
- Debris penetration distance (axial and radial) in the reactor pit, the discharge channel and the spreading floor
- The rate of release of various fission product groups inside the containment
- The airborne mass of various fission product groups inside the containment
- The mass of various fission product groups leaking out of the containment
- Total containment pressure (sum of all partial pressures).

Response to Question 19-124:

This response supersedes the RAI 6 Supplement 1 response to Question 19-124. The MAAP run results reflect the updated core inventory. MAAP run st1.8f was not included since this case is not considered a LRF case.

The risk and consequence-dominant scenarios for the U.S. EPR are the Large Release Fraction (LRF) cases. The following release categories are classified as Large Release:

- RC201-205
- RC30x
- RC702
- RC802

These release categories correspond to MAAP runs: st1.8, st1.8a, st.18b, st1.8c, st1.11, st2.3, and st3.2a. The following figures represent the time evolution information requested for each LRF MAAP case..

The rate of release and airborne mass of various fission product groups inside containment are not explicit parameters in the MAAP4.0.7 computer code, and were not developed as user defined plot variables.

Note: Cases st1.8, st1.8a, st1.8b, st1.8c, and st1.11 simulate a pre-existing failed containment.

Figure 19-124-1—RCS Pressure (st1.8)

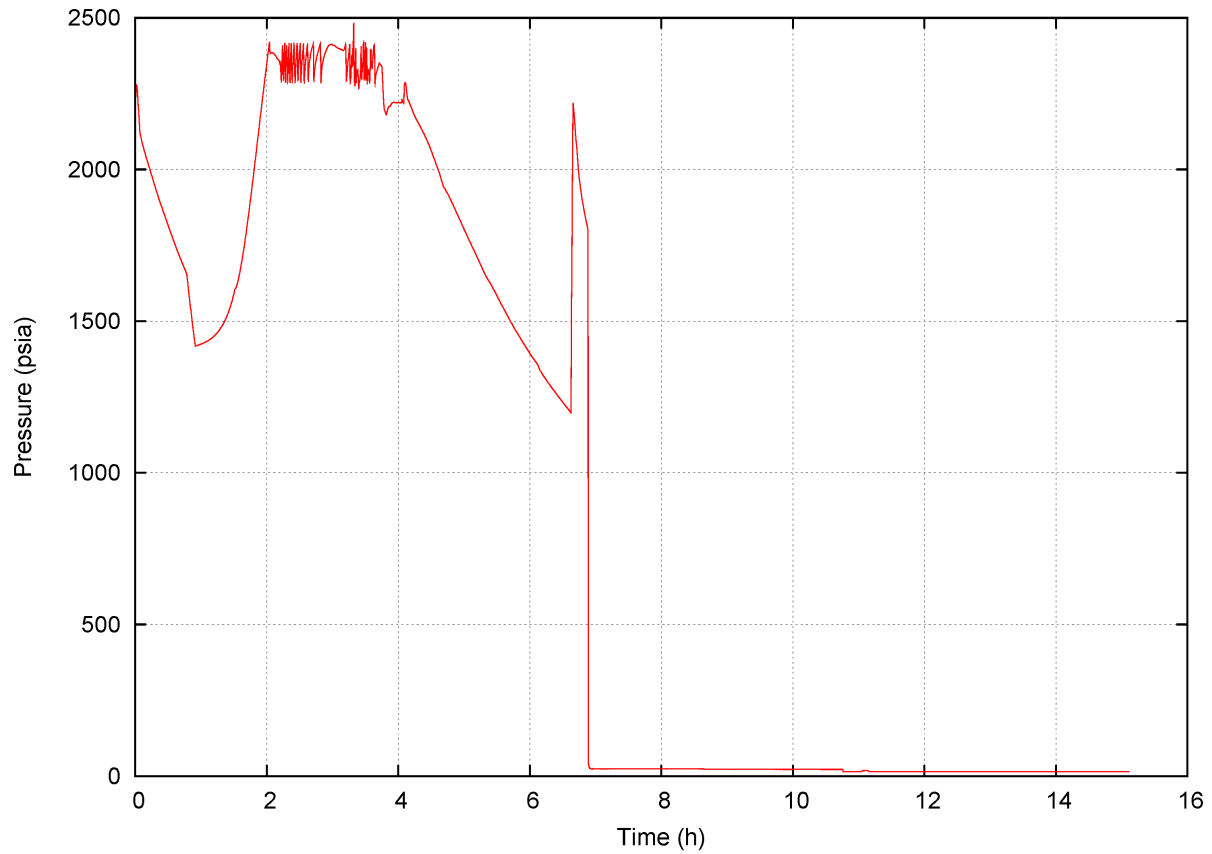


Figure 19-124-2—In-Vessel Hydrogen Production (st1.8)

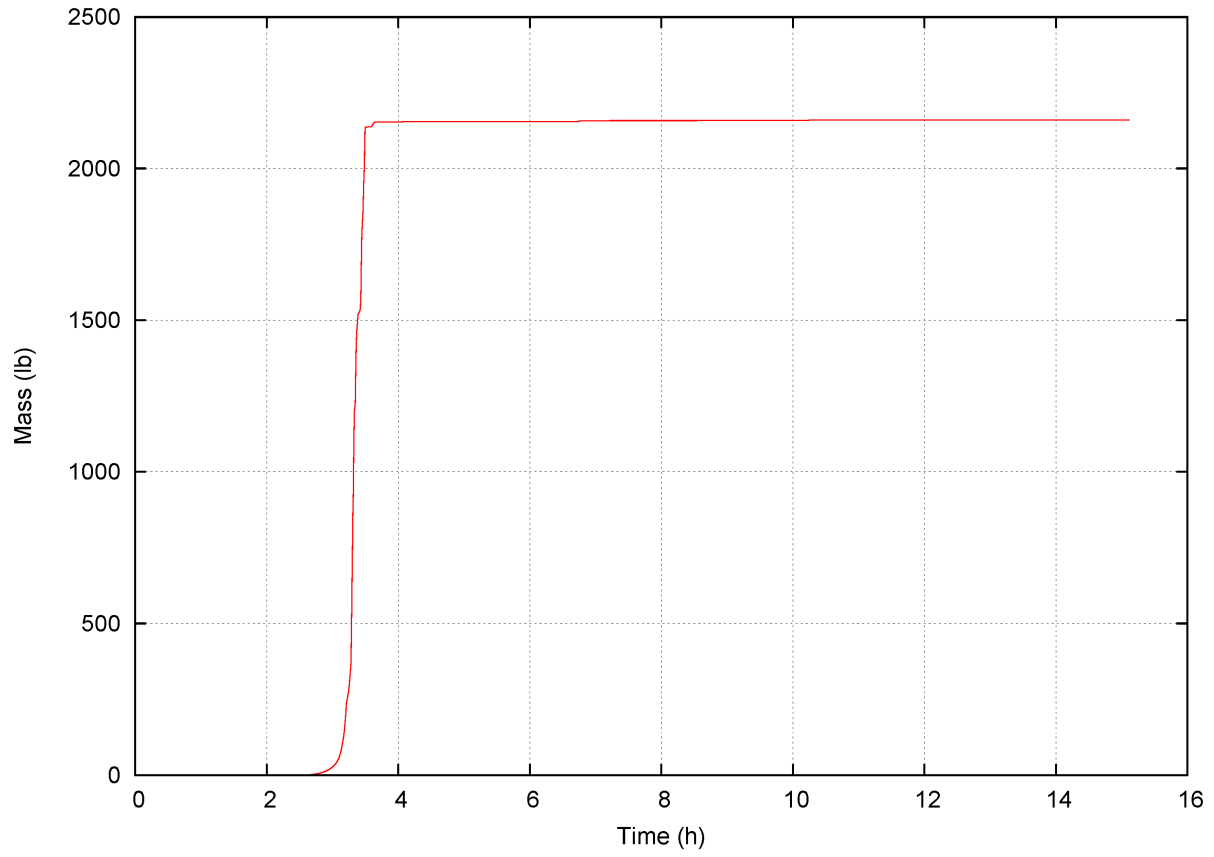


Figure 19-124-3—Mass of Hydrogen in Containment (st1.8)

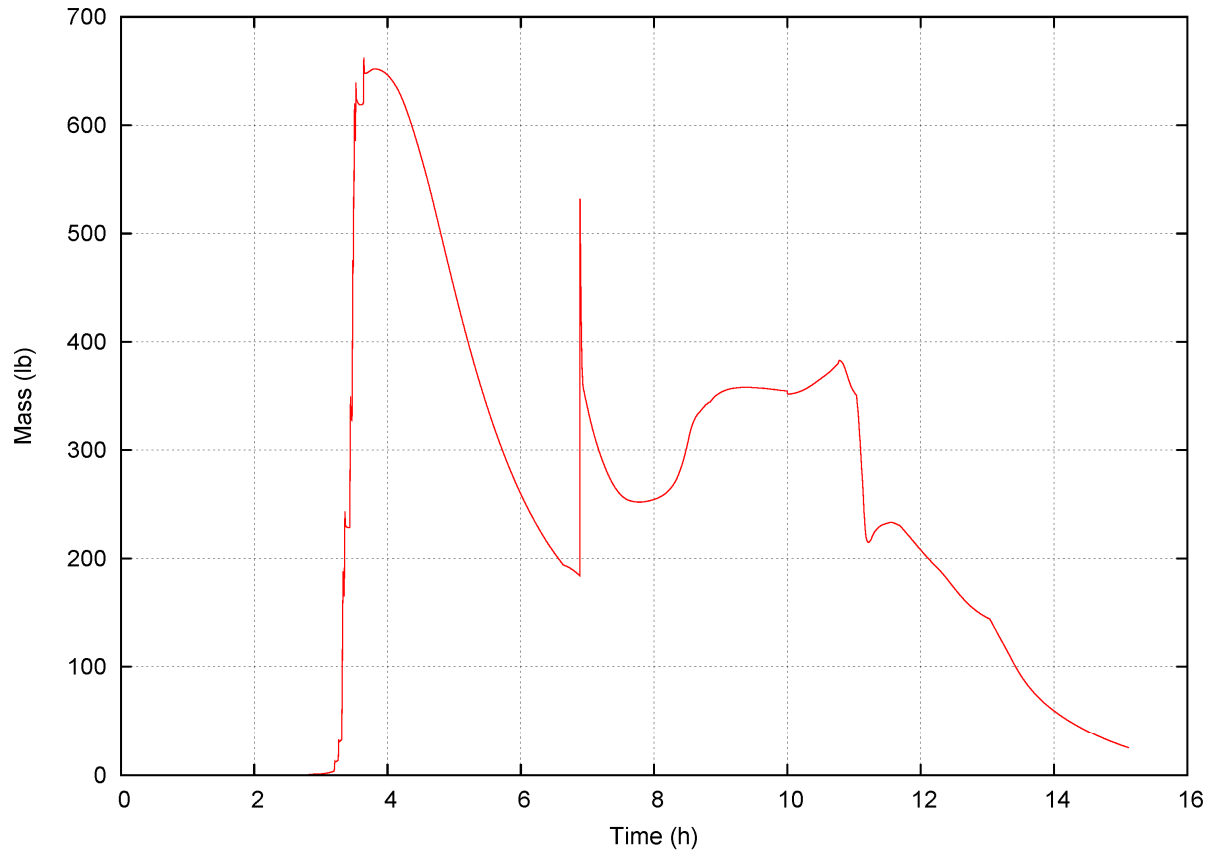


Figure 19-124-4—Concentration of Hydrogen in Containment (st1.8)

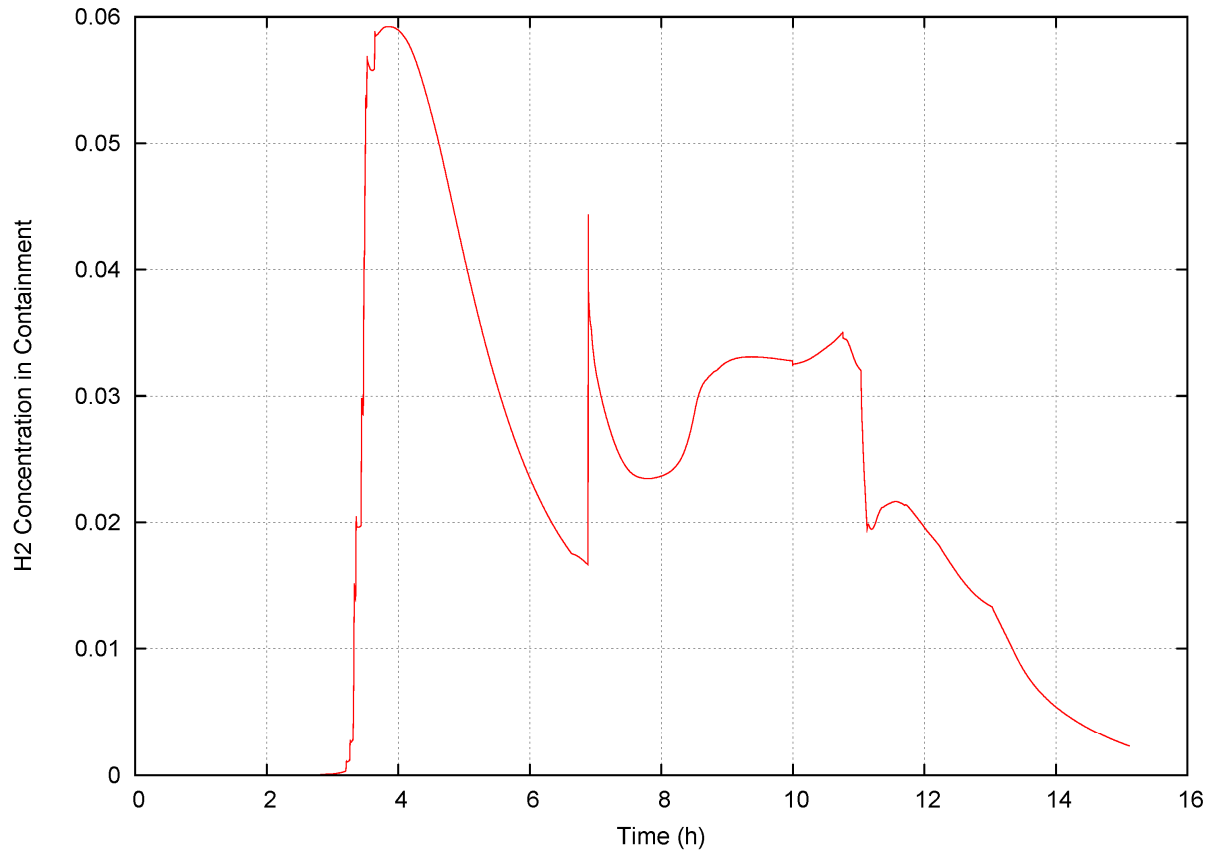


Figure 19-124-5—Hydrogen Consumed by Passive Autocatalytic Recombiners (PARs) (st1.8)

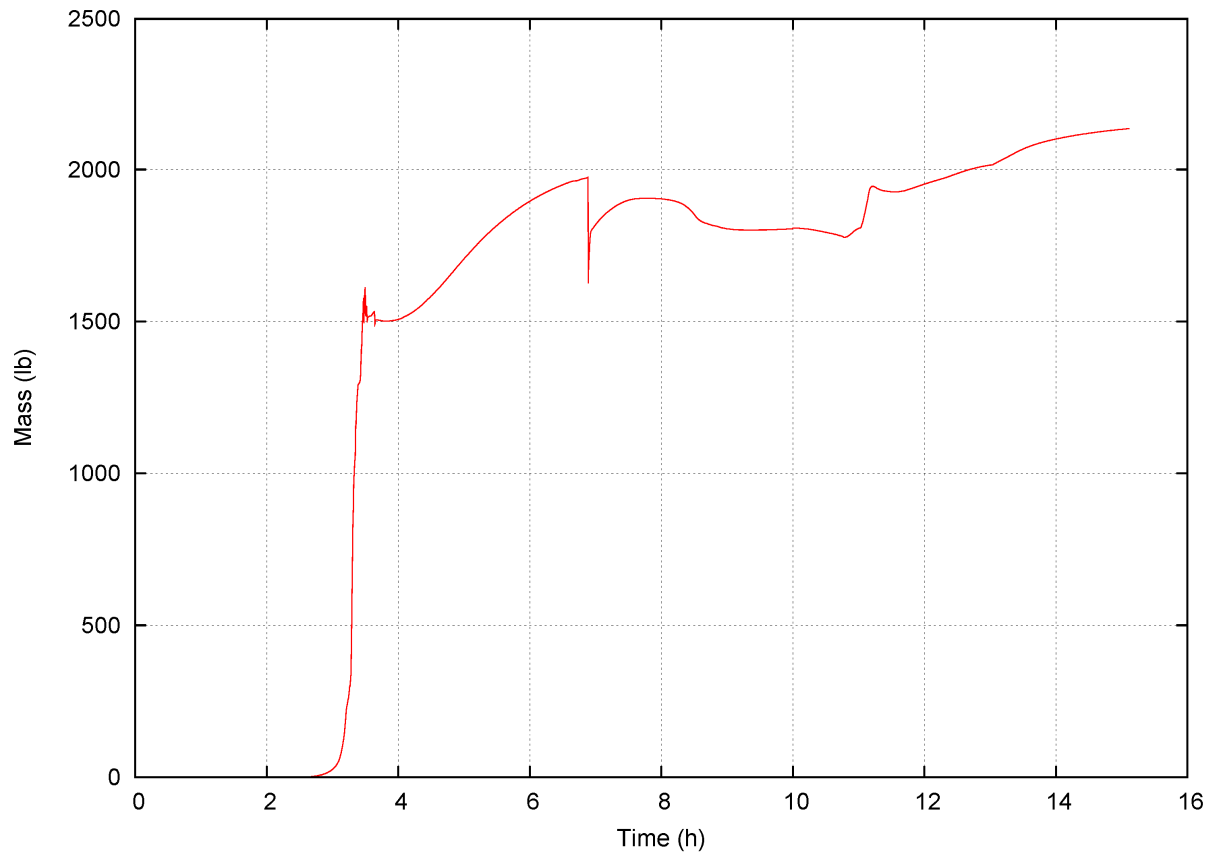


Figure 19-124-6—Mass of Oxygen in Containment (st1.8)

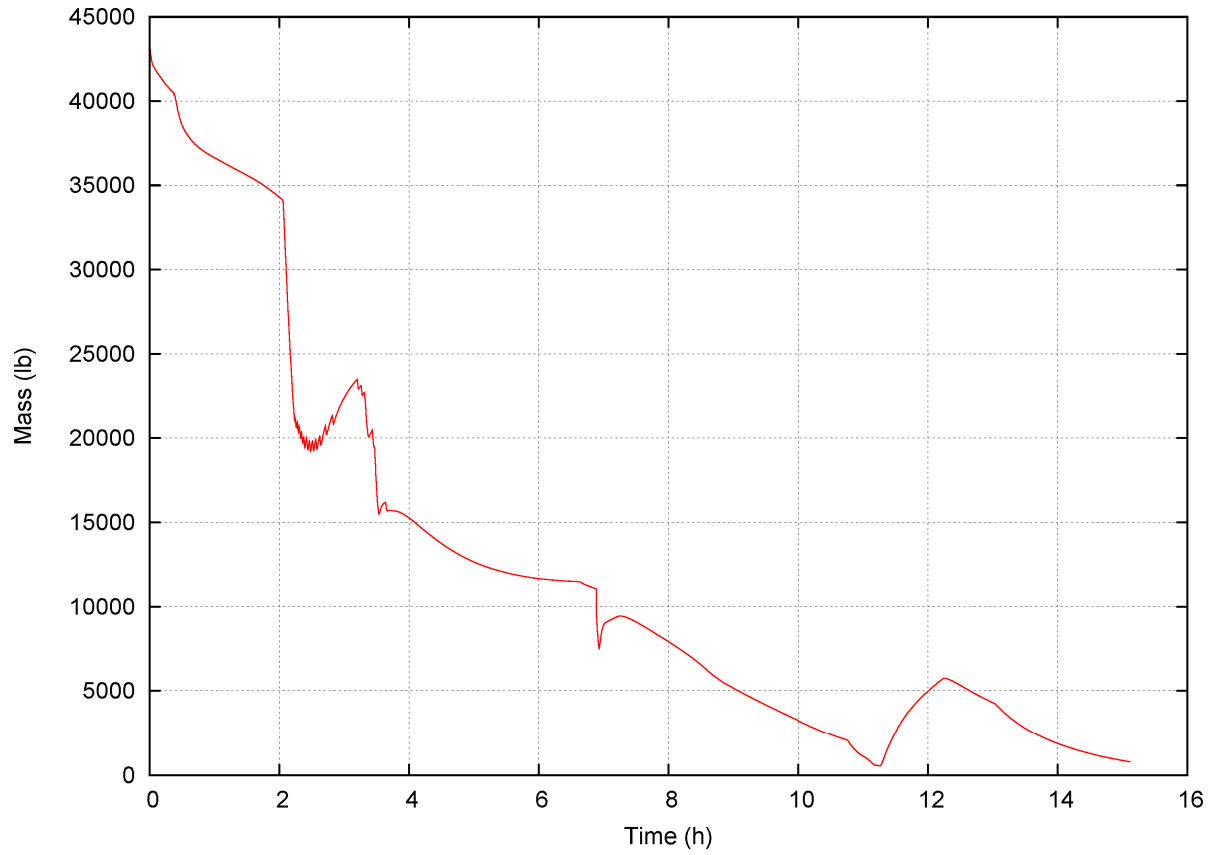


Figure 19-124-7—Concentration of Oxygen in Containment (st1.8)

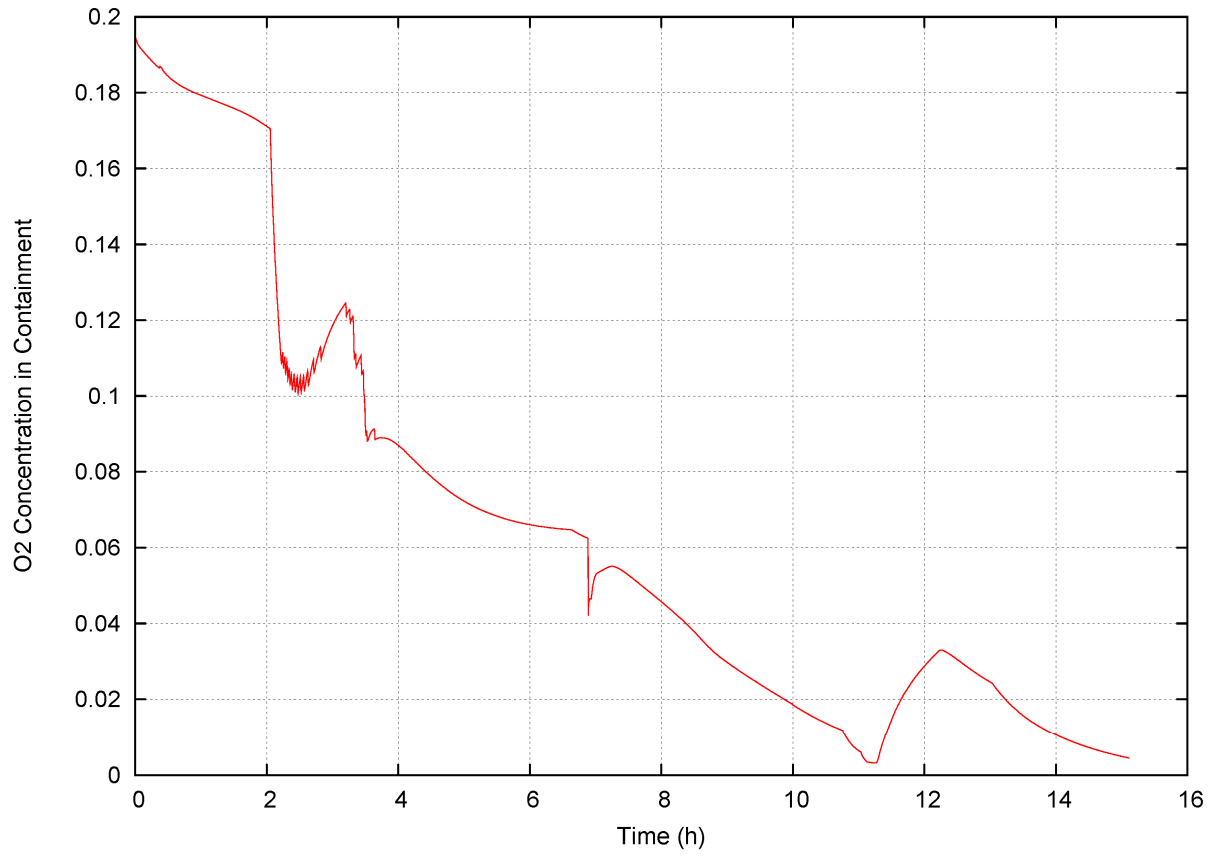


Figure 19-124-8—Mass of Steam in Containment (st1.8)

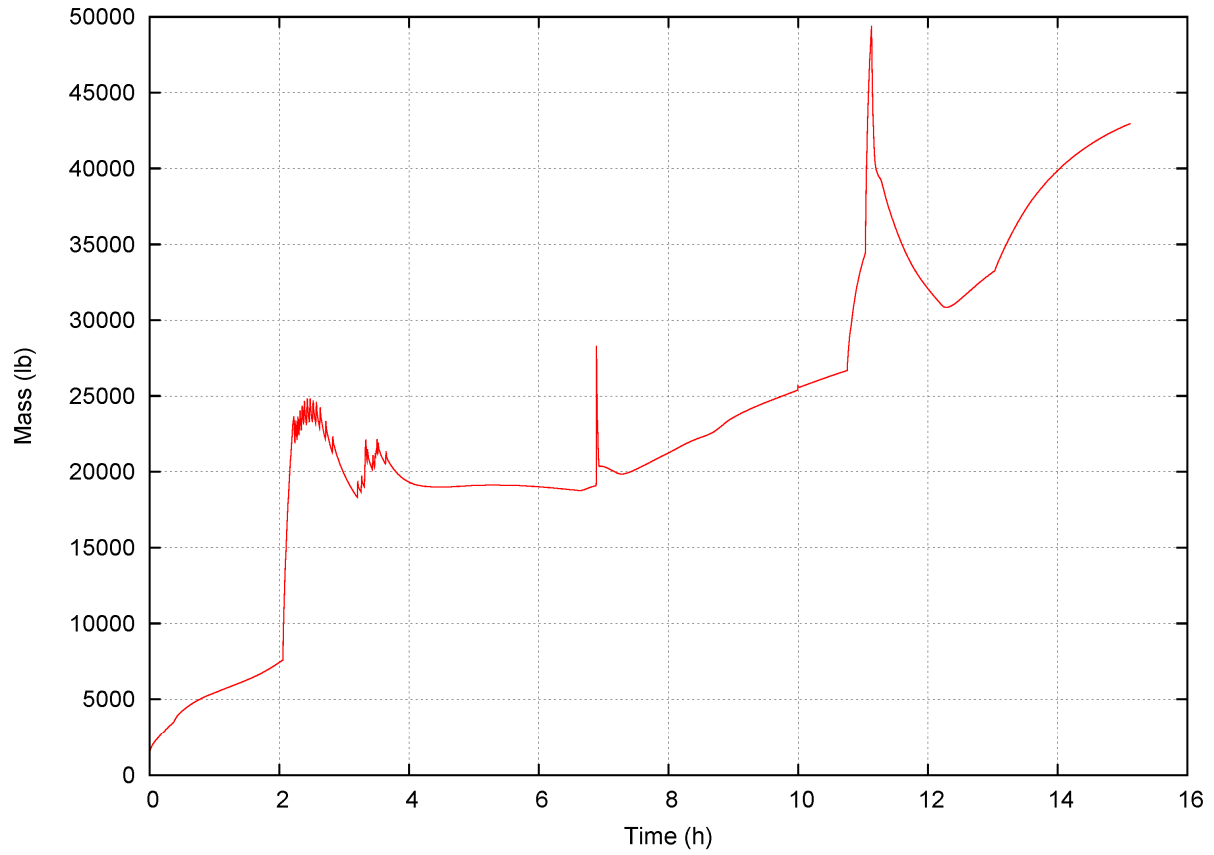


Figure 19-124-9—Concentration of Steam in Containment (st1.8)

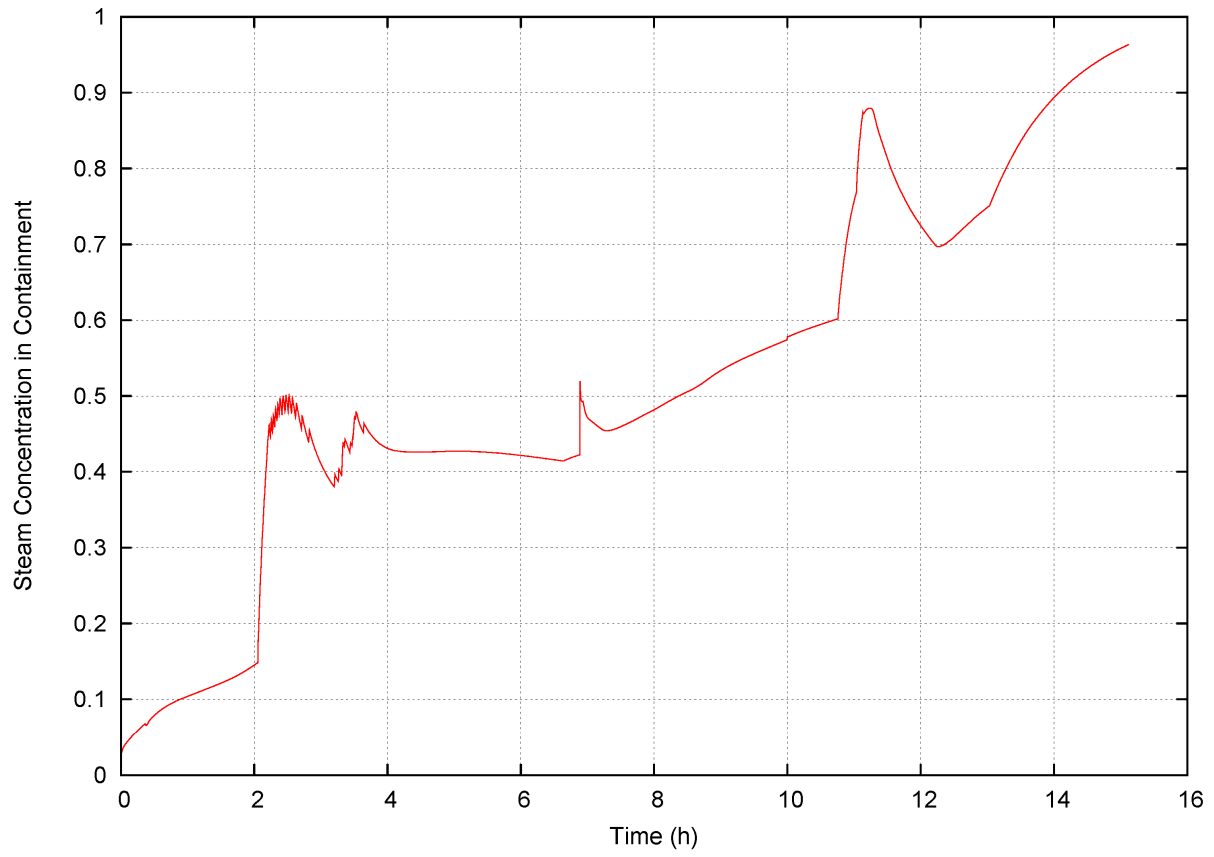


Figure 19-124-10—Mass of Nitrogen in Containment (st1.8)

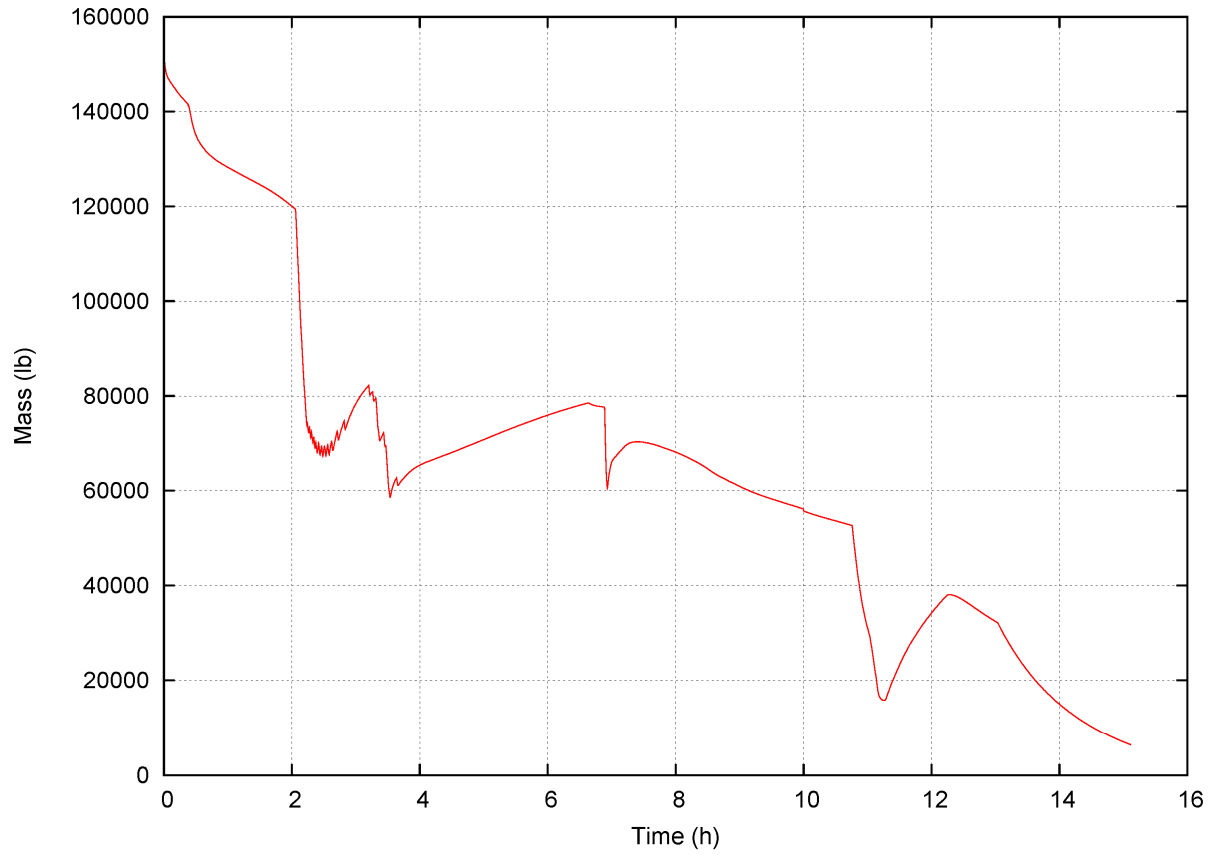


Figure 19-124-11—Concentration of Nitrogen in Containment (st1.8)

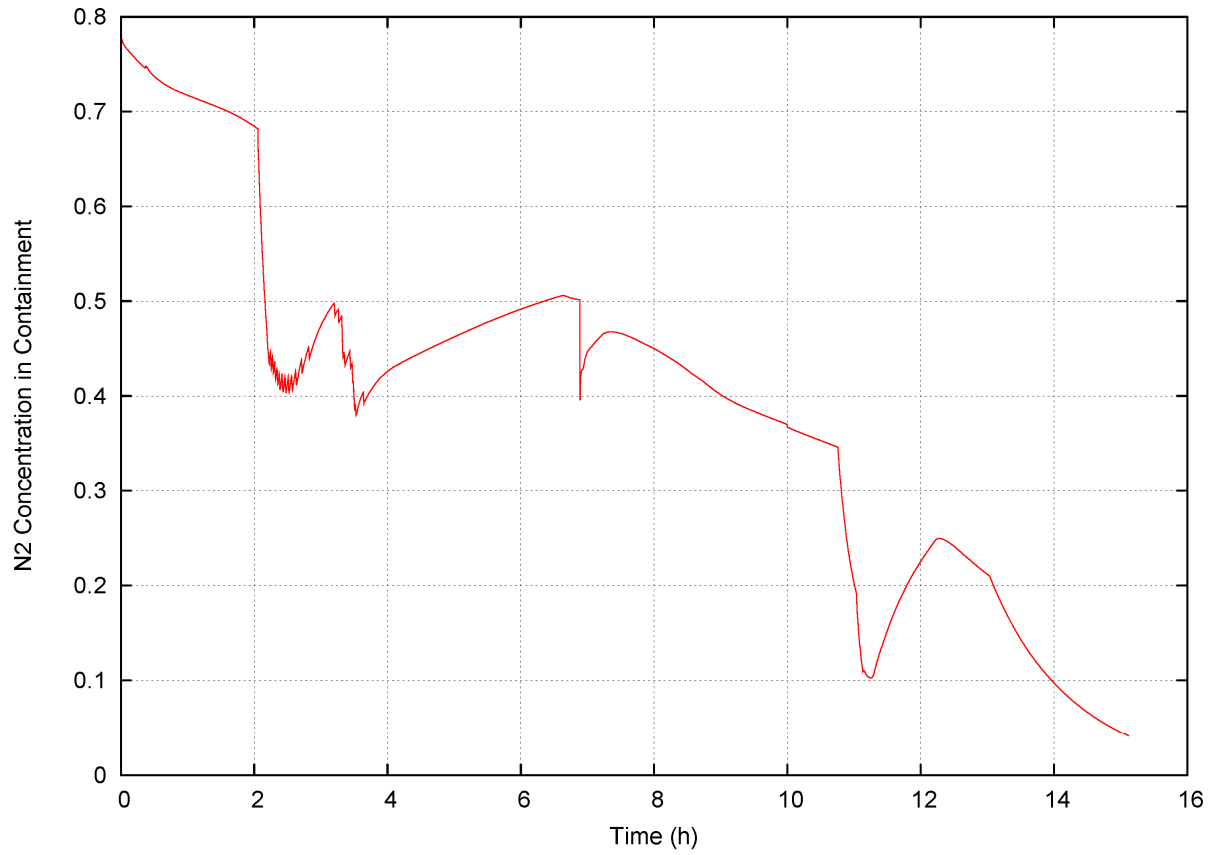


Figure 19-124-12—Mass of Carbon Dioxide in Containment (st1.8)

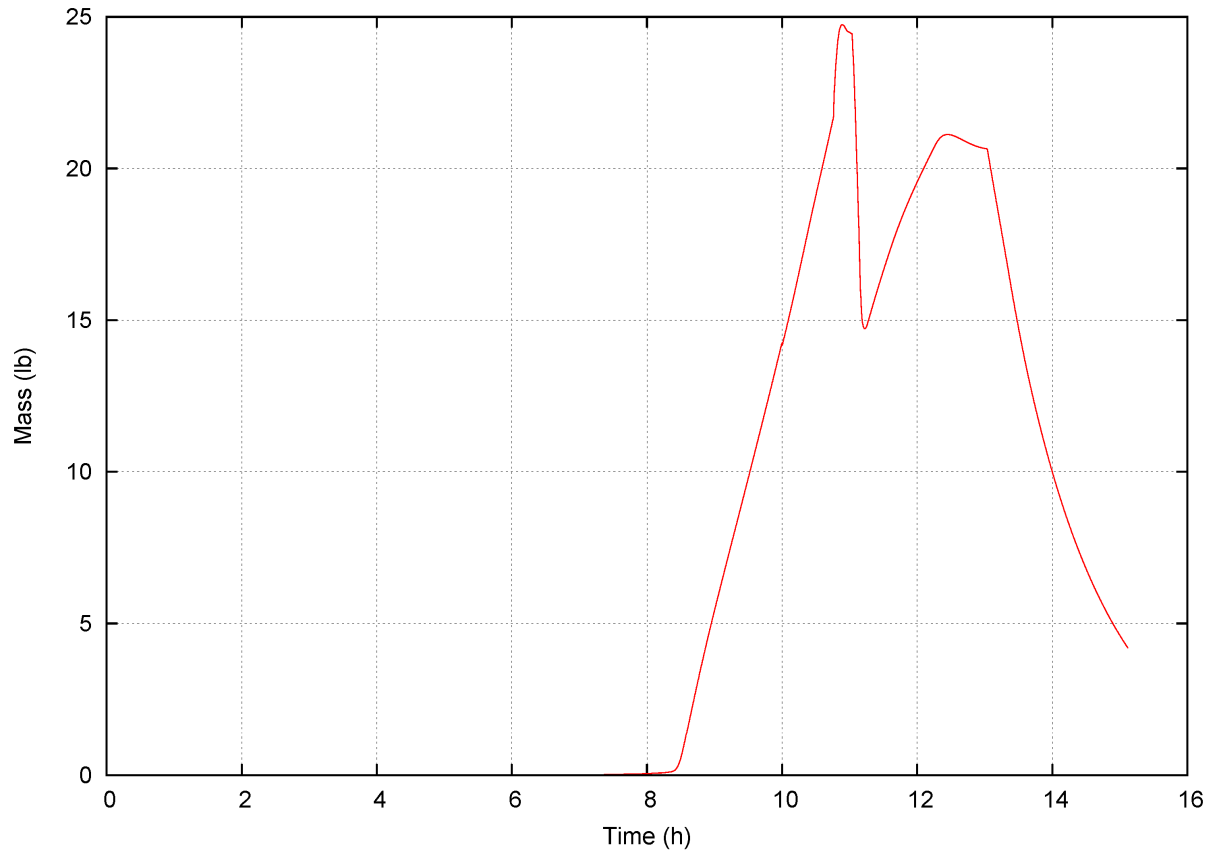


Figure 19-124-13—Concentration of Carbon Dioxide in Containment (st1.8)

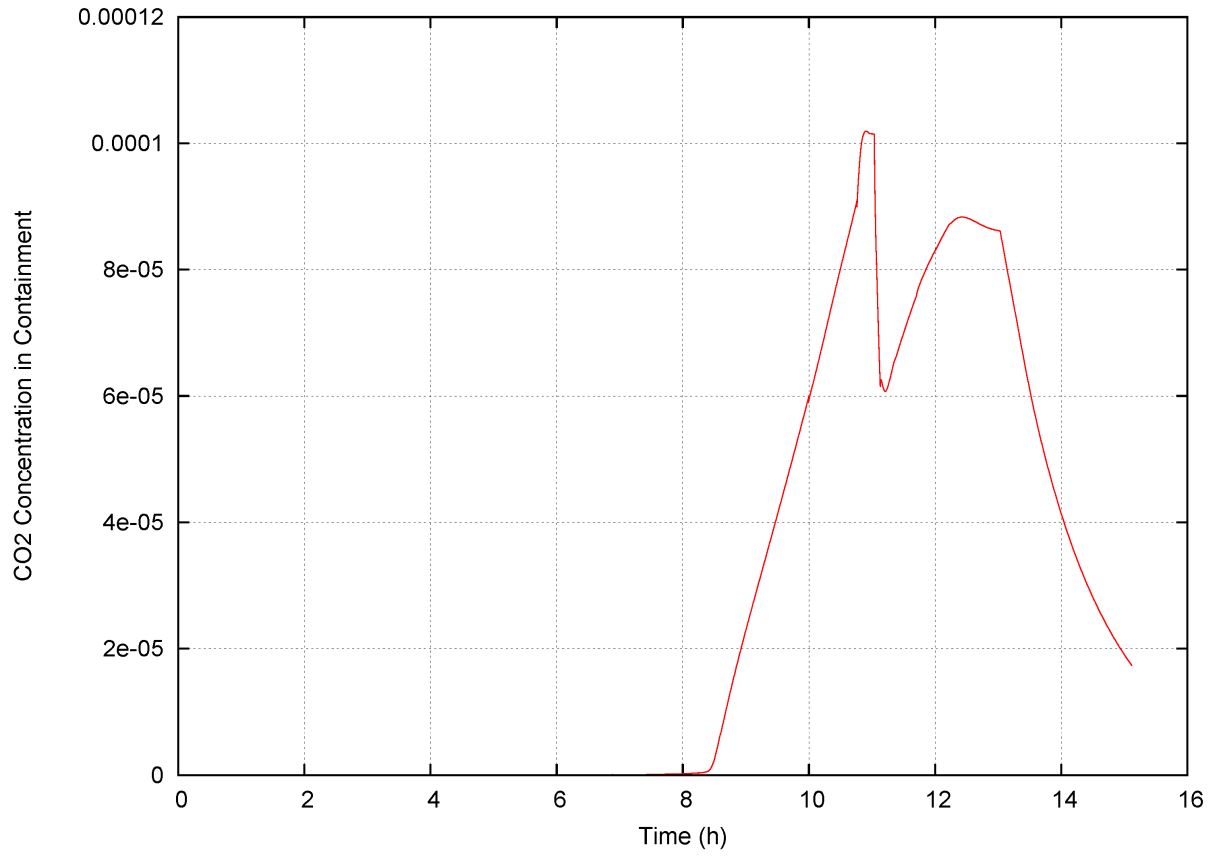
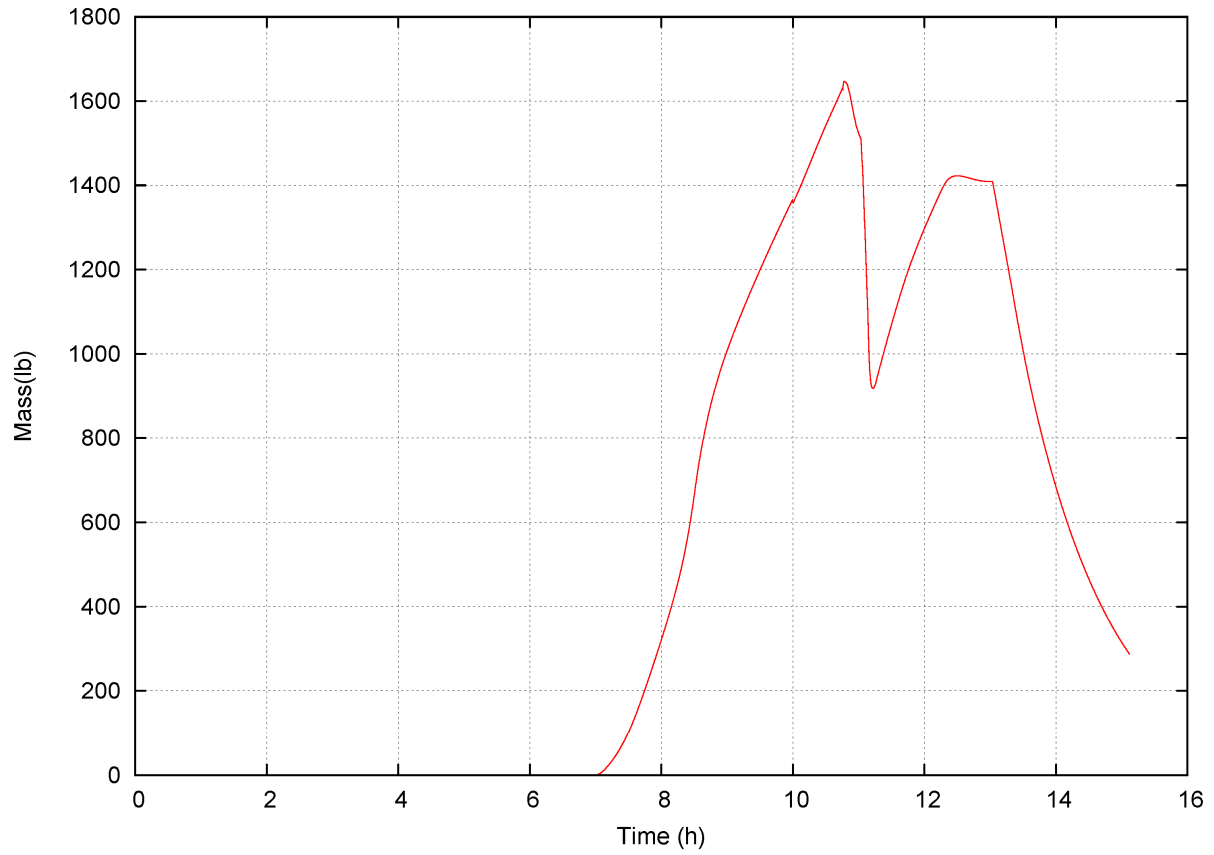
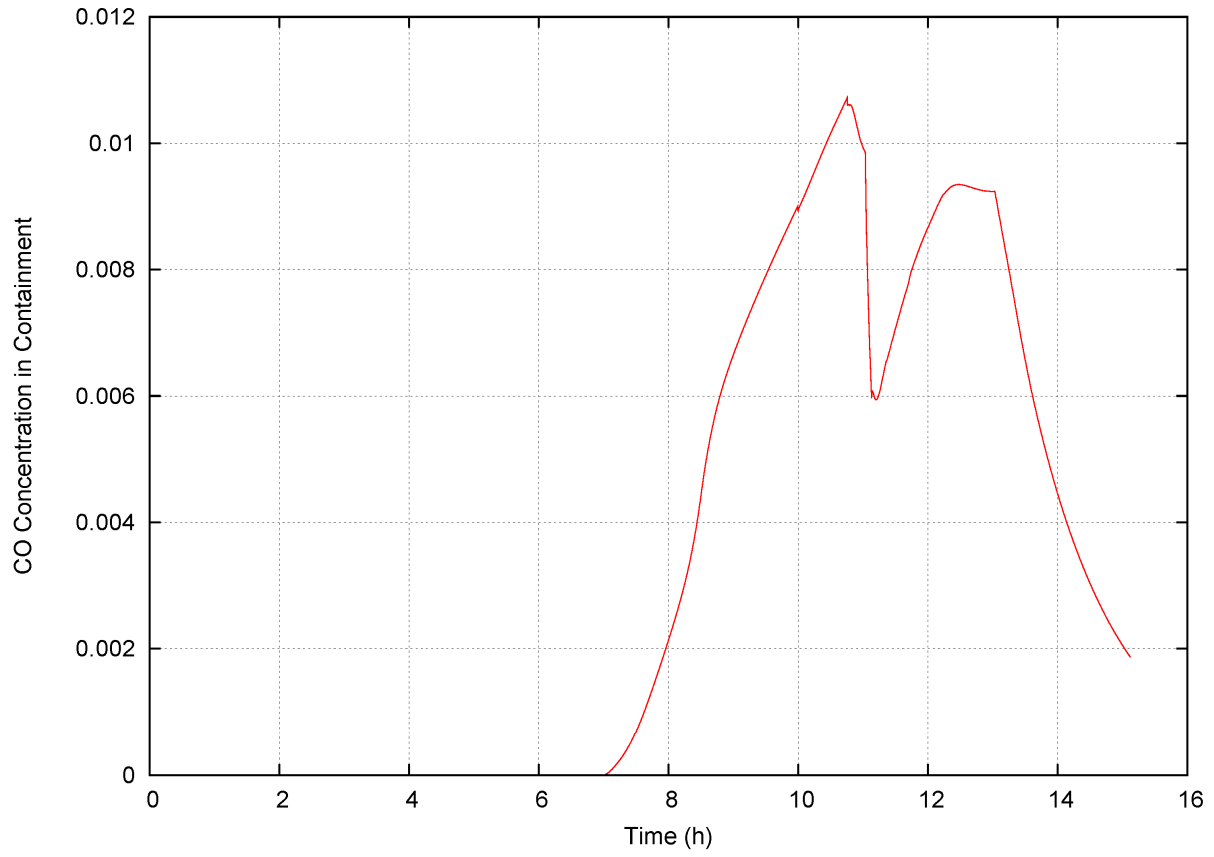


