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Your ref: Docket No. 52-006
Our ref: DCP/NRC2378

February 9, 2009

Subject: AP1000 Responses to Requests for Additional Information (SRP 5)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 5. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI:

RAI-SRP5.4.6-SRSB-01

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
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/Enclosure

1. Response to Request for Additional Information on SRP Section 5

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 5

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP5.4.6-SRSB-01
Revision: 0

Question:

In Revision 17 to DCD, Tier 1 Table 2.1.2-4, Inspection, Tests, Analyses, and Acceptance Criteria (ITAAC), item 11.b, the acceptance criteria for the opening times (after receipt of signal from the PMS) of the remotely operated automatic depressurization system (ADS) stages 1, 2 and 3 valves (RCS-PL-V001A/B, V002A/B, V003A/B, V011A/B, V012A/B, and V013A/B) have been changed to longer times. Westinghouse AP1000 – DCD Revision 17 Changes Matrix indicates that the stroke times for these valves are modified to match actuator capacity.

Explain whether the changes of the ITAAC acceptance criteria of these ADS valve stroke times are consistent with the assumptions of the ADS valve opening time delay and stroke time assumed in the Chapter 15 safety analyses, and describe the effects of these changes on the safety analysis results of the events that result in the ADS actuation, such as small break loss-of-coolant accidents.

Westinghouse Response:

The primary role of the Automatic Depressurization System (ADS) is to mitigate a small break loss-of-coolant accident (SBLOCA). To that end the effect of changing valve stroke times on the ADS regarding the impact on other Chapter 15 safety analyses is insignificant.

The results of the three SBLOCA transient cases from Chapter 15 Safety Analyses with ADS actuation are described below. The major sequence of events and corresponding figures are provided.

2" Cold Leg Break

Table 1 compares the time sequence of events for the DCD and updated 2-inch Cold Leg (CL) Break cases. The updated case which includes the revised ADS valve stroke time and logic changes also incorporates other design changes such as the changes to the pressurizer and internals.

ADS stage 1 actuation occurs later than in the DCD analysis and ADS stage 2 actuation occurs earlier than in the DCD analysis. This causes Accumulator injection to be delayed.

Figures 1 - 6 relate the comparison of the change in ADS valve (RCS-PL-V001A/B, V002A/B, V003A/B, V011A/B, V012A/B, and V013A/B) stroke times on the DCD 2" SBLOCA CL break transients. Figures 1 and 2 show minimal changes due to the change in stroke time. It is possible to discern a slightly higher pressure in the initial case at approximately 2400 seconds. This contributes to the slight differences observed in the integrated vapor and liquid flow resulting from time differences in the Stage 4 ADS actuation which is discussed below.

Figures 3 and 4 compare the IRWST injection flow rates. Figures 5 and 6 represent the integrated liquid and vapor flow through ADS 1-3. The analysis with the increased ADS stroke time demonstrates less discharge flow through 5000 seconds. This is due to the change in logic associated with the Stage 4 ADS. Additionally, the magnitude of IRWST flow remains virtually unchanged, but the Stage 4 ADS valve opens approximately 25 seconds sooner for the transient with the increased ADS stroke time. The Stage 4 ADS valve opening sooner for the case with the increased valve stroke time reduces the integrated discharge liquid and vapor flow rates. However, the core mixture level, pressurizer level, and RCS Inventory (Figure 7) remain indiscernibly unchanged indicating this has no effect on the magnitude of heat transfer to the coolant in the core resulting in no impact to the safety analysis. The conclusion that there is no core uncovery for this case remains valid.

Table 1: Cold Leg Break Time Table Sequence of Events

Event	DCD Time (seconds)	ADS Change Time (seconds)
Transient Initiation	0.0	0.0
Reactor Trip Signal	54.7	54.6
Steam turbine stop valves close	60.7	59.6
Safety Injection Signal	61.9	62.0
Reactor coolant pumps start to coast down	67.9	68.0
ADS Stage 1	1334.1	1341.8
ADS Stage 2	1404.1	1389.9
Accumulator injection starts	1405	1406.3
ADS Stage 3	1524.1	1509.8
Accumulators empty	1940.2	1921.8
ADS Stage 4	2418.6	2393.9
Core makeup tank (CMT) empty	2895	2923
IRWST injection starts	3280	3361