Figure 19-124-14—Mass of Carbon Monoxide in Containment (st1.8)



**Figure 19-124-15—Concentration of Carbon Monoxide in Containment
(st1.8)**



**Figure 19-124-16—In-containment Refueling Water Storage Tank (IRWST)
Water Level (st1.8)**

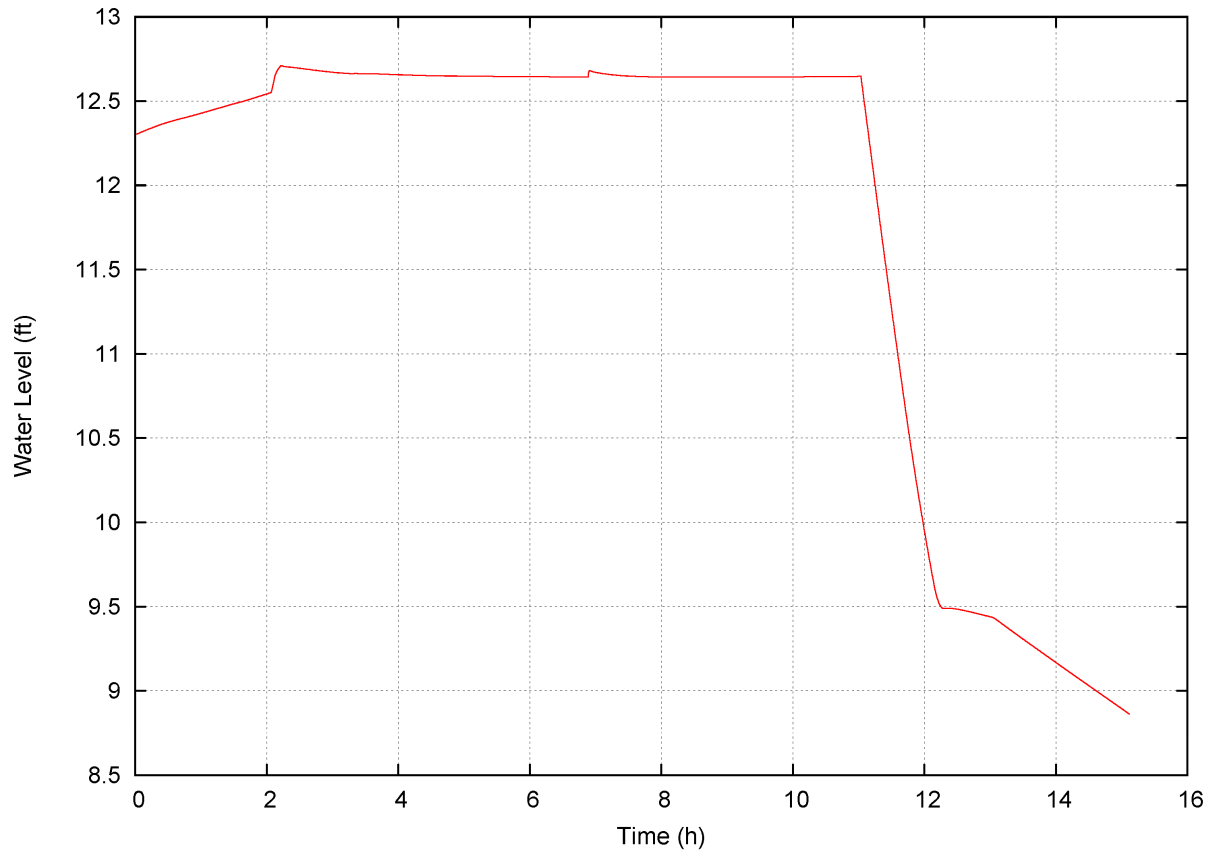


Figure 19-124-17—Spreading Room Water Level (st1.8)

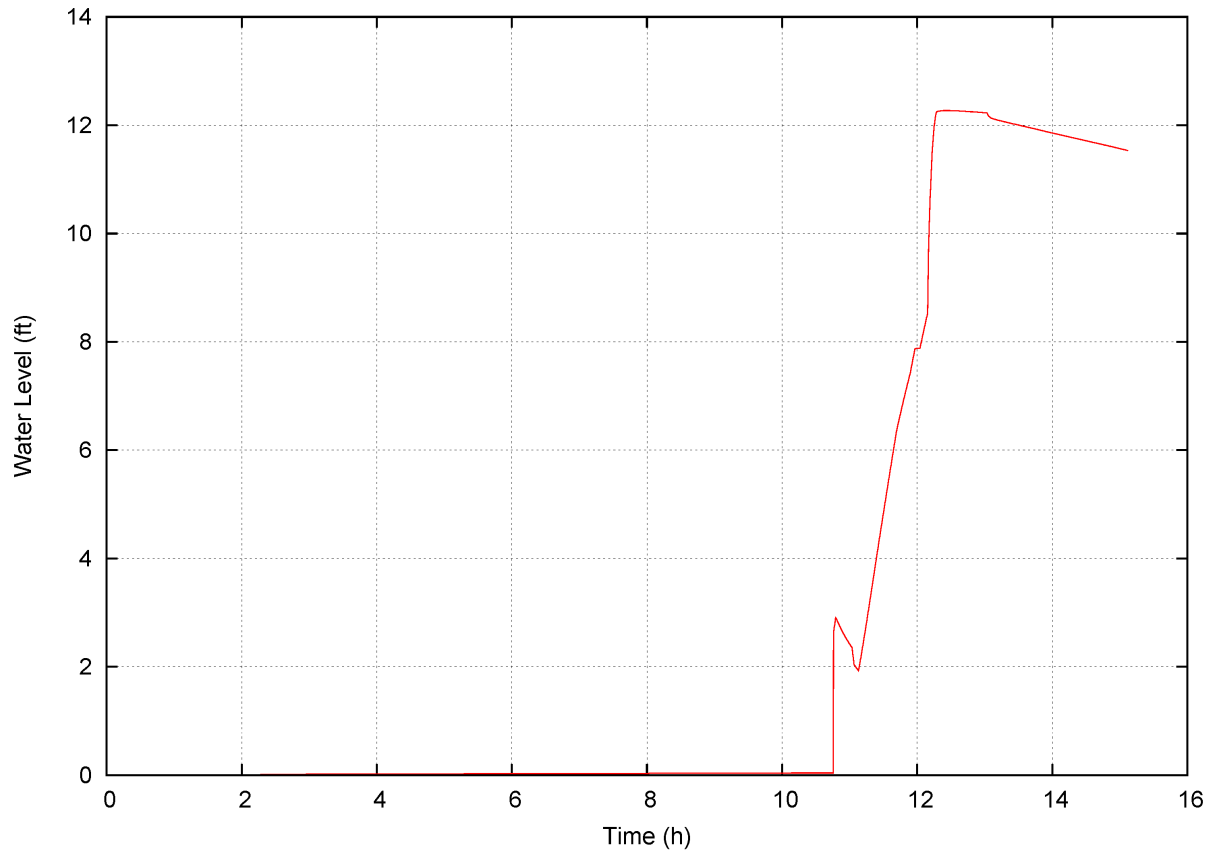


Figure 19-124-18—Reactor Pit Water Level (st1.8)

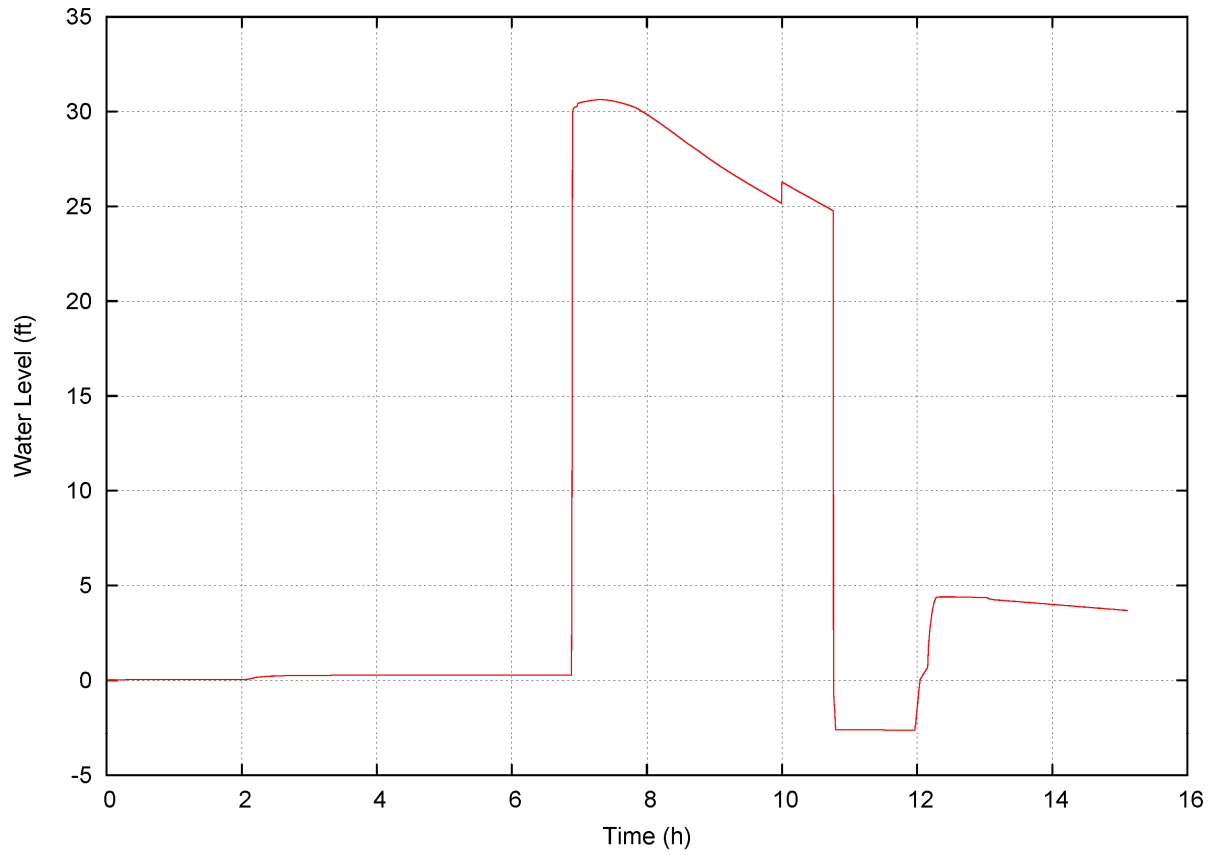


Figure 19-124-19—Mass of Corium in Reactor Pit (st1.8)

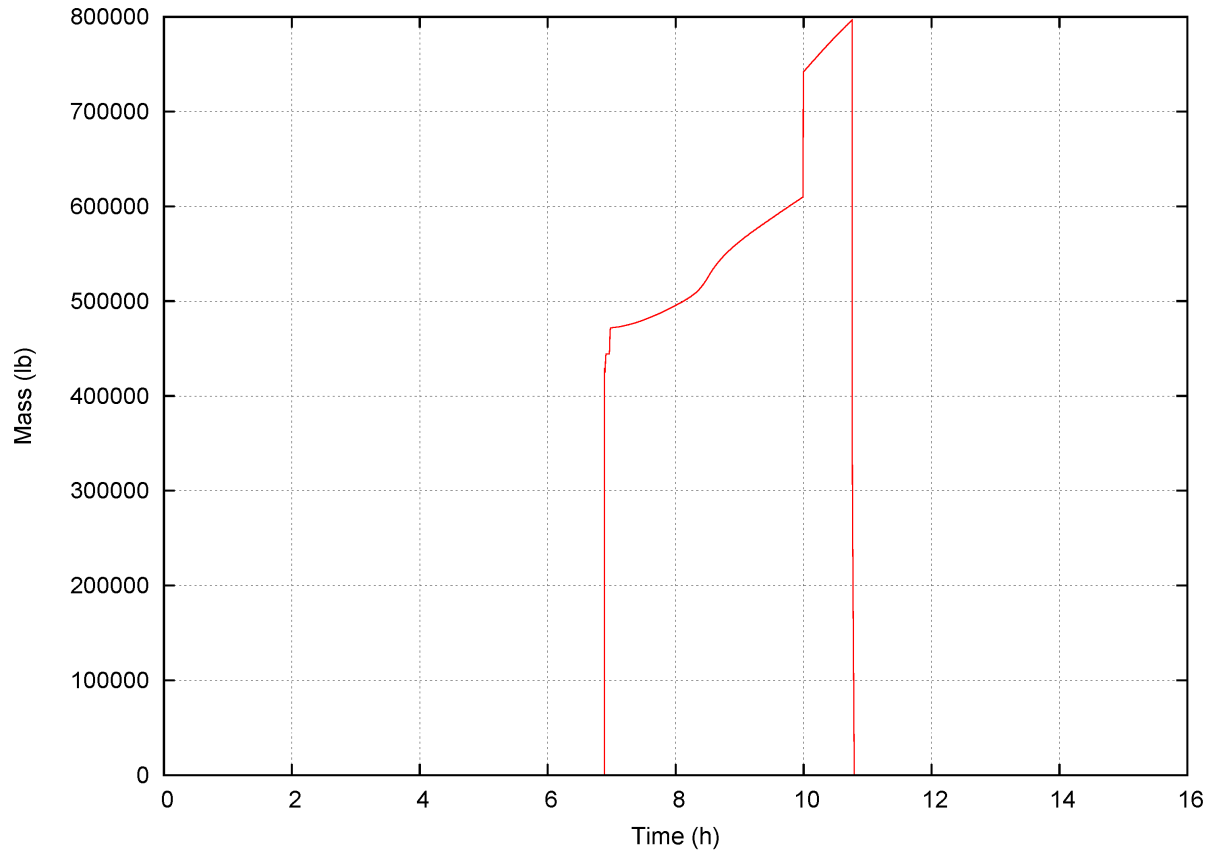


Figure 19-124-20—Mass of Corium in Spreading Room (st1.8)

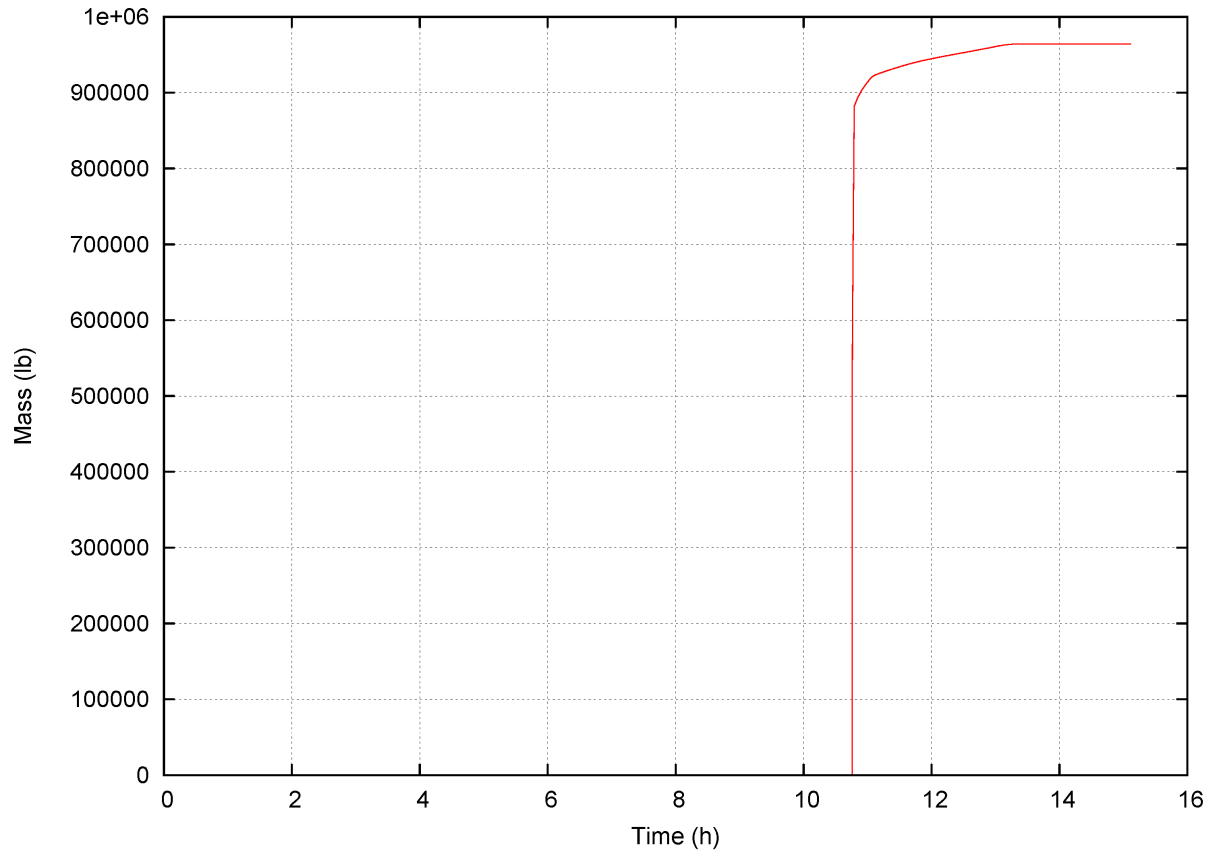


Figure 19-124-21—Reactor Pit Ablation (Axial) (st1.8)

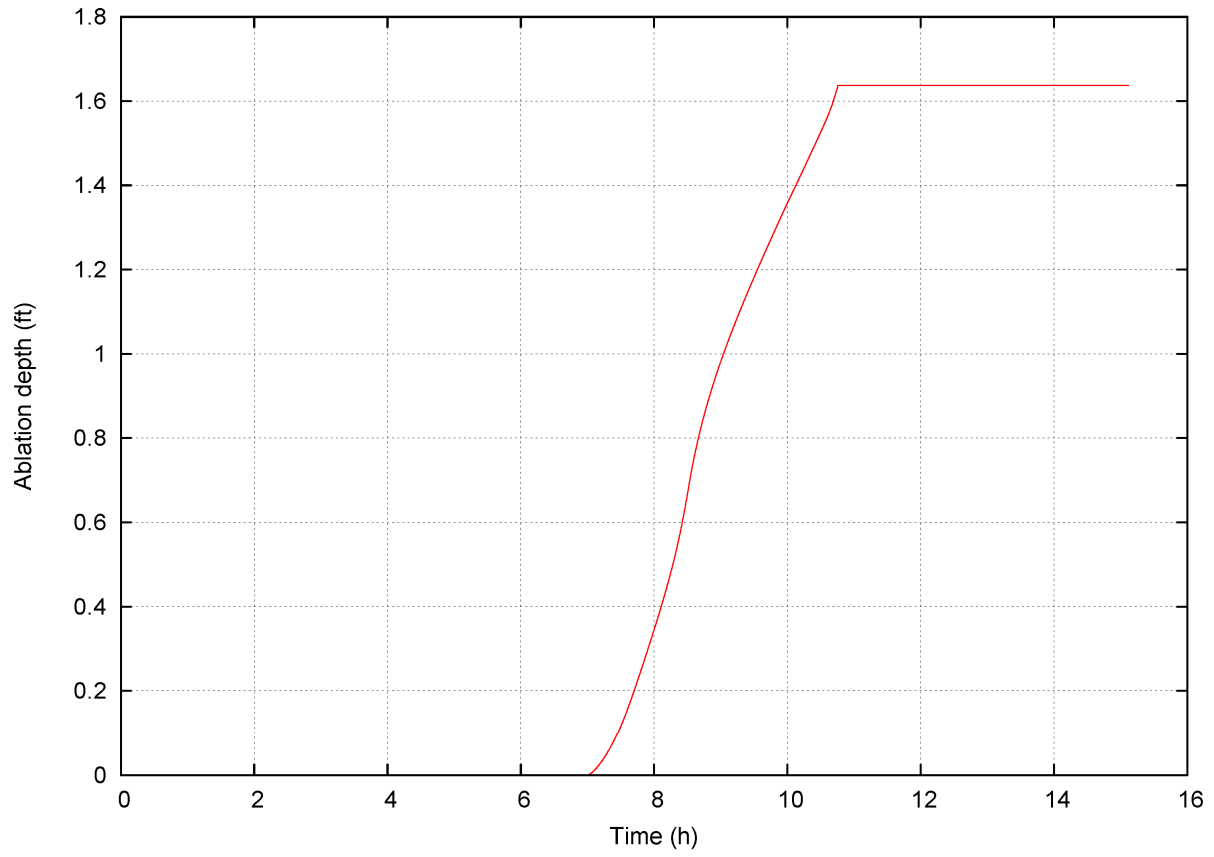


Figure 19-124-22—Reactor Pit Ablation (Radial) (st1.8)

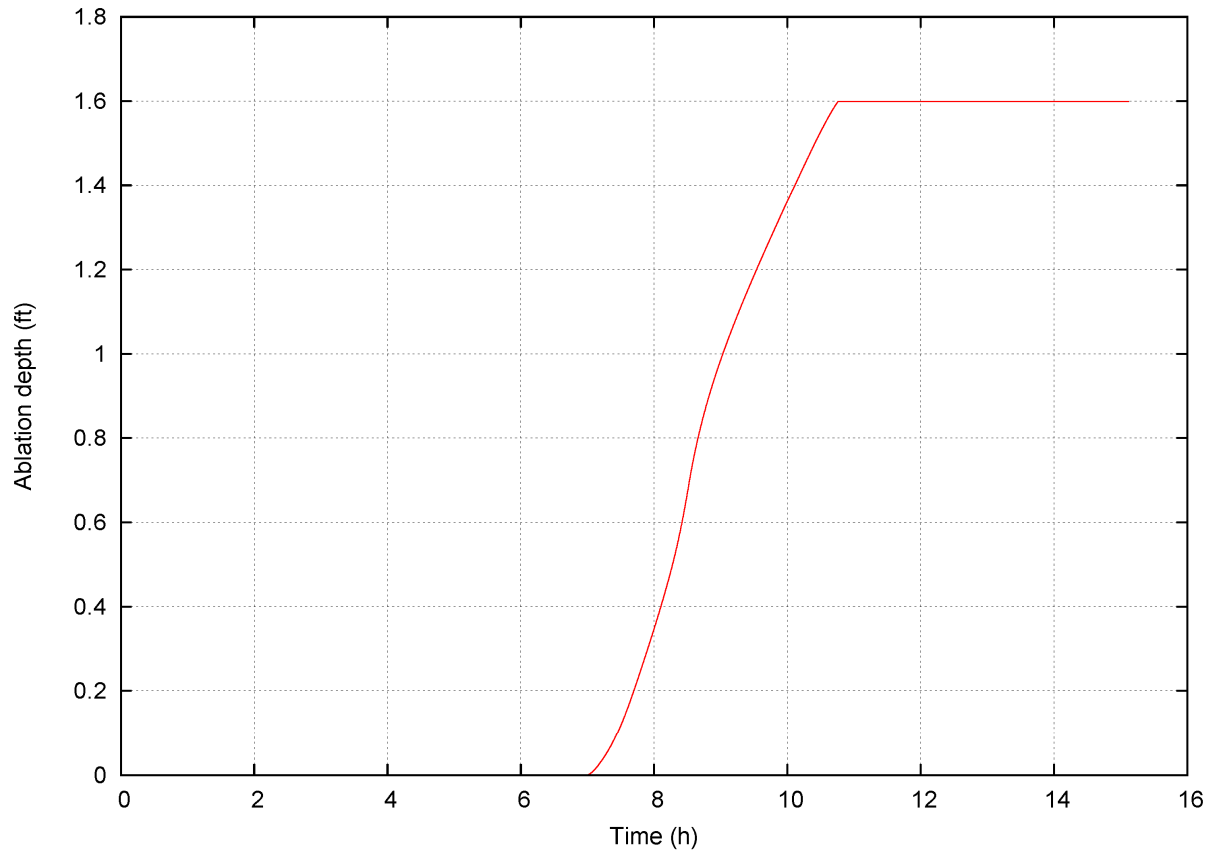


Figure 19-124-23—Spreading Room Ablation (Axial) (st1.8)

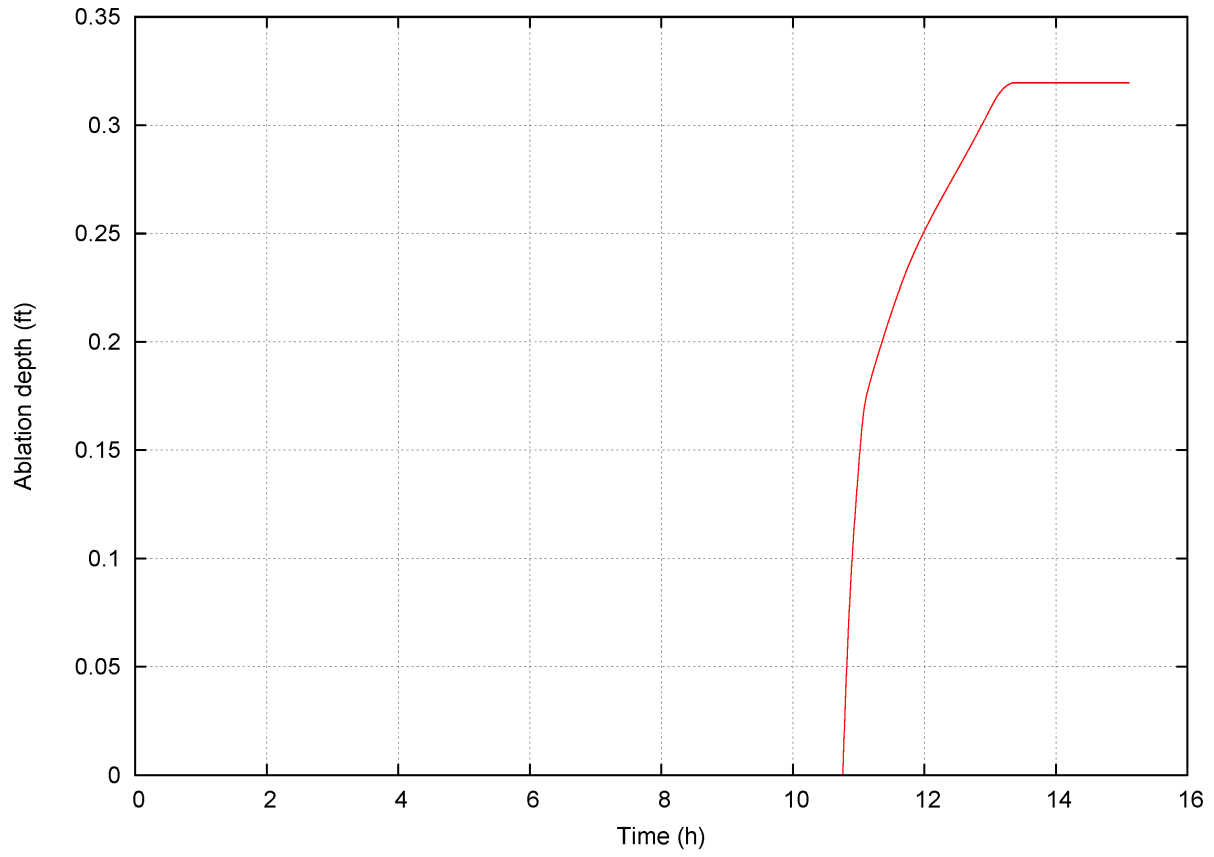


Figure 19-124-24—Spreading Room Ablation (Radial) (st1.8)

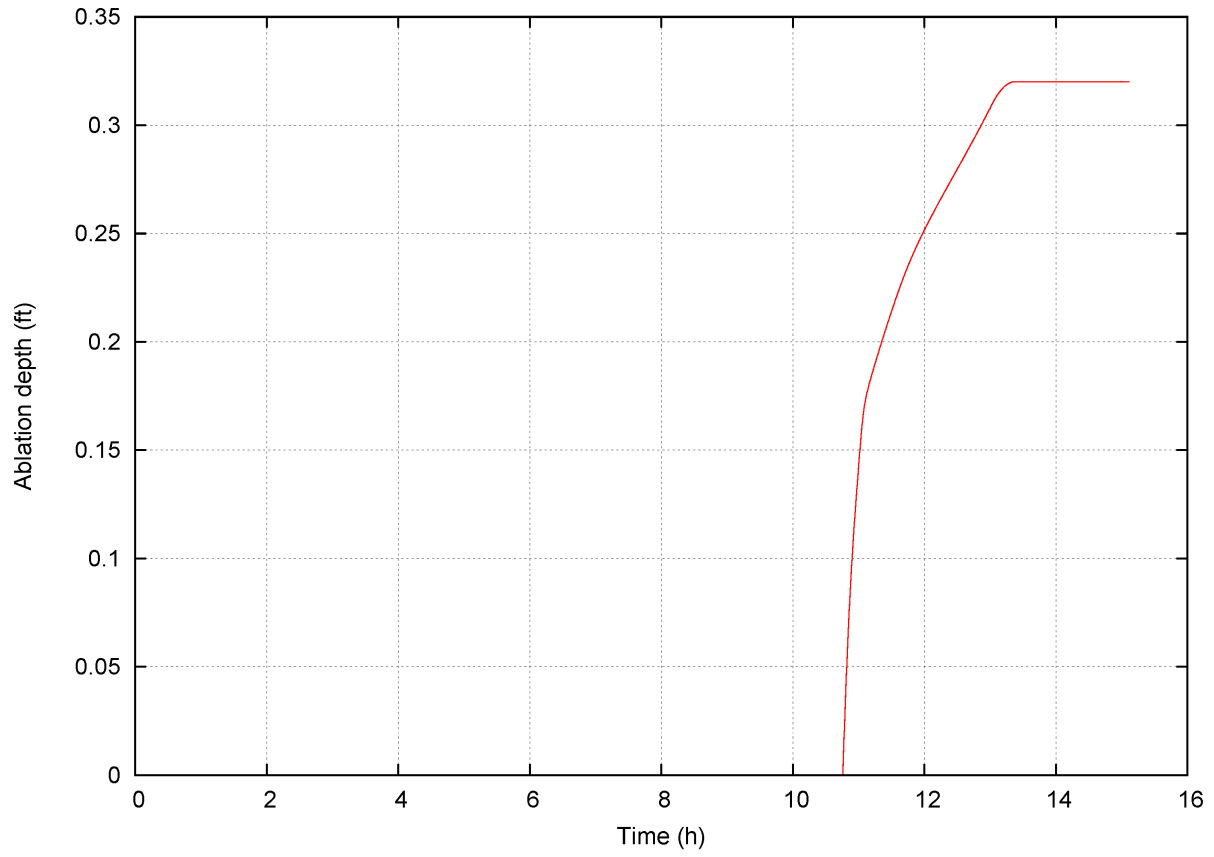


Figure 19-124-25—Fission Product Mass Inside Reactor (st1.8)

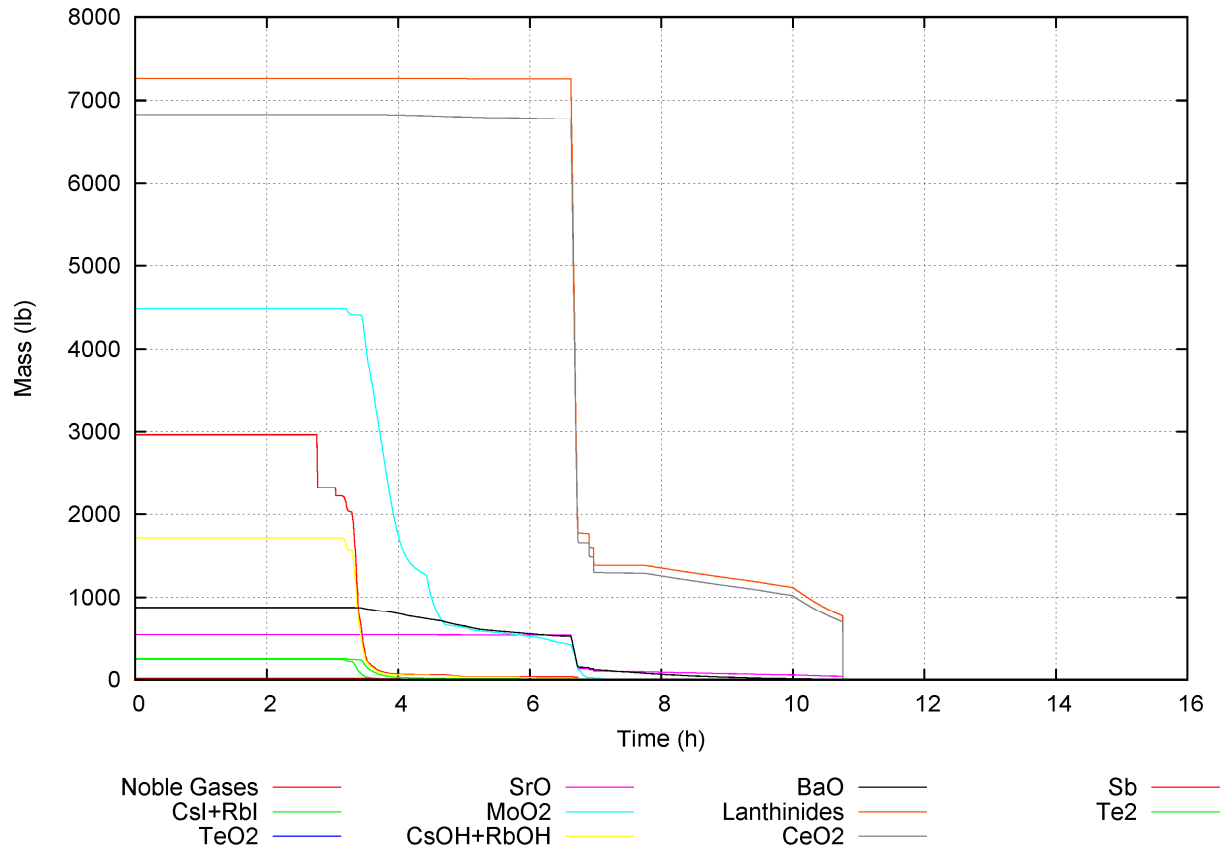


Figure 19-124-26—Fission Product Mass Inside Reactor – Actinides (st1.8)

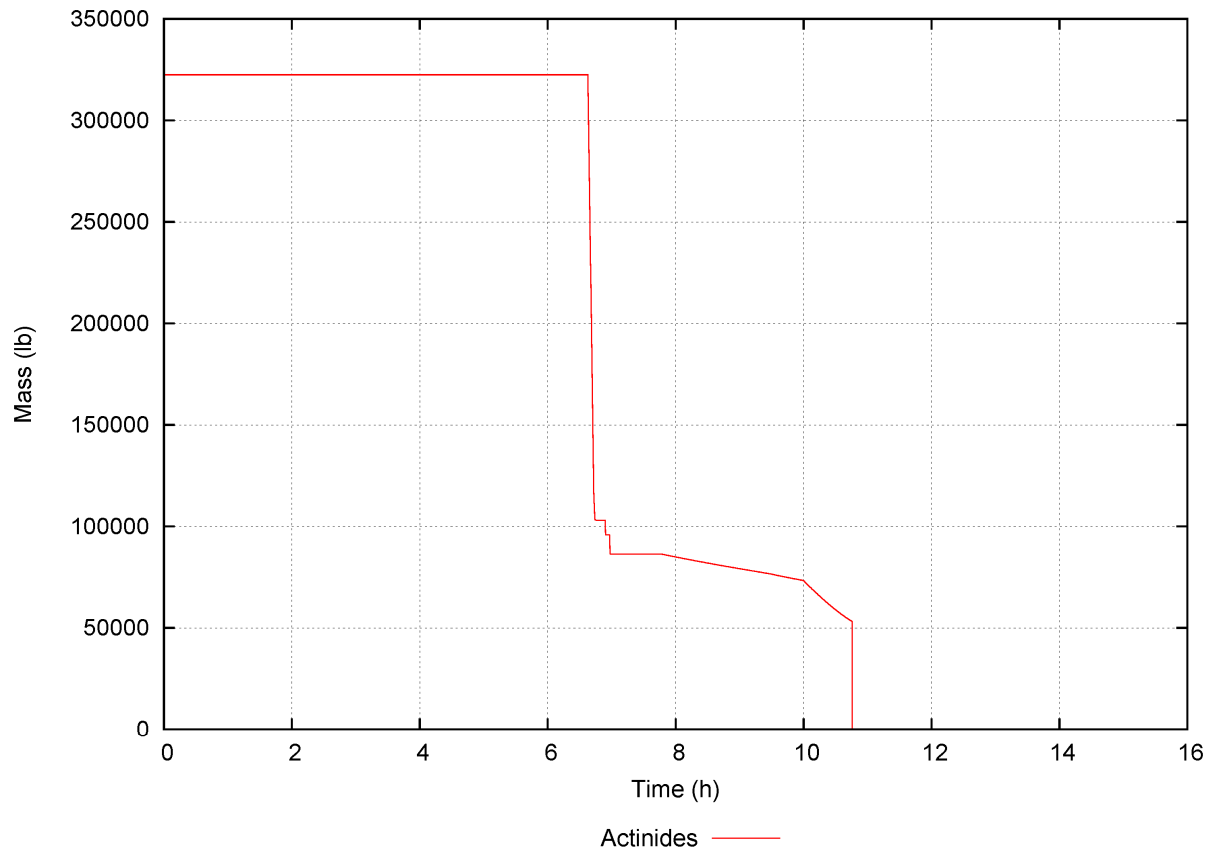


Figure 19-124-27—Fission Product Mass in Containment (st1.8)

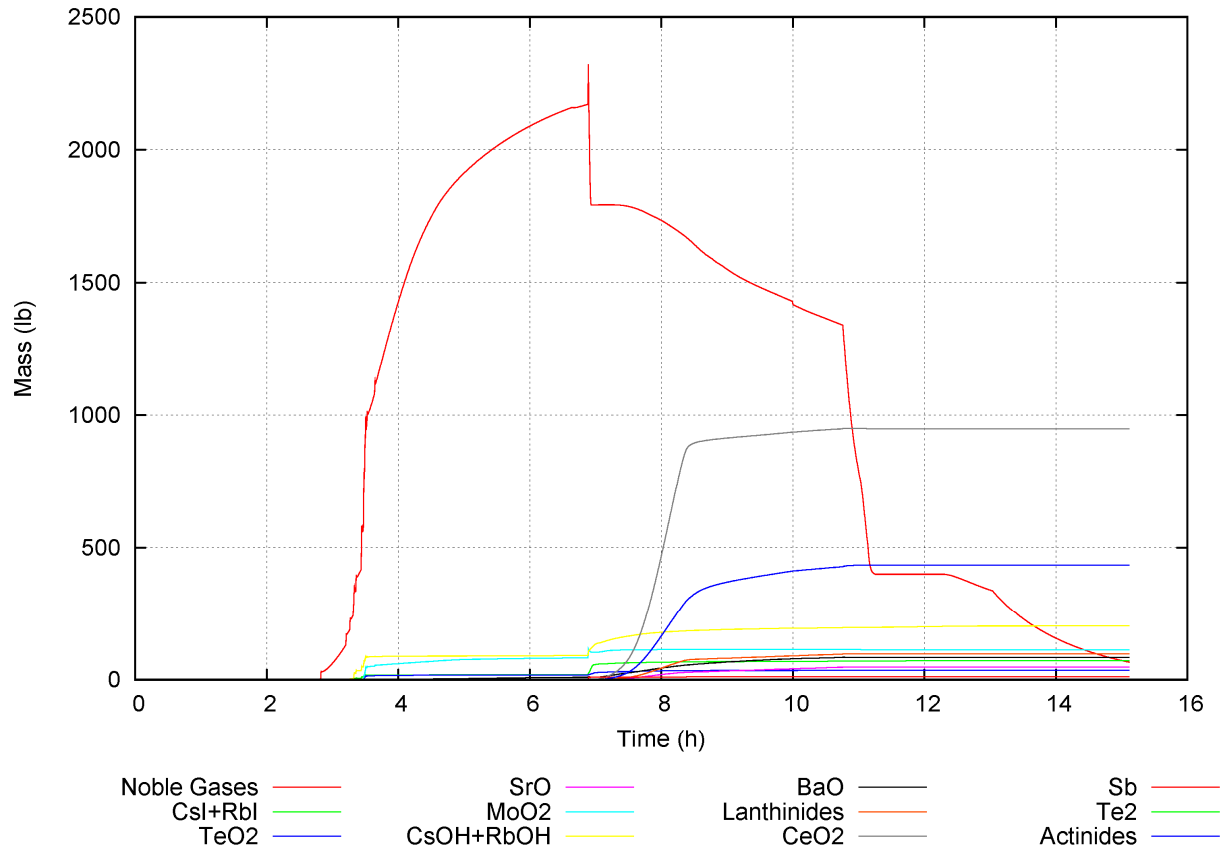


Figure 19-124-29—Failed Containment Pressure (st1.8)

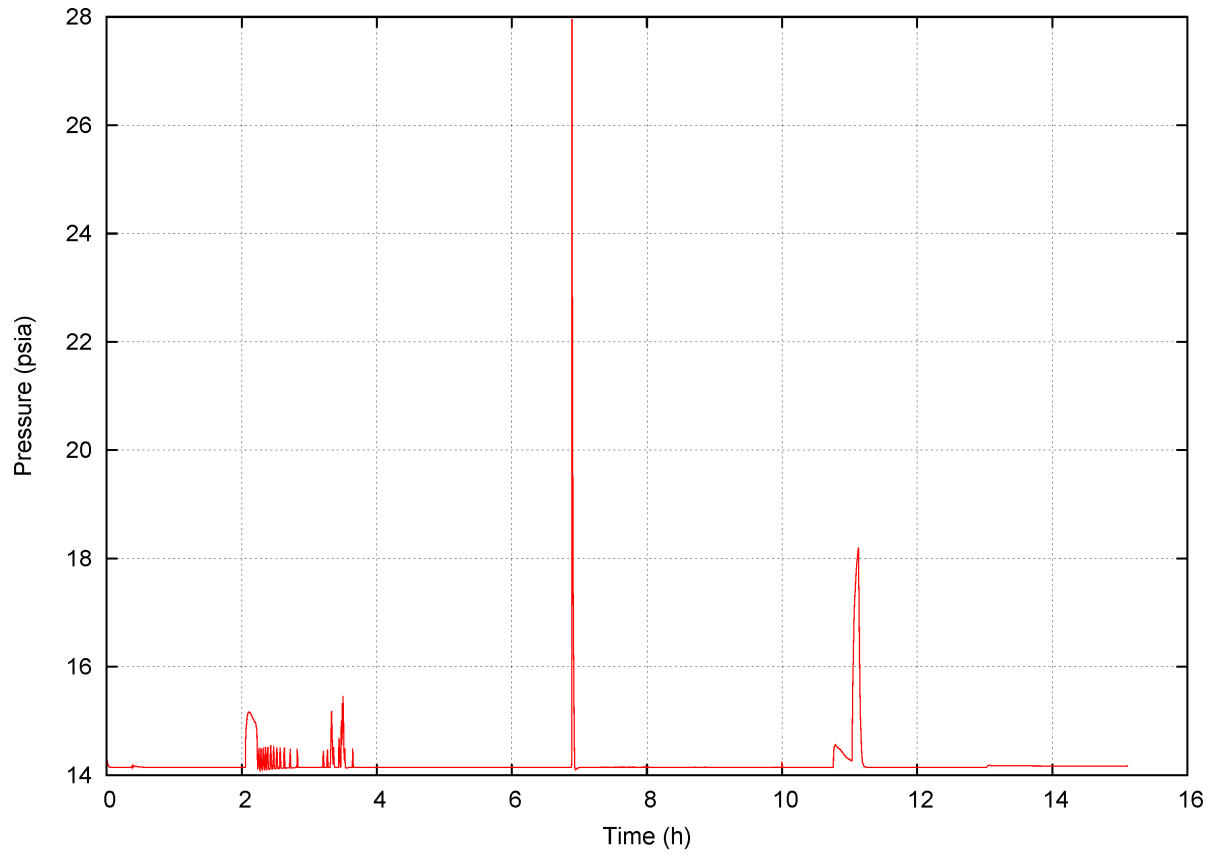


Figure 19-124-30—RCS Pressure (st1.8a)

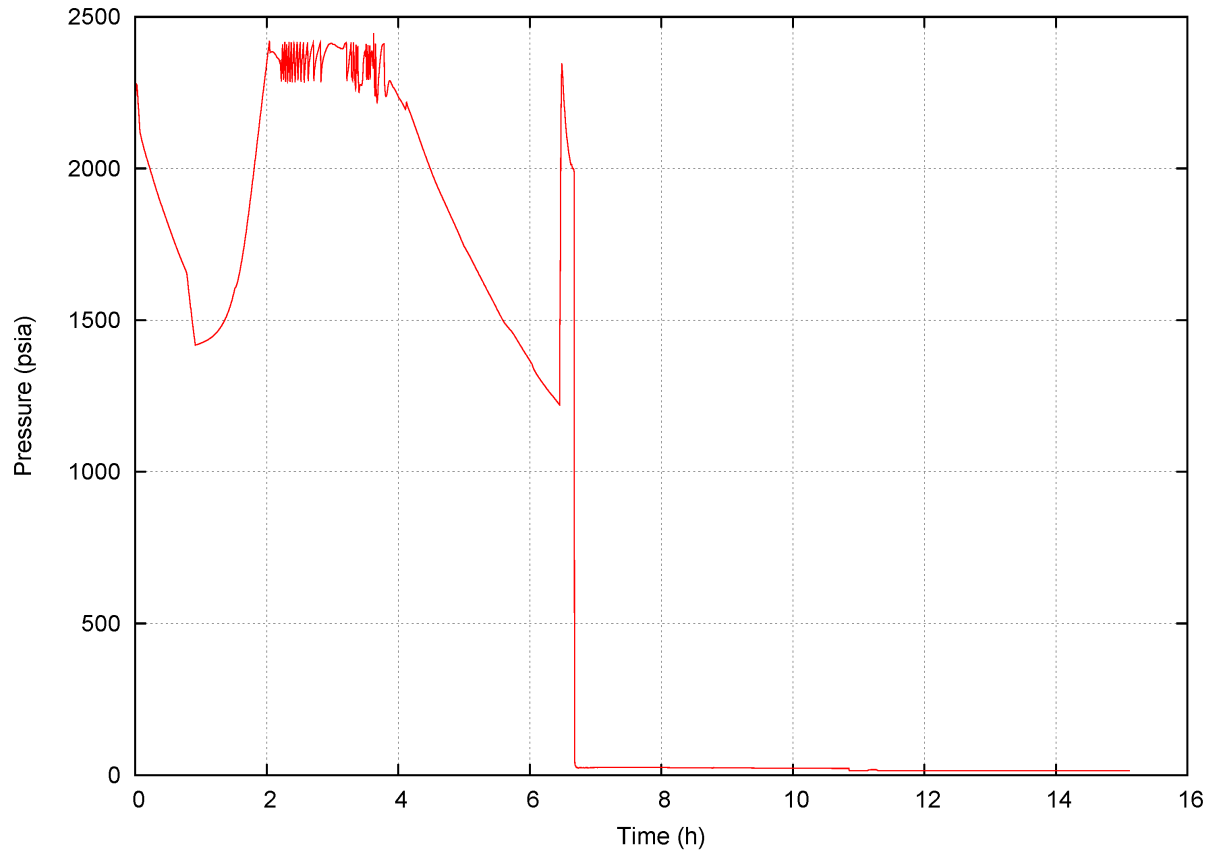


Figure 19-124-31—In-Vessel Hydrogen Production (st1.8a)

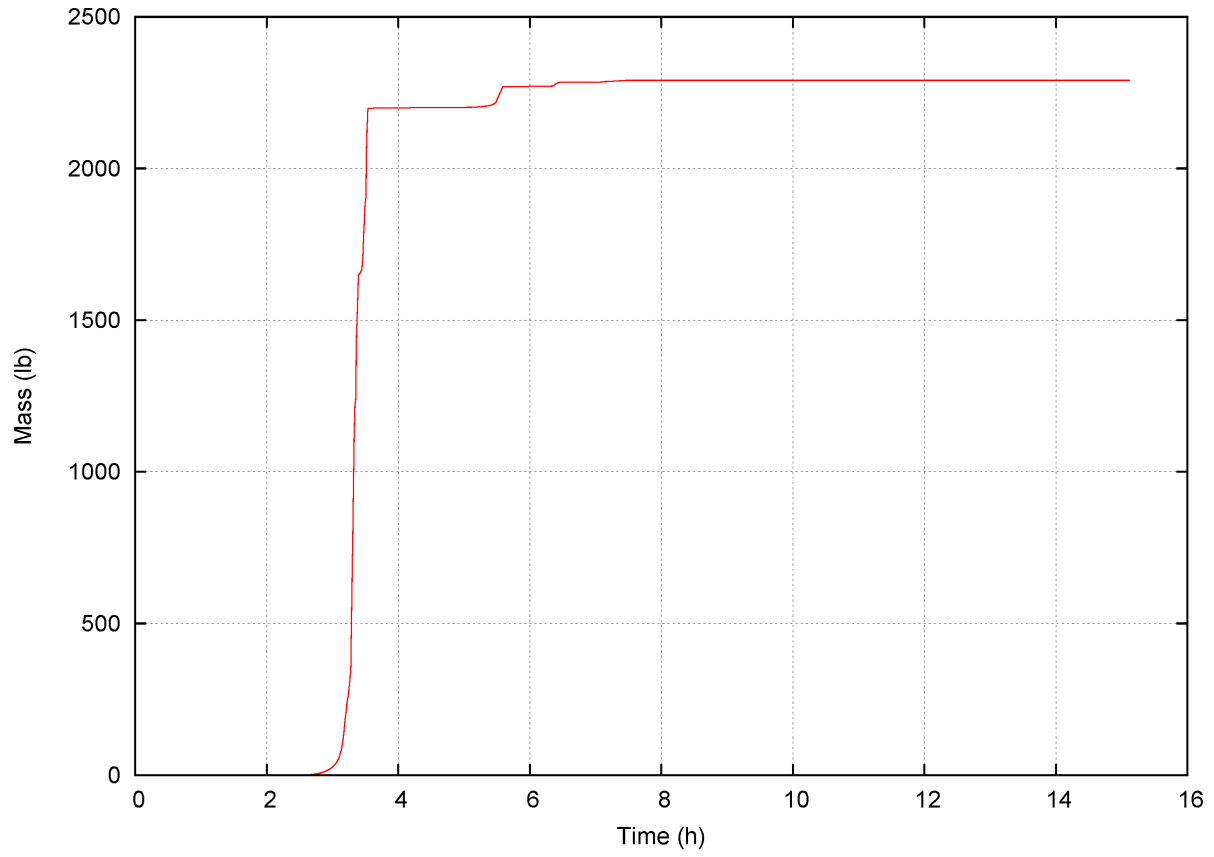


Figure 19-124-32—Mass of Hydrogen in Containment (st1.8a)

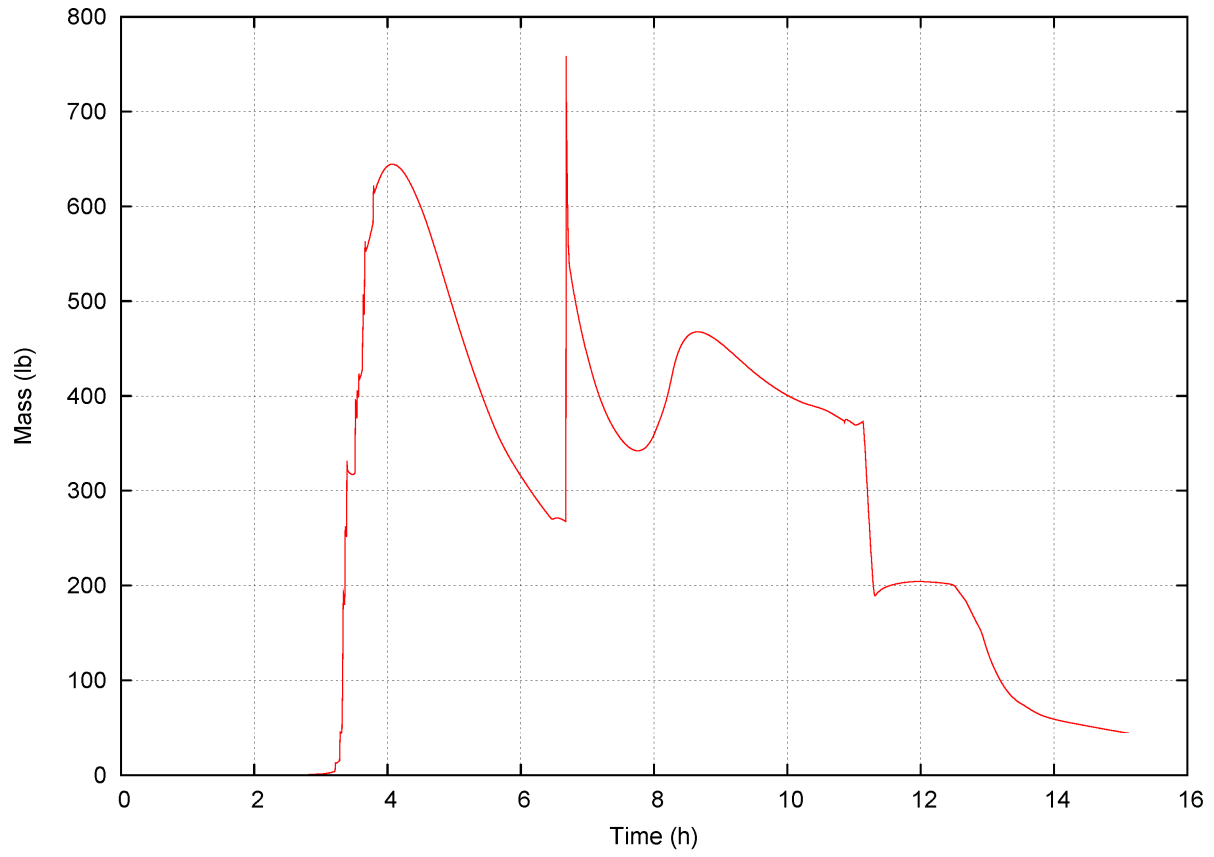


Figure 19-124-33—Concentration of Hydrogen in Containment (st1.8a)

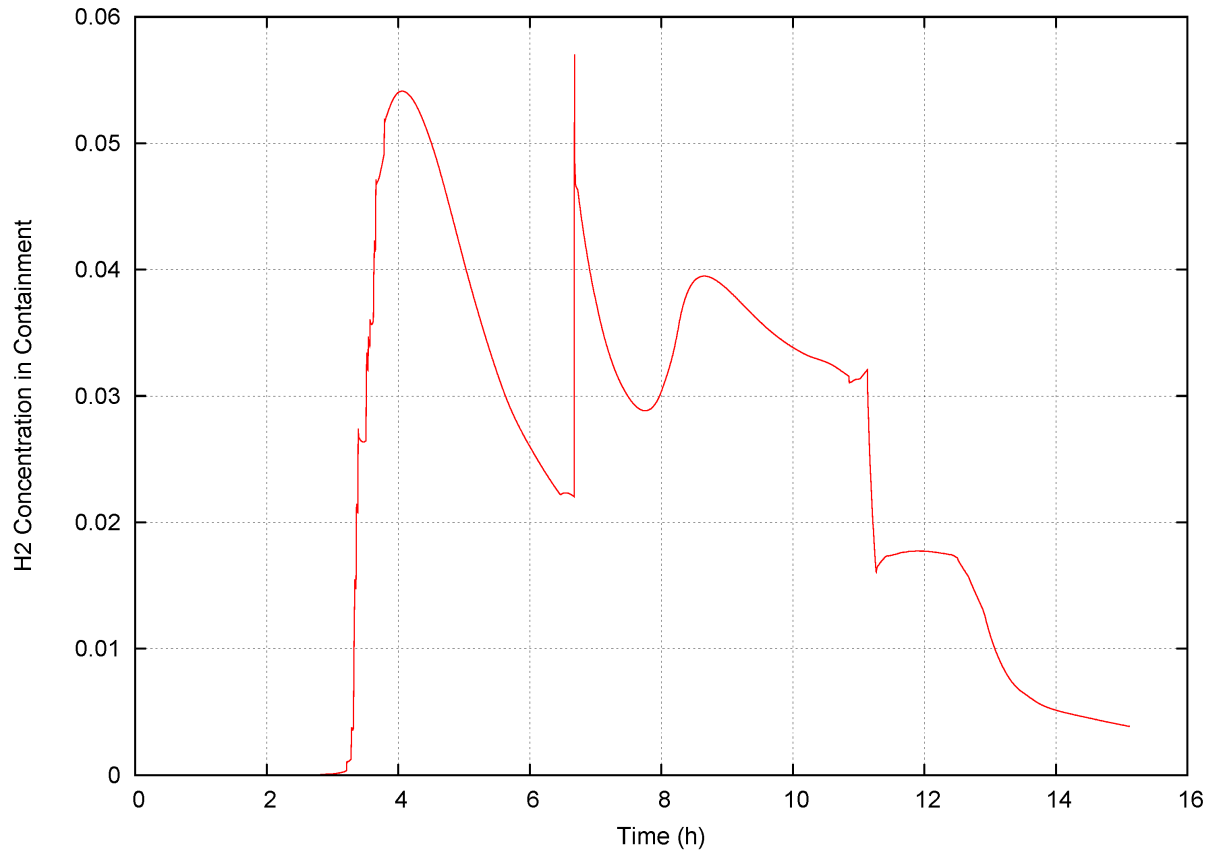


Figure 19-124-34—Hydrogen Consumed by PARs (st1.8a)

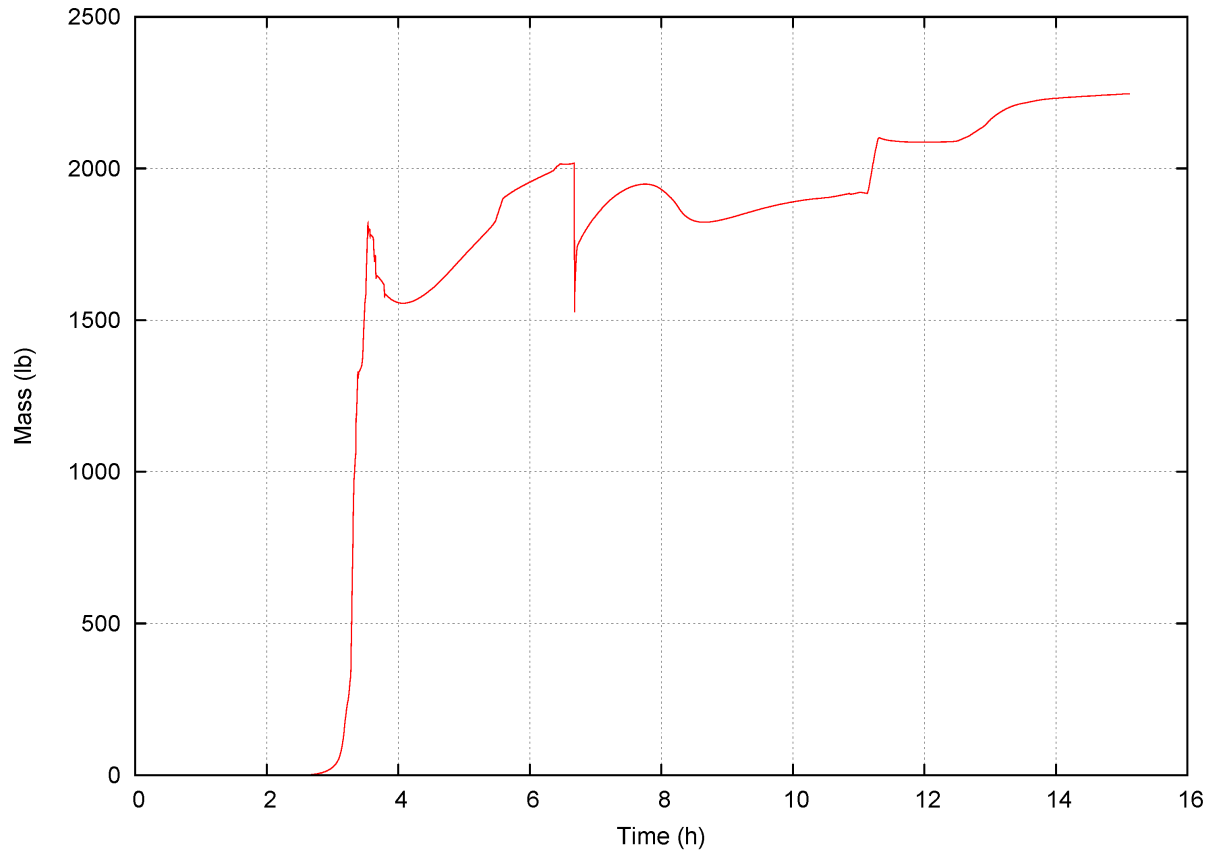


Figure 19-124-35—Mass of Oxygen in Containment (st1.8a)

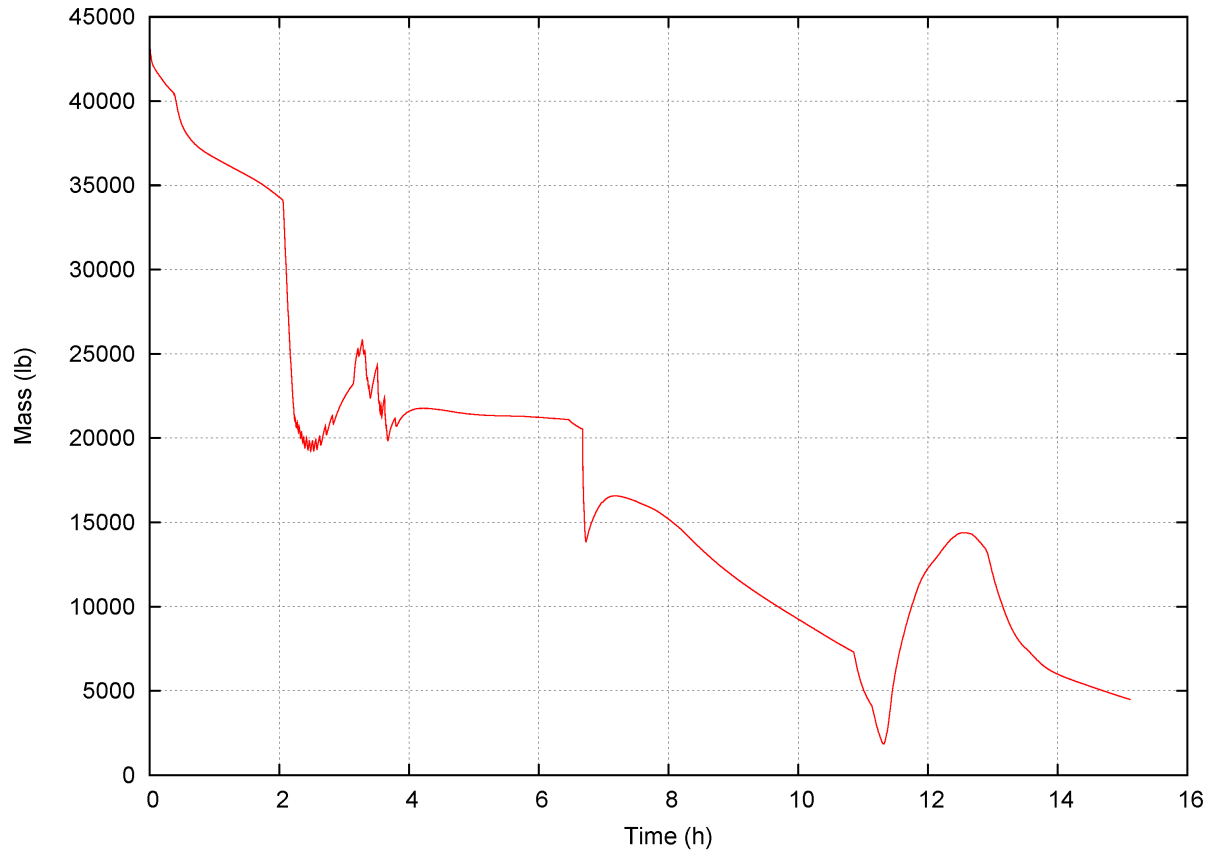


Figure 19-124-36—Concentration of Oxygen in Containment (st1.8a)

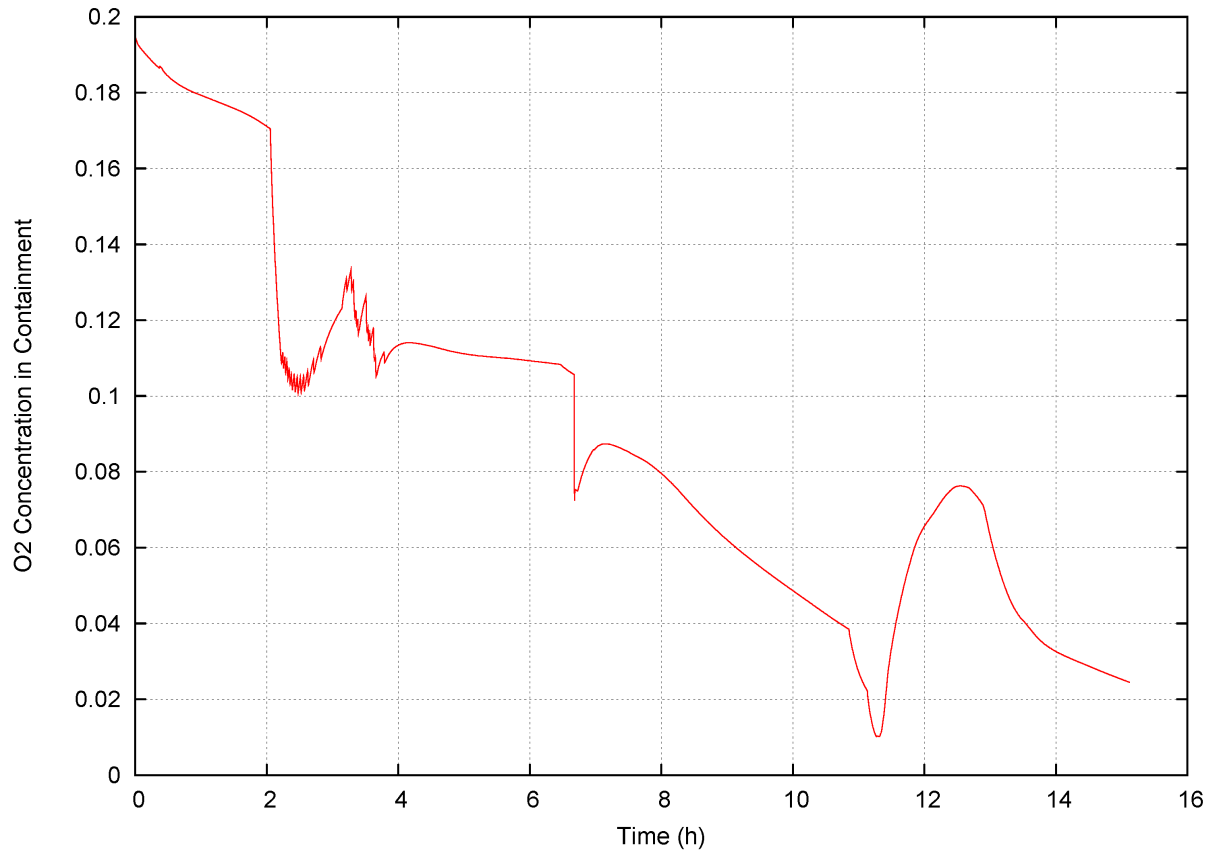


Figure 19-124-37—Mass of Steam in Containment (st1.8a)

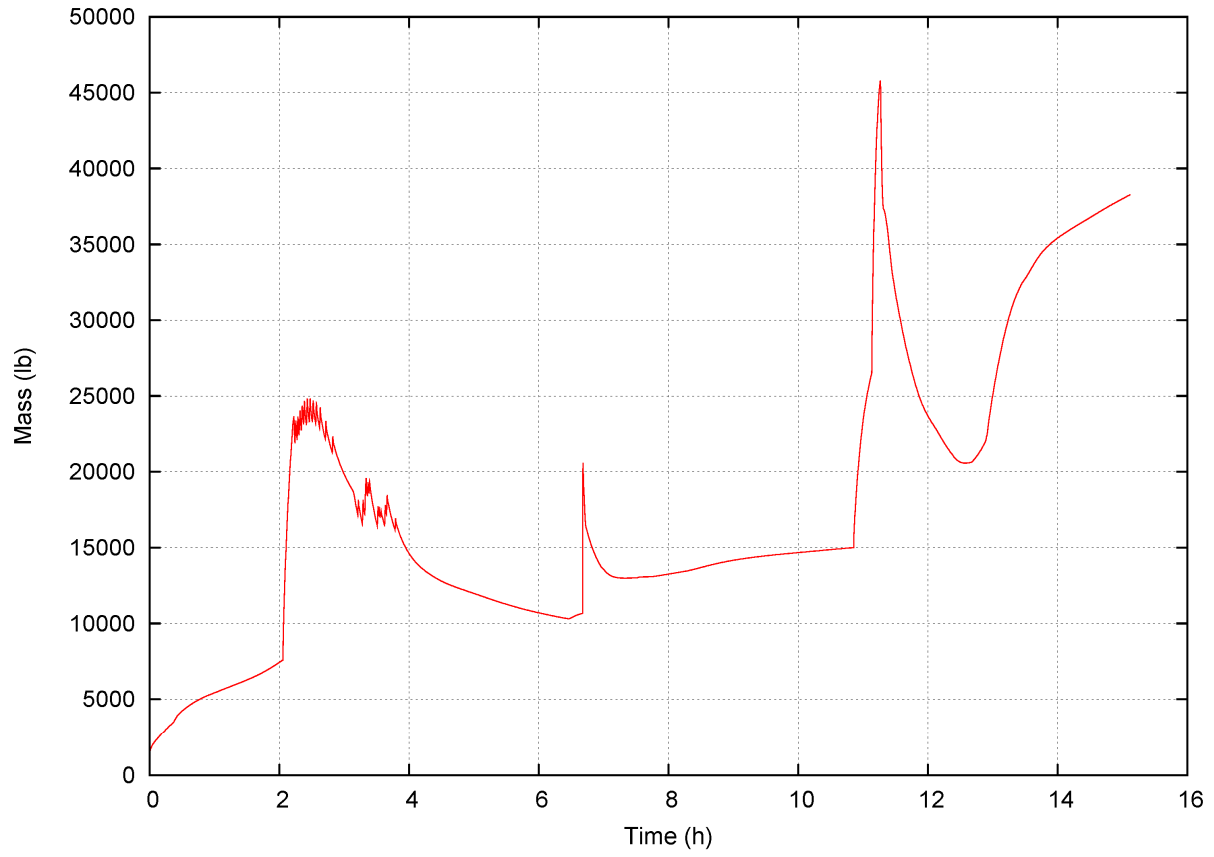


Figure 19-124-38—Concentration of Steam in Containment (st1.8a)

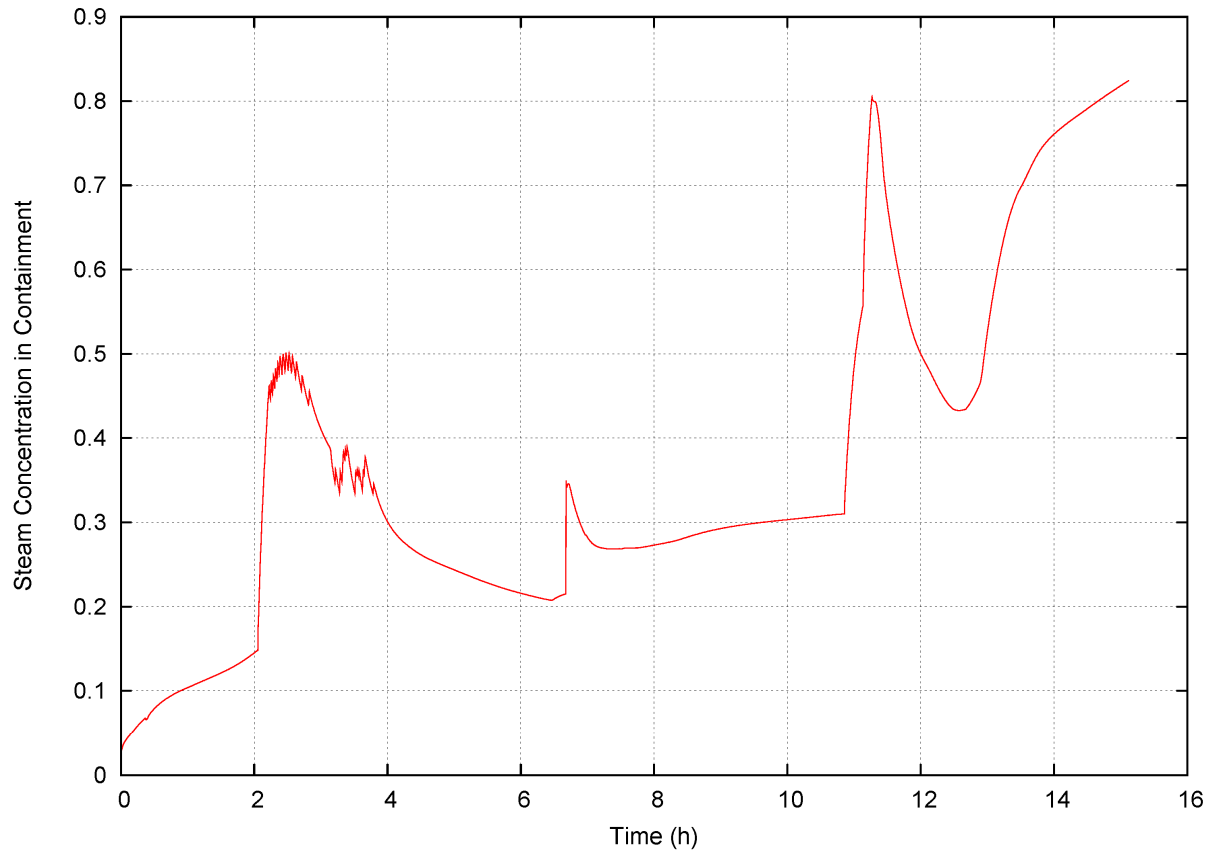


Figure 19-124-39—Mass of Nitrogen in Containment (st1.8a)

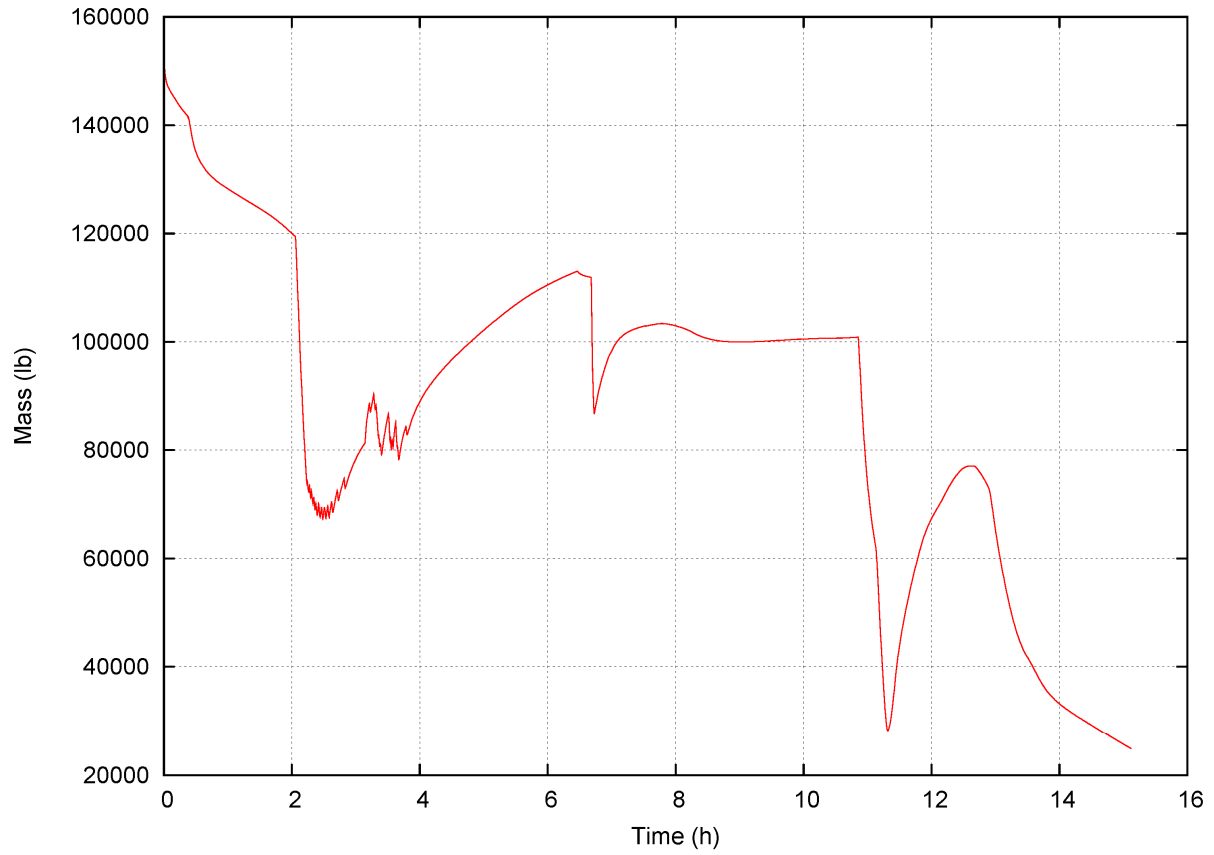


Figure 19-124-40—Concentration of Nitrogen in Containment (st1.8a)

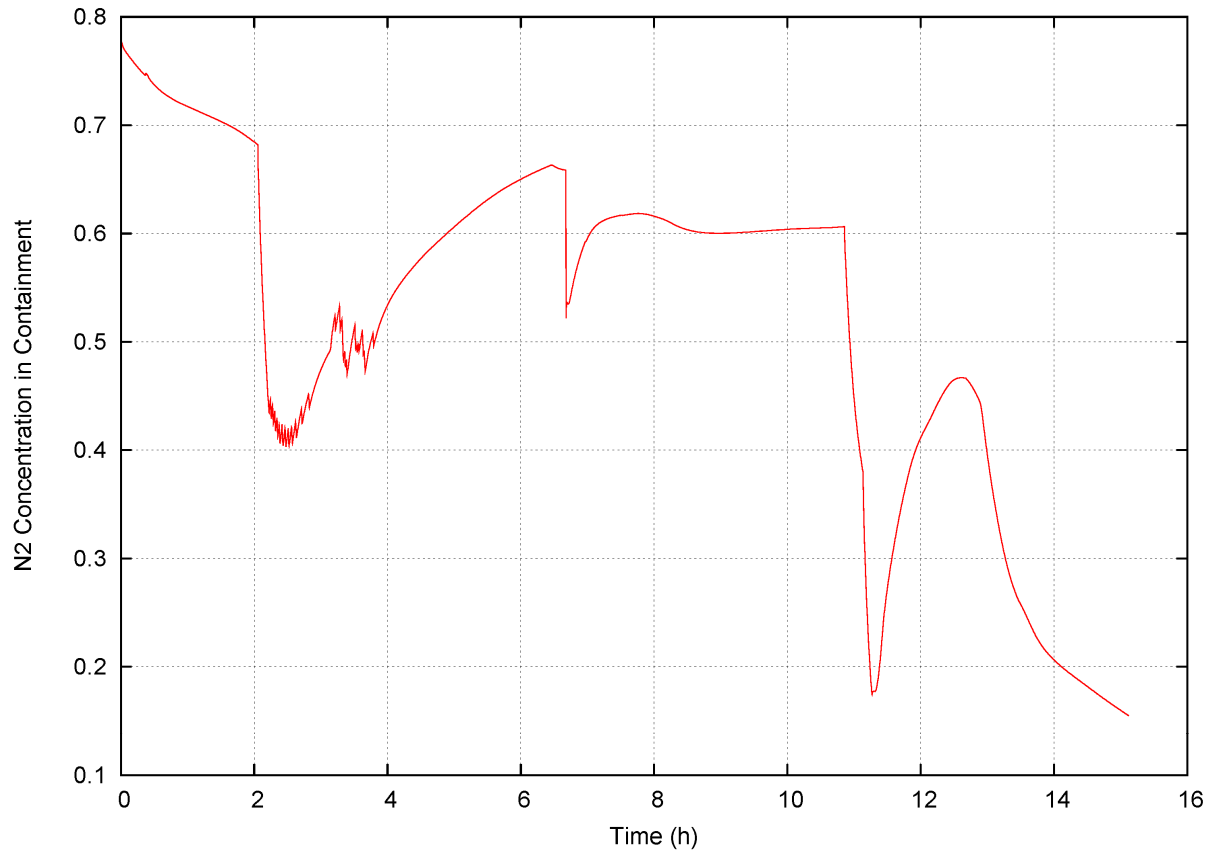


Figure 19-124-41—Mass of Carbon Dioxide in Containment (st1.8a)

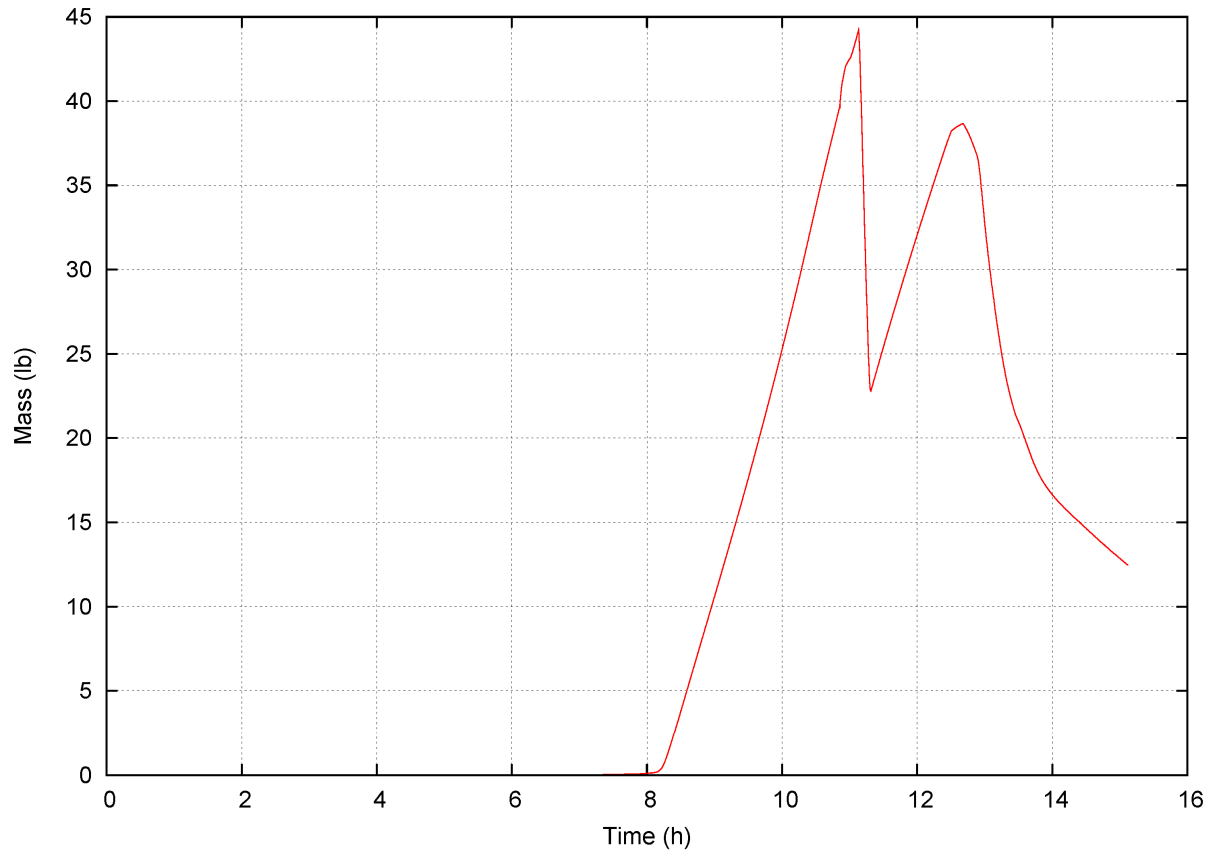


Figure 19-124-42—Concentration of Carbon Dioxide in Containment (st1.8a)

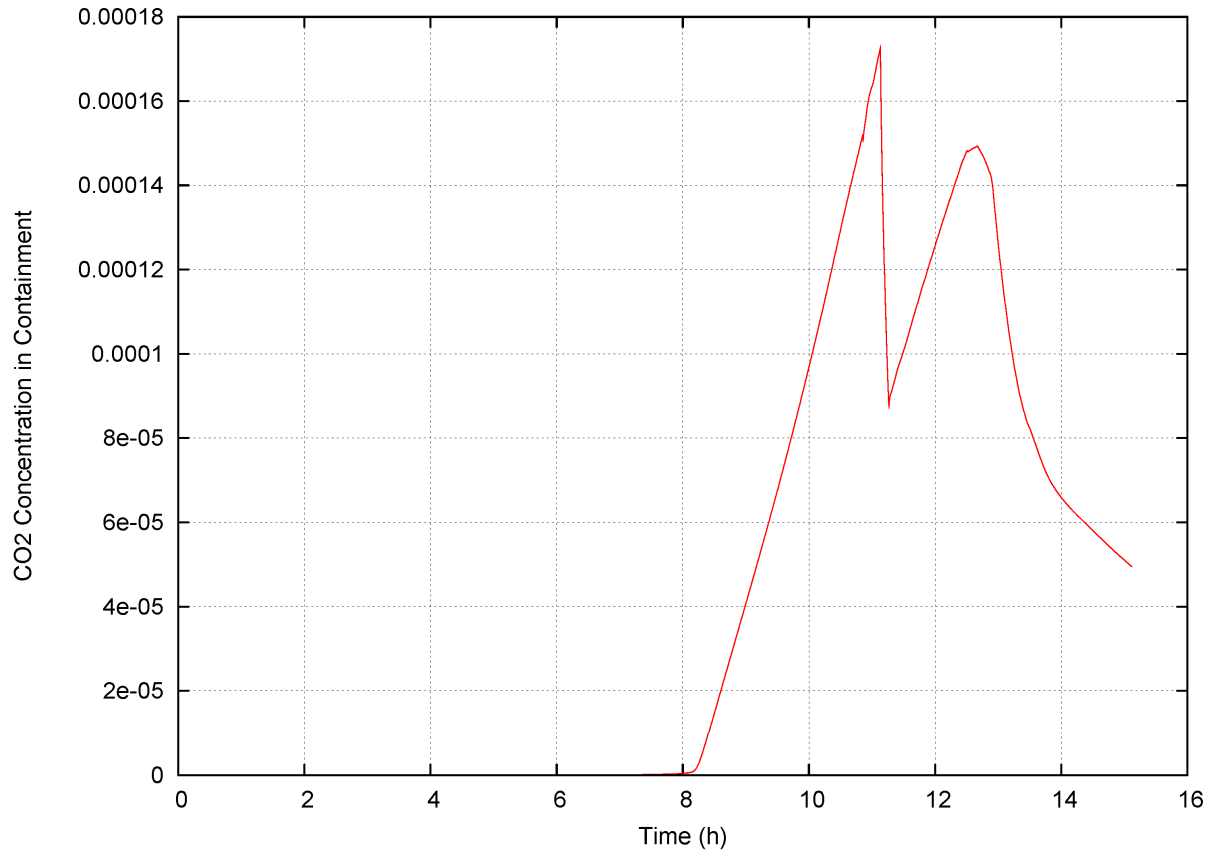
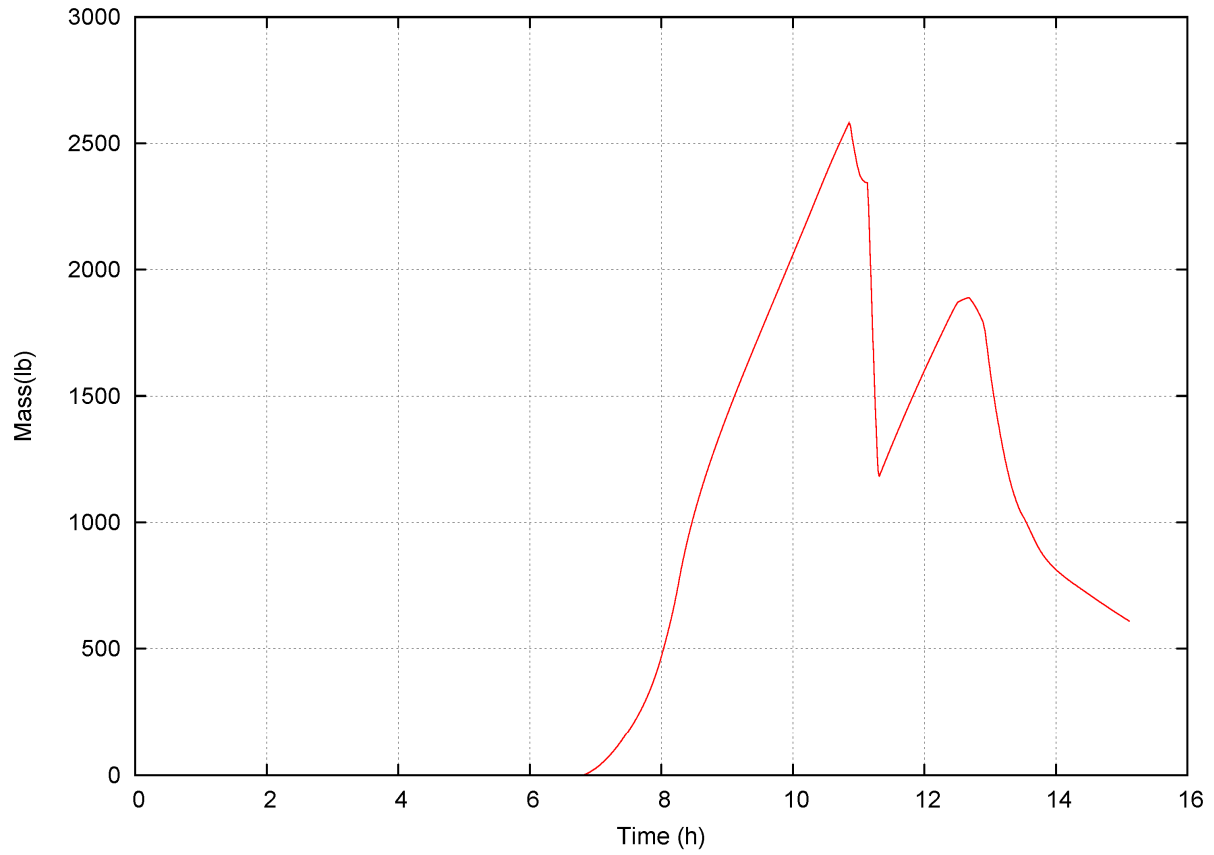


Figure 19-124-43—Mass of Carbon Monoxide in Containment (st1.8a)