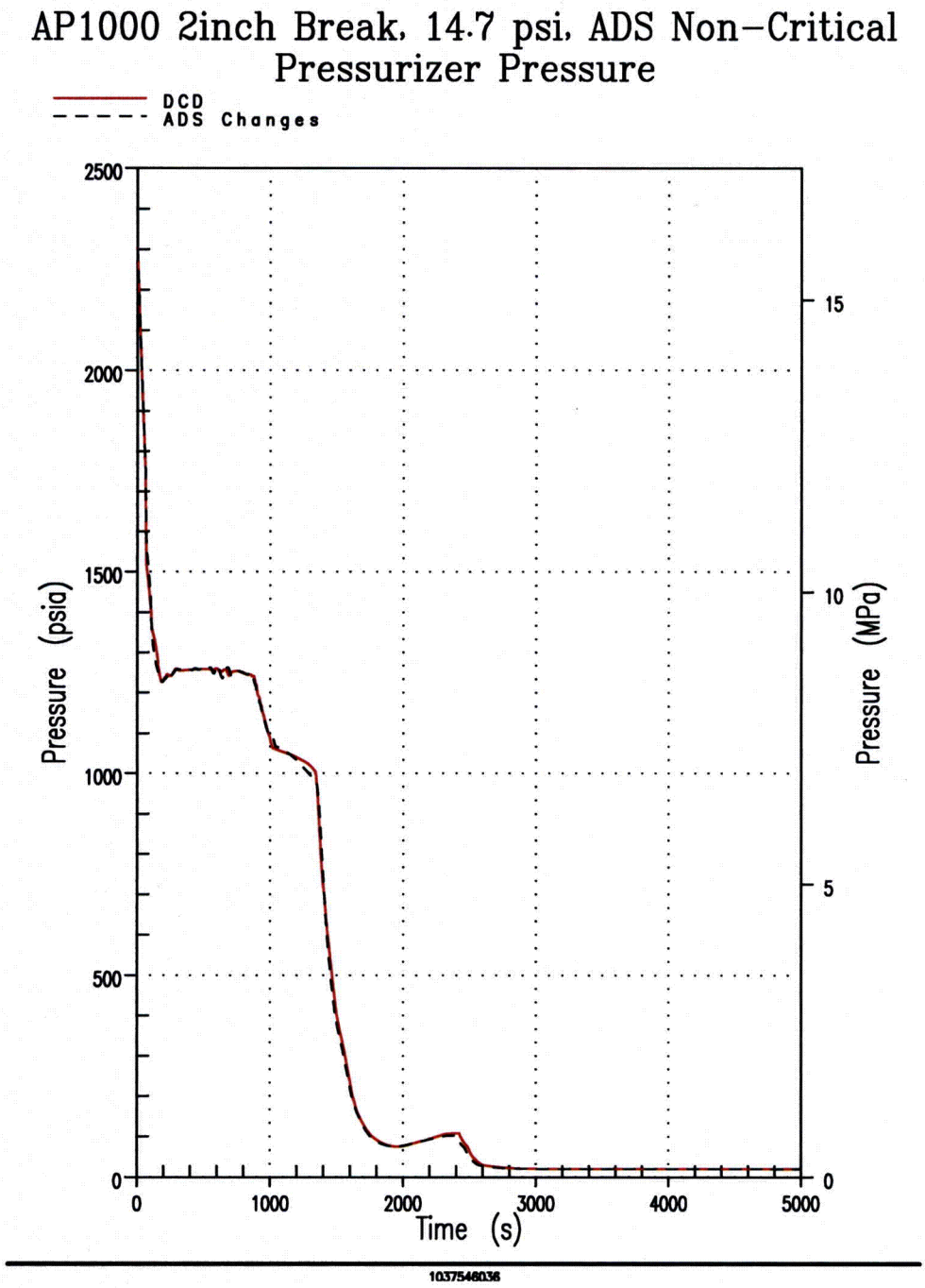

Figure 1: Pressurizer Pressure

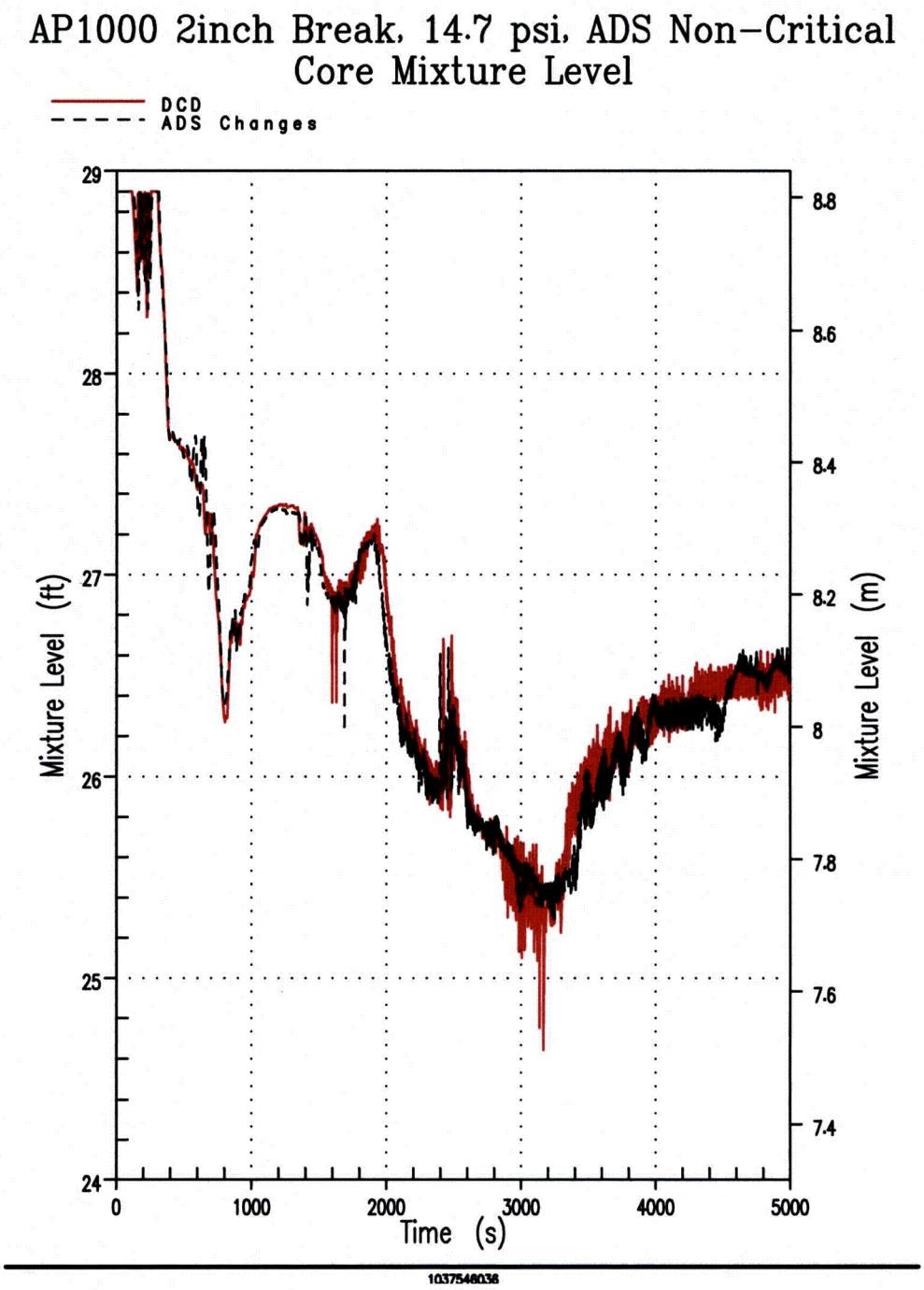

Figure 1: Core Mixture Level

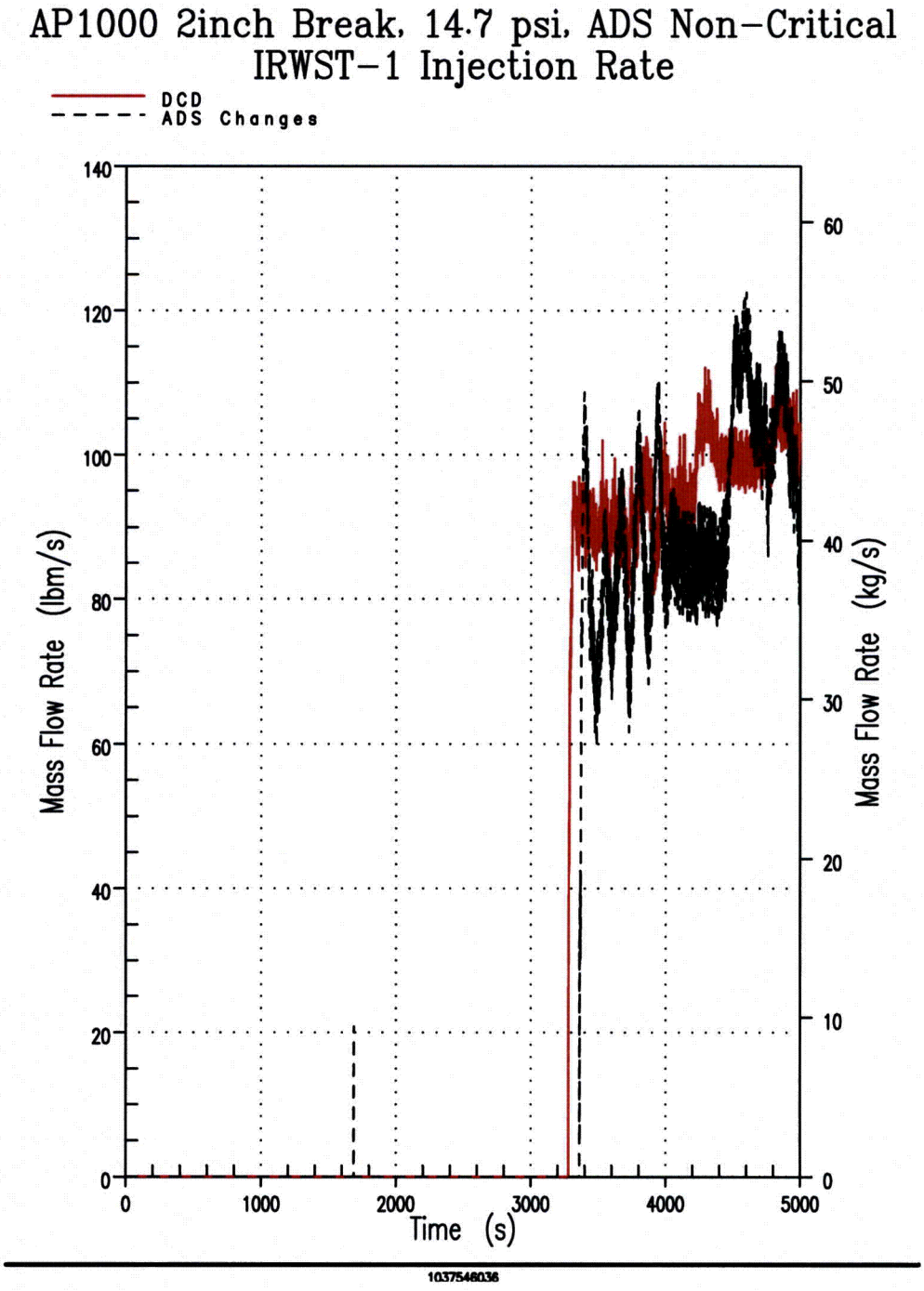

Figure 2: IRWST - 1 Injection Rate

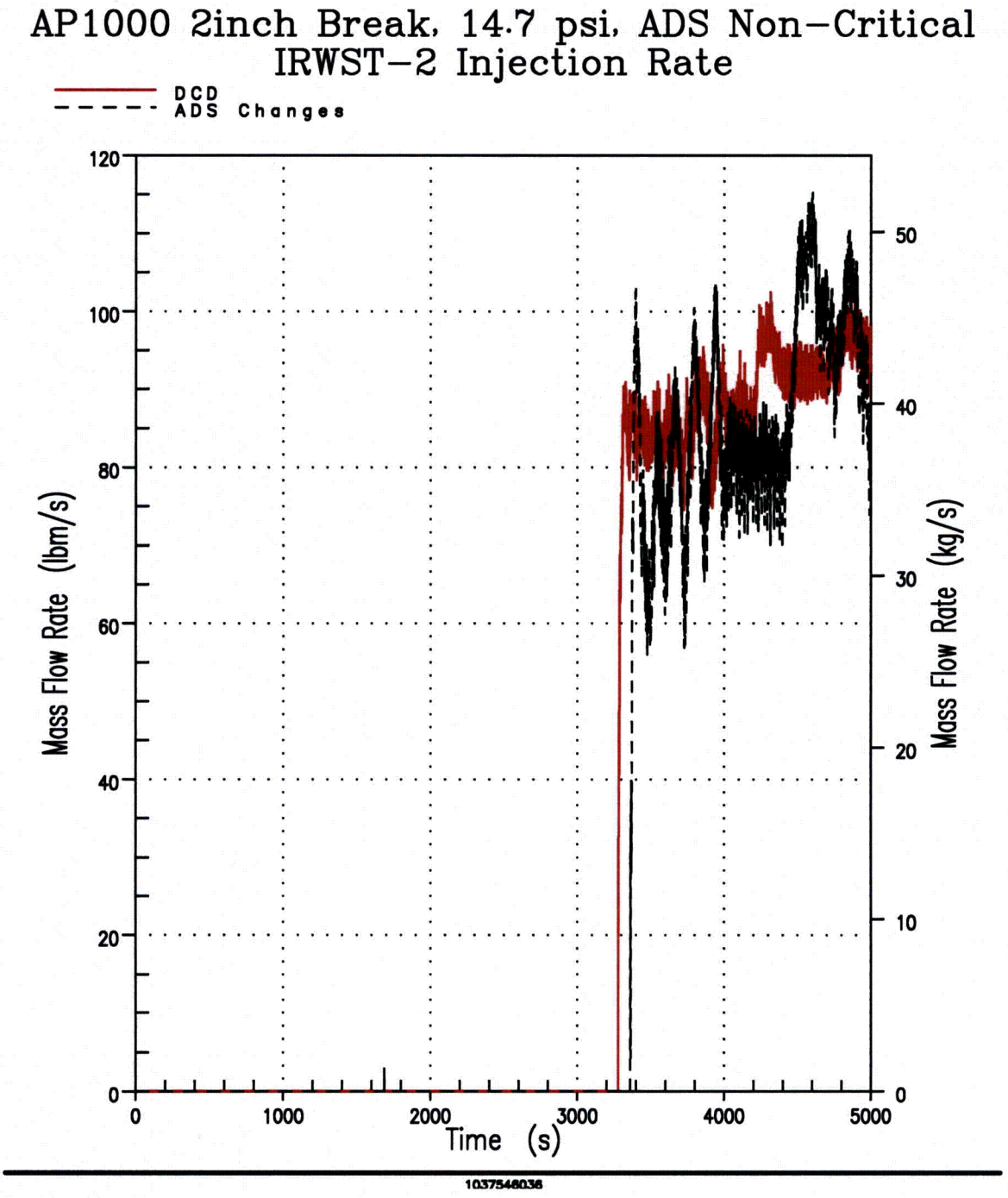

Figure 3: IRWST - 2 Injection Rate

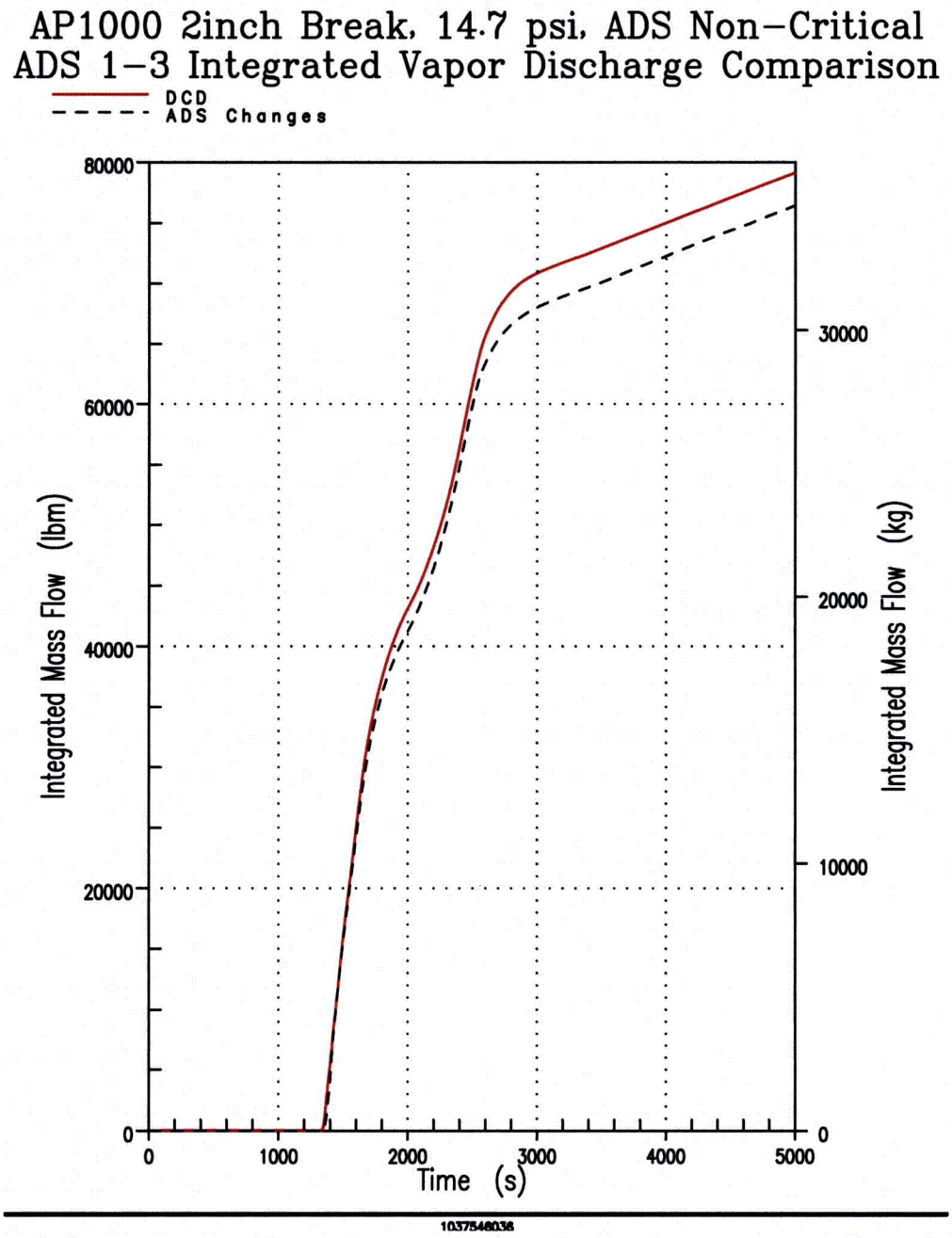