**Figure 19-124-44—Concentration of Carbon Monoxide in Containment
(st1.8a)**

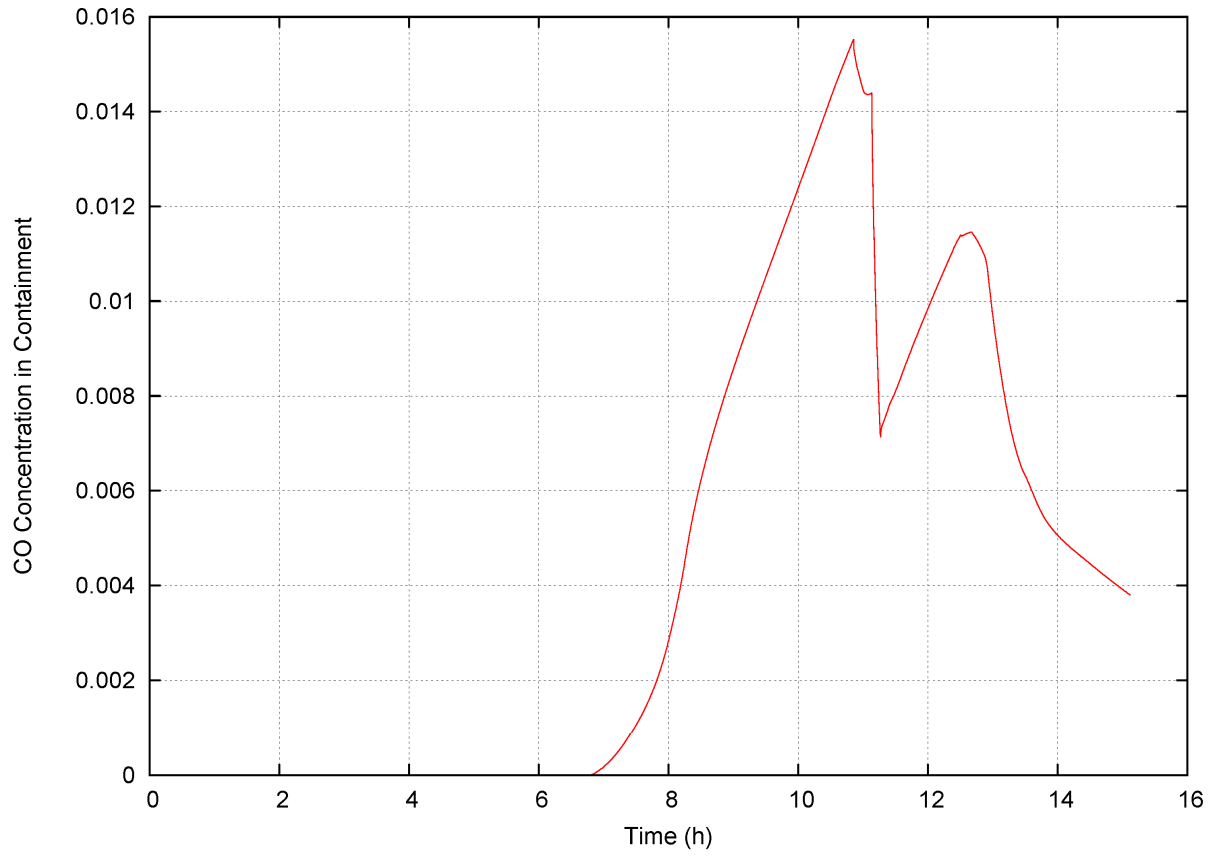


Figure 19-124-45—IRWST Water Level (st1.8a)

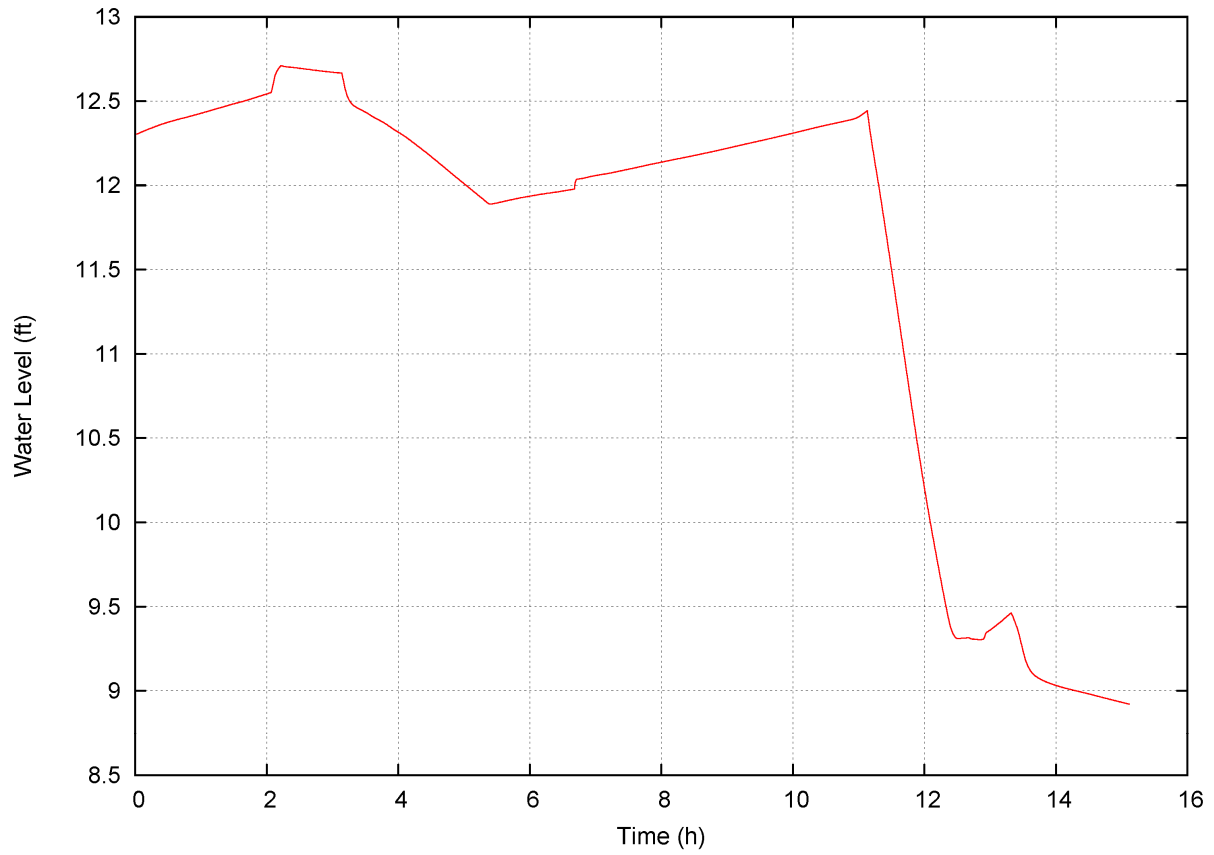


Figure 19-124-46—Spreading Room Water Level (st1.8a)

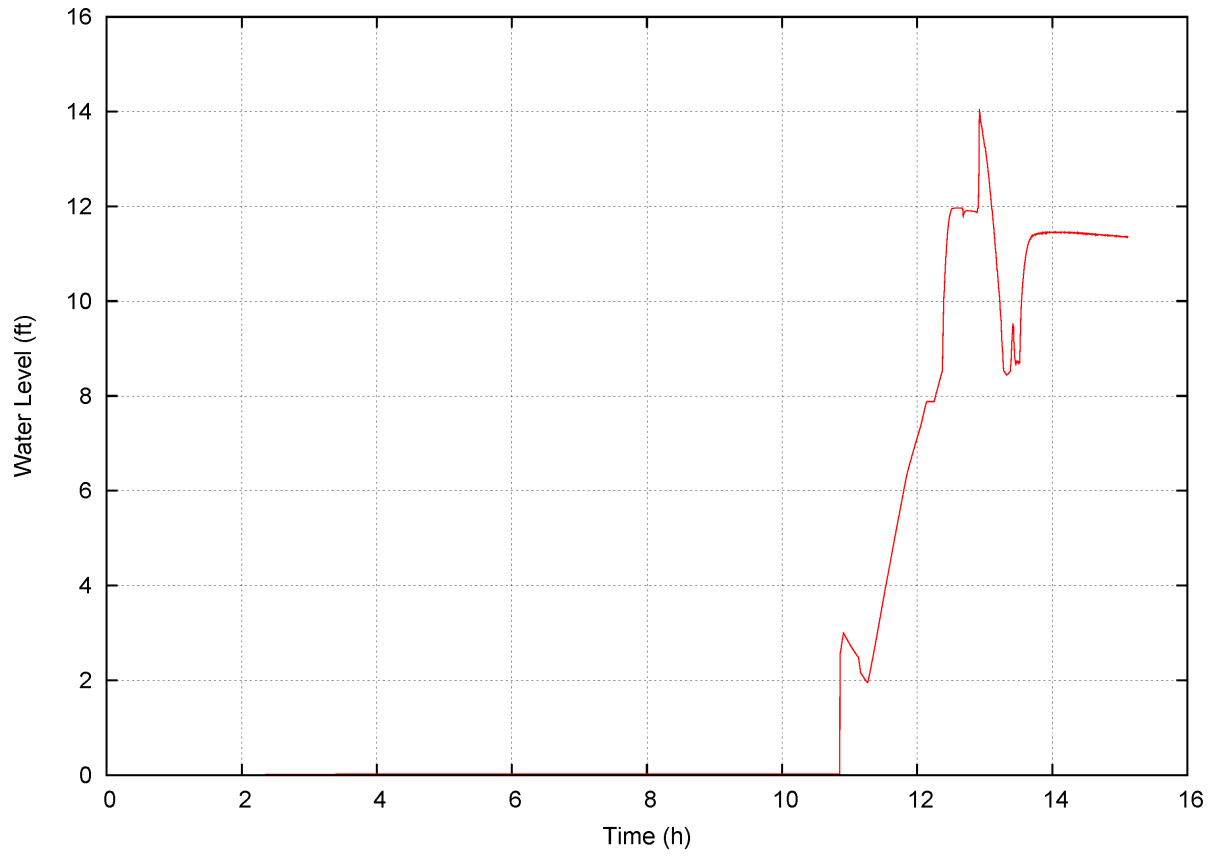


Figure 19-124-47—Reactor Pit Water Level (st1.8a)

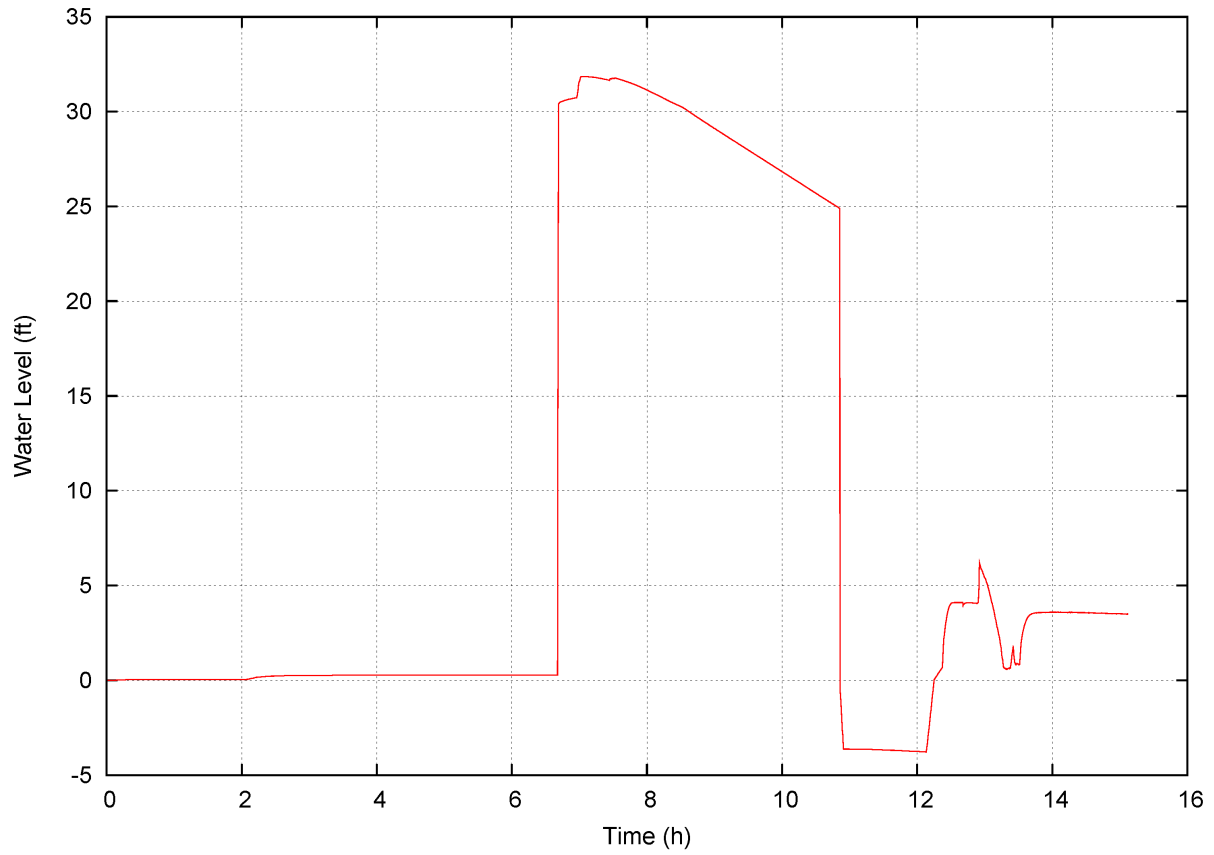


Figure 19-124-48—Mass of Corium in Reactor Pit (st1.8a)

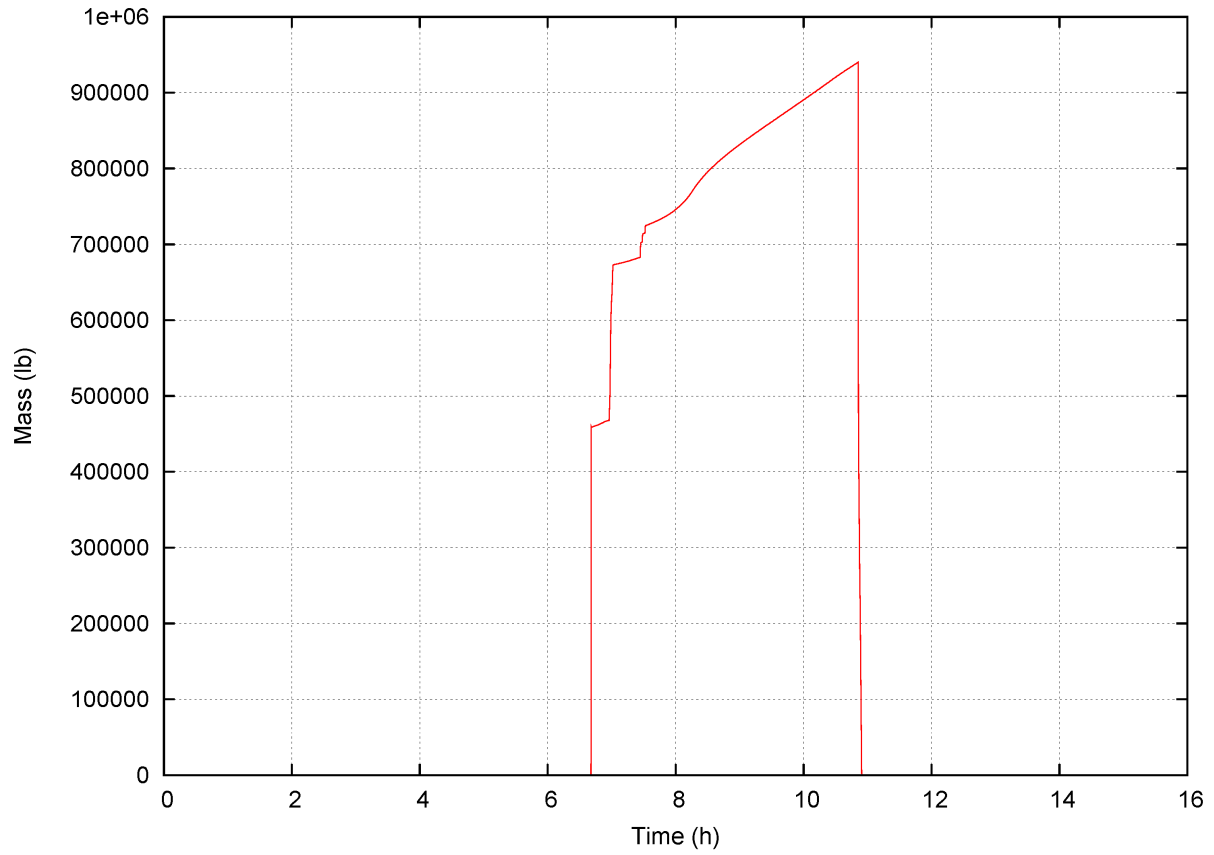


Figure 19-124-49—Mass of Corium in Spreading Room (st1.8a)

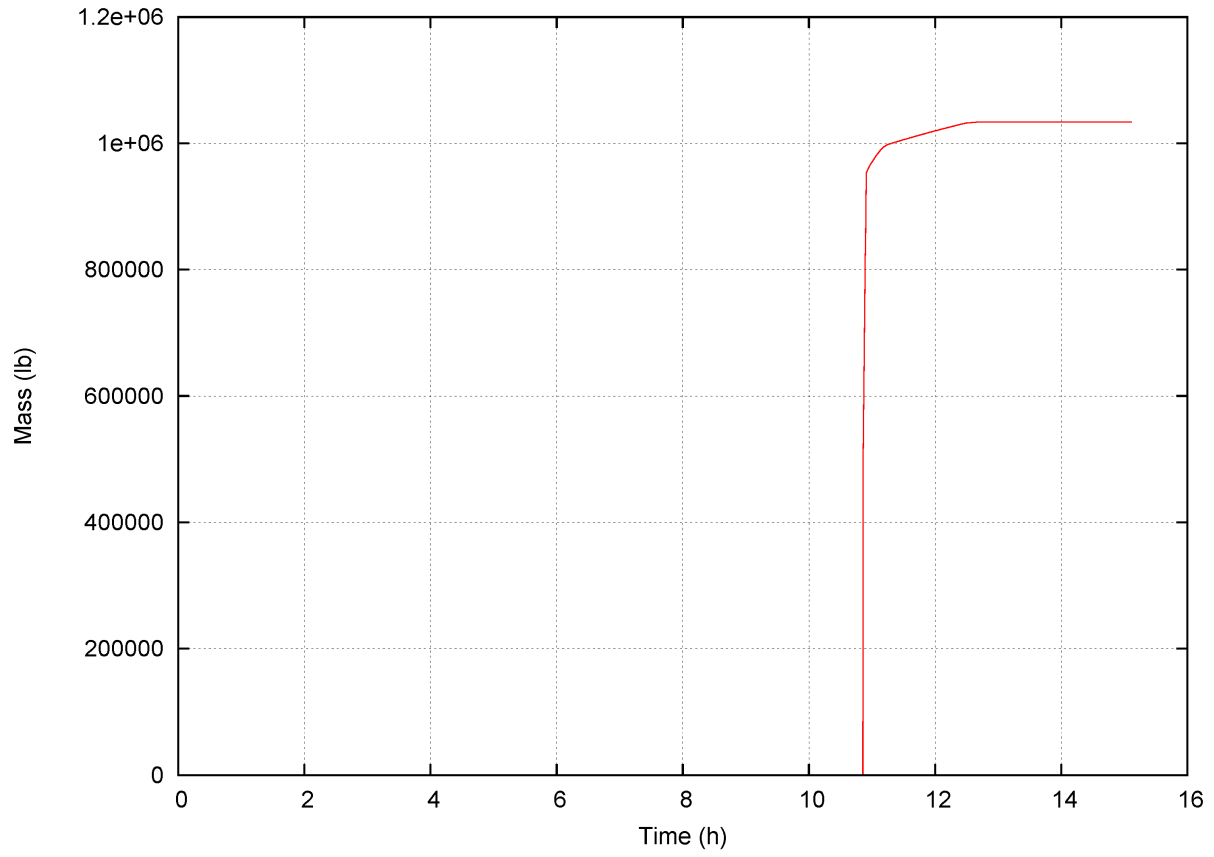


Figure 19-124-50—Reactor Pit Ablation (Axial) (st1.8a)

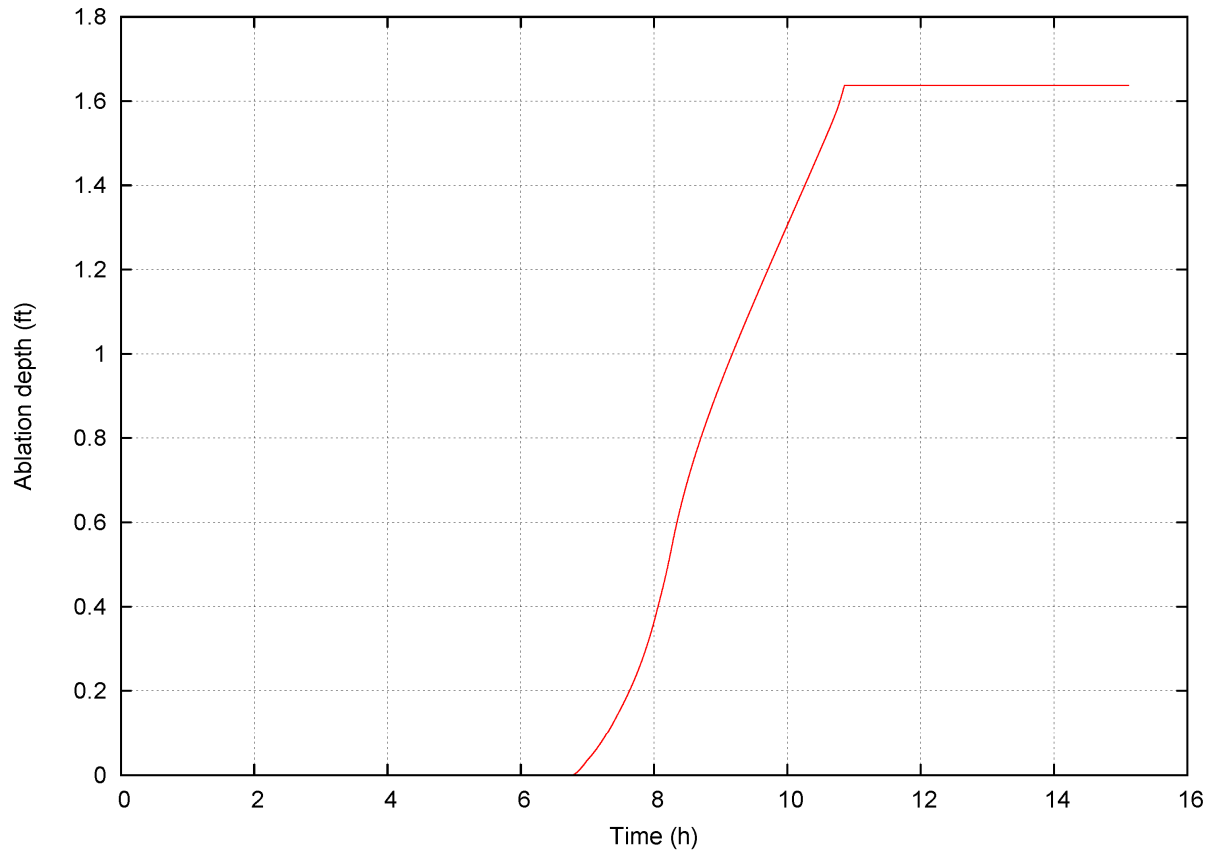


Figure 19-124-51—Reactor Pit Ablation (Radial) (st1.8a)

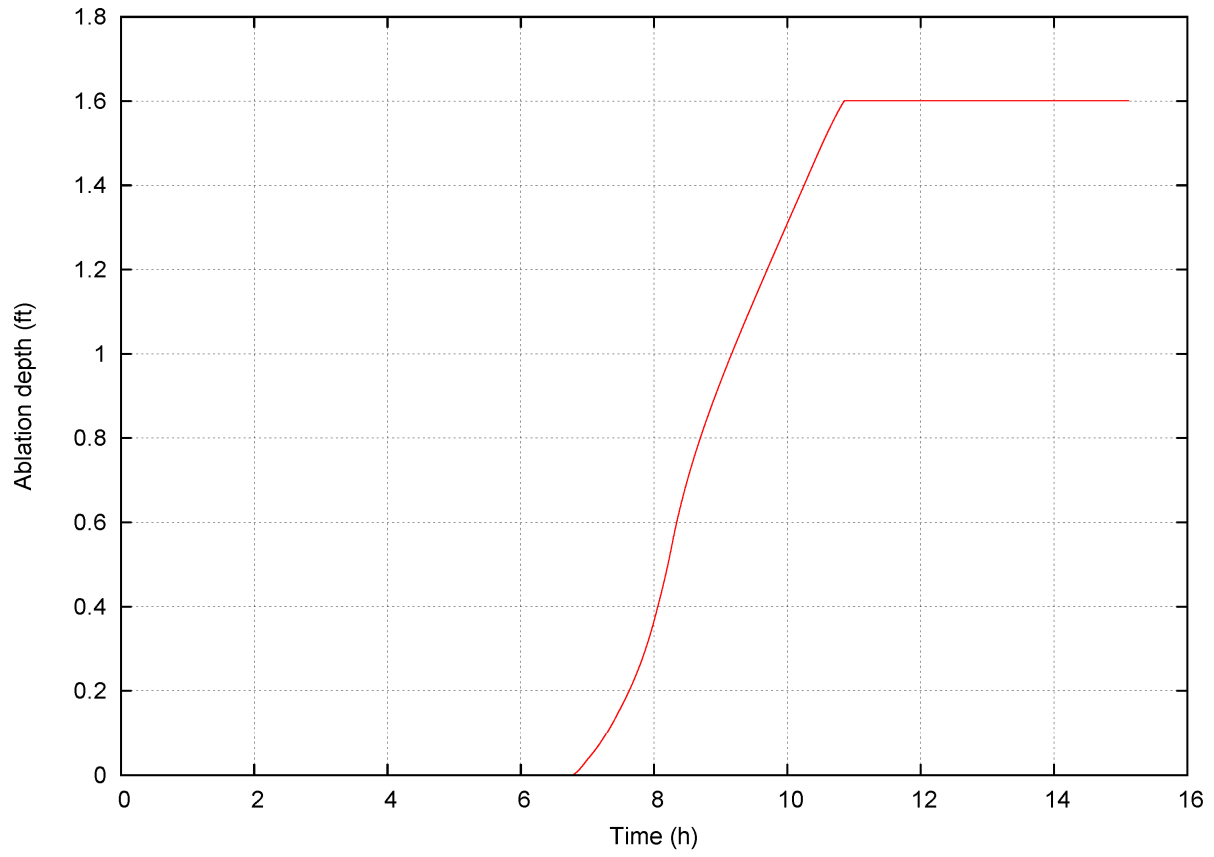


Figure 19-124-52—Spreading Room Ablation (Axial) (st1.8a)

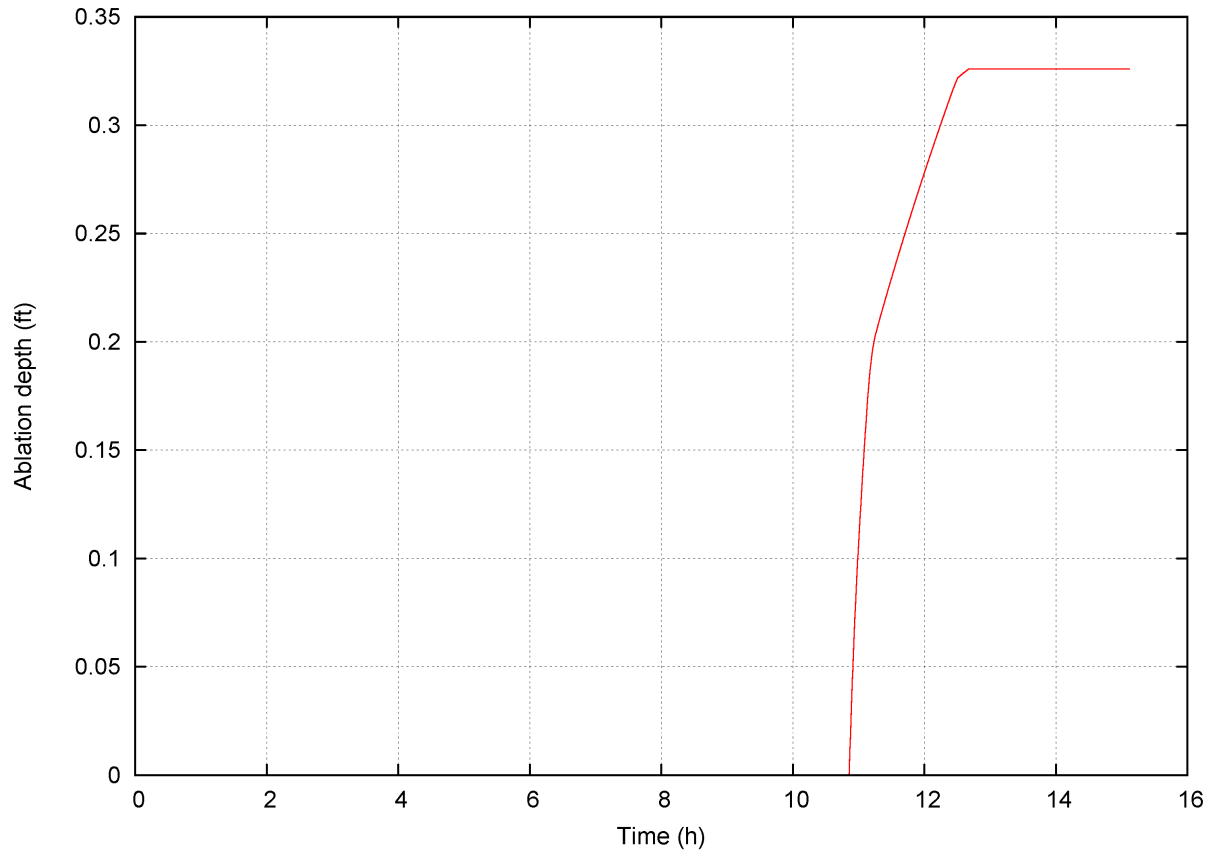


Figure 19-124-53—Spreading Room Ablation (Radial) (st1.8a)

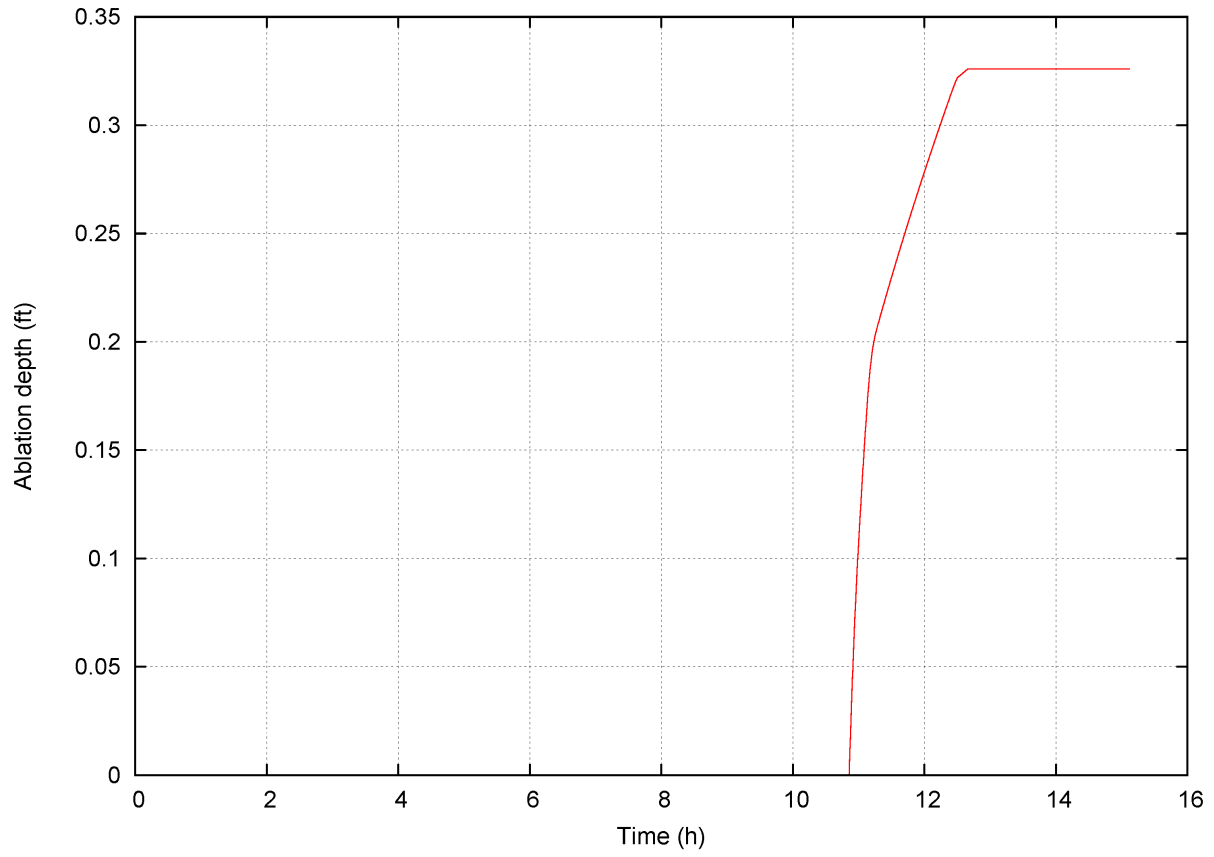


Figure 19-124-54—Fission Product Mass Inside Reactor (st1.8a)

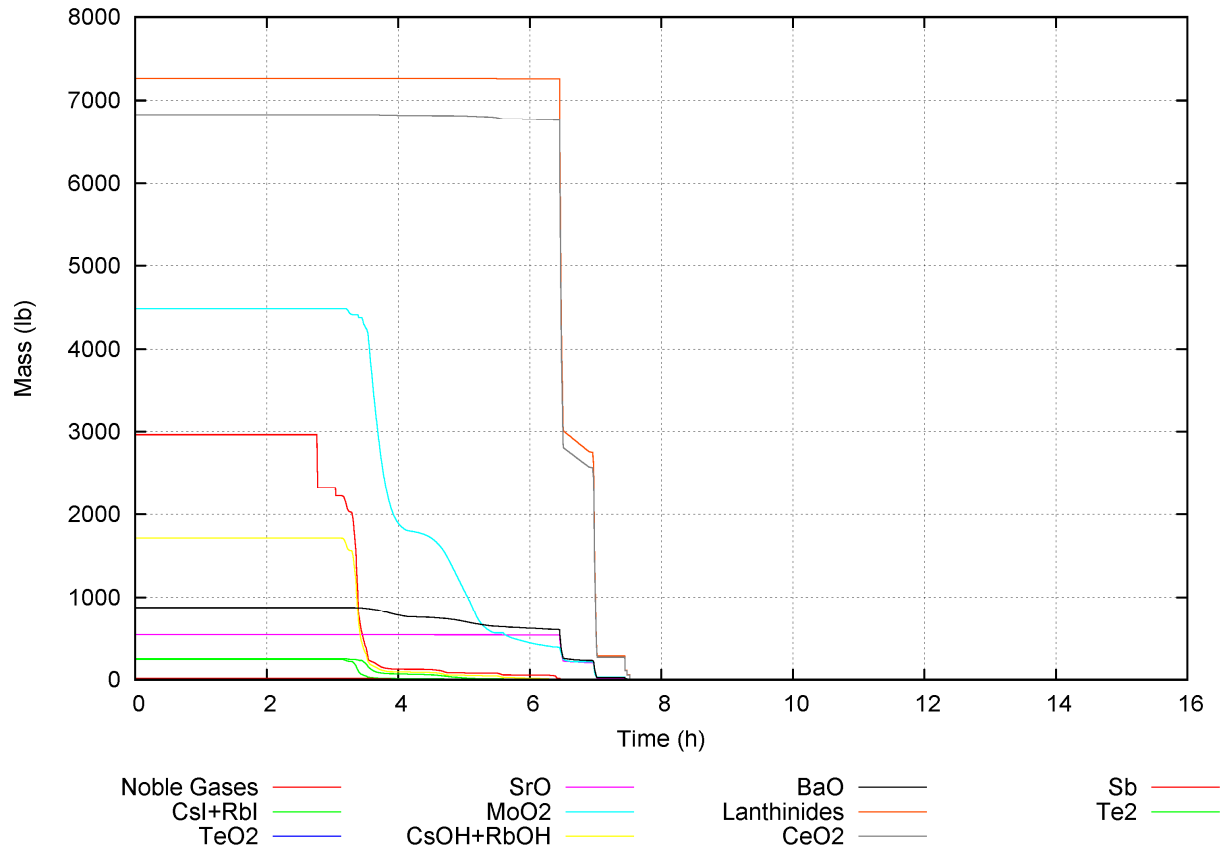


Figure 19-124-55—Fission Product Mass Inside Reactor - Actinides (st1.8a)

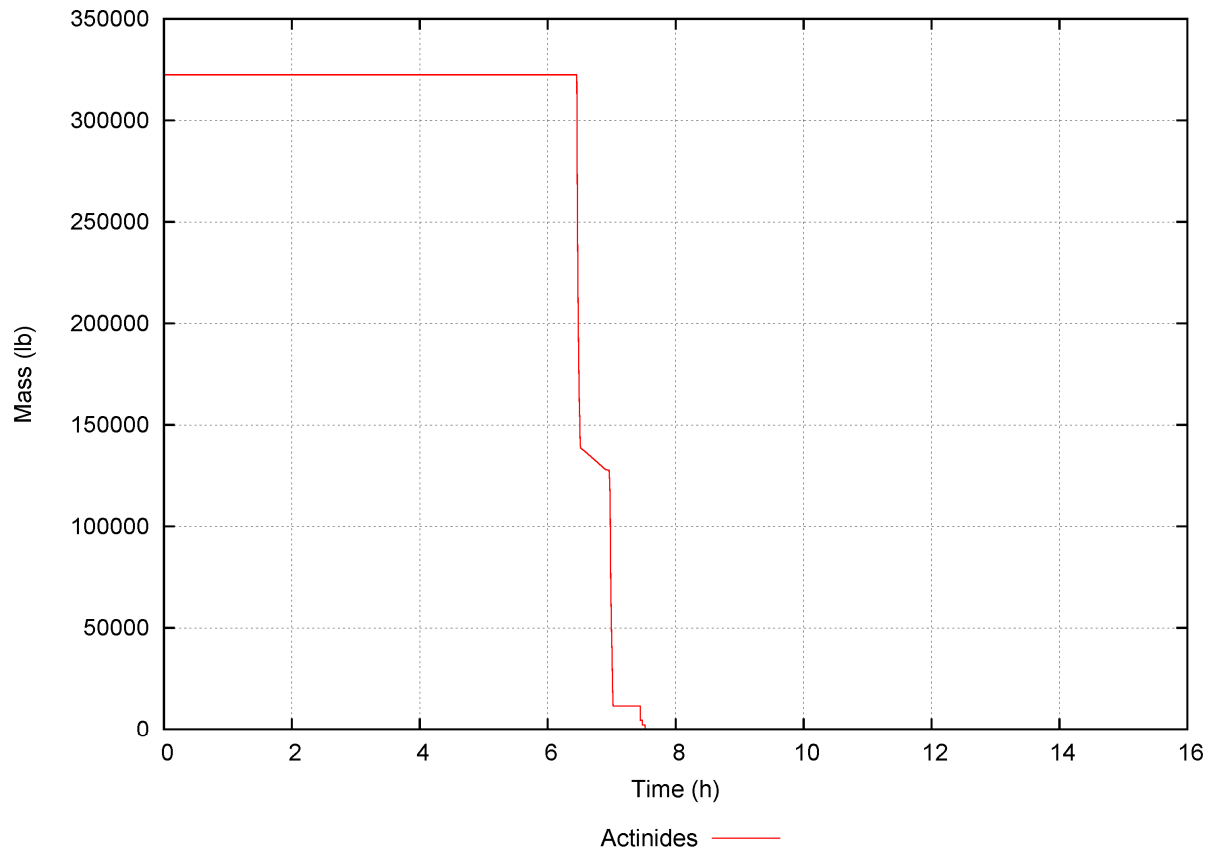


Figure 19-124-57—Fission Product Mass Released to Environment (st1.8a)

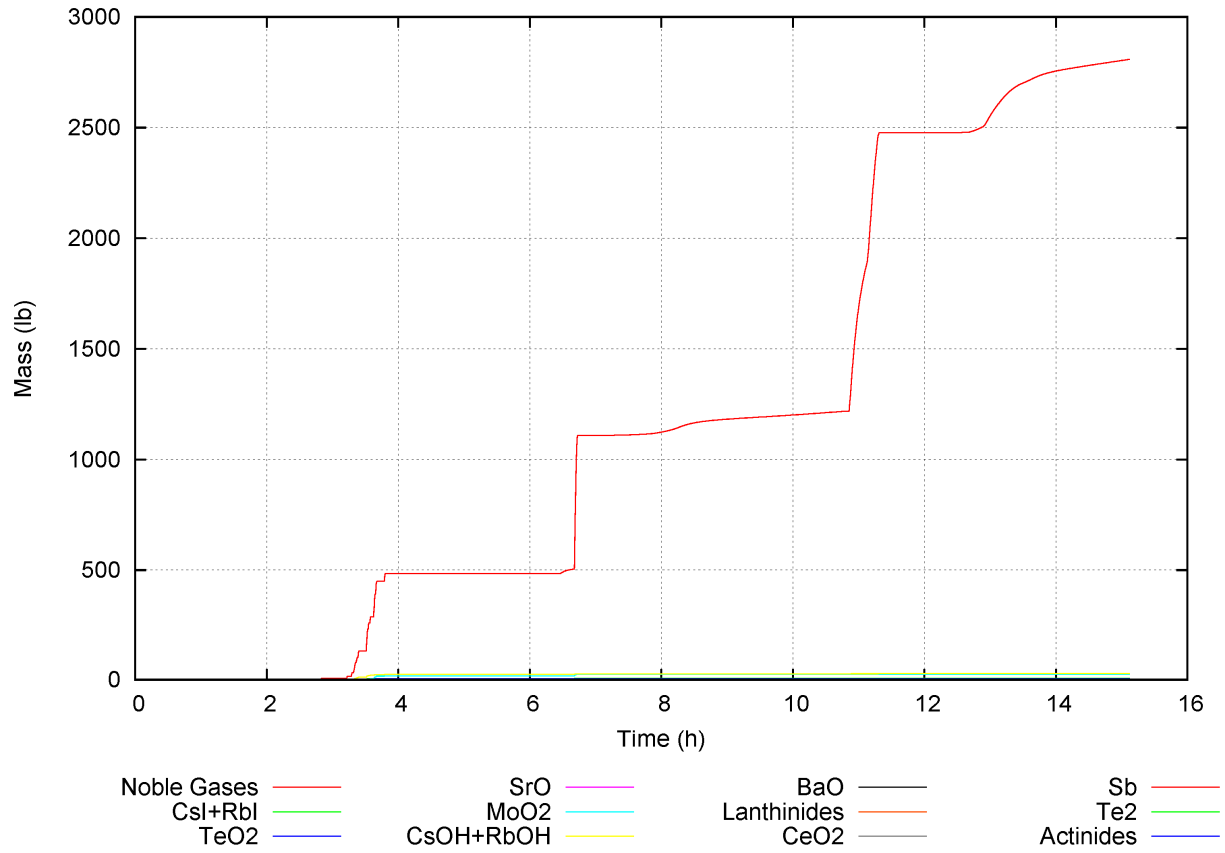


Figure 19-124-58—Failed Containment Pressure (st1.8a)

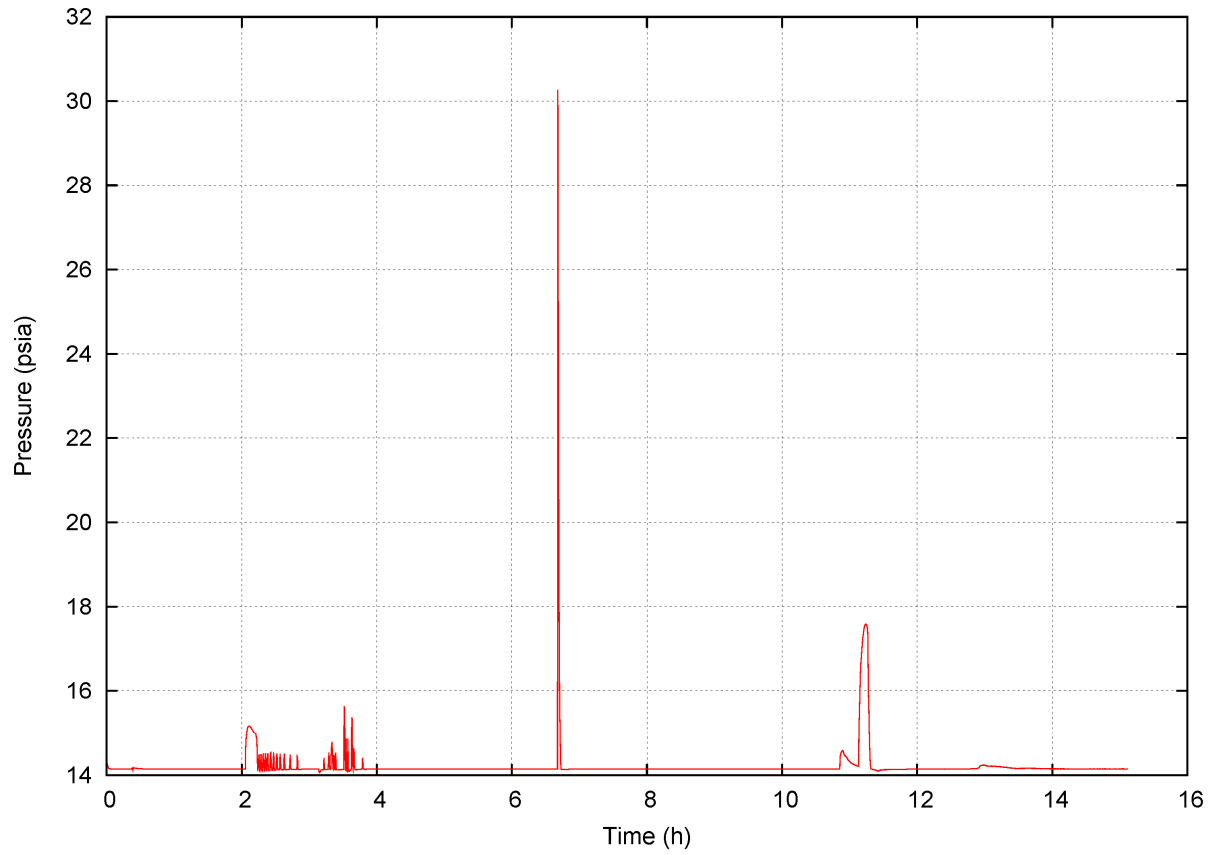


Figure 19-124-59—RCS Pressure (st1.8b)

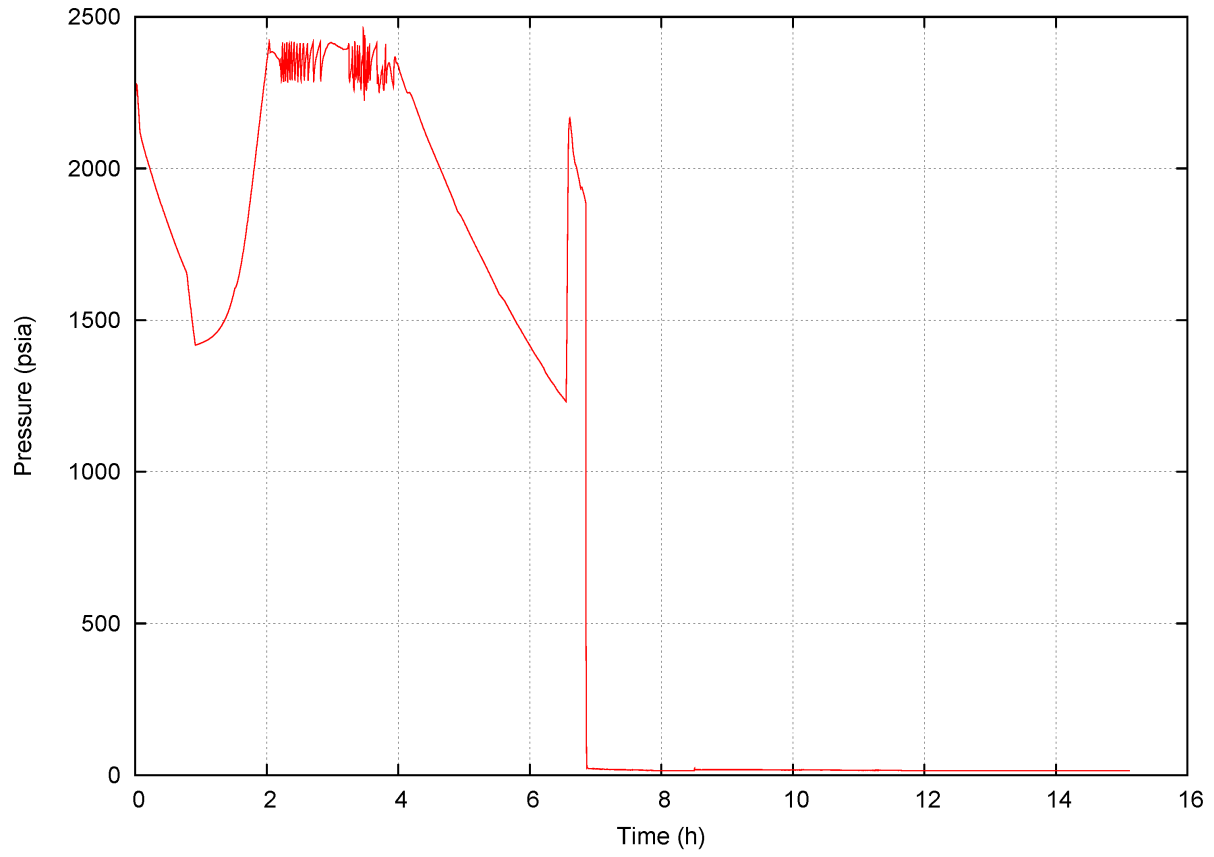


Figure 19-124-60—In-Vessel Hydrogen Production (st1.8b)

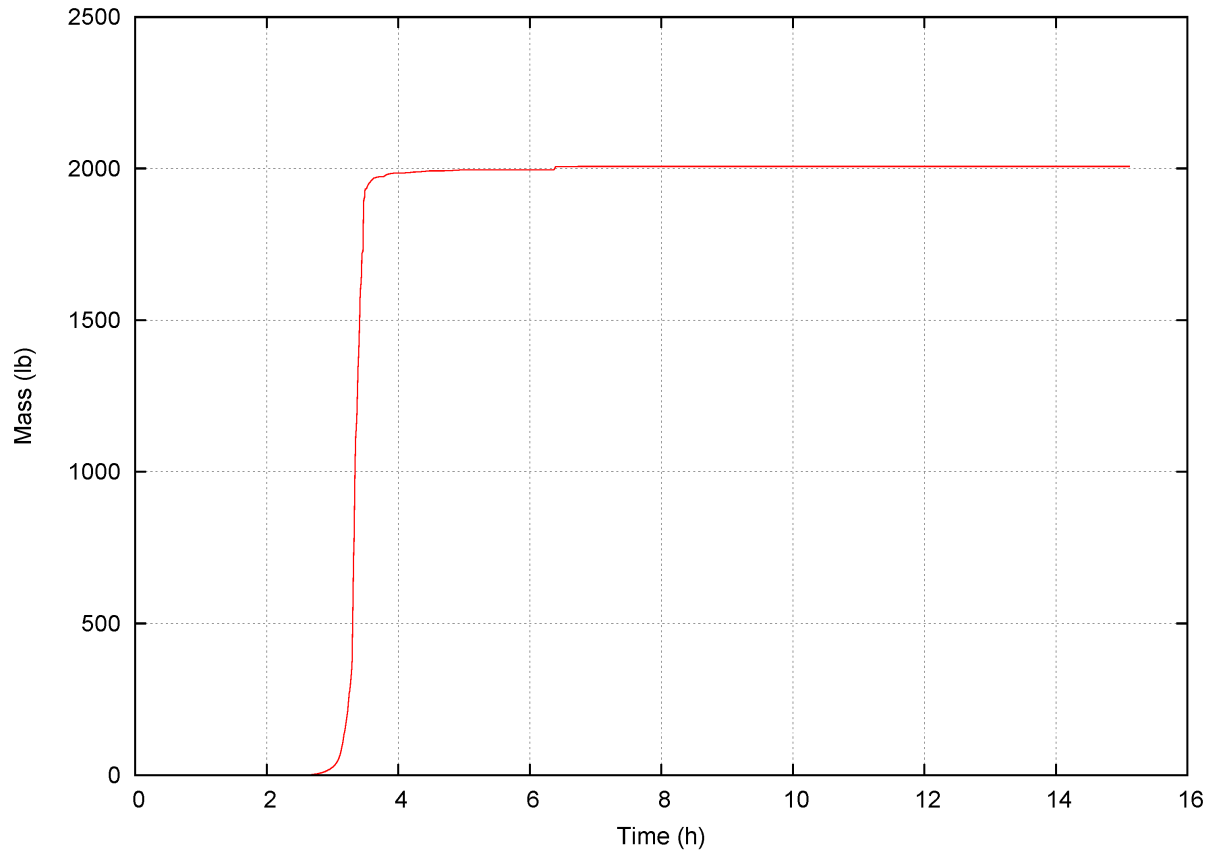


Figure 19-124-61—Mass of Hydrogen in Containment (st1.8b)

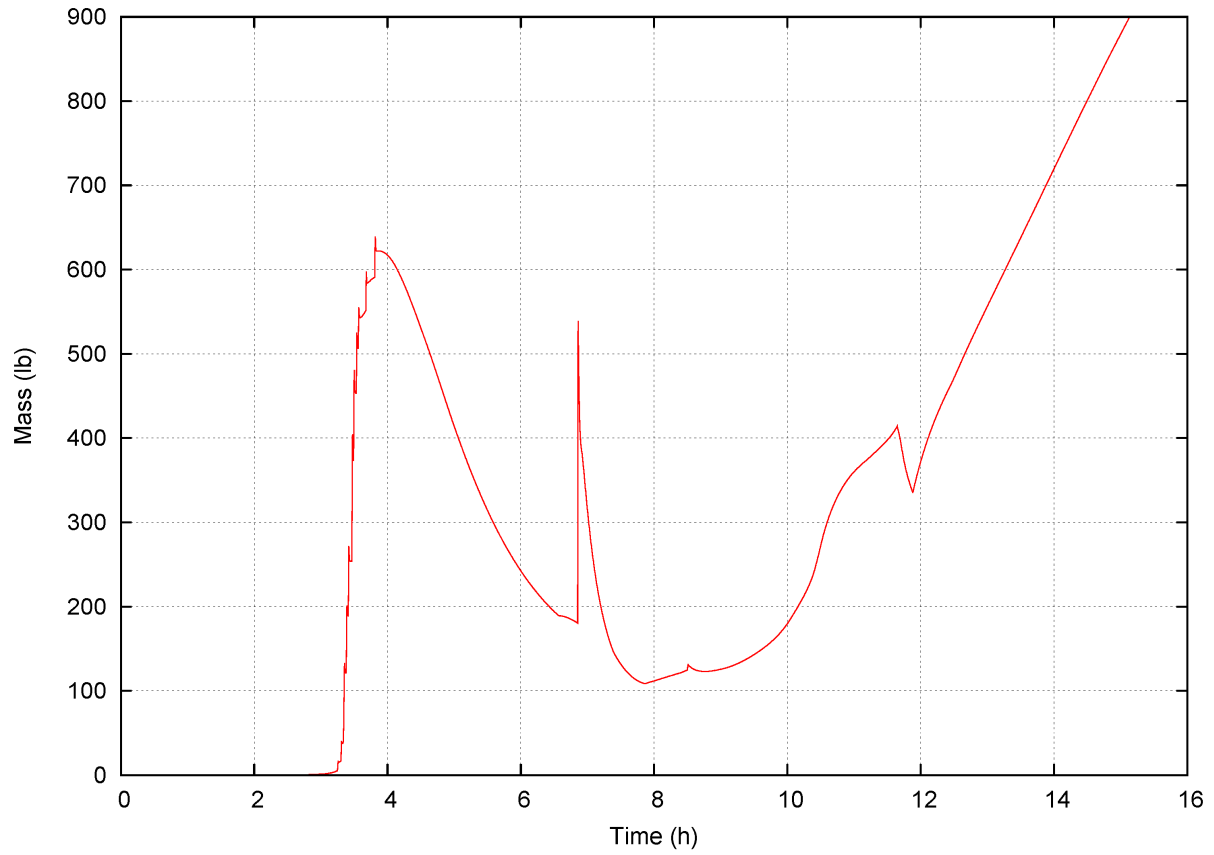


Figure 19-124-62: Concentration of Hydrogen in Containment (st1.8b)

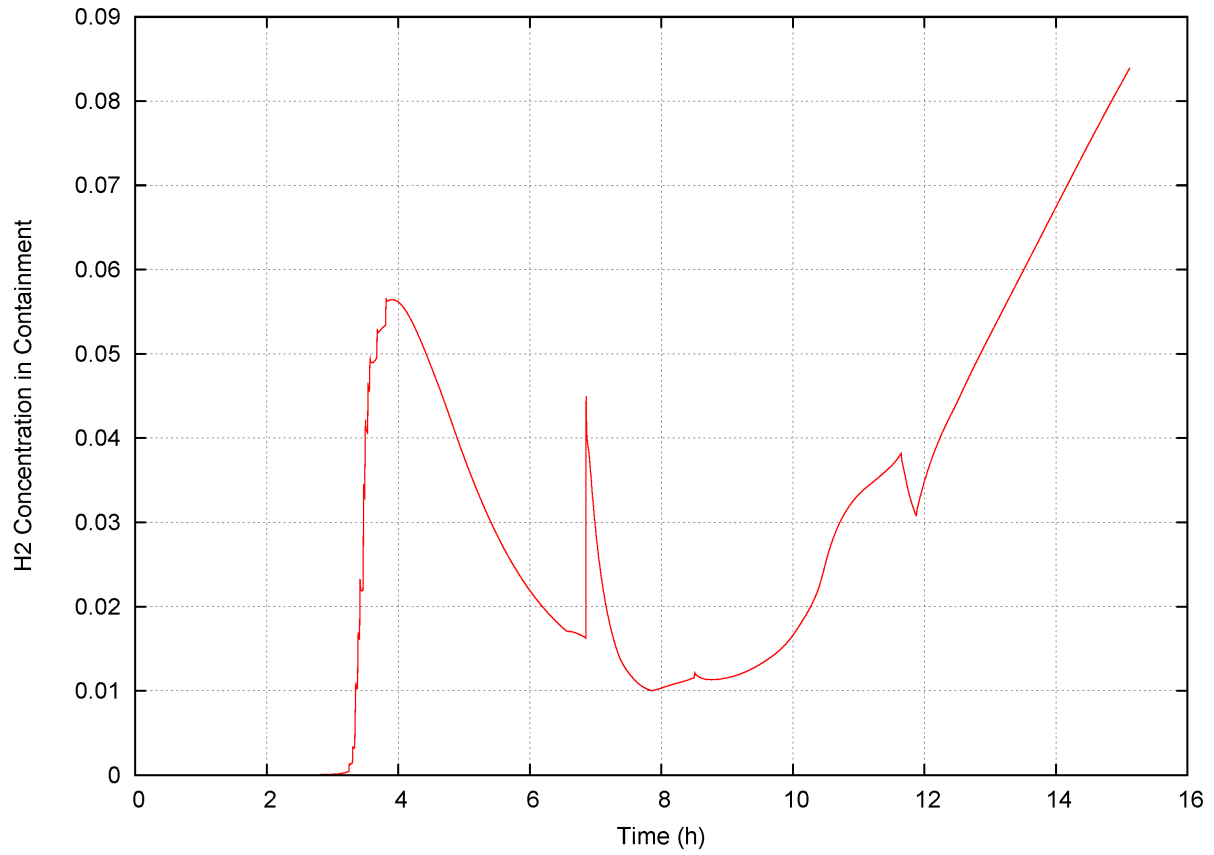


Figure 19-124-63—Hydrogen Consumed by PARs (st1.8b)

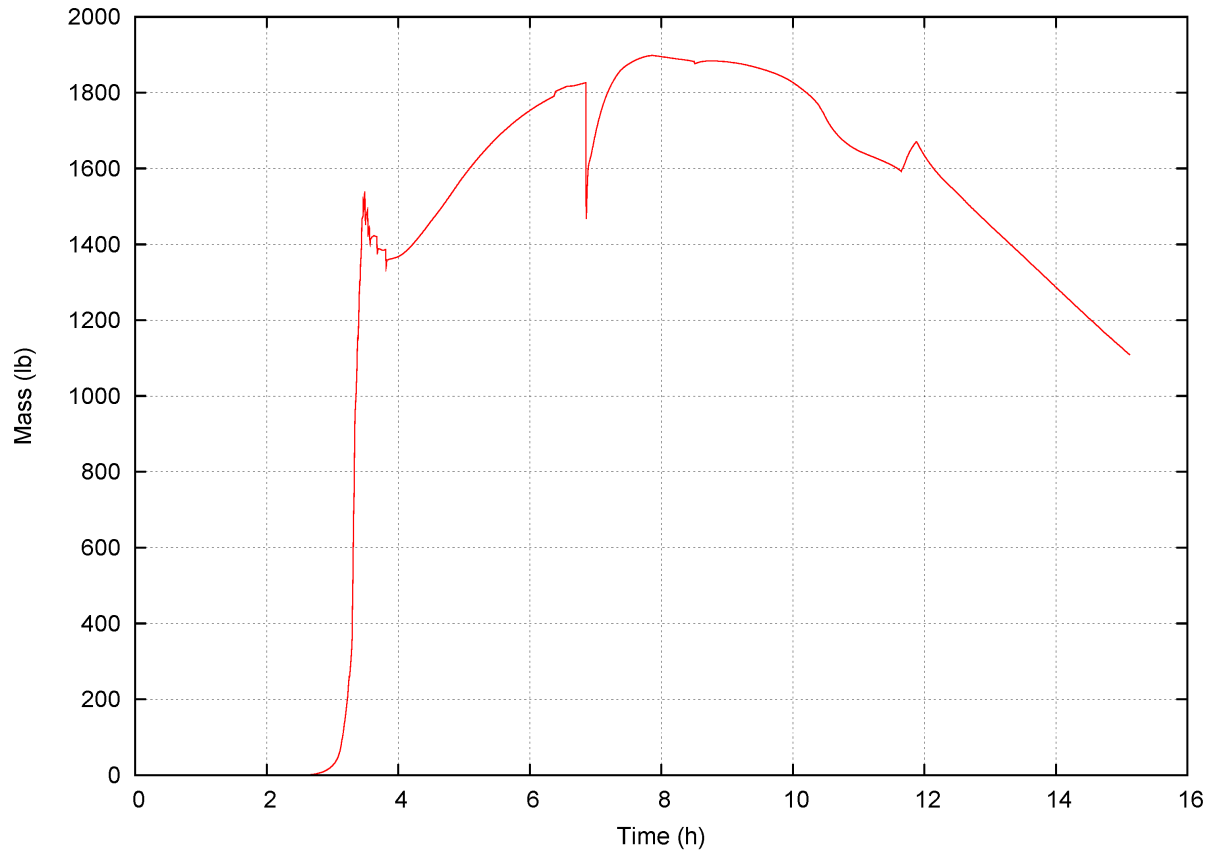


Figure 19-124-64—Mass of Oxygen in Containment (st1.8b)

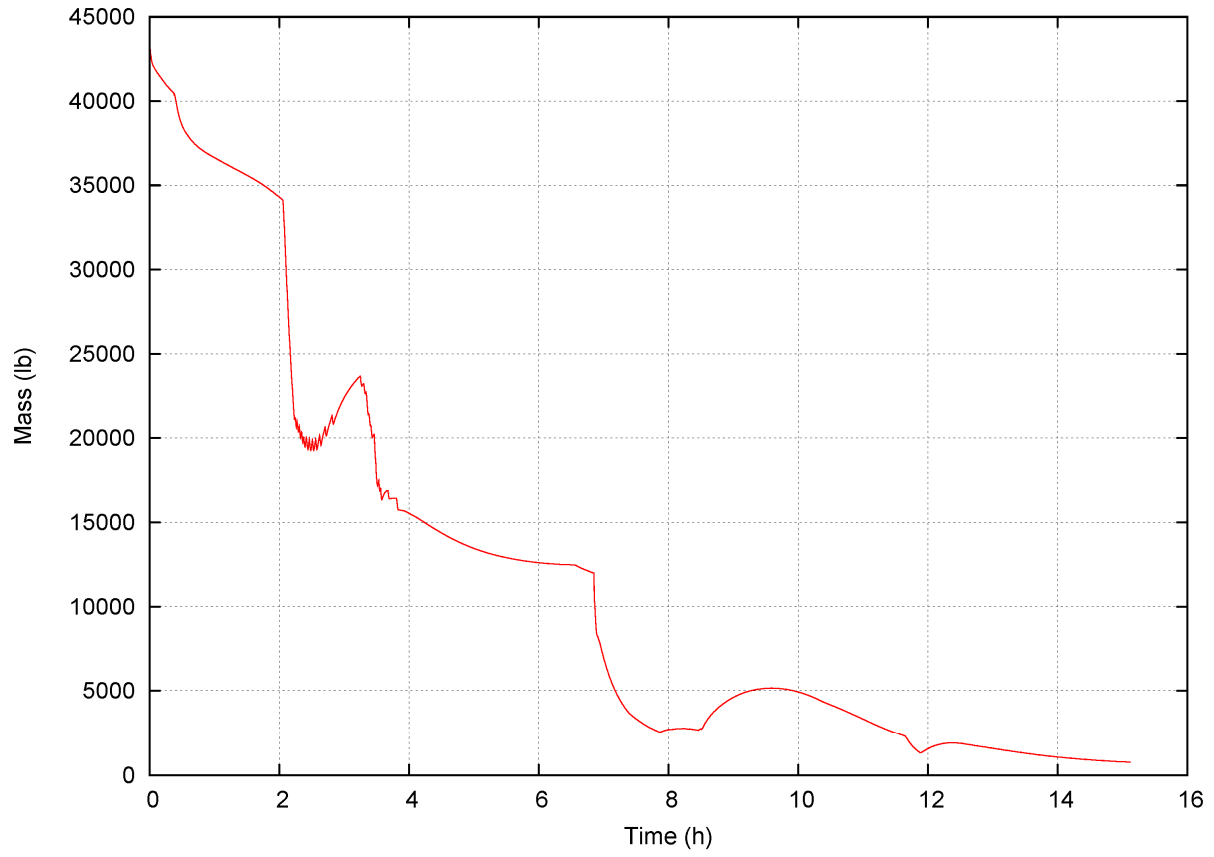


Figure 19-124-65—Concentration of Oxygen in Containment (st1.8b)

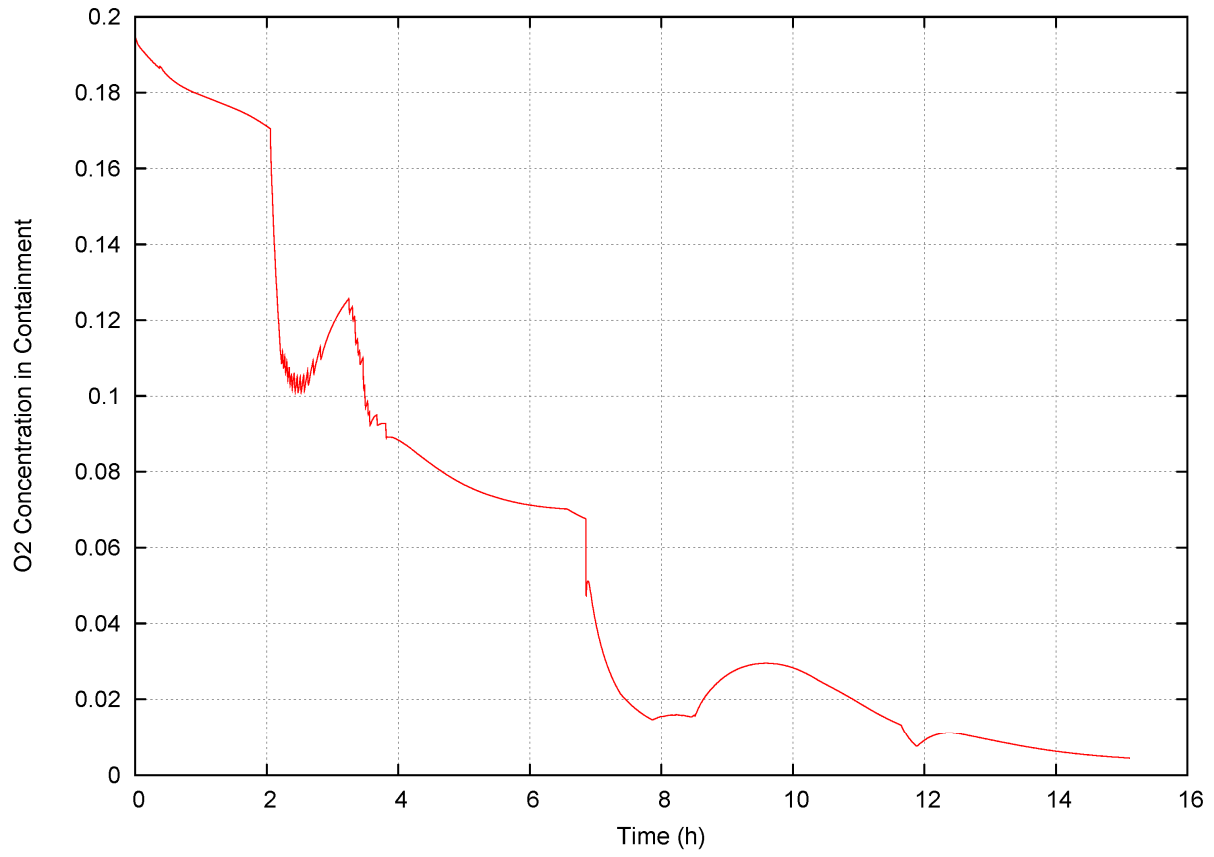


Figure 19-124-66—Mass of Steam in Containment (st1.8b)

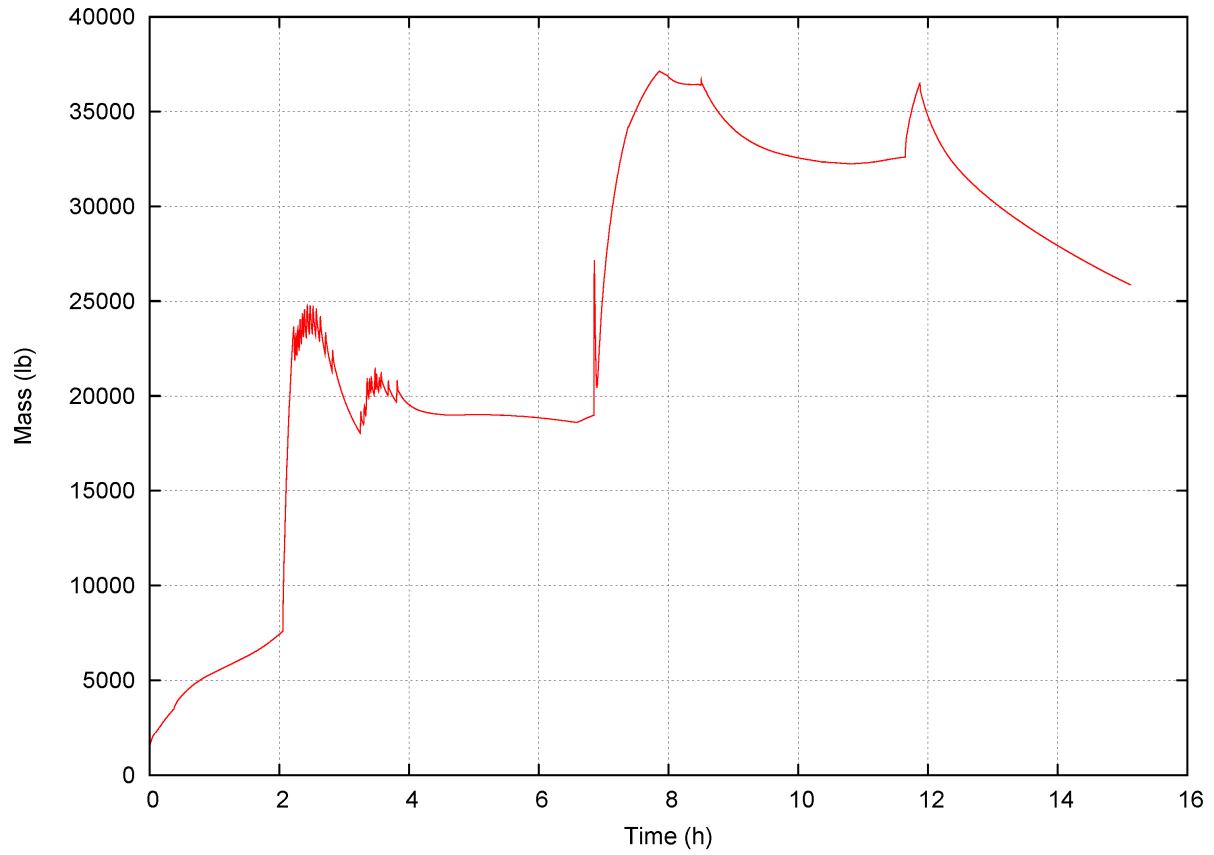


Figure 19-124-67—Concentration of Steam in Containment (st1.8b)

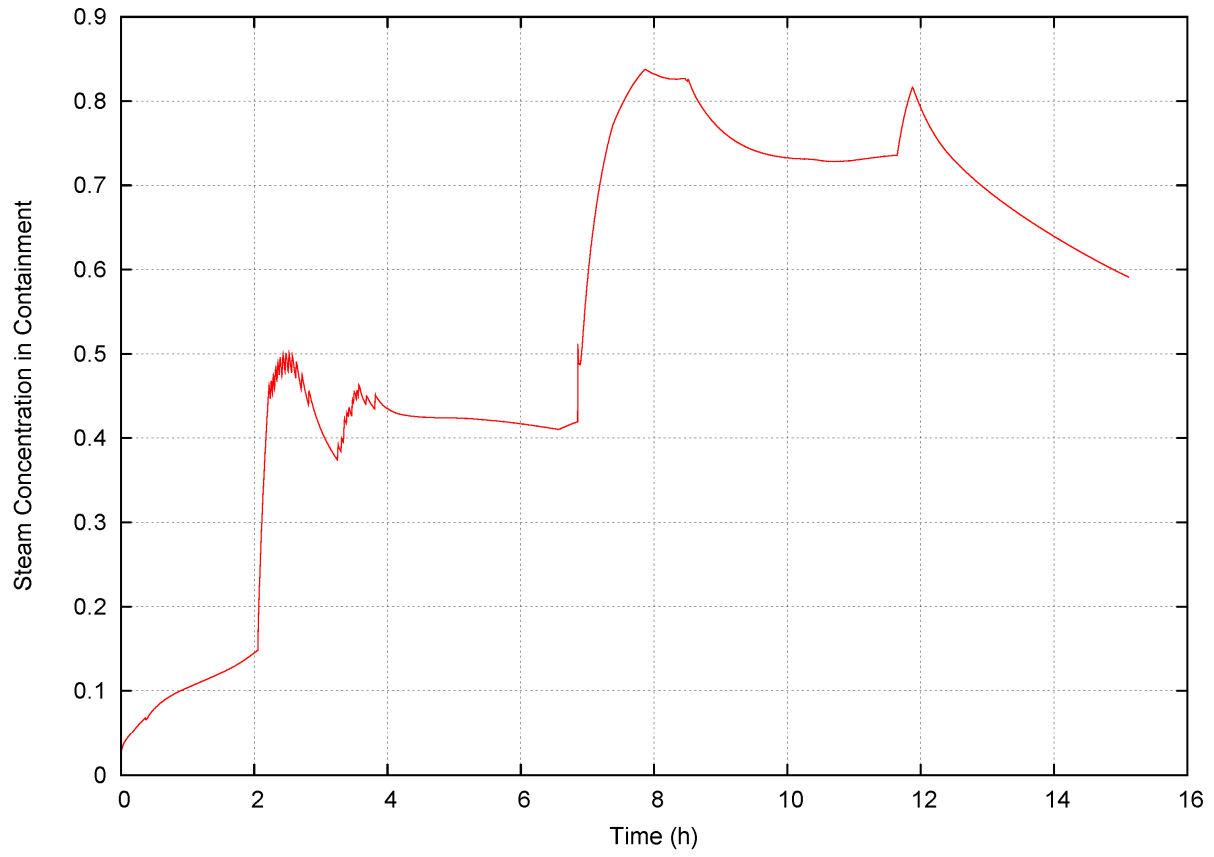


Figure 19-124-68—Mass of Nitrogen in Containment (st1.8b)

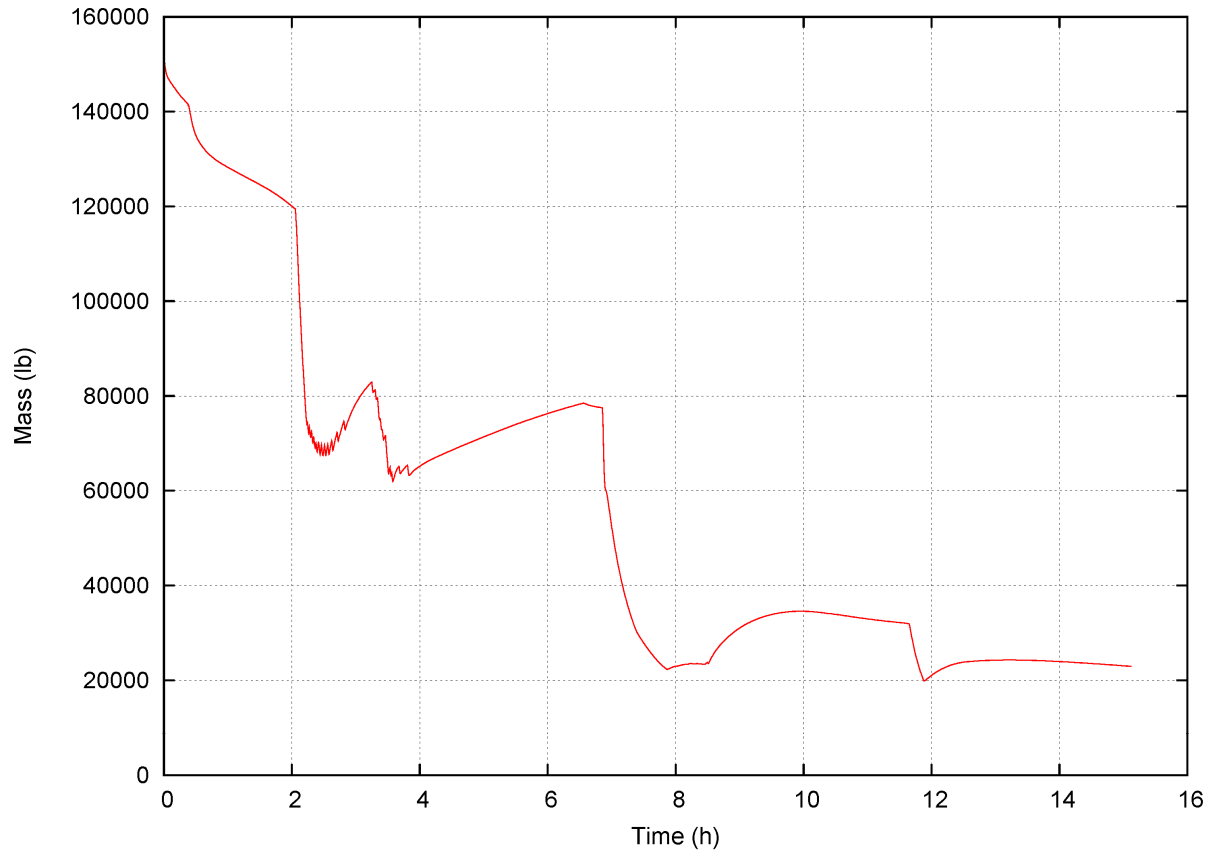


Figure 19-124-69—Concentration of Nitrogen in Containment (st1.8b)

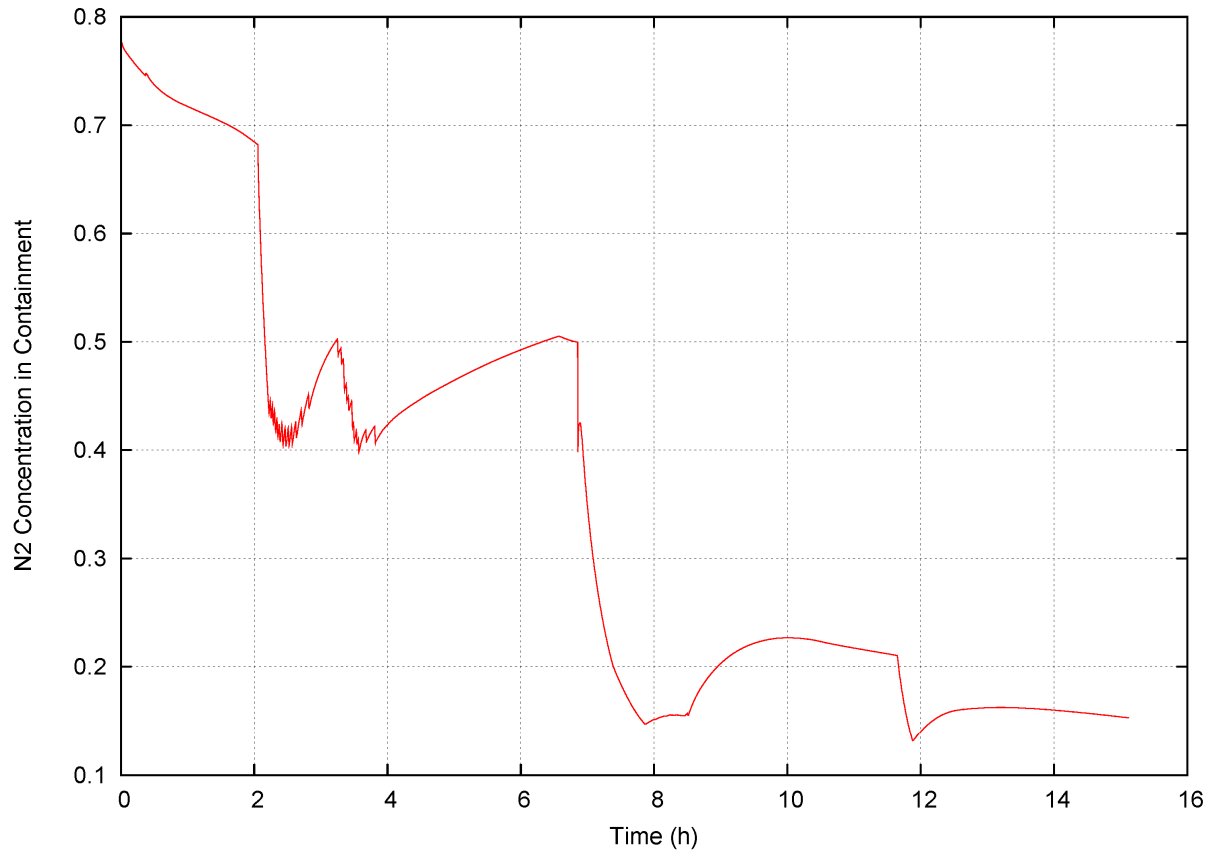


Figure 19-124-70—Mass of Carbon Dioxide in Containment (st1.8b)

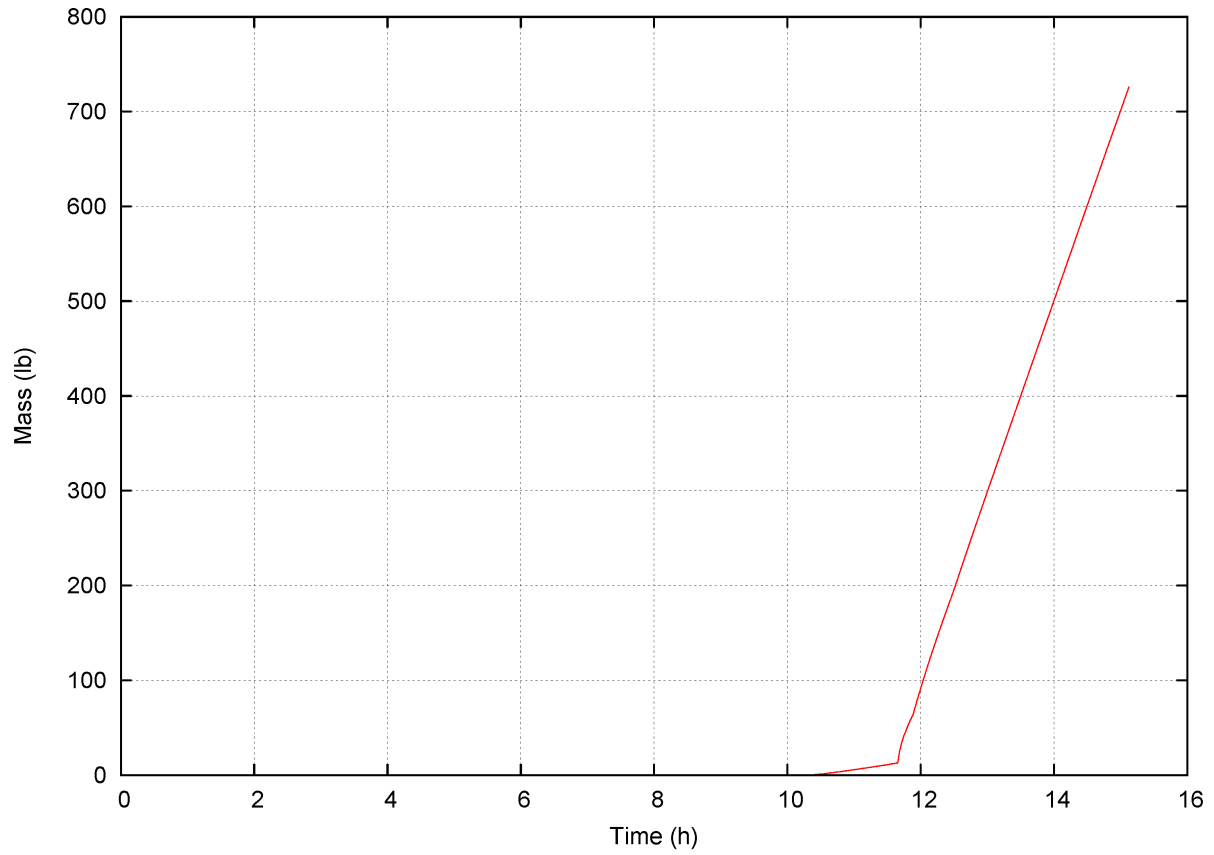


Figure 19-124-71—Concentration of Carbon Dioxide in Containment (st1.8b)

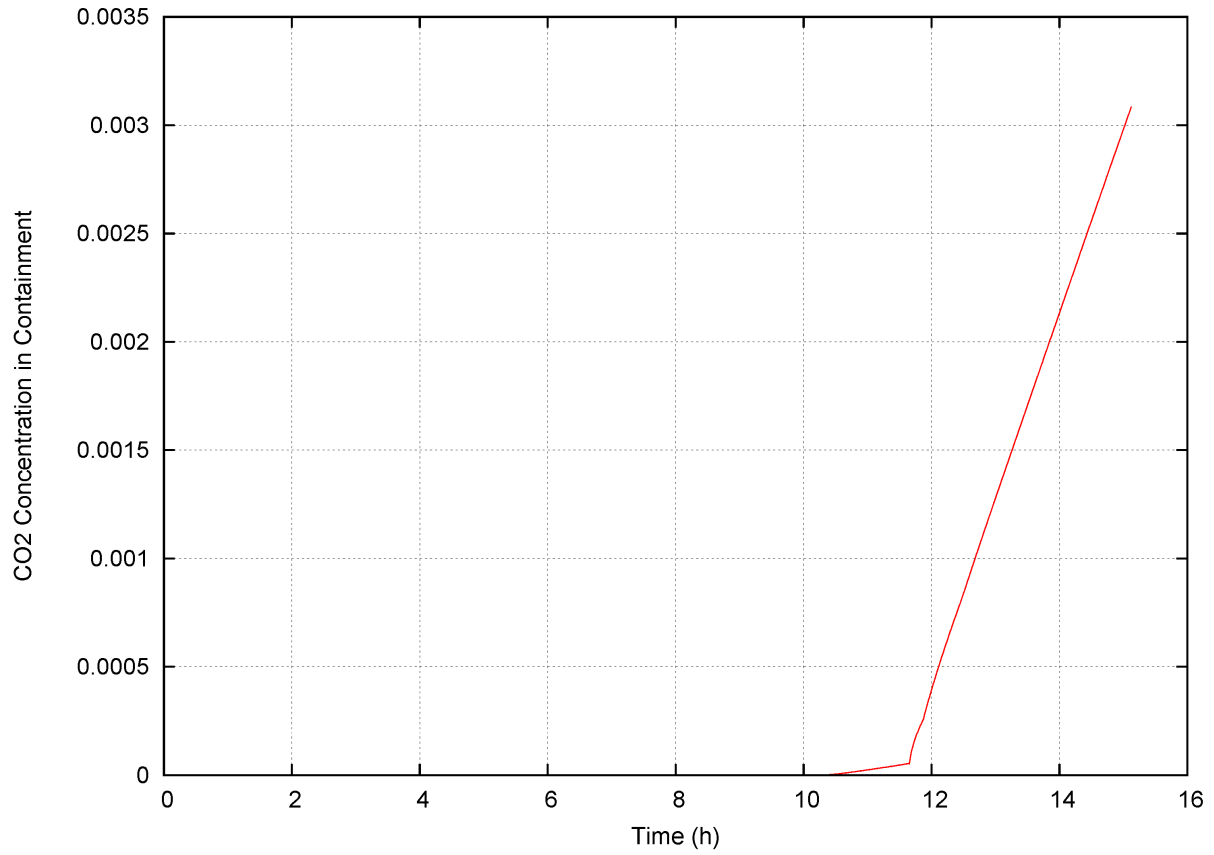


Figure 19-124-72—Mass of Carbon Monoxide in Containment (st1.8b)

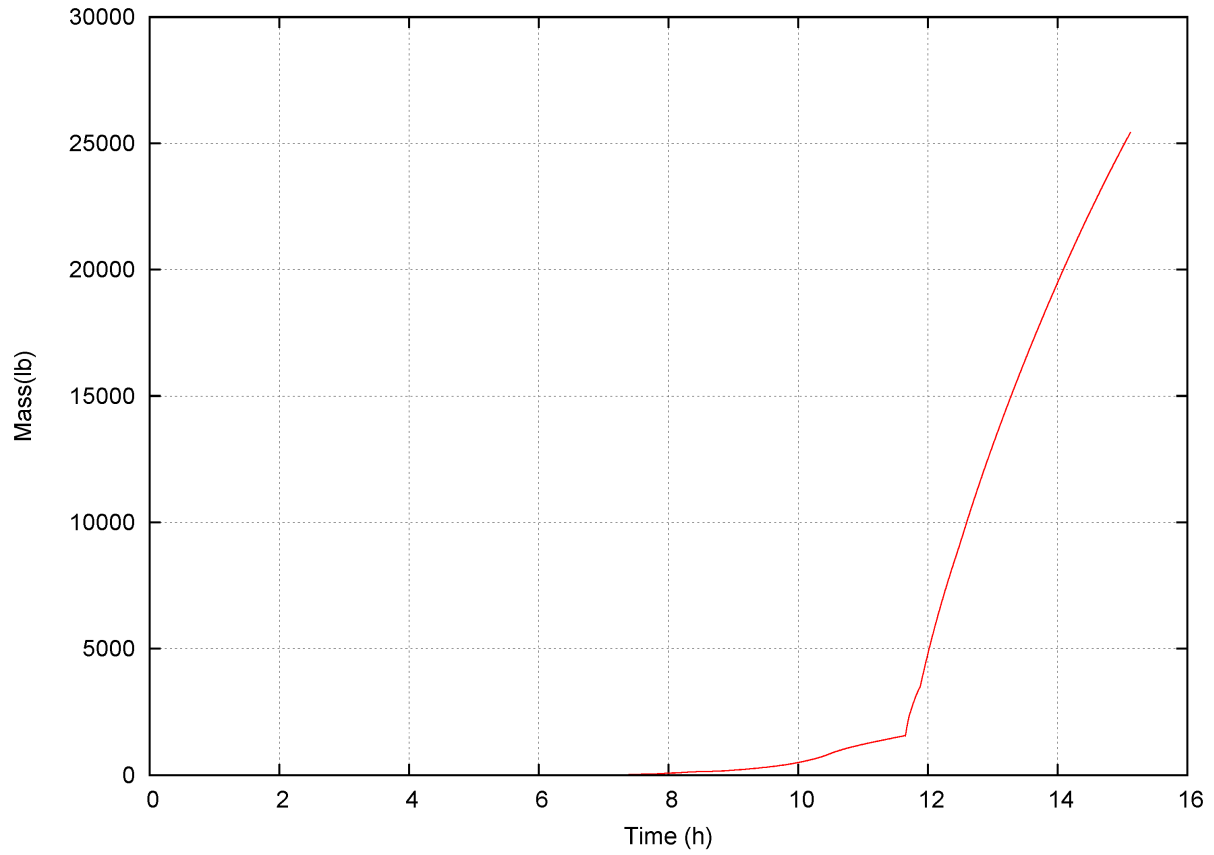


Figure 19-124-73—Concentration of Carbon Monoxide in Containment (st1.8b)