Figure 4: Integrated Vapor Discharge Comparison

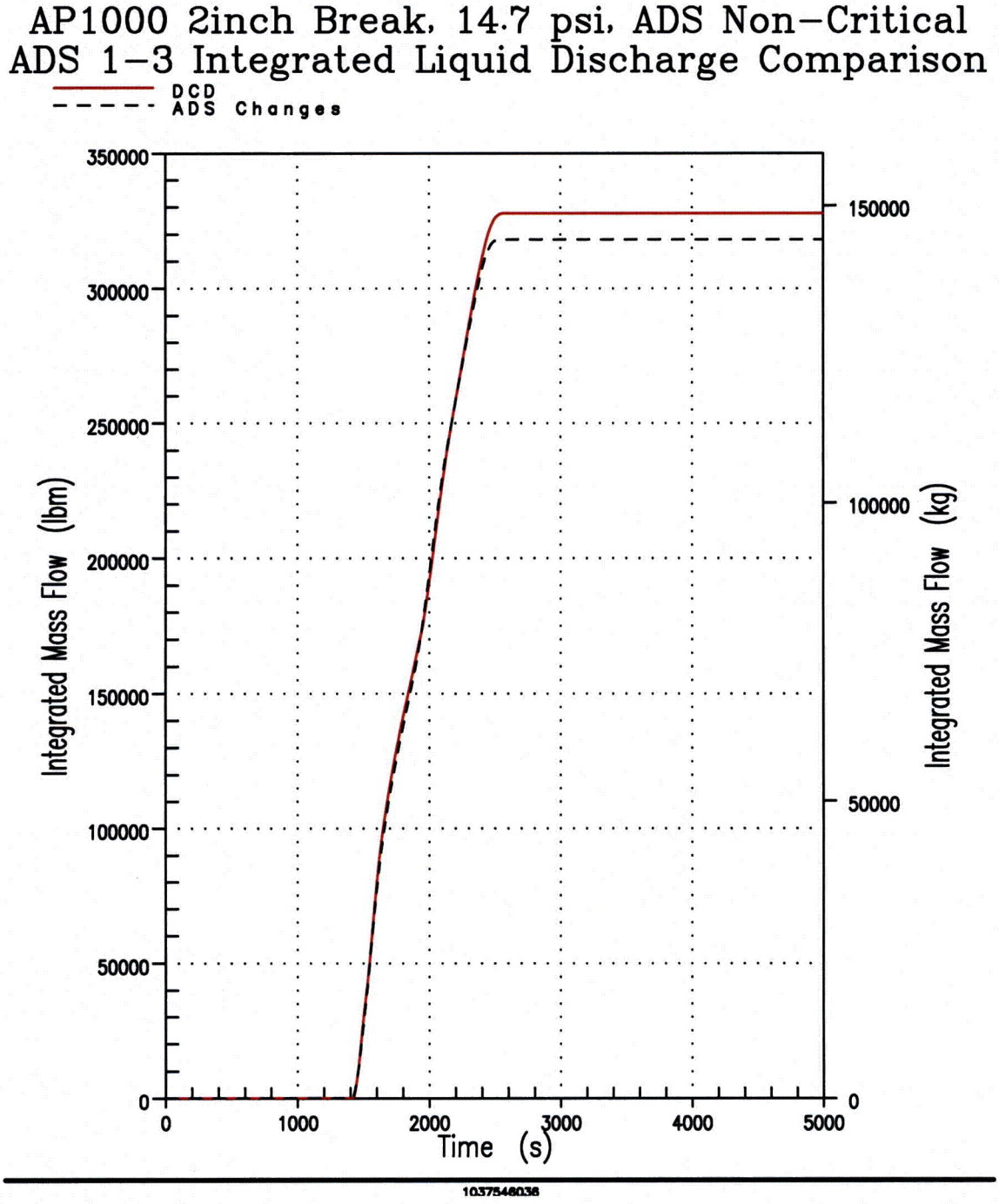

Figure 5: Integrated Liquid Discharge Comparison

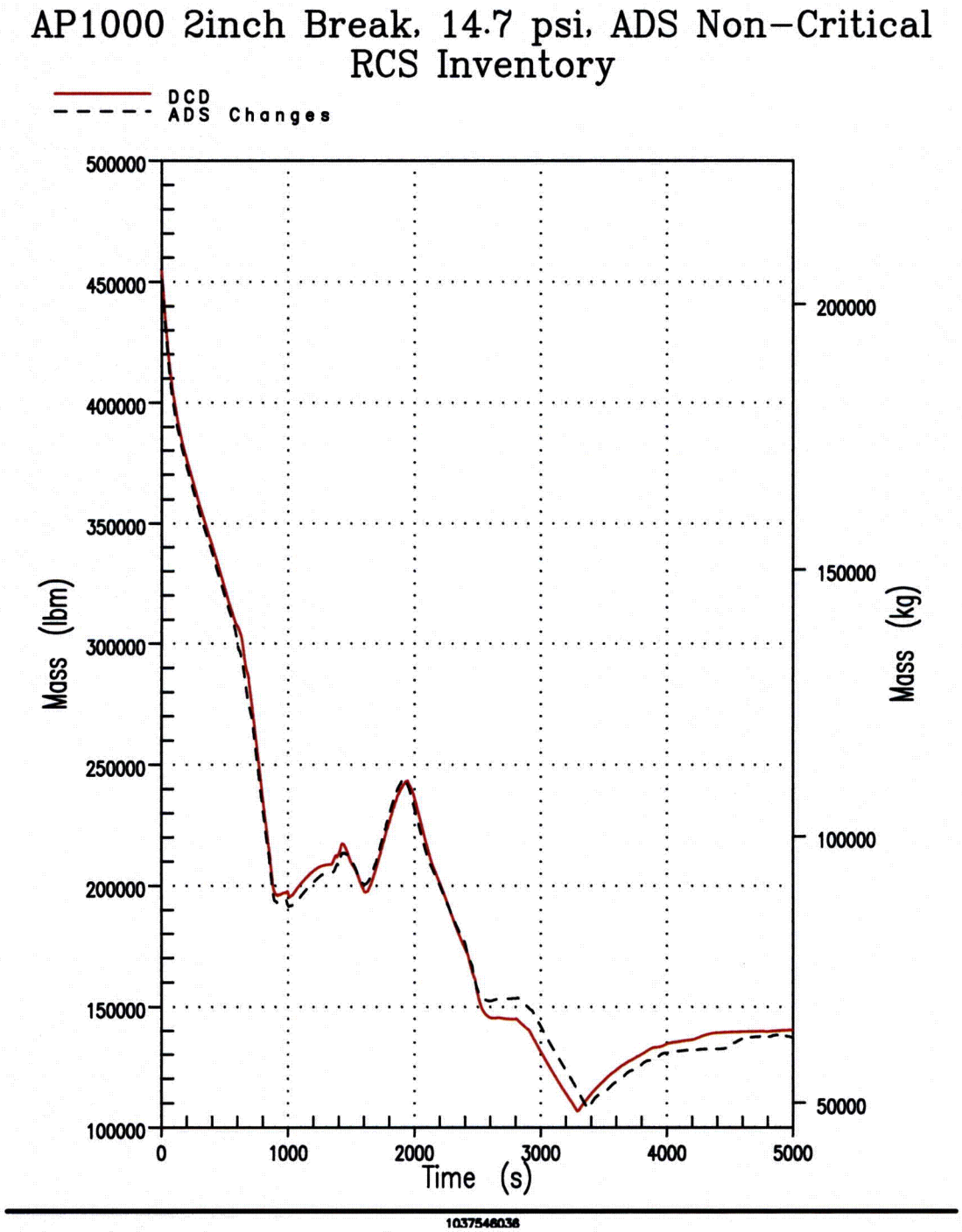

Figure 6: RCS Inventory

DEDVI Break

The second case analyzed for sensitivity to ADS valve stroke time increase is the Double Ended Direct Vessel Injection (DEDVI) line break. The updated case which includes the revised ADS valve stroke time and logic changes also incorporates other design changes such as the changes to the pressurizer and internals.

Table 2 is the comparison of the DEDVI line break major sequence of events. Once again there are no major differences with the exception of the 10 second offset in the ADS Stage 1 & 2 valve actuation times. Figures 8-14 once again exhibit no significant differences. Figures 12 and 13 display the integrated ADS 1-3 vapor and liquid discharge flow through 3000 seconds. The deviation occurring at approximately 500 seconds is the difference in the Stage 4 valve actuation times. The conclusion that there is no core uncovery for this case remains valid.

Table 2: DEDVI Line Break Sequence of Events

Event	DCD Time (seconds)	ADS Change Time (seconds)
Transient Initiation	0.0	0.0
Reactor Trip Signal	13.1	13.0
Safety Injection Signal	18.6	18.0
Steam turbine stop valves close	19.1	18.0
Reactor coolant pumps start to coast down	24.6	24.0
ADS Stage 1	182.5	192.1
ADS Stage 2	252.5	240.1
Intact Loop Accumulator injection starts	254	254.2
ADS Stage 3	372.5	360.1
ADS Stage 4	492.5	488.1
Intact Loop Accumulator empties	600.	595.9
Intact Loop IRWST injection starts	1470	1671
Intact Loop Core makeup tank (CMT) empty	2123	2097

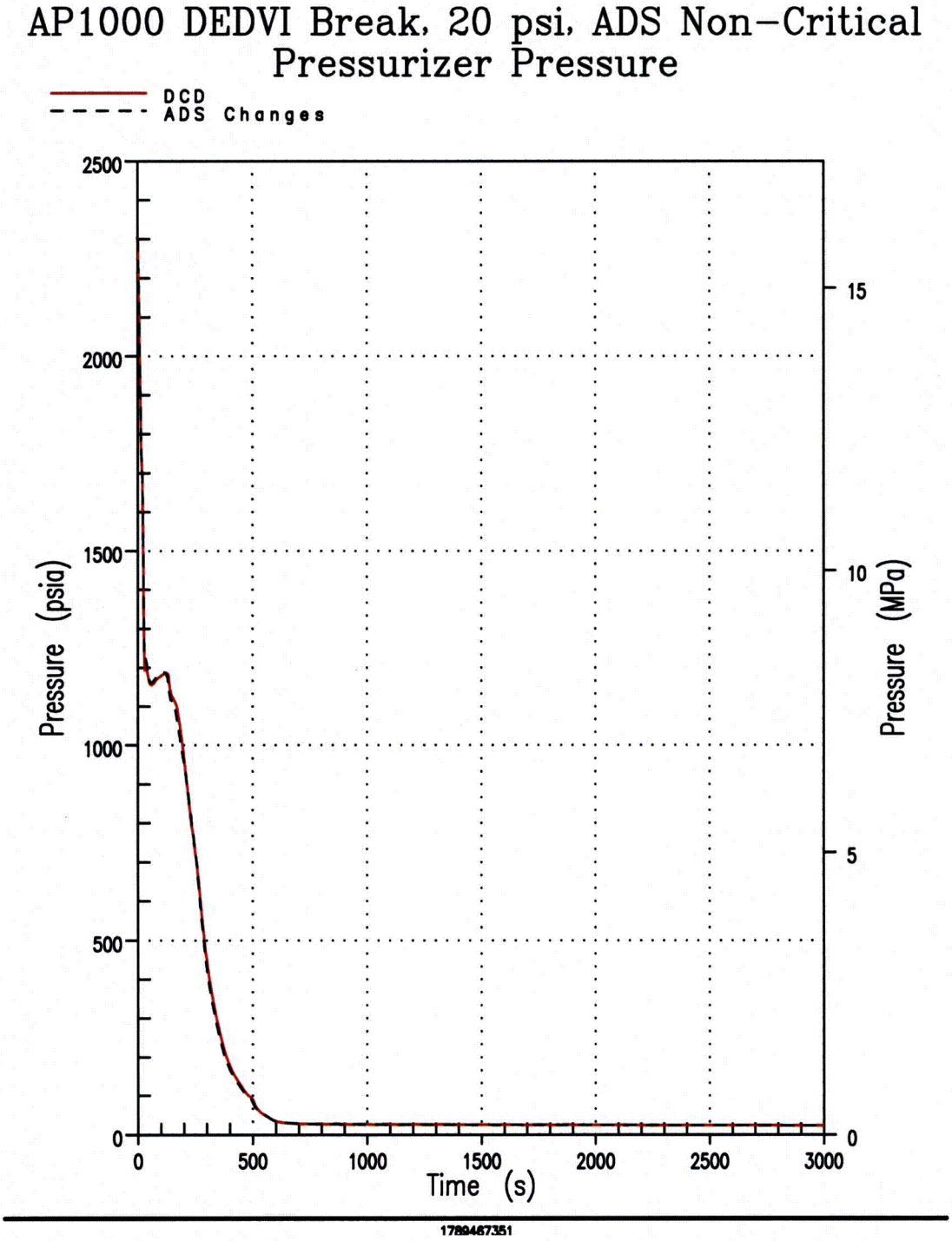

Figure 7: Pressurizer Pressure