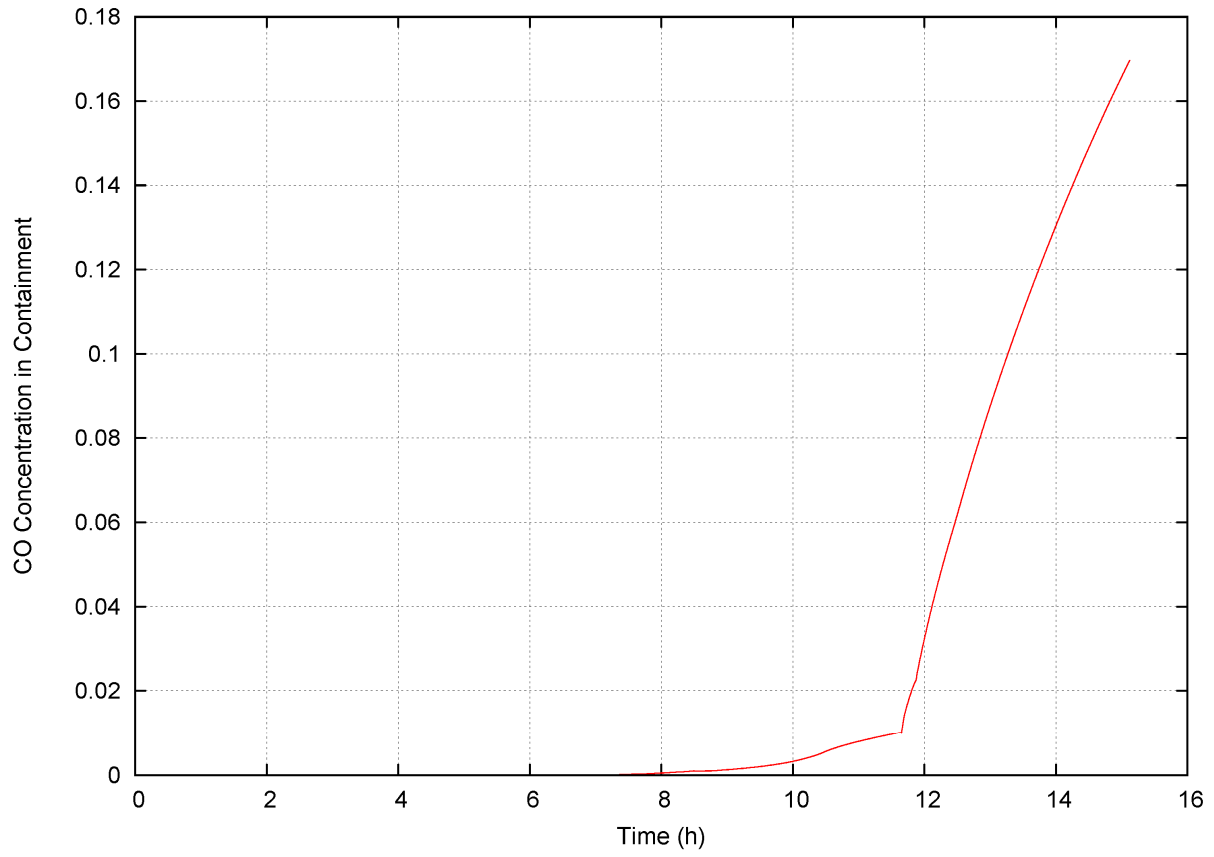


Figure 19-124-74—IRWST Water Level (st1.8b)

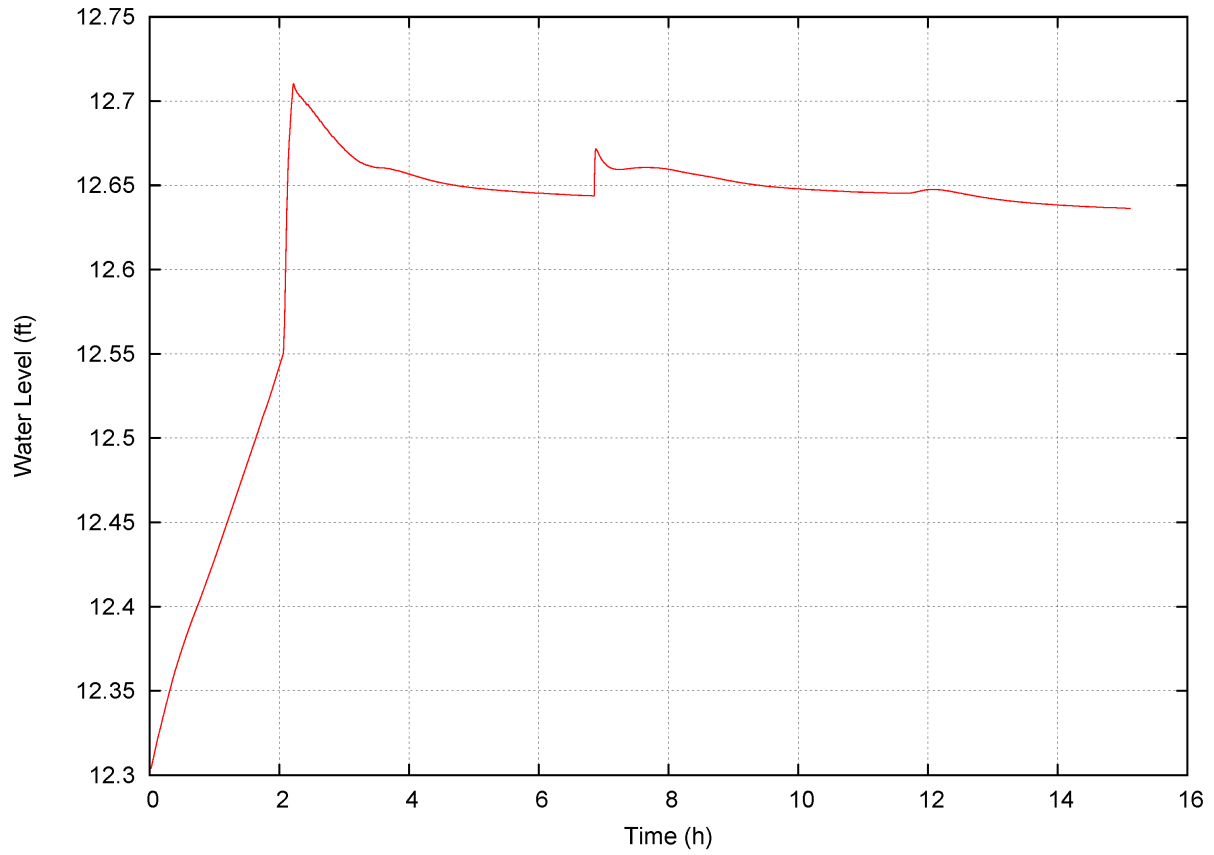


Figure 19-124-75—Spreading Room Water Level (st1.8b)

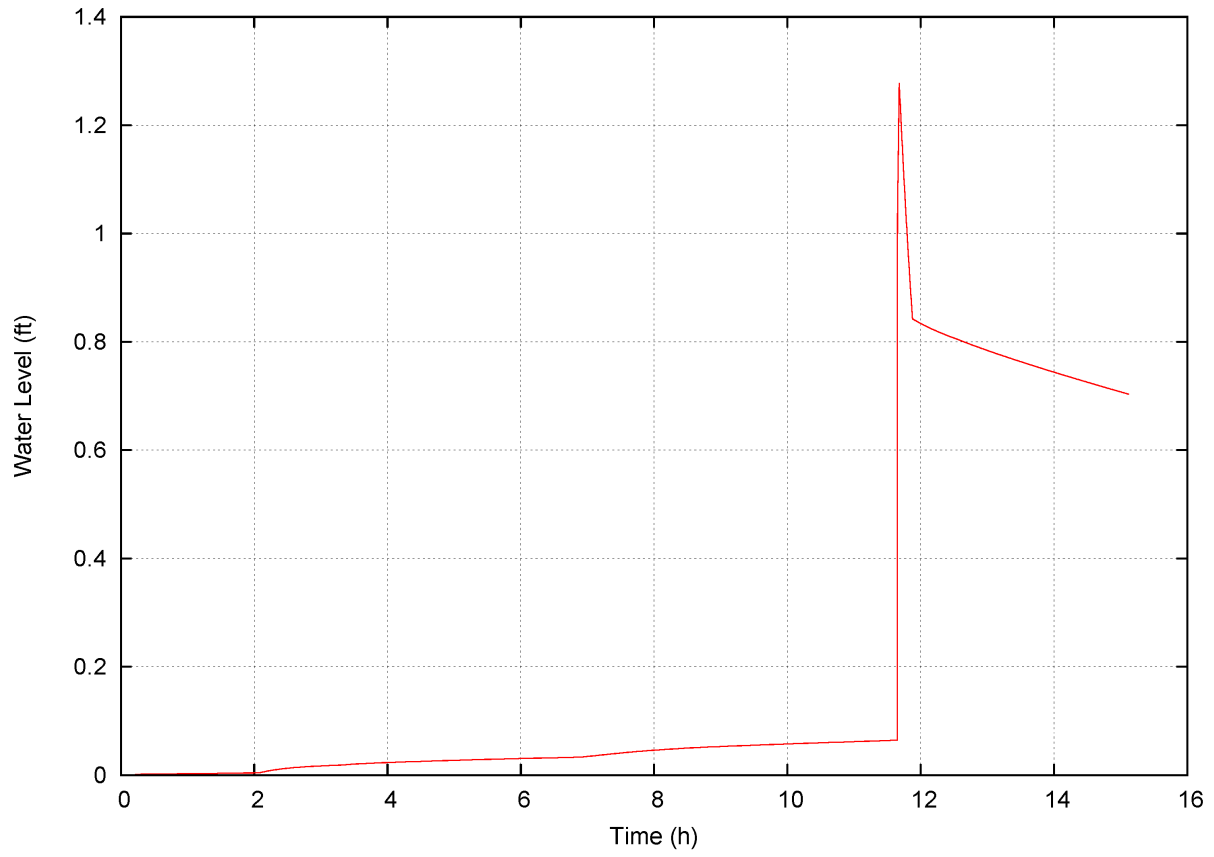


Figure 19-124-76—Reactor Pit Water Level (st1.8b)

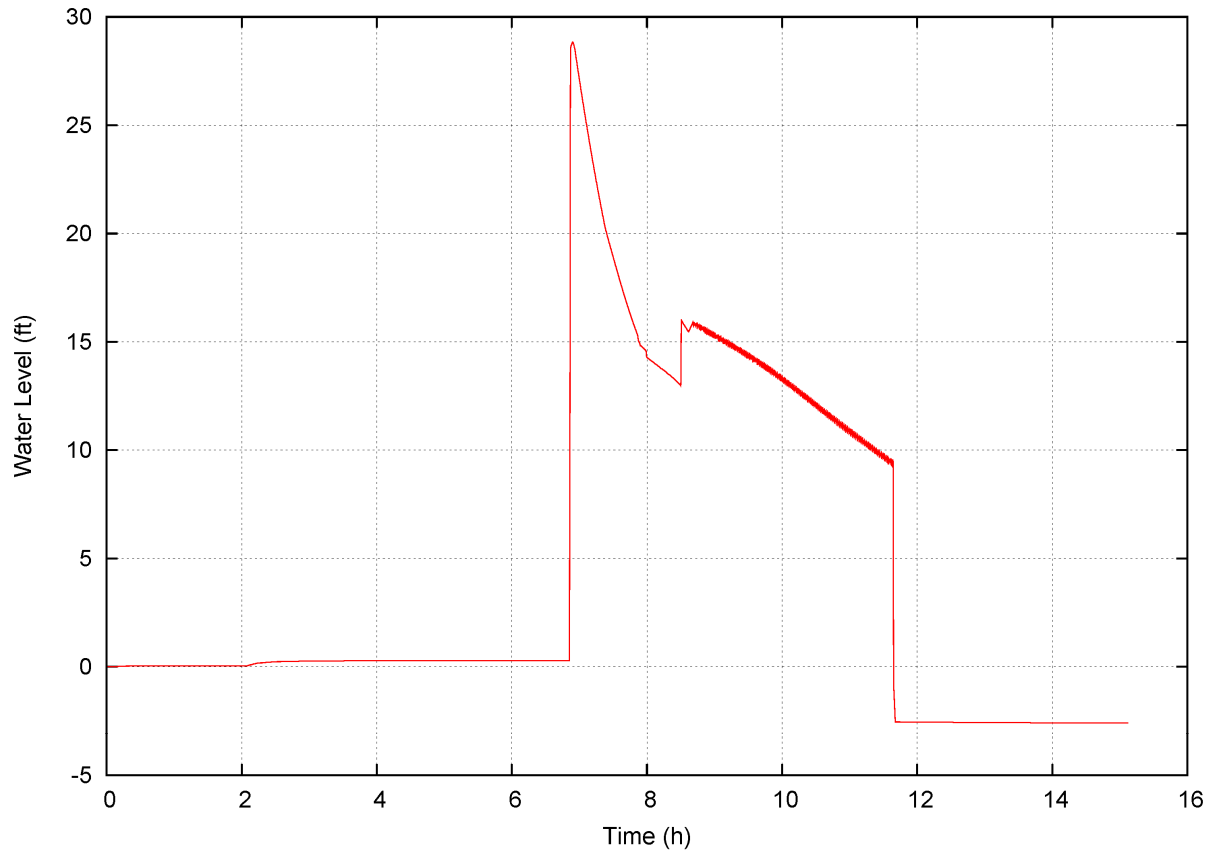


Figure 19-124-77—Mass of Corium in Reactor Pit (st1.8b)

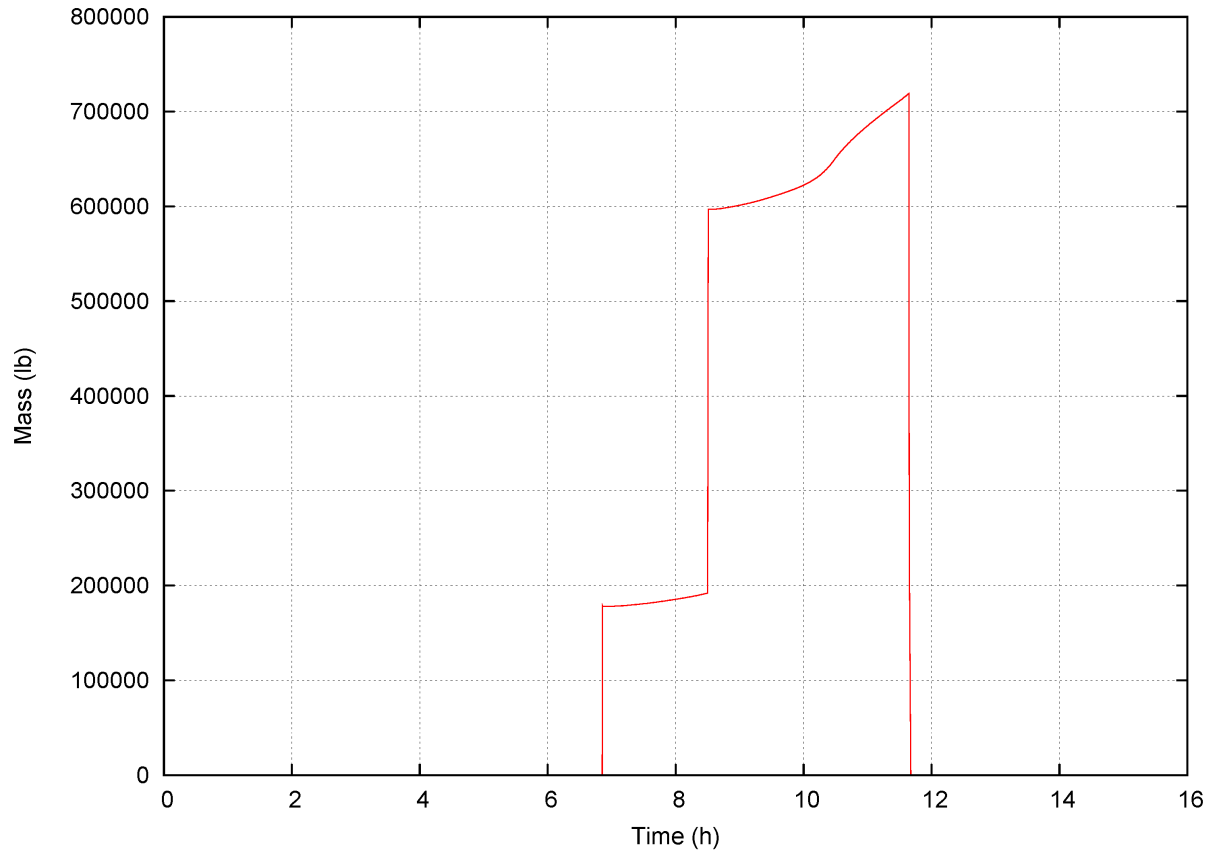


Figure 19-124-78—Mass of Corium in Spreading Room (st1.8b)

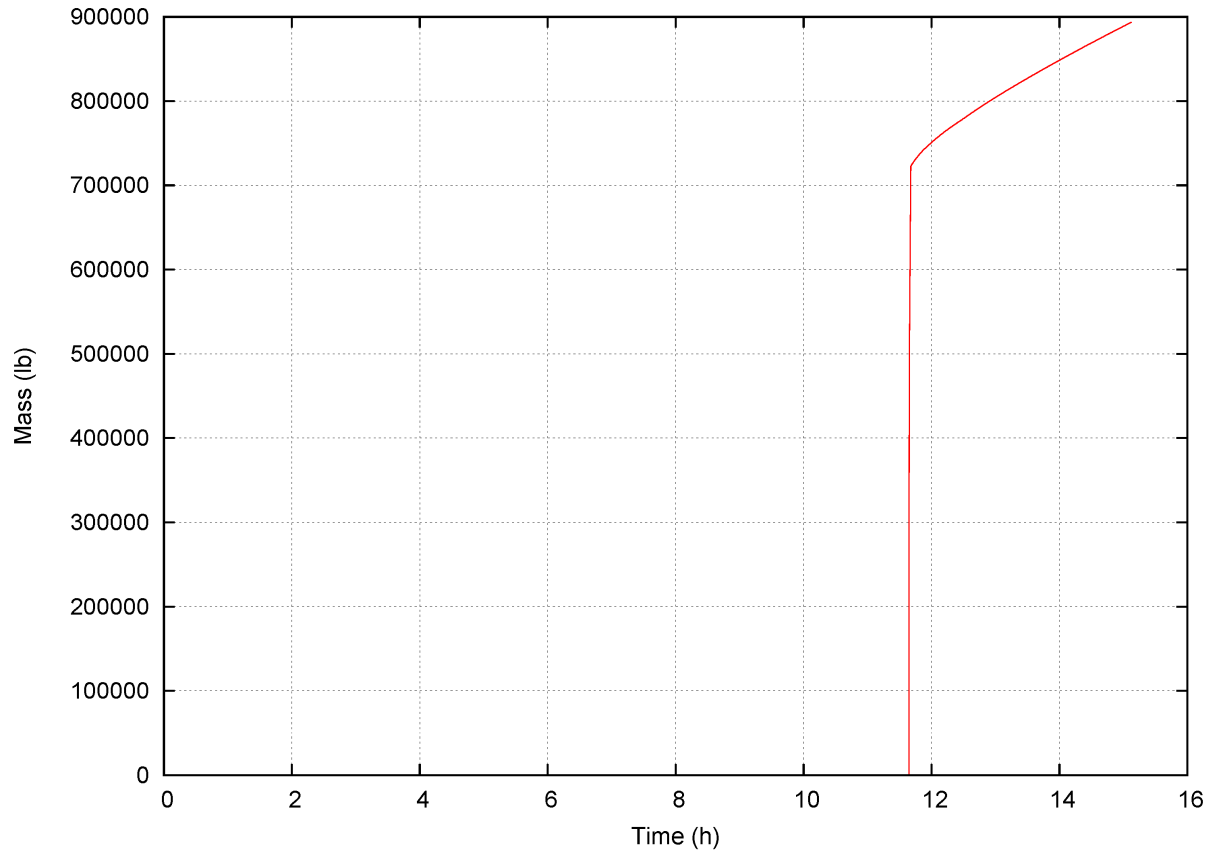


Figure 19-124-79—Reactor Pit Ablation (Axial) (st1.8b)

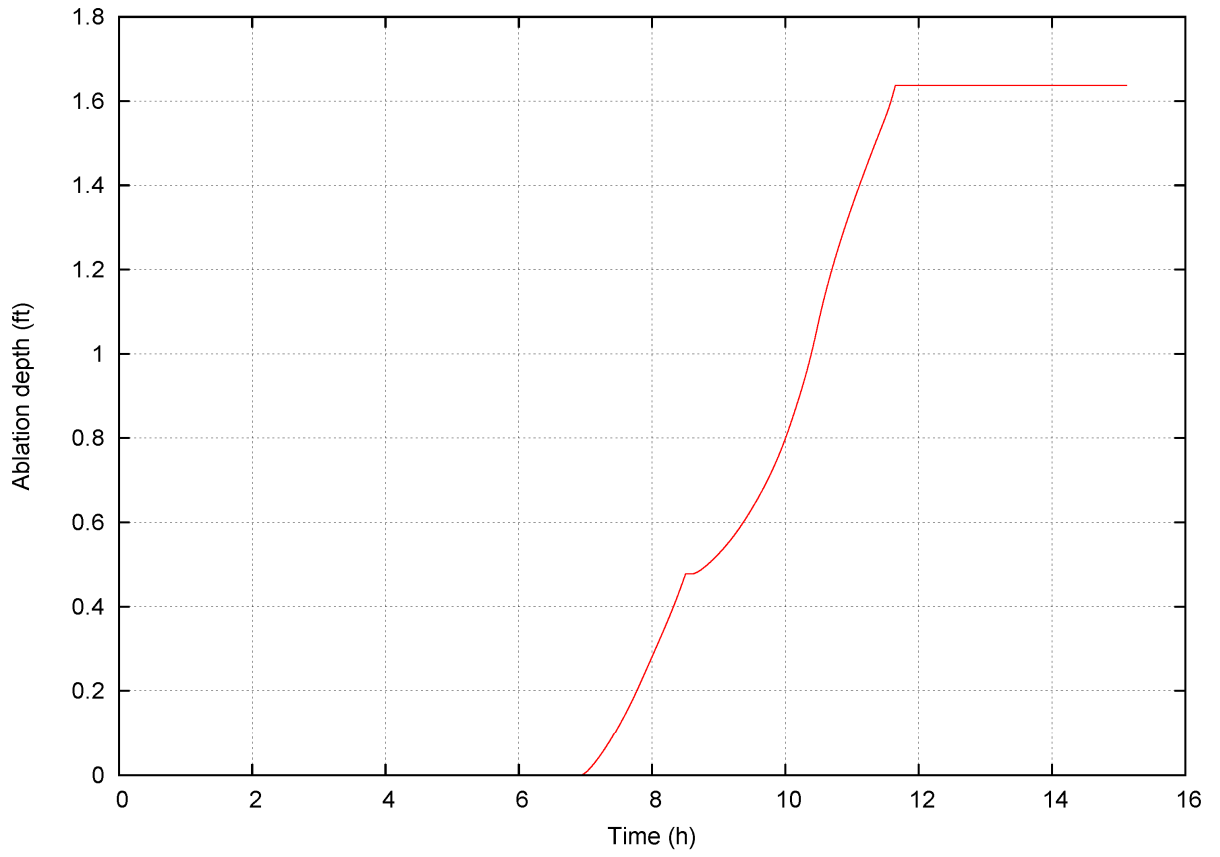


Figure 19-124-80—Reactor Pit Ablation (Radial) (st1.8b)

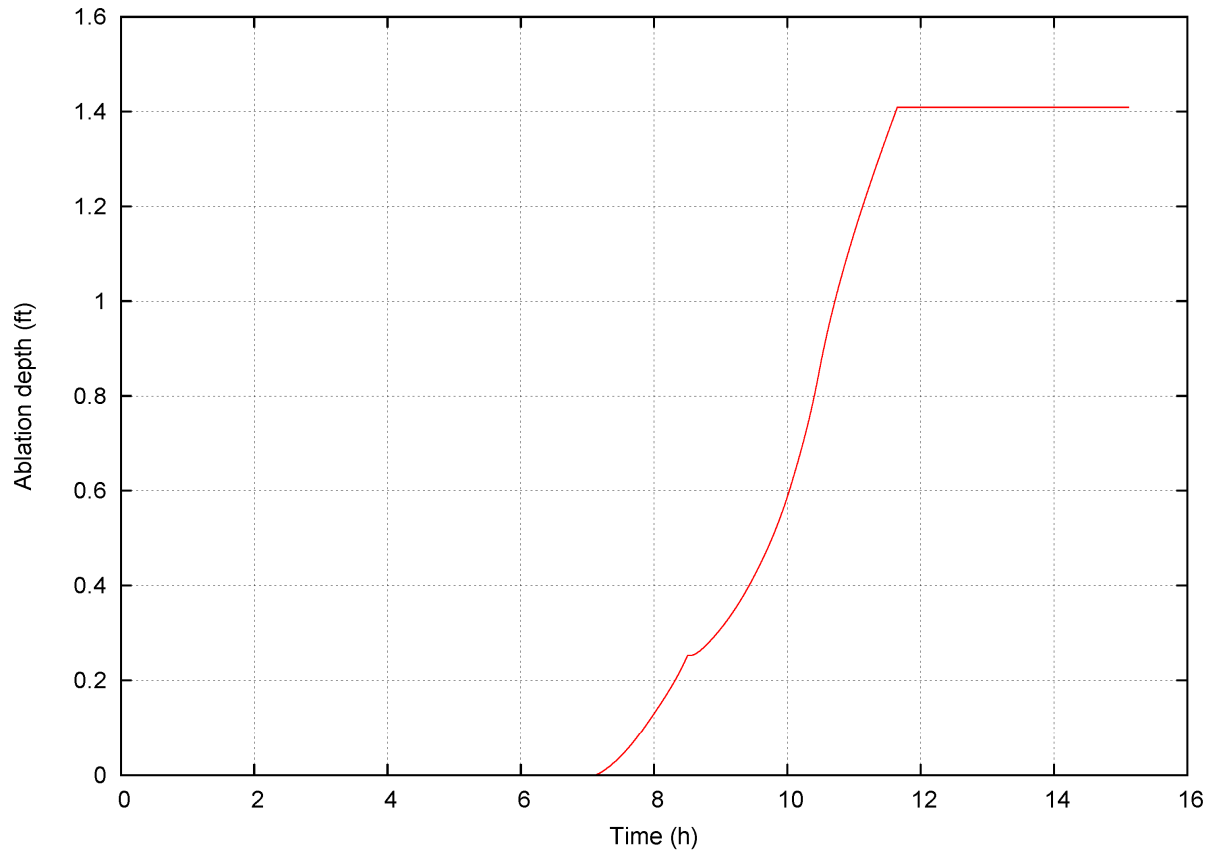


Figure 19-124-81—Spreading Room Ablation (Axial) (st1.8b)

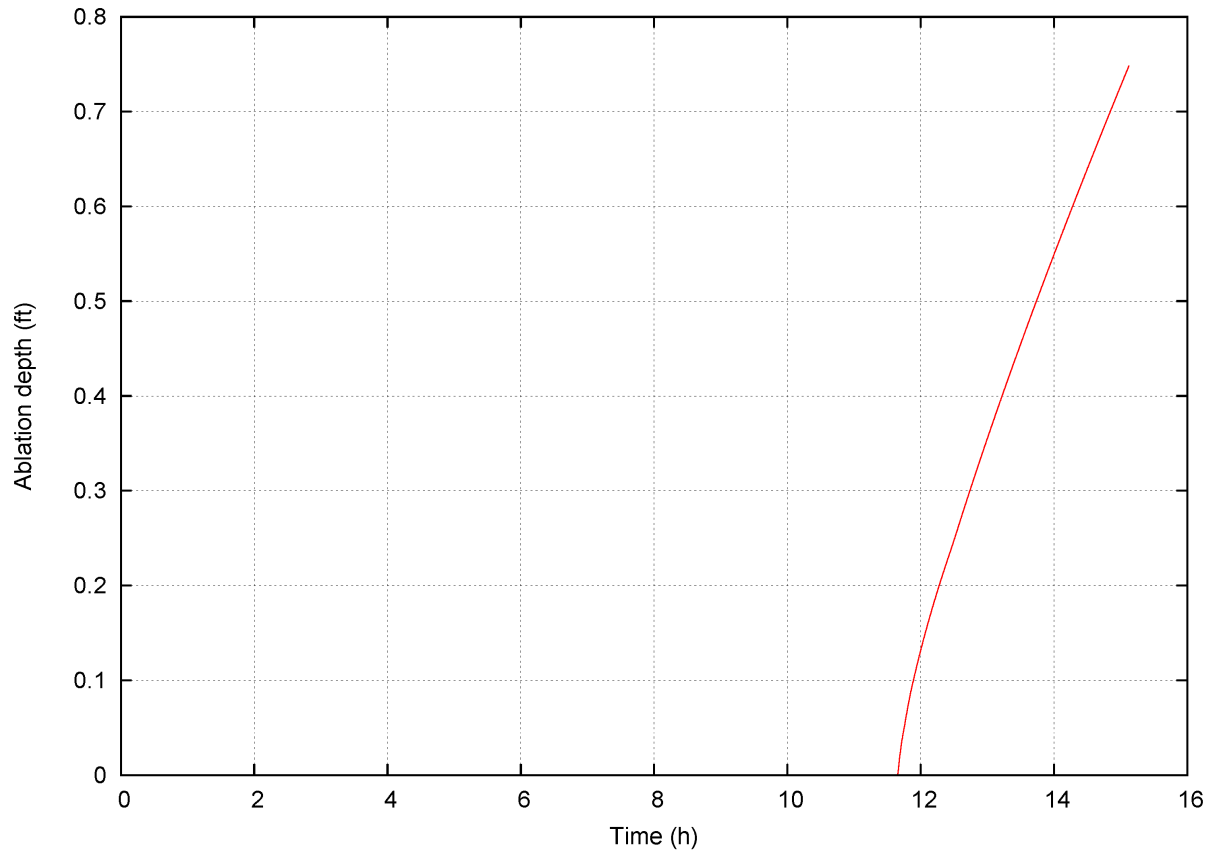


Figure 19-124-82—Spreading Room Ablation (Radial) (st1.8b)

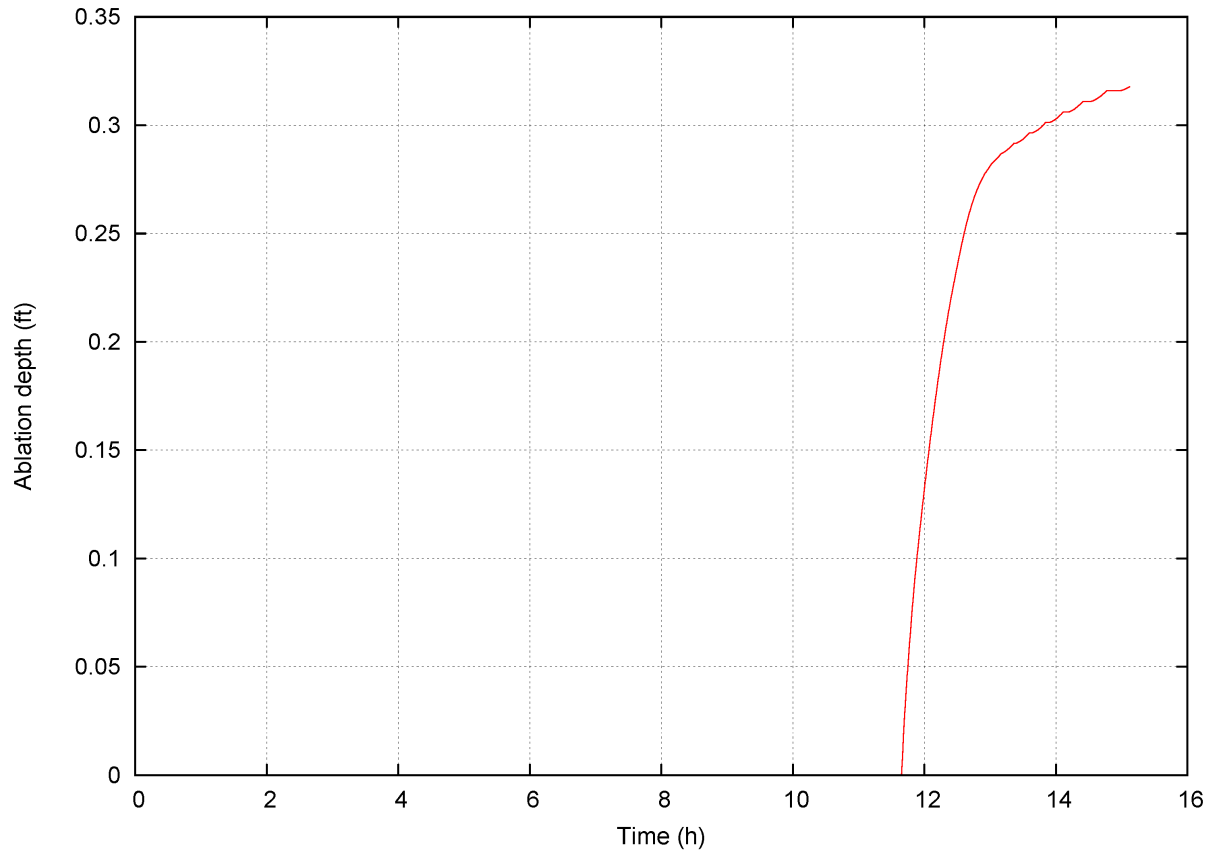


Figure 19-124-83—Fission Product Mass Inside Reactor (st1.8b)

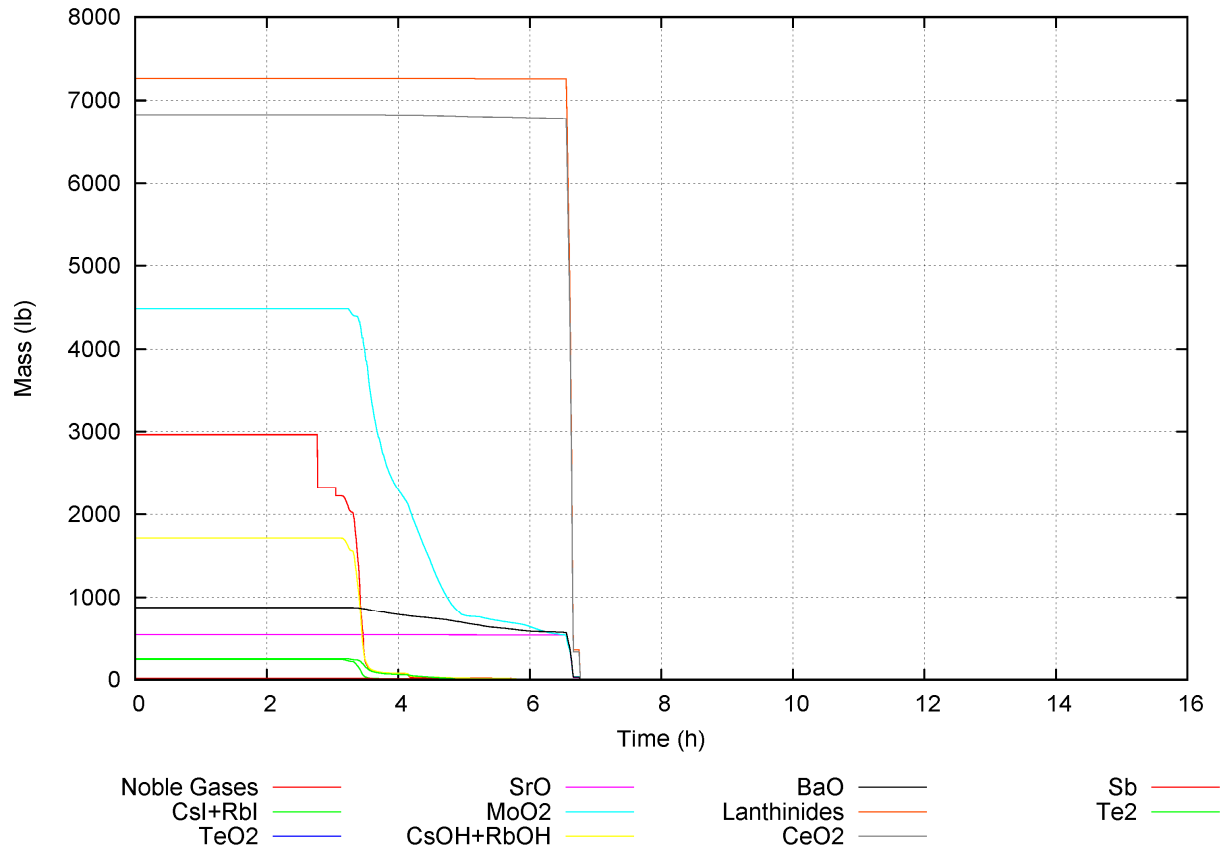


Figure 19-124-84—Fission Product Mass Inside Reactor – Actinides (st1.8b)

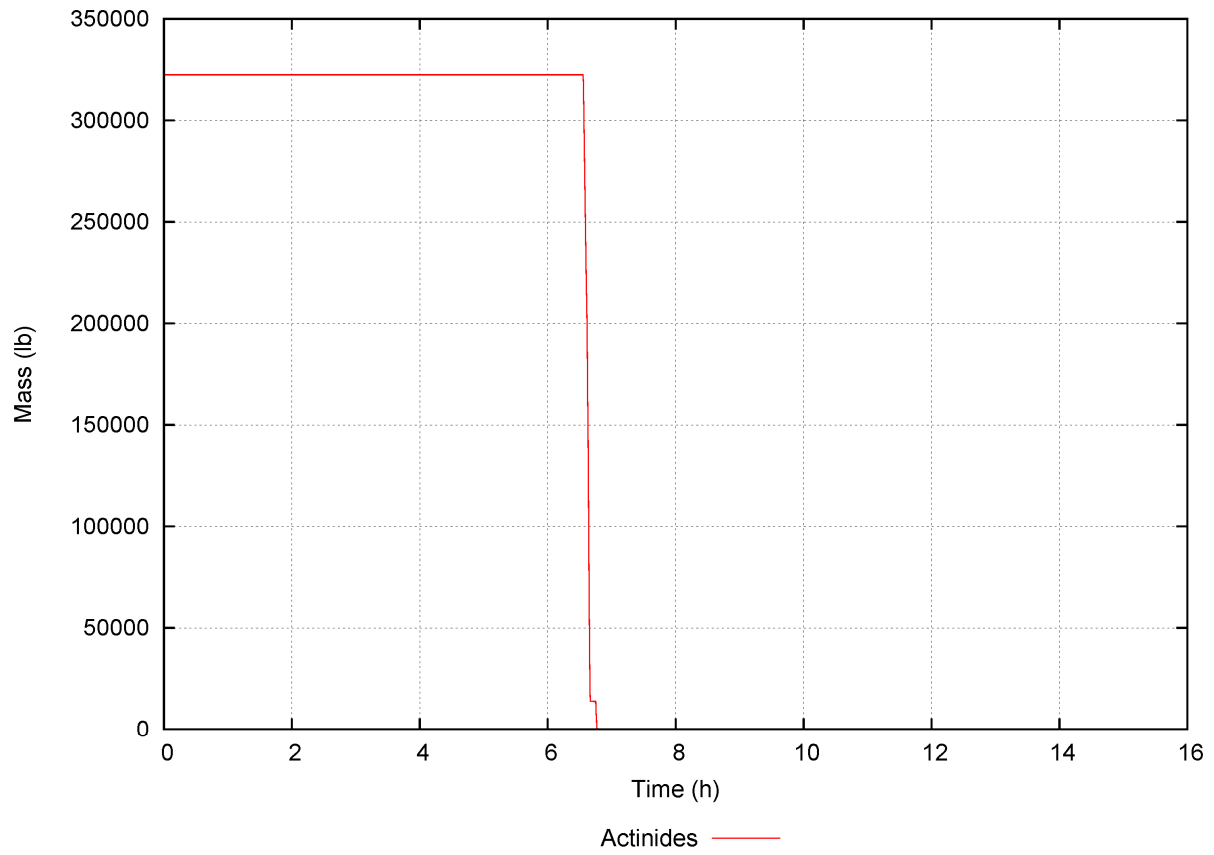


Figure 19-124-87—Failed Containment Pressure (st1.8b)

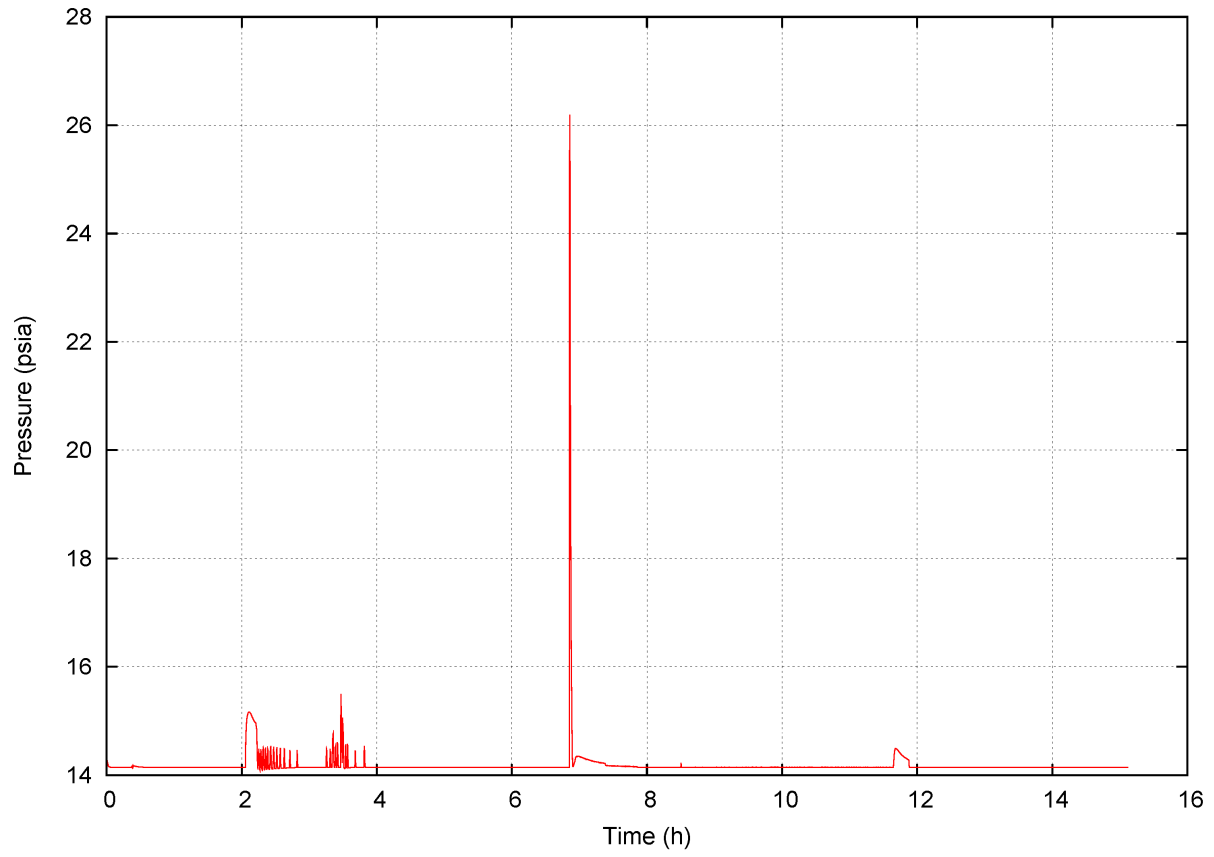


Figure 19-124-88—RCS Pressure (st1.8c)

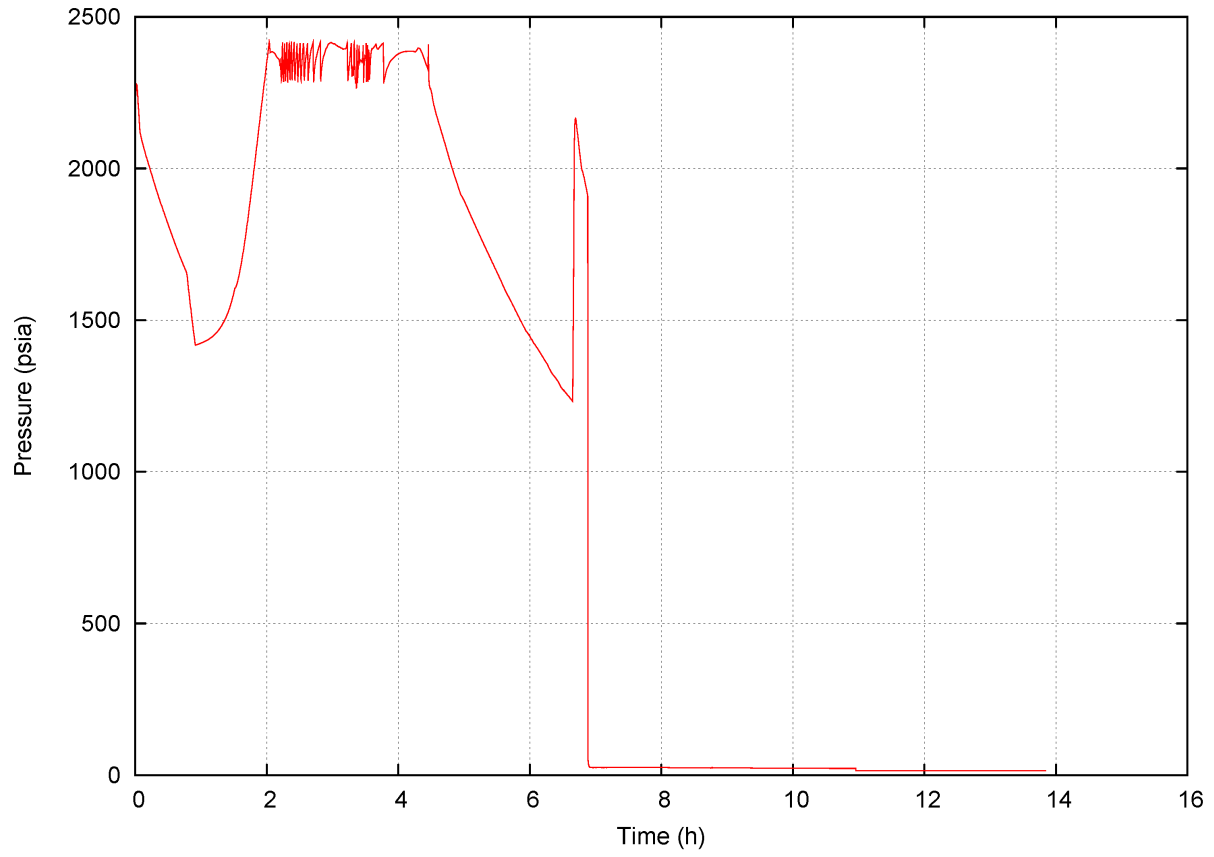


Figure 19-124-89—In-Vessel Hydrogen Production (st1.8c)

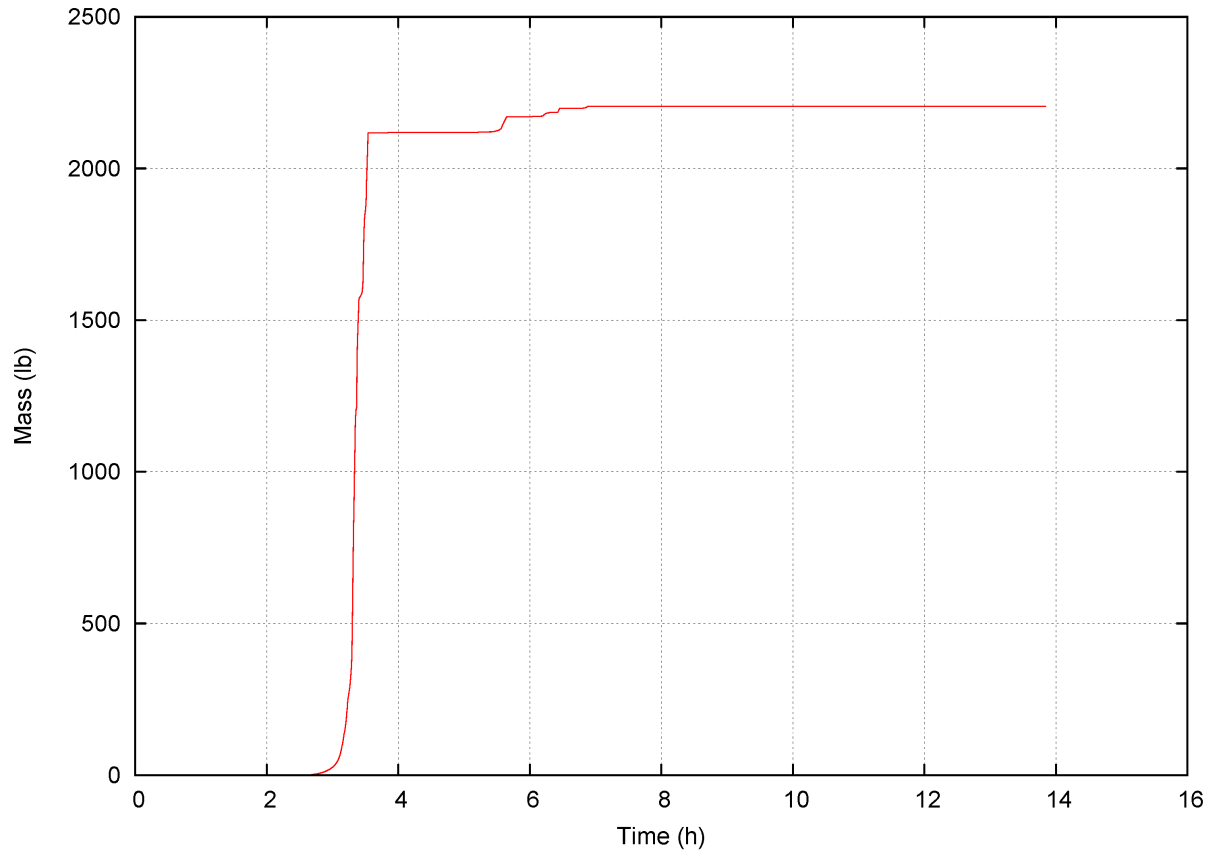


Figure 19-124-90—Mass of Hydrogen in Containment (st1.8c)

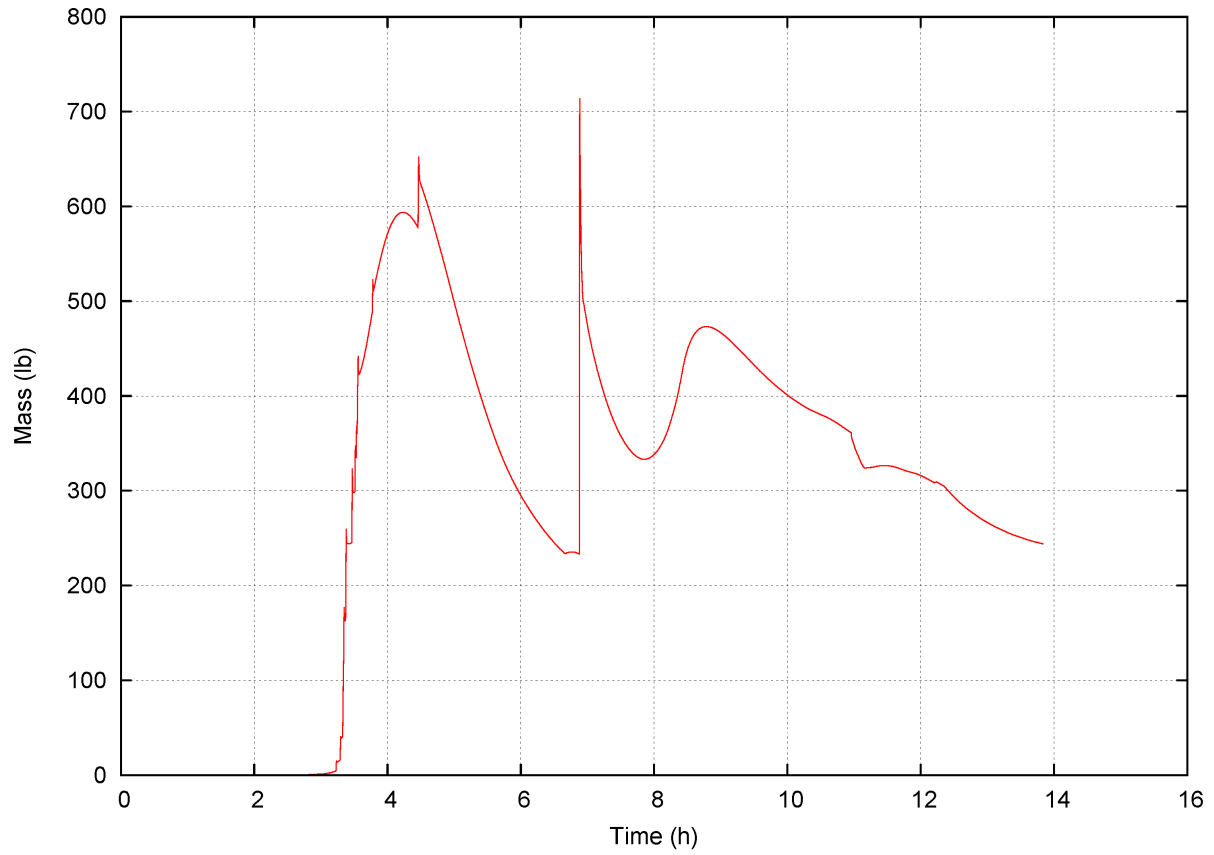


Figure 19-124-91—Concentration of Hydrogen in Containment (st1.8c)

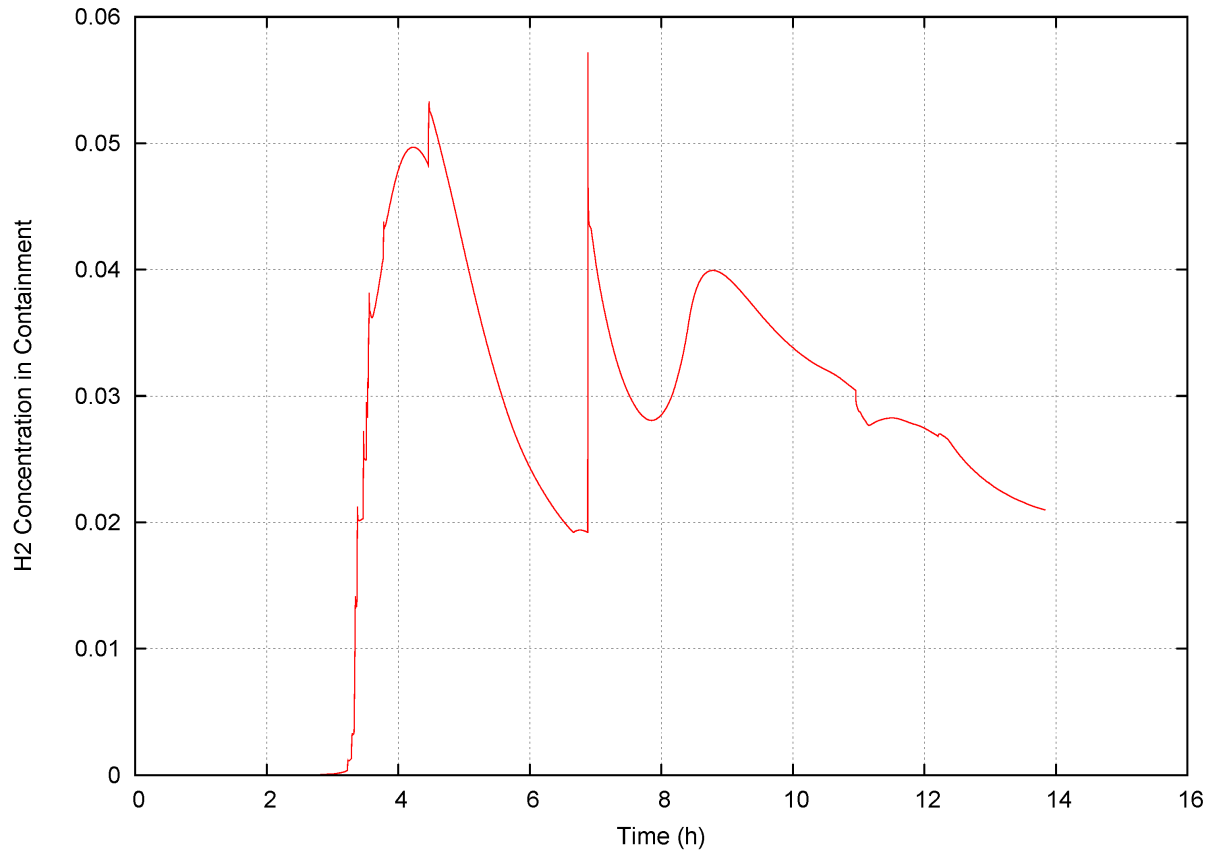


Figure 19-124-92—Hydrogen Consumed by PARs (st1.8c)

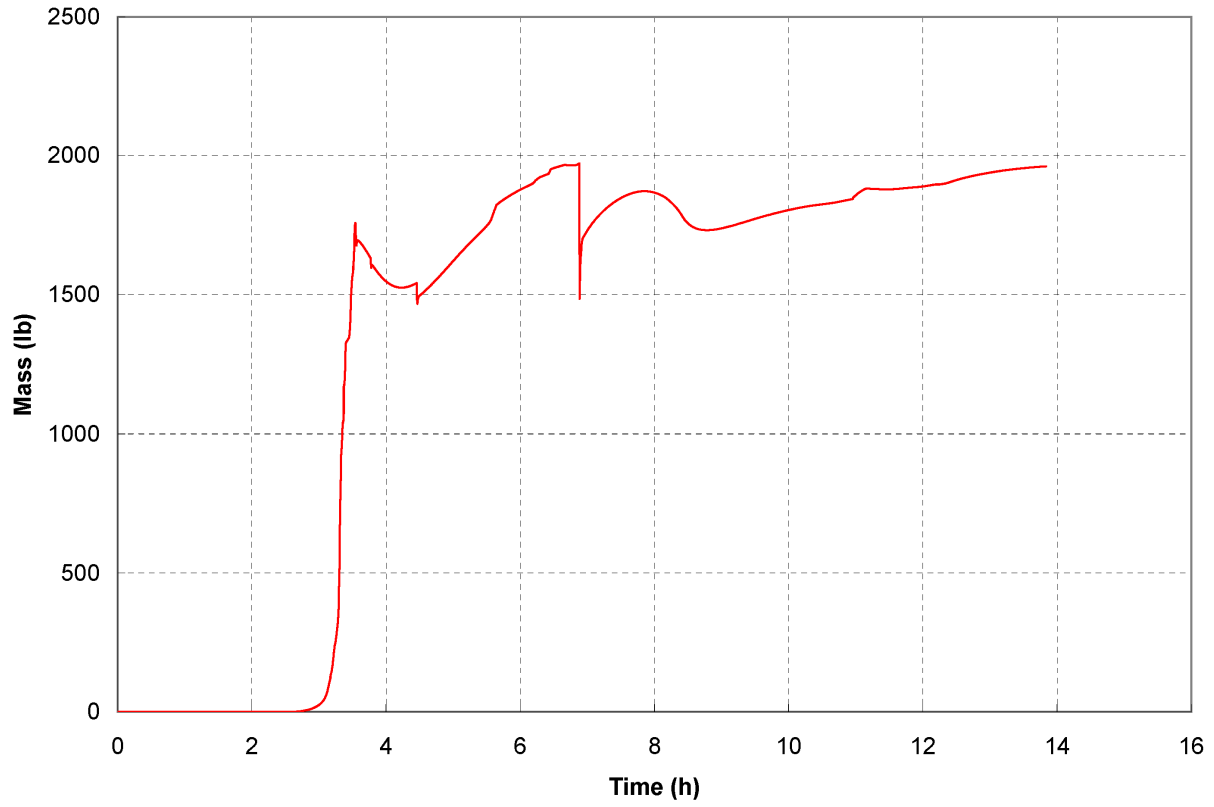


Figure 19-124-93—Mass of Oxygen in Containment (st1.8c)

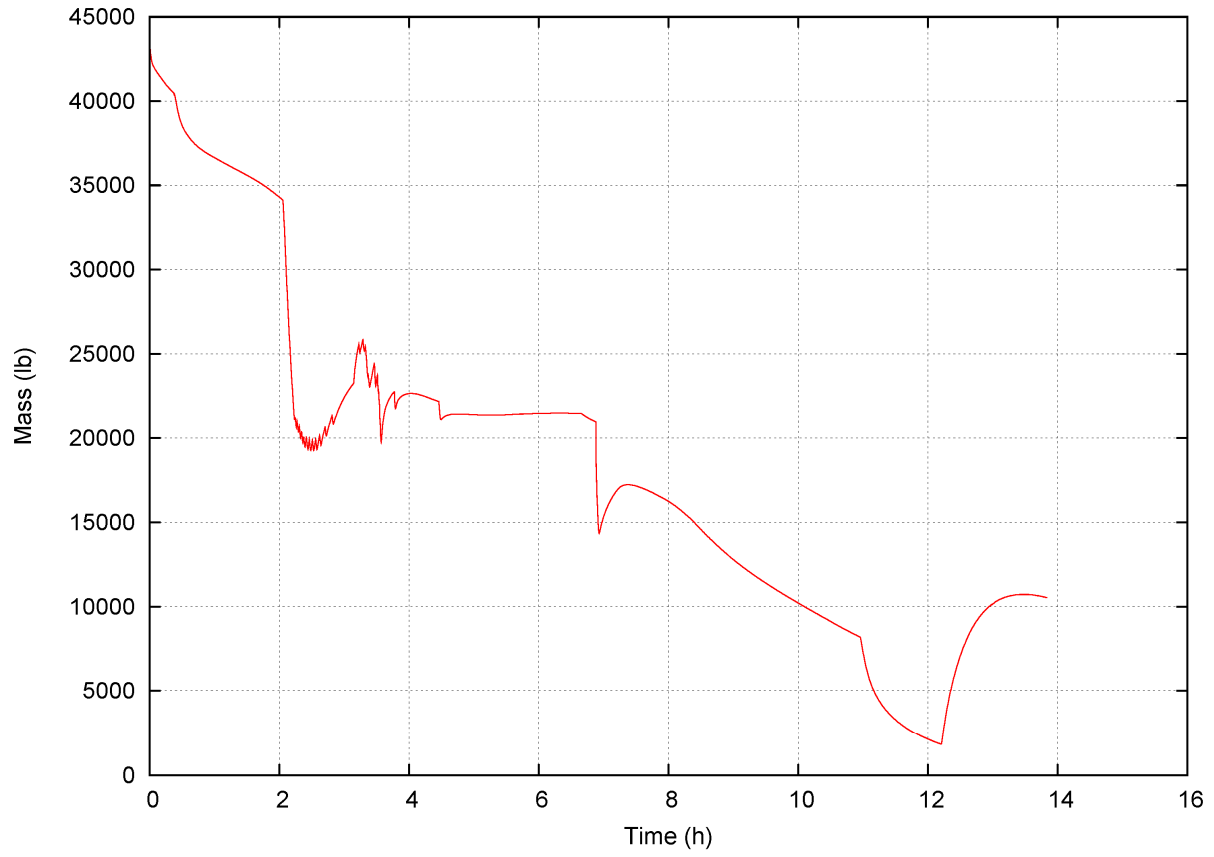


Figure 19-124-94—Concentration of Oxygen in Containment (st1.8c)

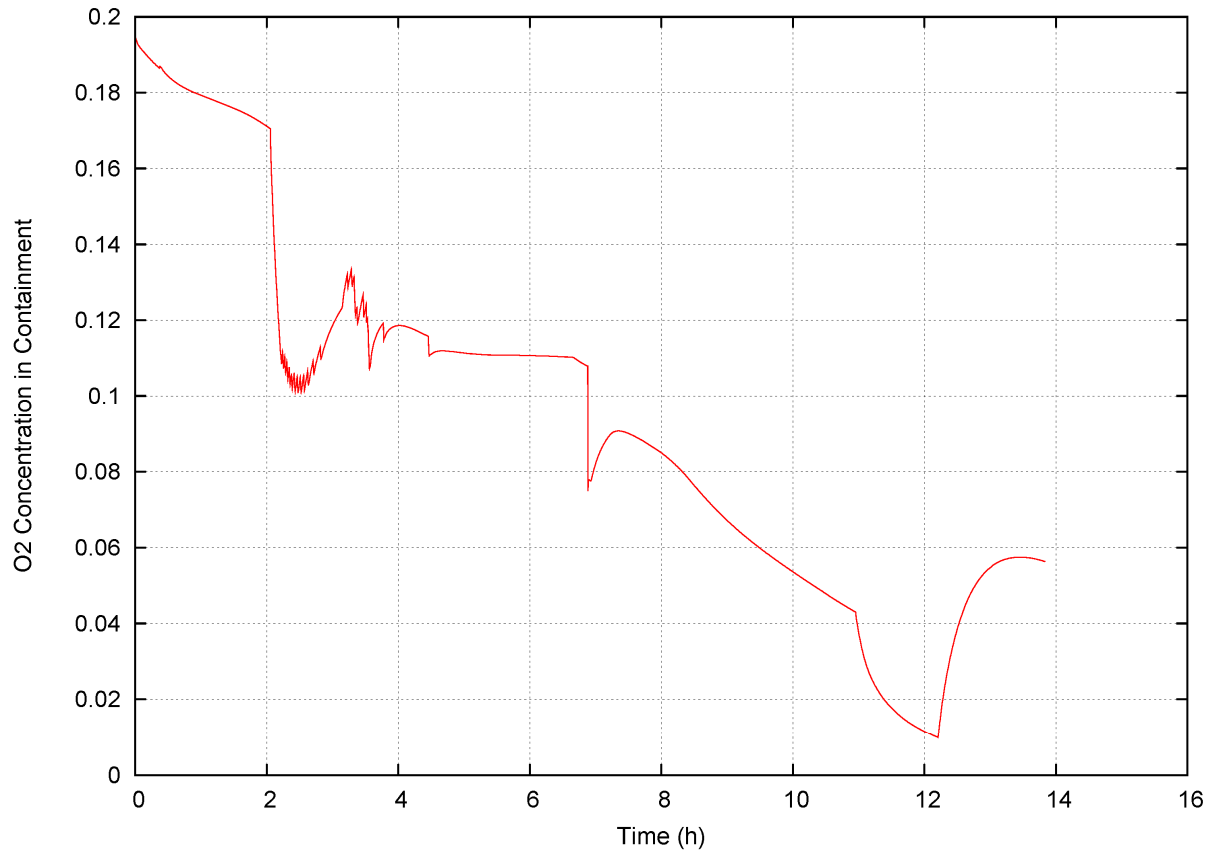


Figure 19-124-95—Mass of Steam in Containment (st1.8c)

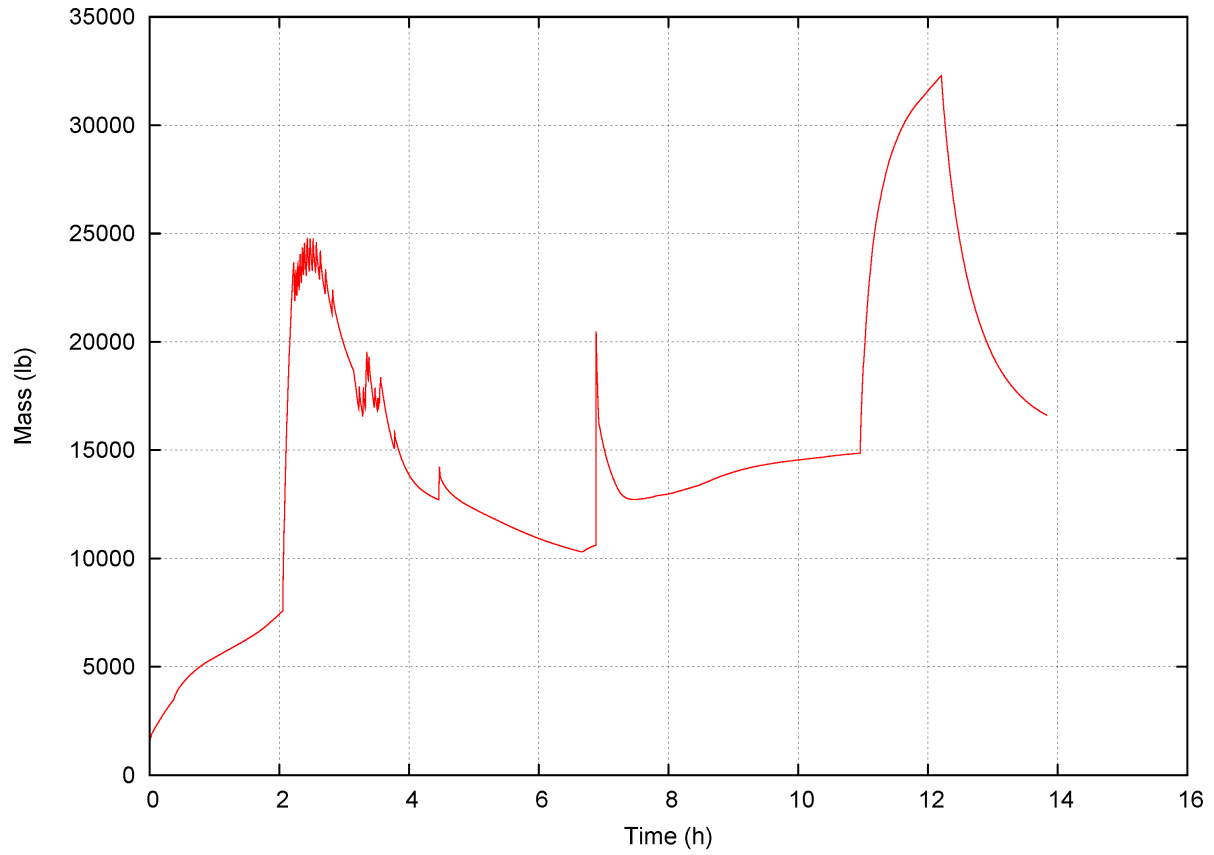


Figure 19-124-96—Concentration of Steam in Containment (st1.8c)

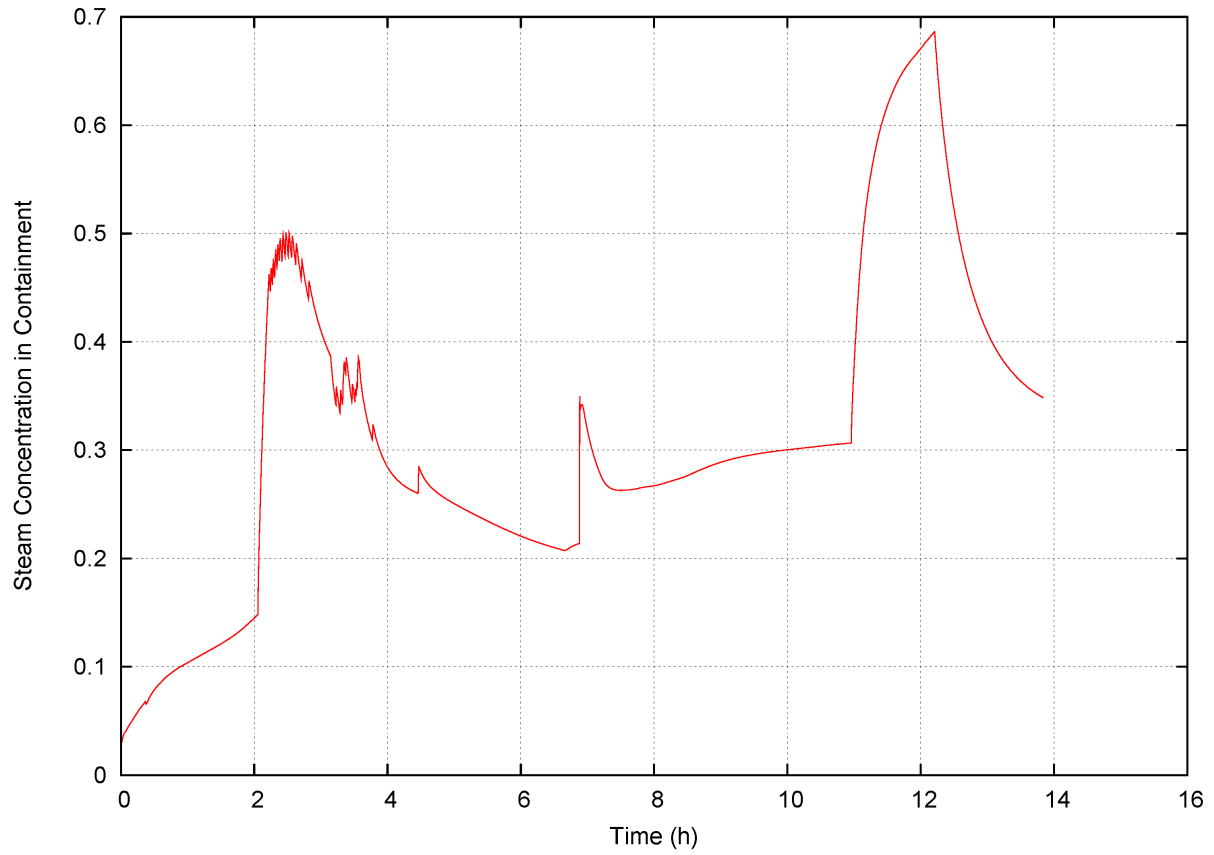


Figure 19-124-97—Mass of Nitrogen in Containment (st1.8c)

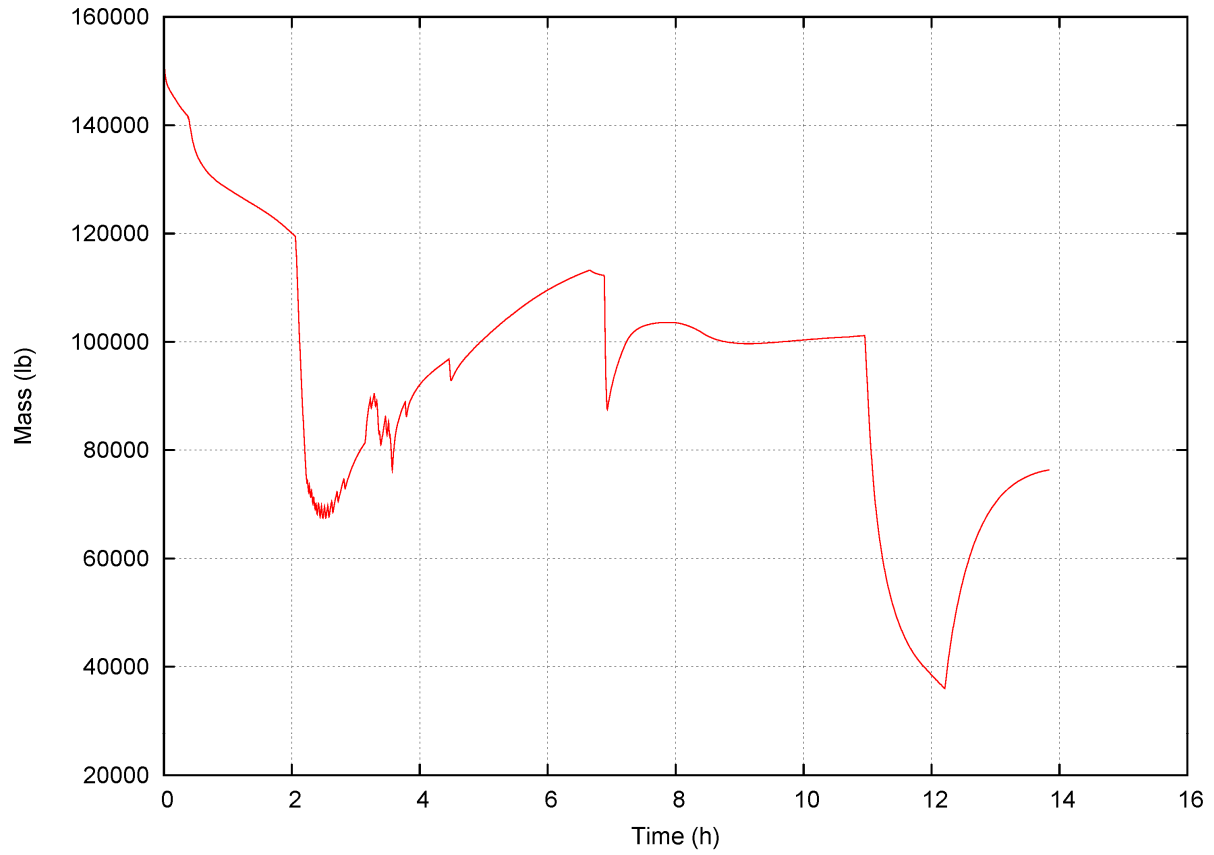


Figure 19-124-98—Concentration of Nitrogen in Containment (st1.8c)

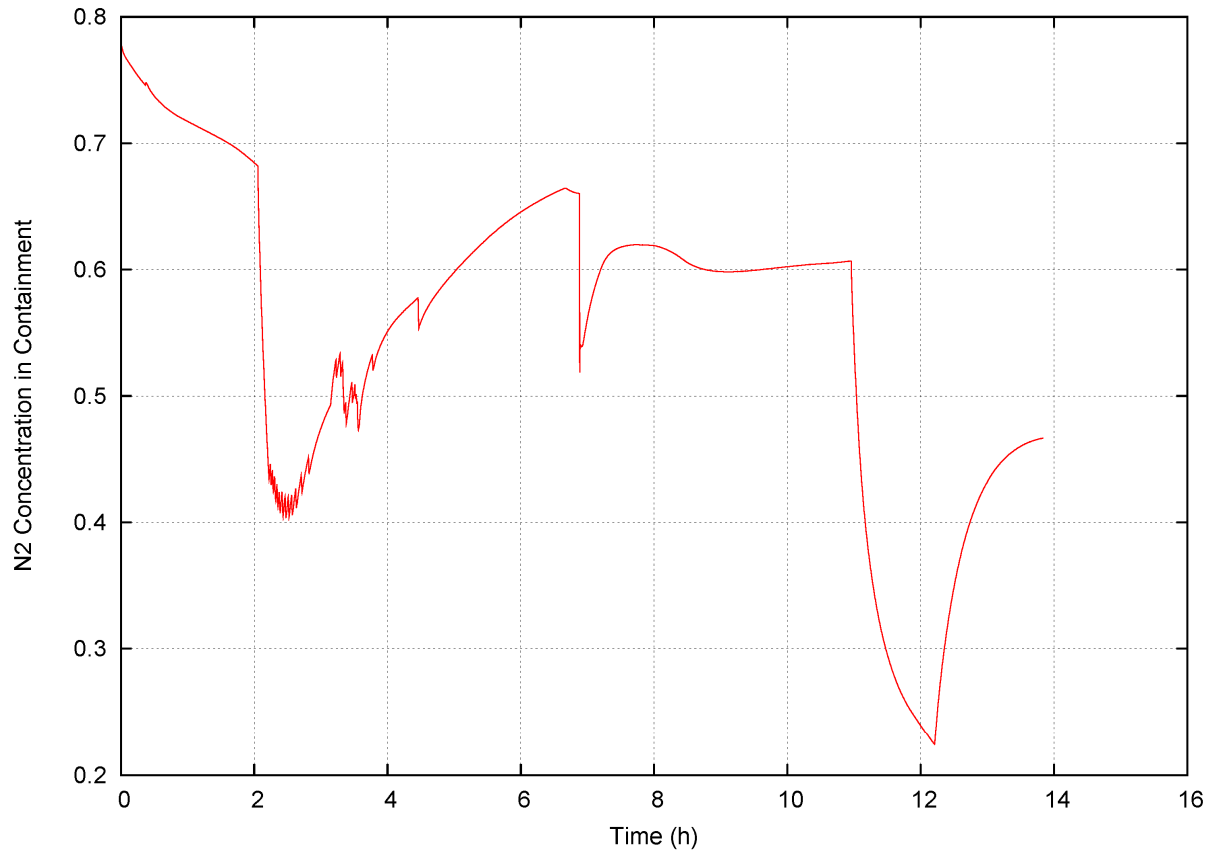
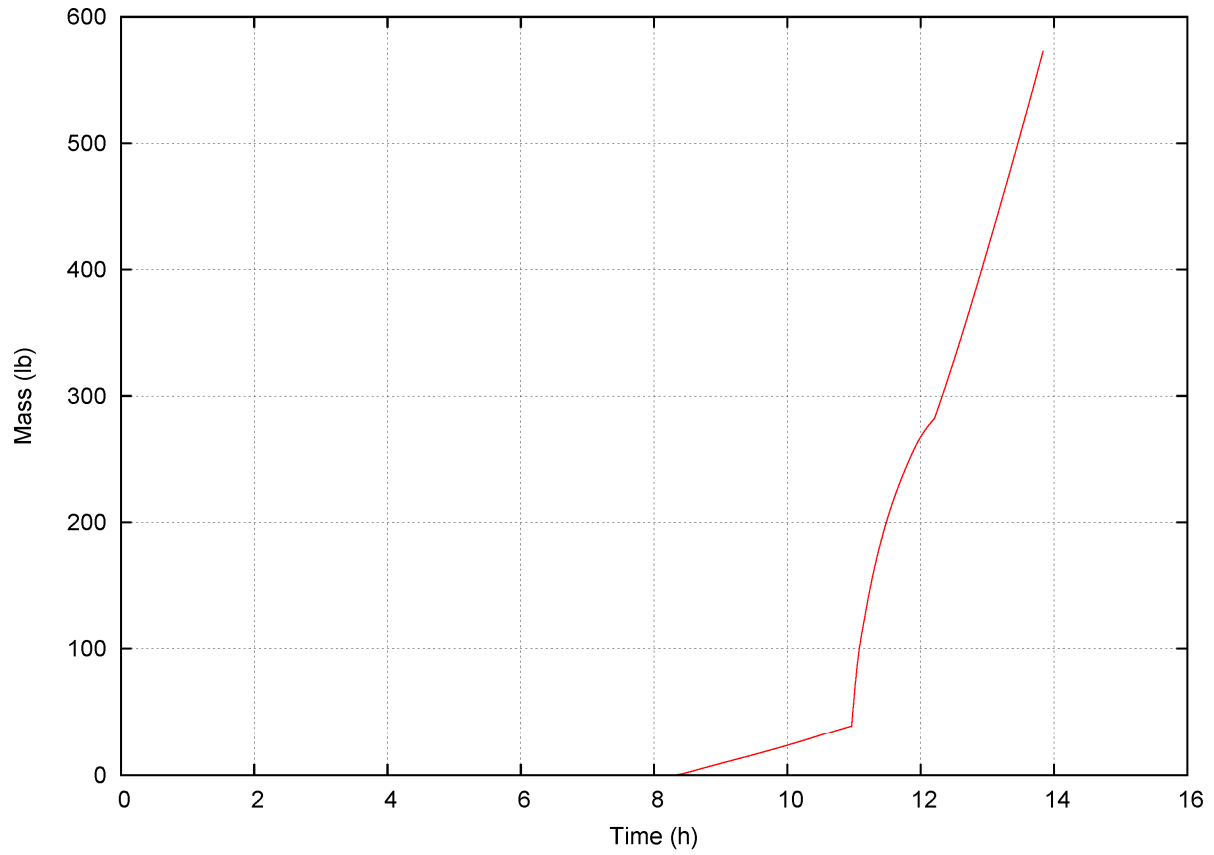


Figure 19-124-99—Mass of Carbon Dioxide in Containment (st1.8c)



**Figure 19-124-100—Concentration of Carbon Dioxide in Containment
(st1.8c)**

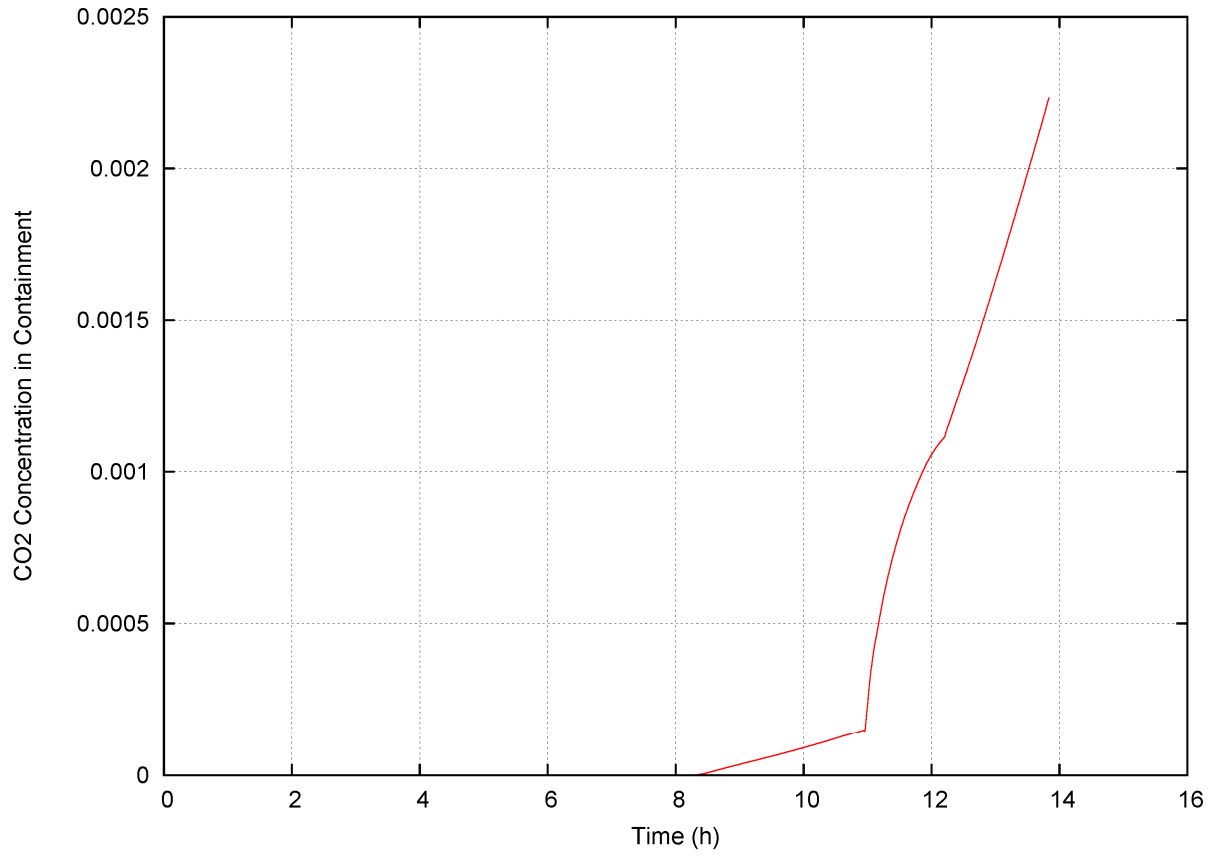
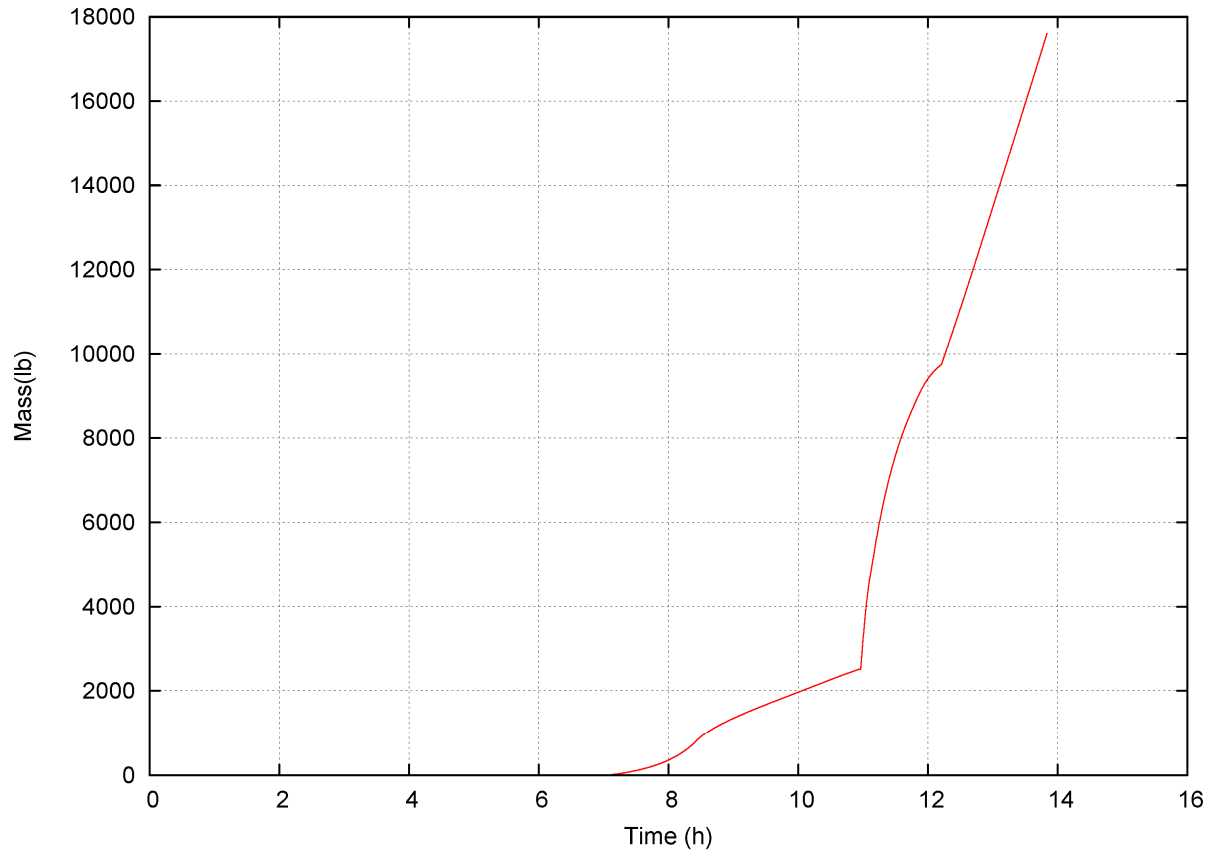


Figure 19-124-101—Mass of Carbon Monoxide in Containment (st1.8c)



**Figure 19-124-102—Concentration of Carbon Monoxide in Containment
(st1.8c)**

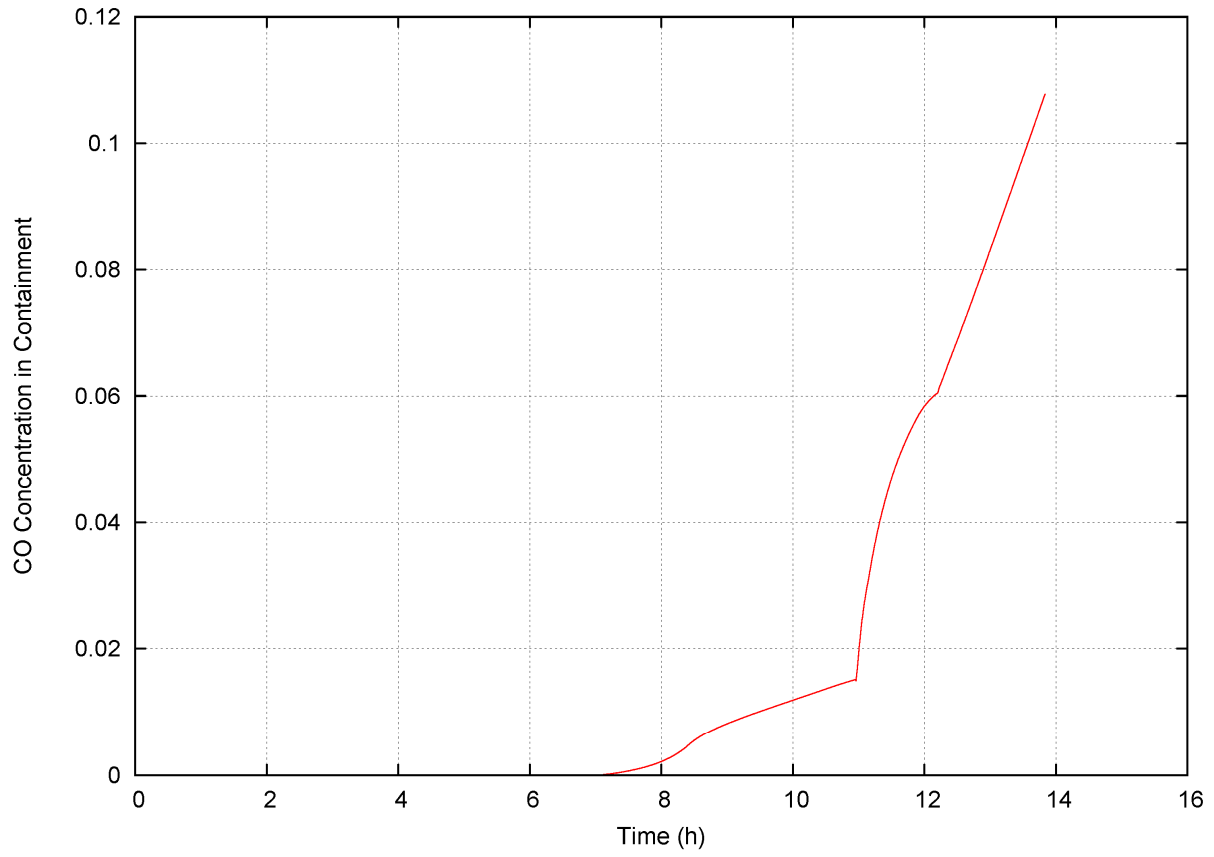


Figure 19-124-103—IRWST Water Level (st1.8c)

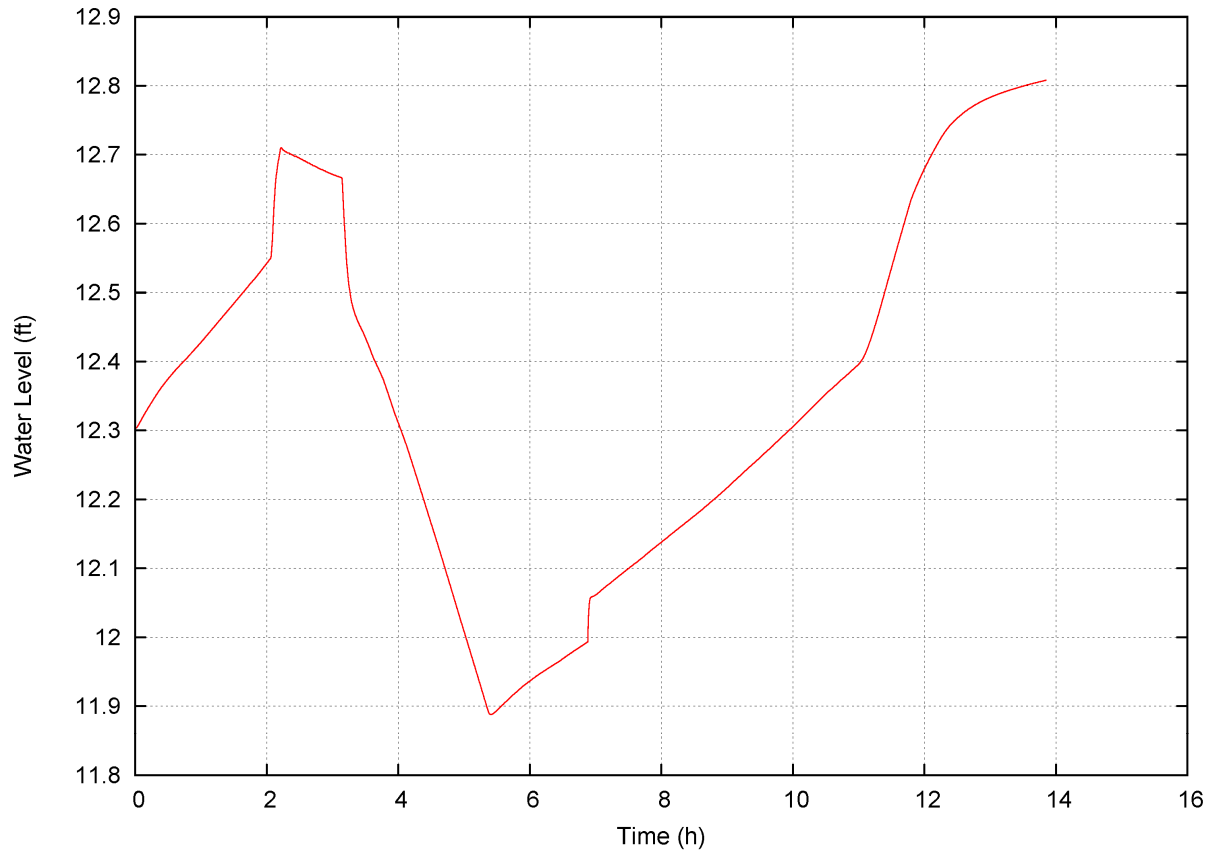


Figure 19-124-104—Spreading Room Water Level (st1.8c)

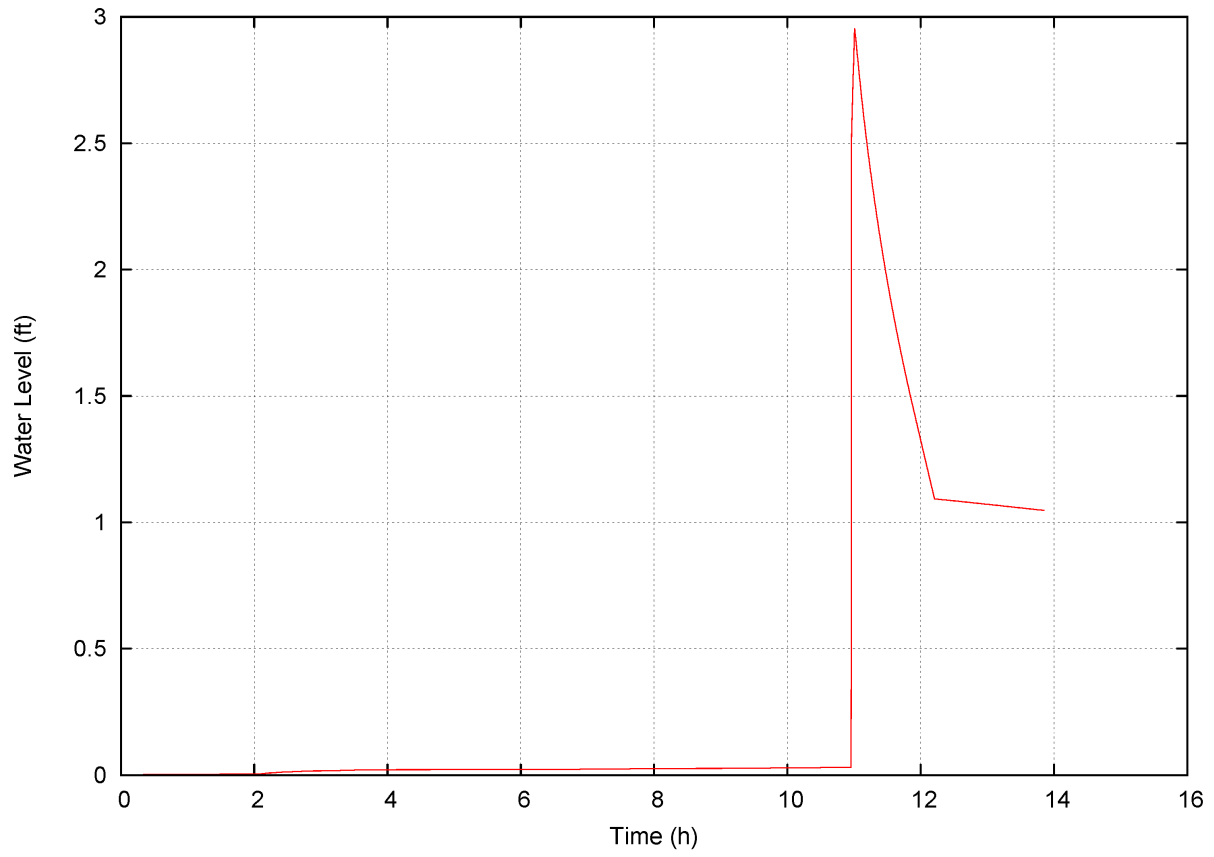


Figure 19-124-105—Reactor Pit Water Level (st1.8c)

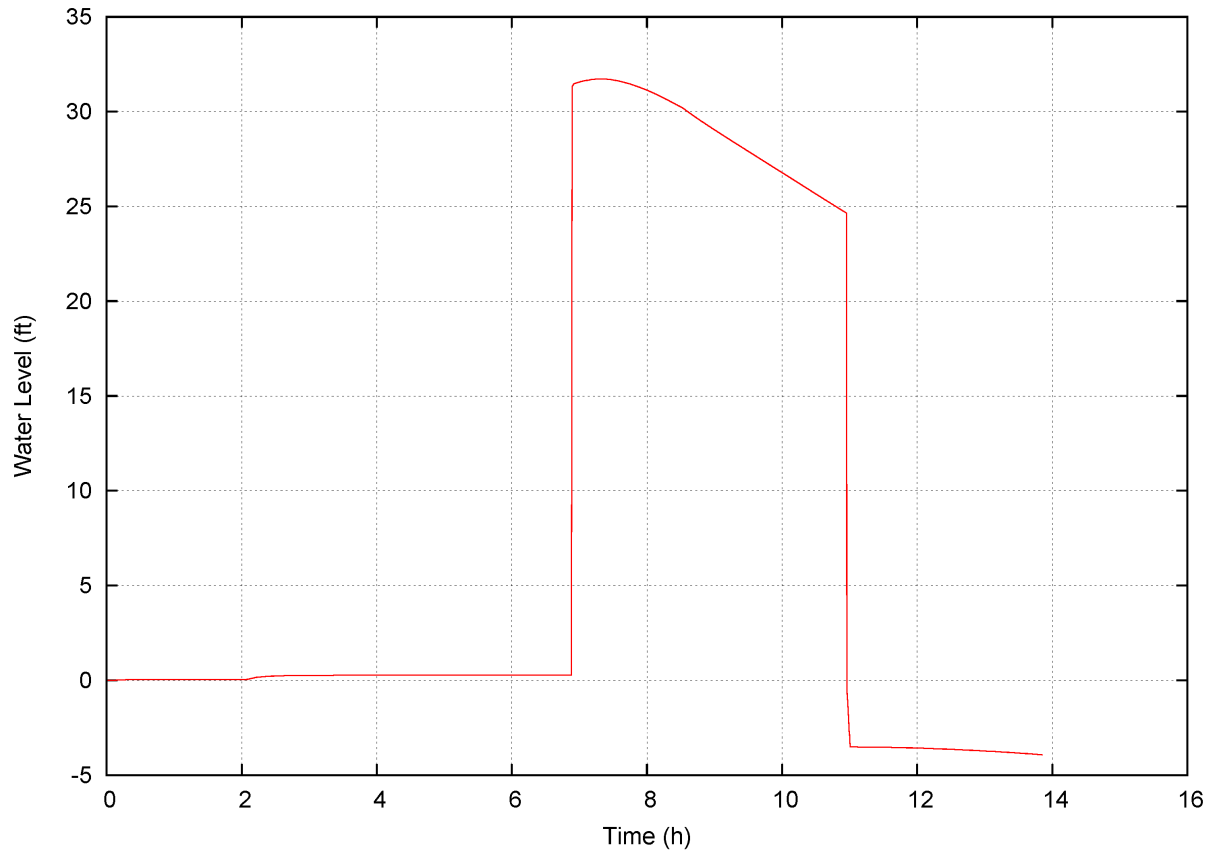


Figure 19-124-106—Mass of Corium in Reactor Pit (st1.8c)

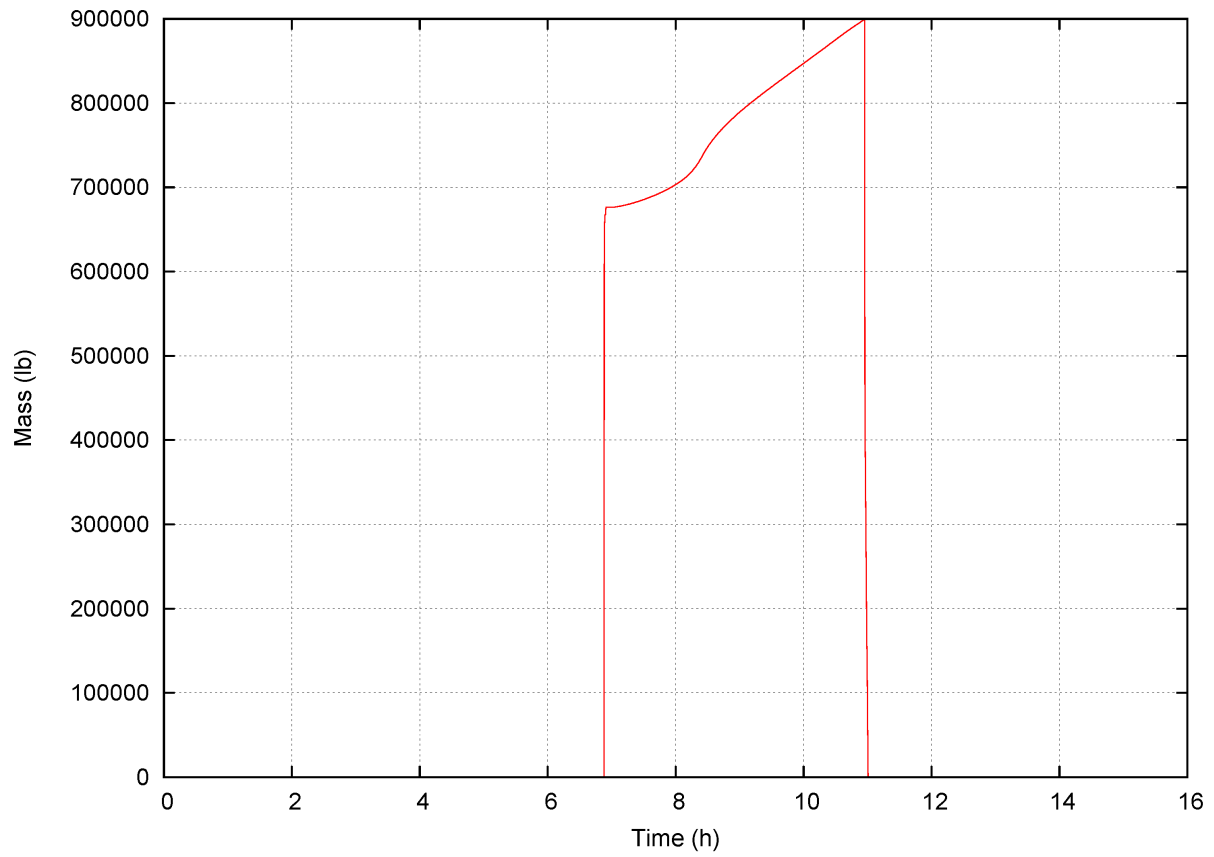


Figure 19-124-107—Mass of Corium in Spreading Room (st1.8c)

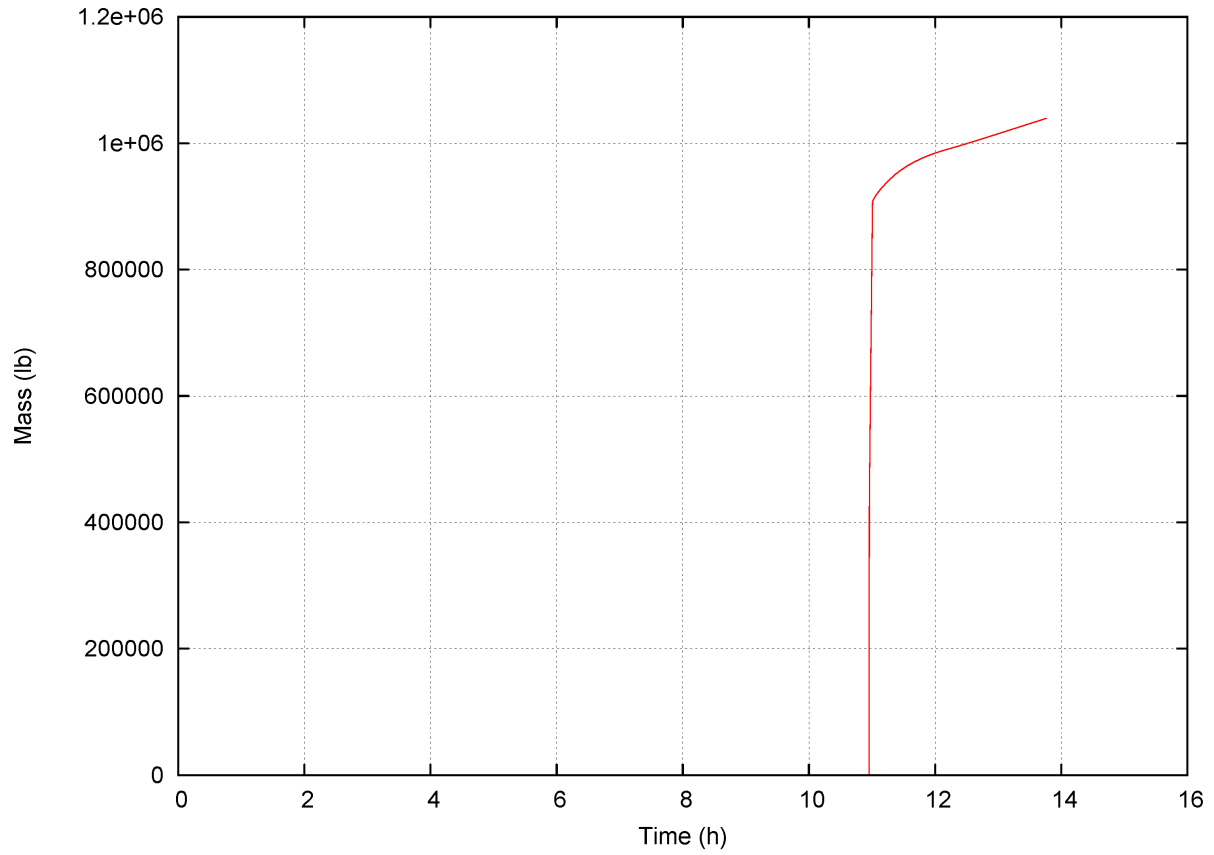


Figure 19-124-108—Reactor Pit Ablation (Axial) (st1.8c)

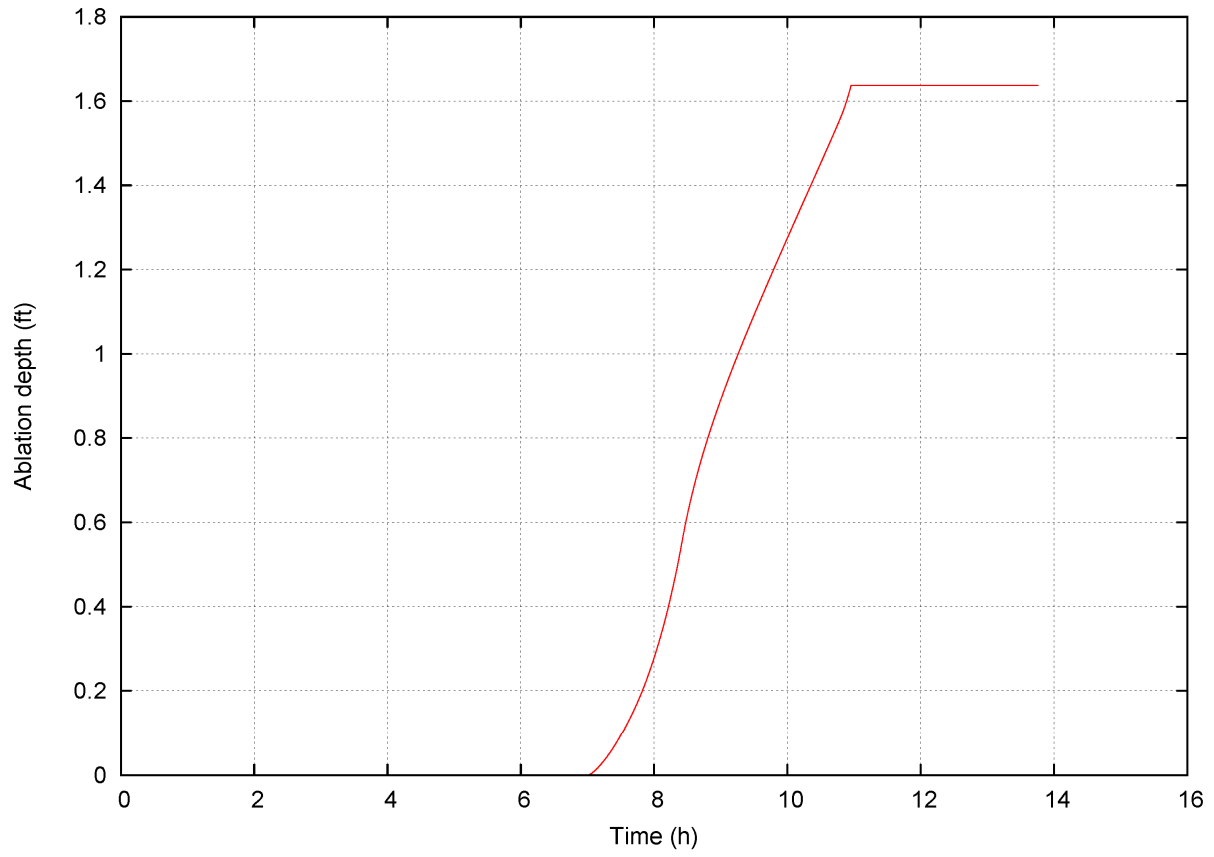


Figure 19-124-109—Reactor Pit Ablation (Radial) (st1.8c)

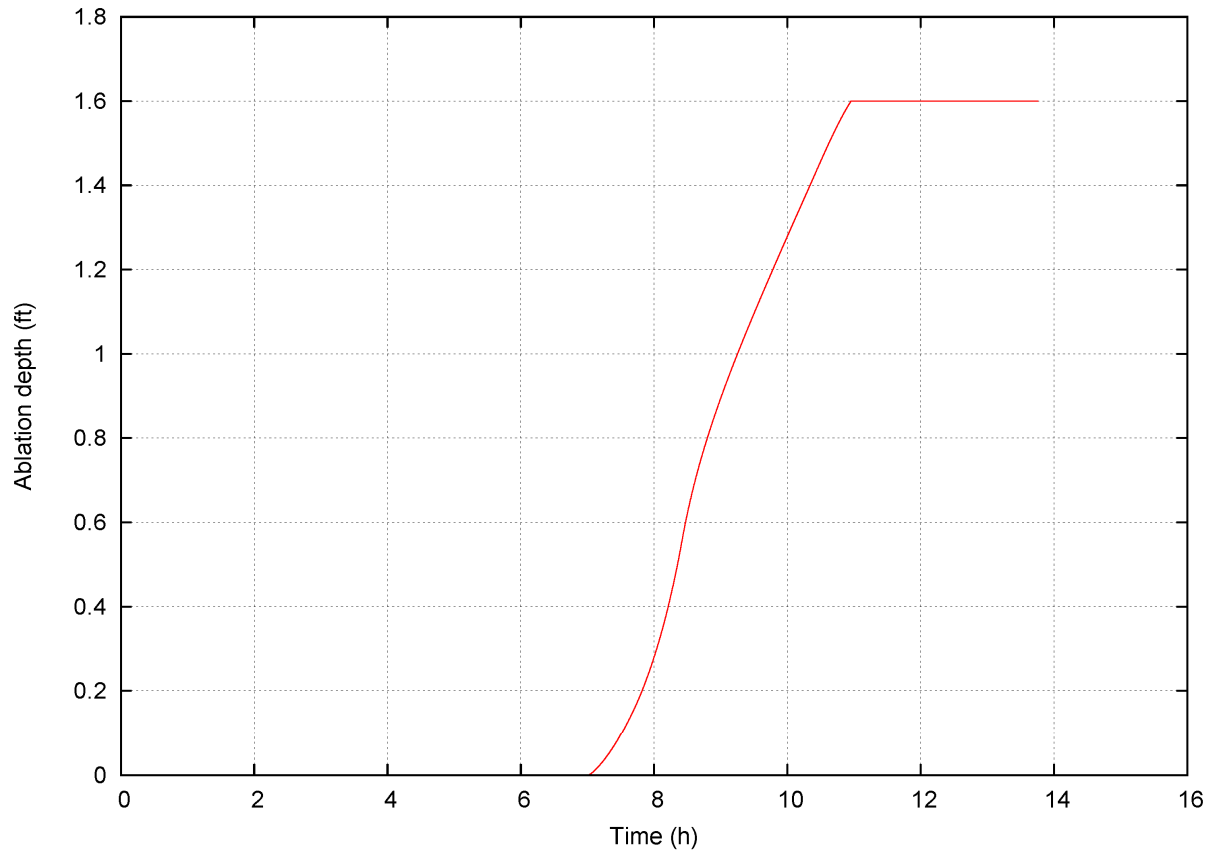


Figure 19-124-110—Spreading Room Ablation (Axial) (st1.8c)

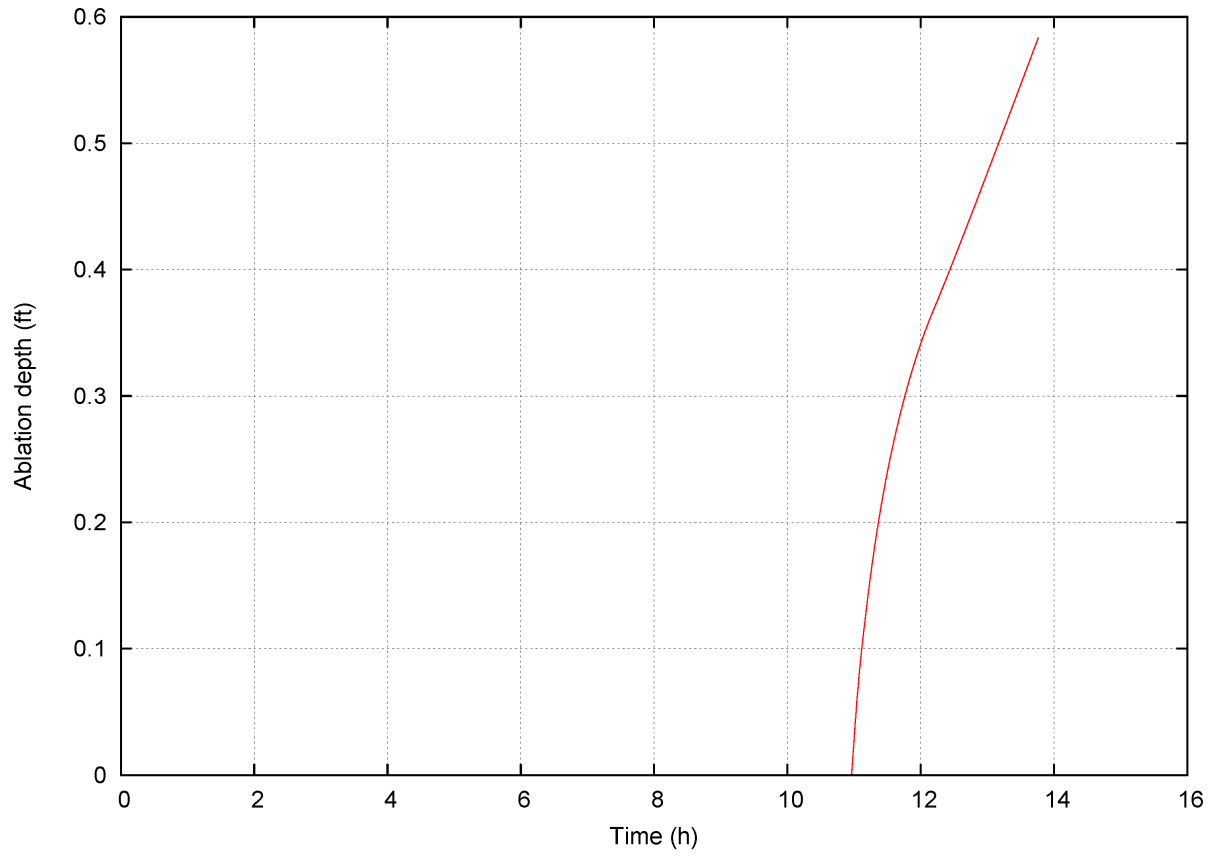


Figure 19-124-111—Spreading Room Ablation (Radial) (st1.8c)

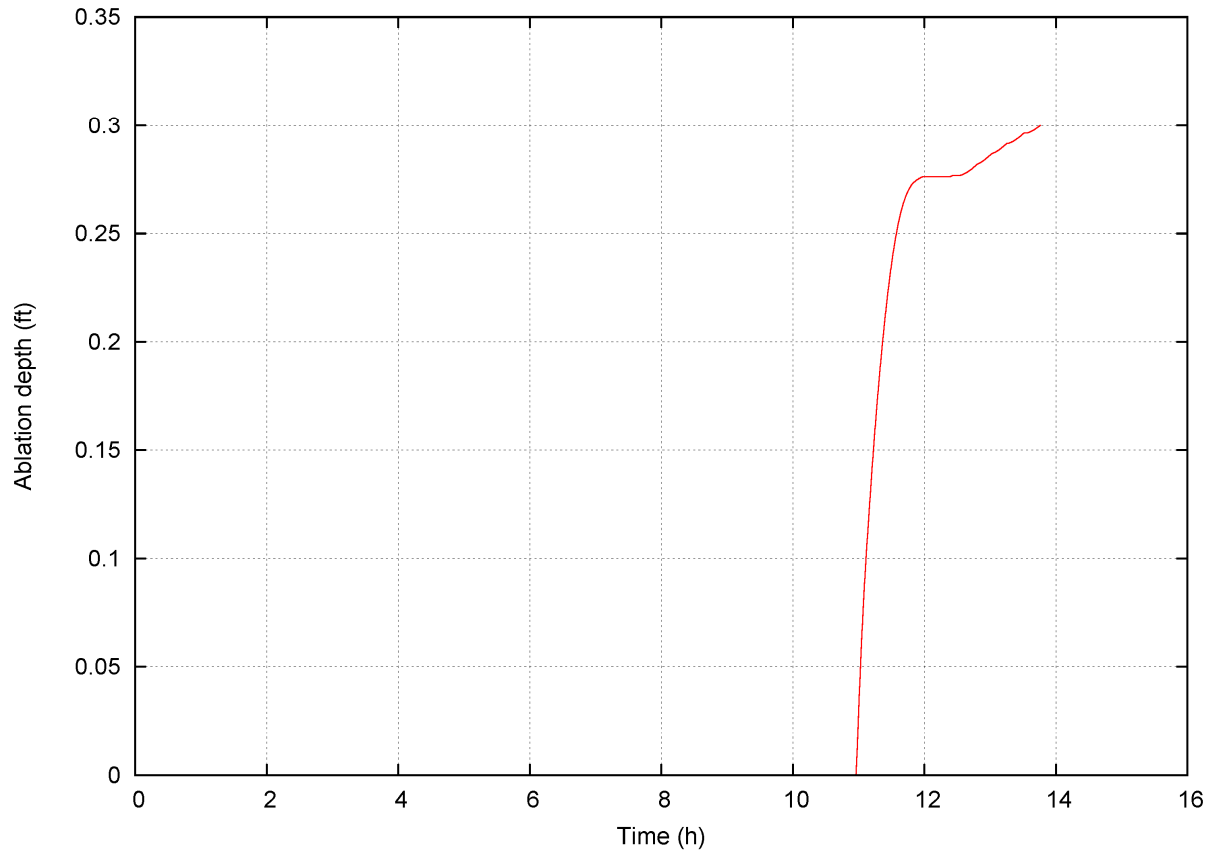
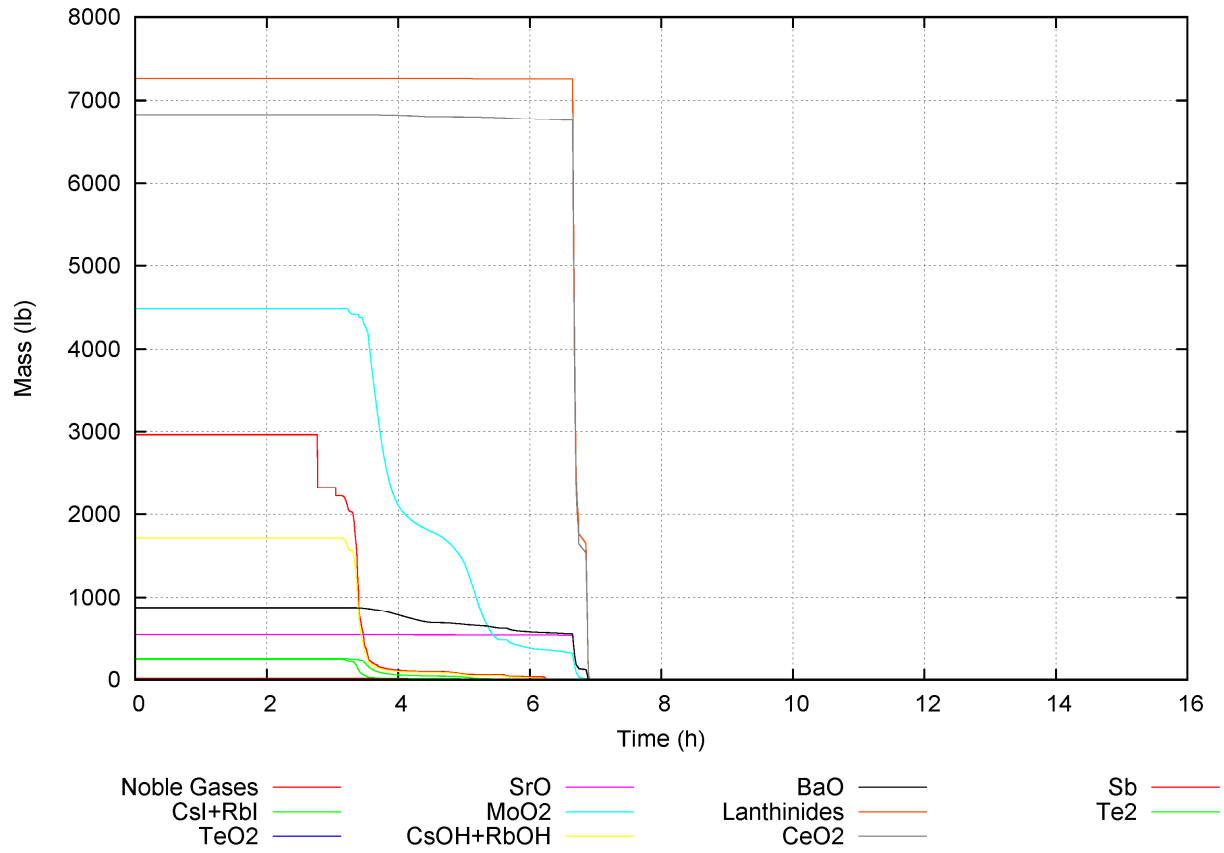


Figure 19-124-112—Fission Product Mass Inside Reactor (st1.8c)



**Figure 19-124-113—Fission Product Mass Inside Reactor – Actinides
(st1.8c)**

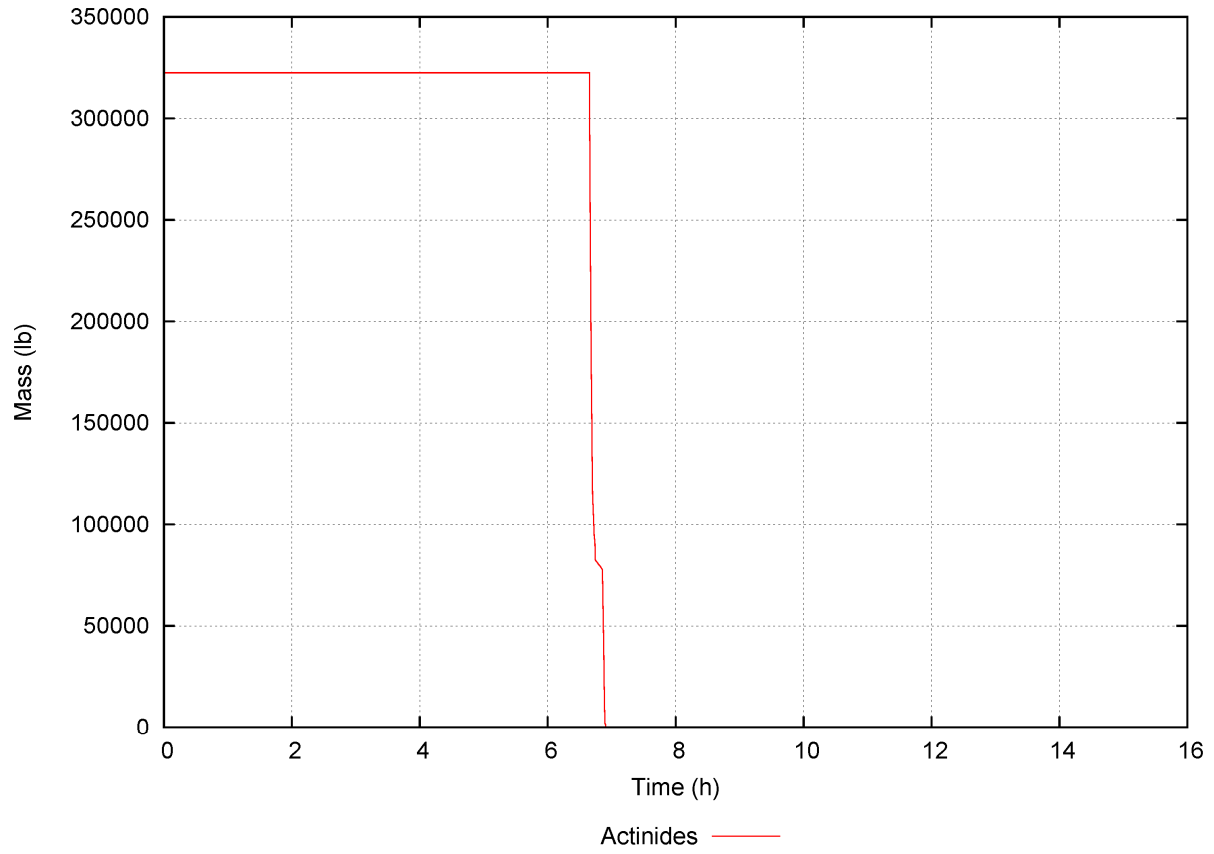


Figure 19-124-114—Fission Product Mass in Containment (st1.8c)

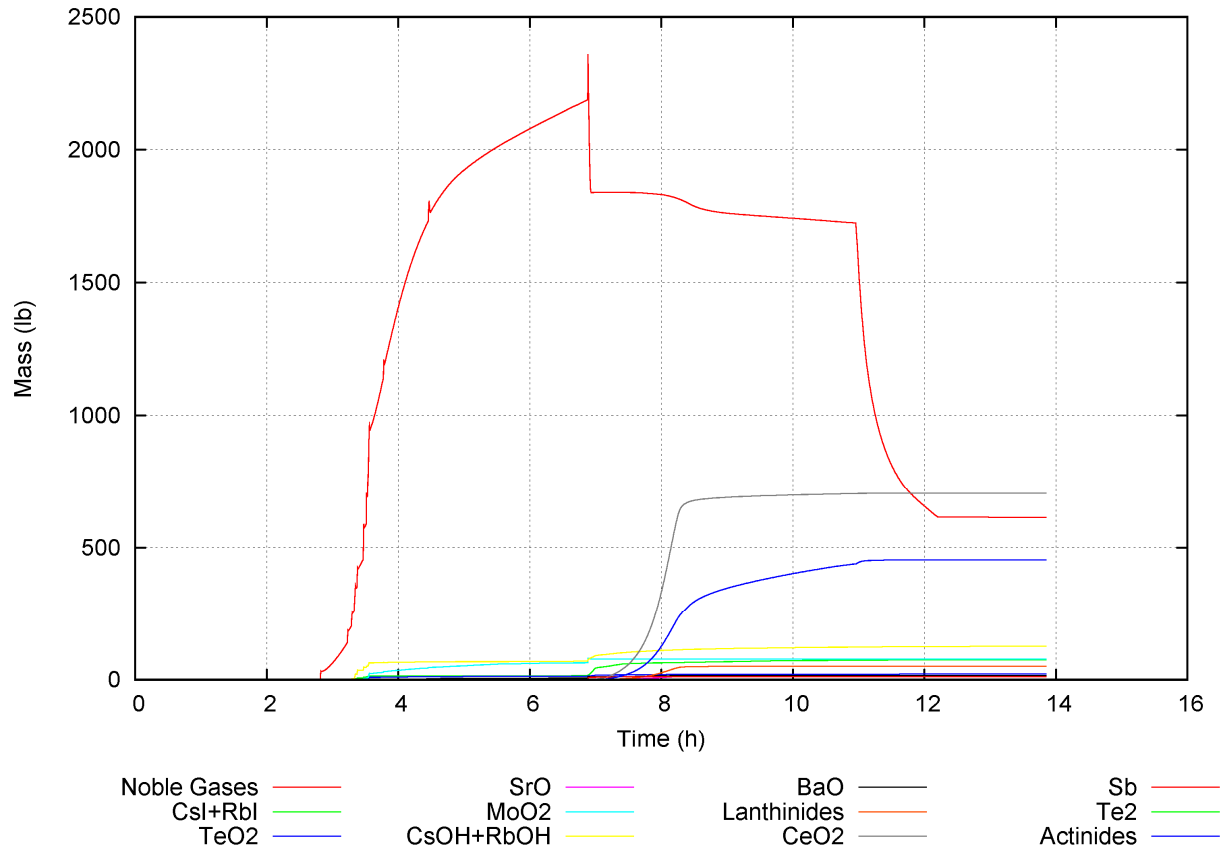


Figure 19-124-116—Failed Containment Pressure (st1.8c)

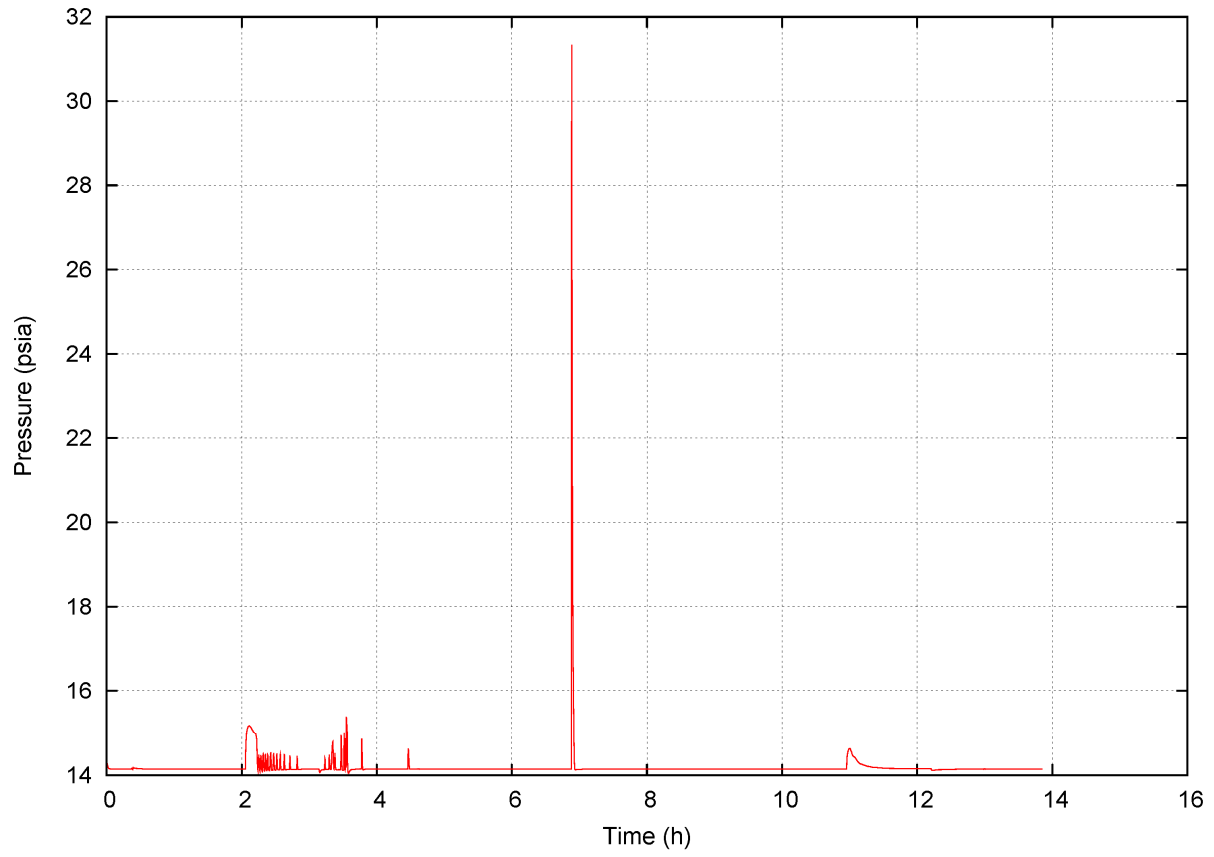


Figure 19-124-117—RCS Pressure (st1.11)

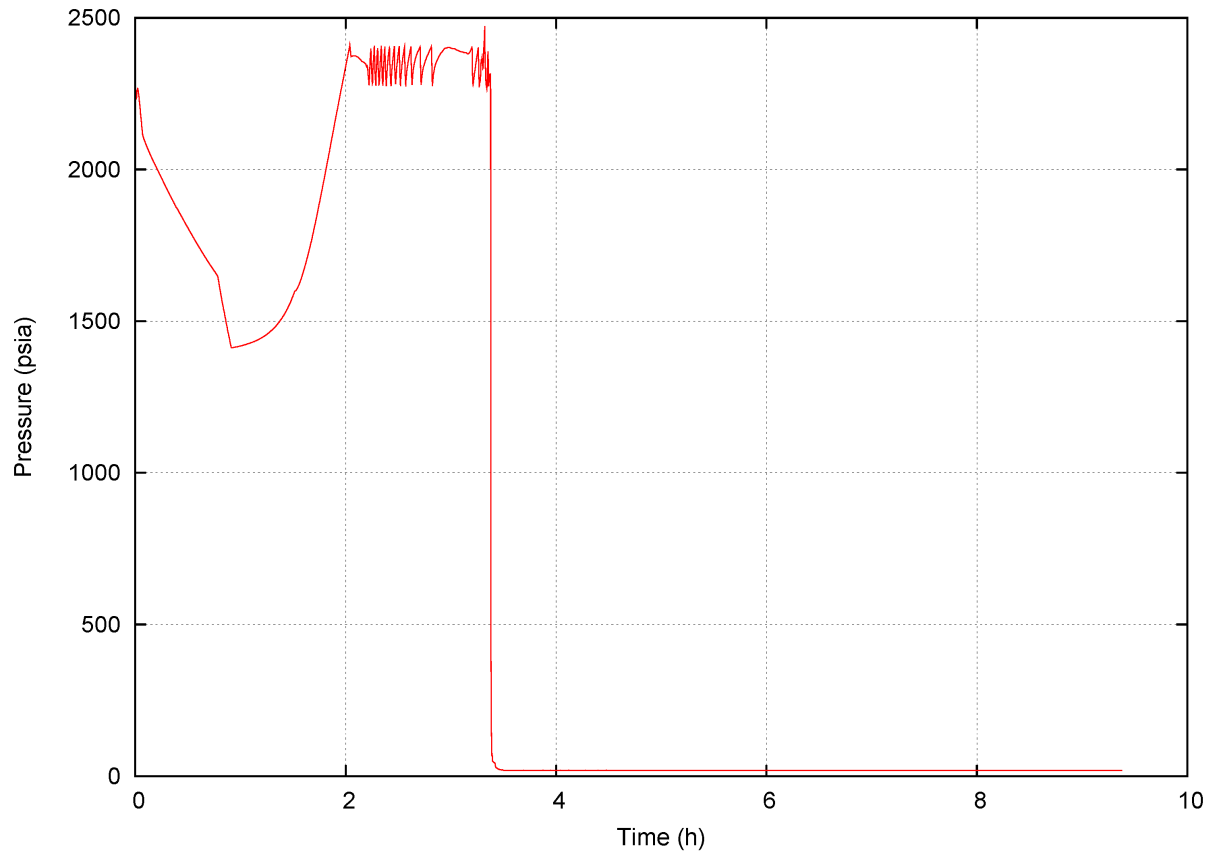


Figure 19-124-118: In-Vessel Hydrogen Production (st1.11)

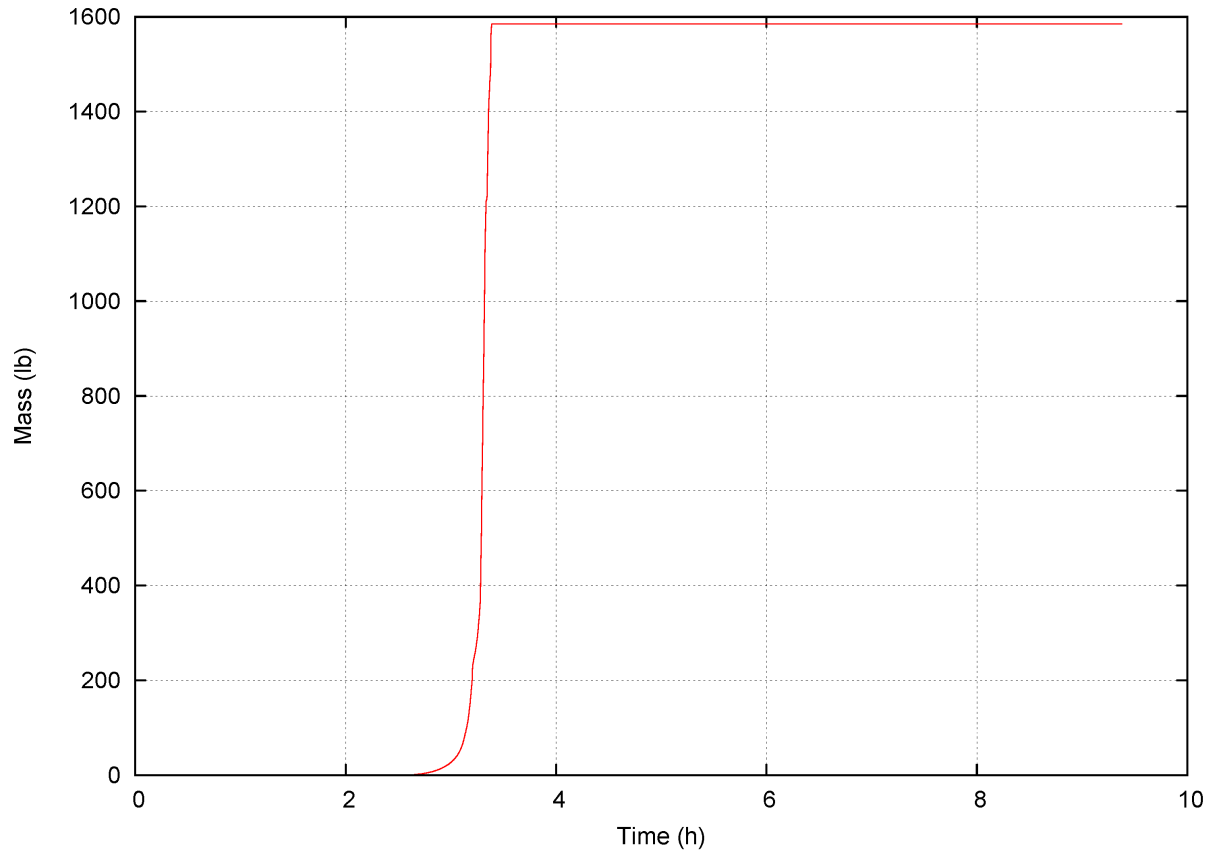


Figure 19-124-119—Mass of Hydrogen in Containment (st1.11)