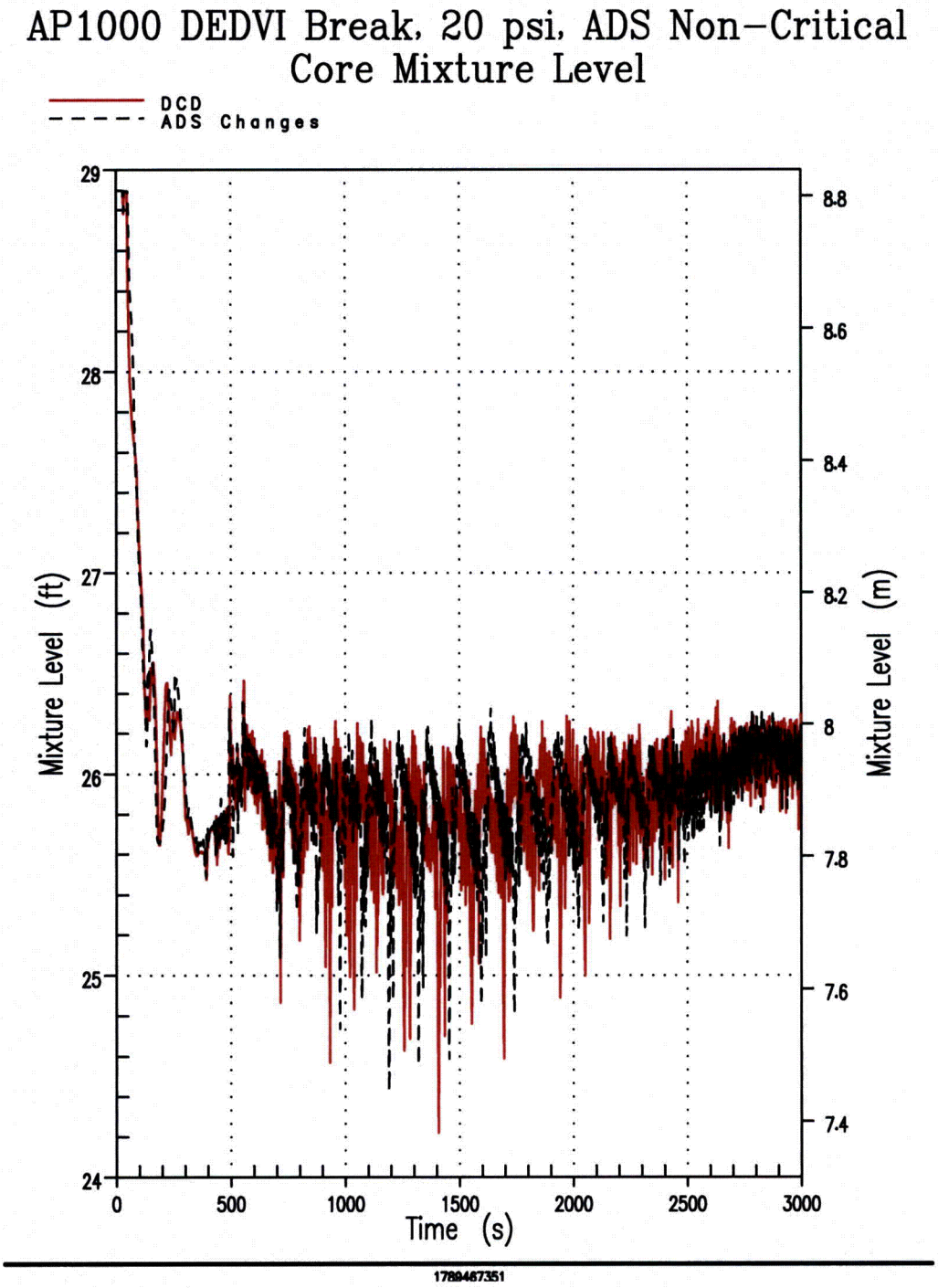

Figure 8: Core Mixture Level

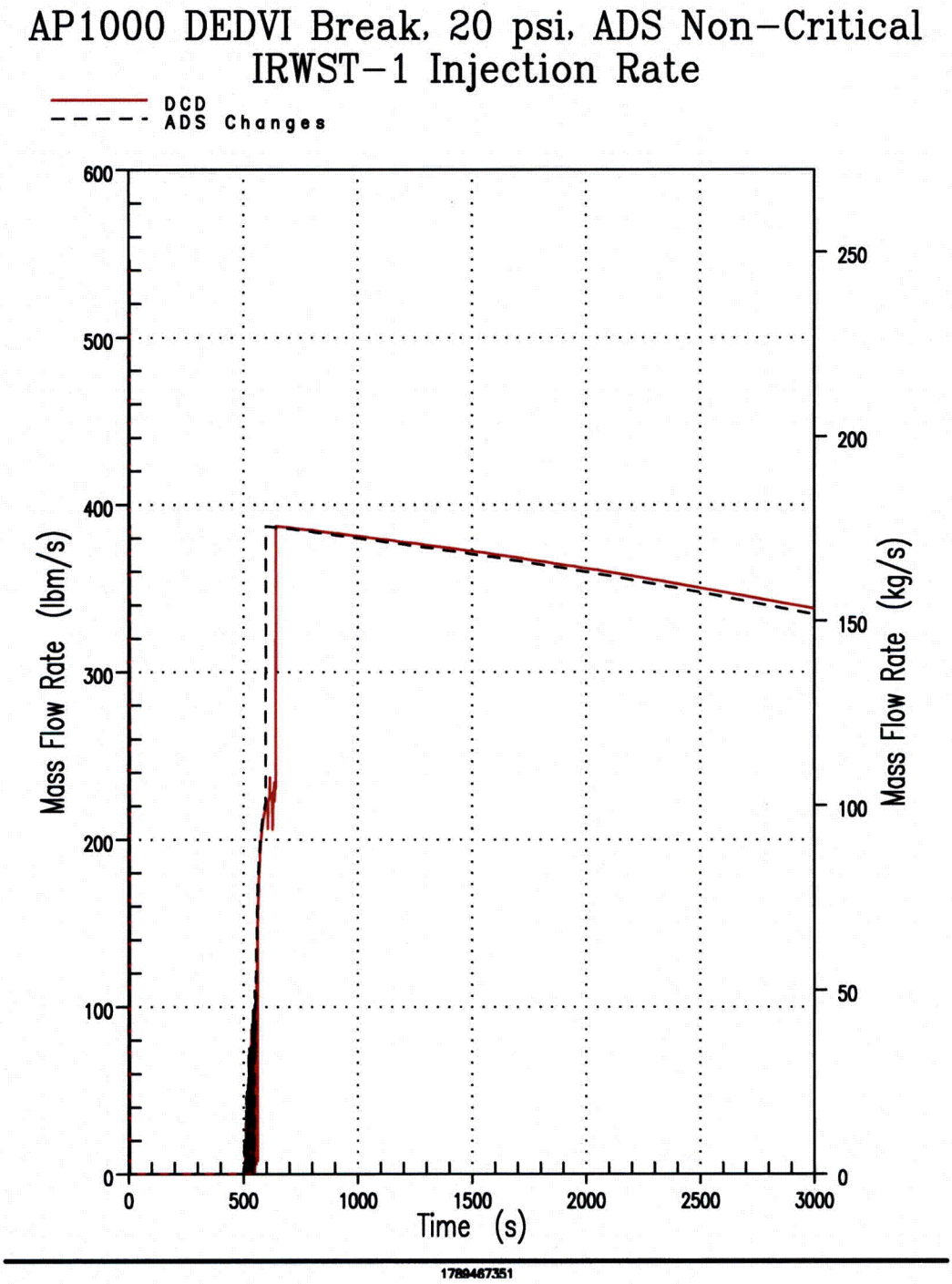

Figure 9: IRWST – 1 Injection Rate

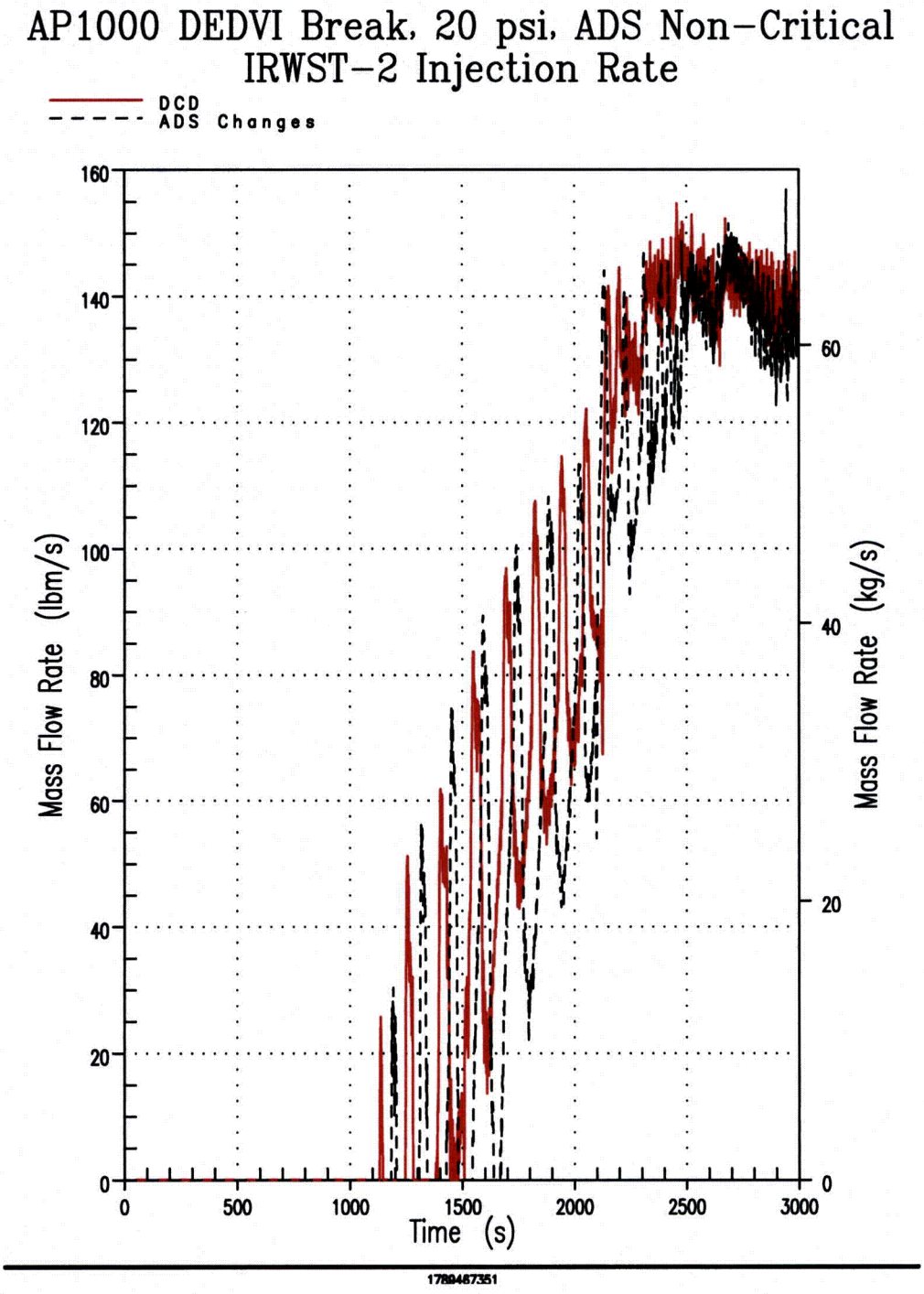

Figure 10: IRWST-2 Injection Rate

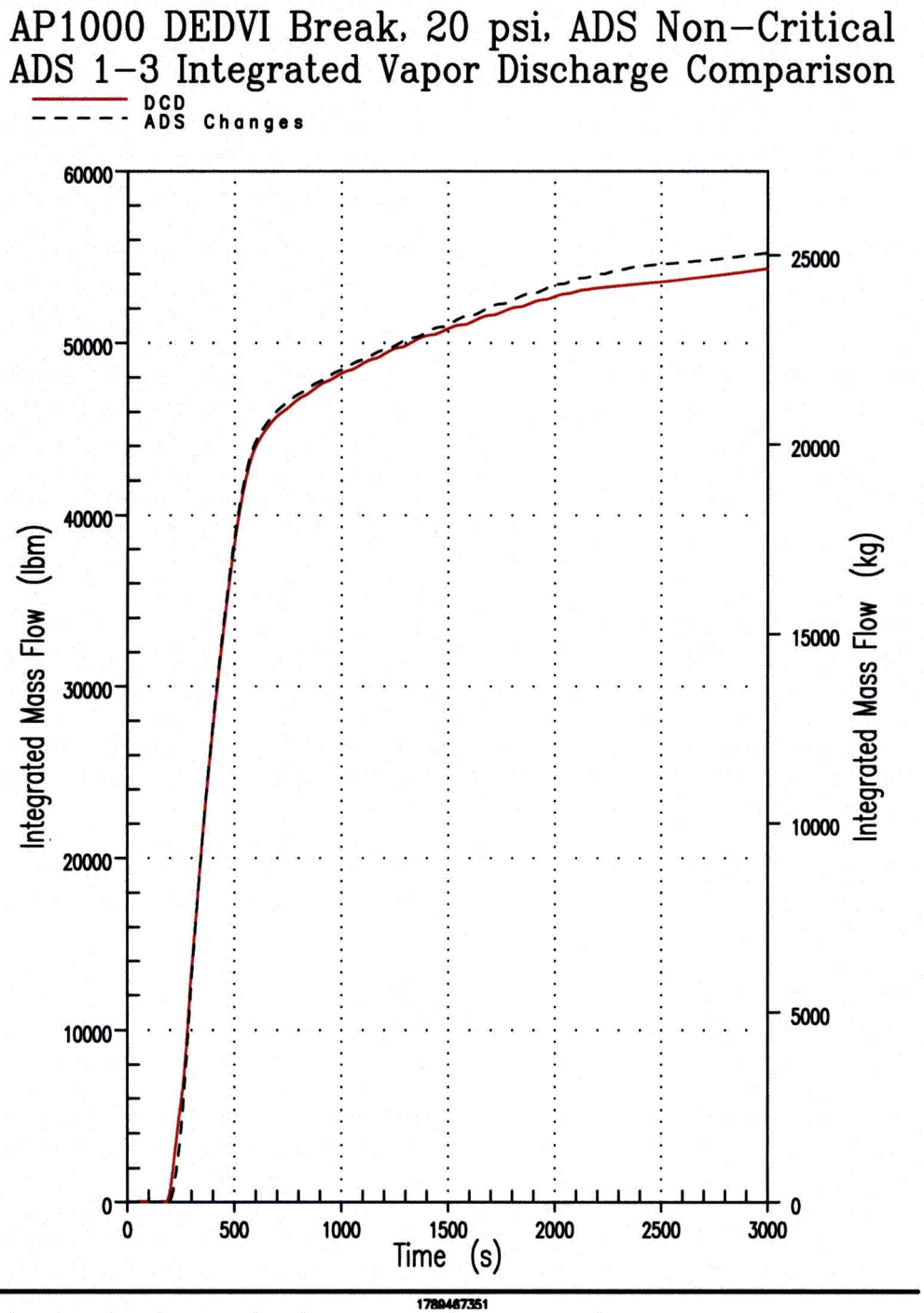

Figure 11: Integrated Vapor Discharge Comparison

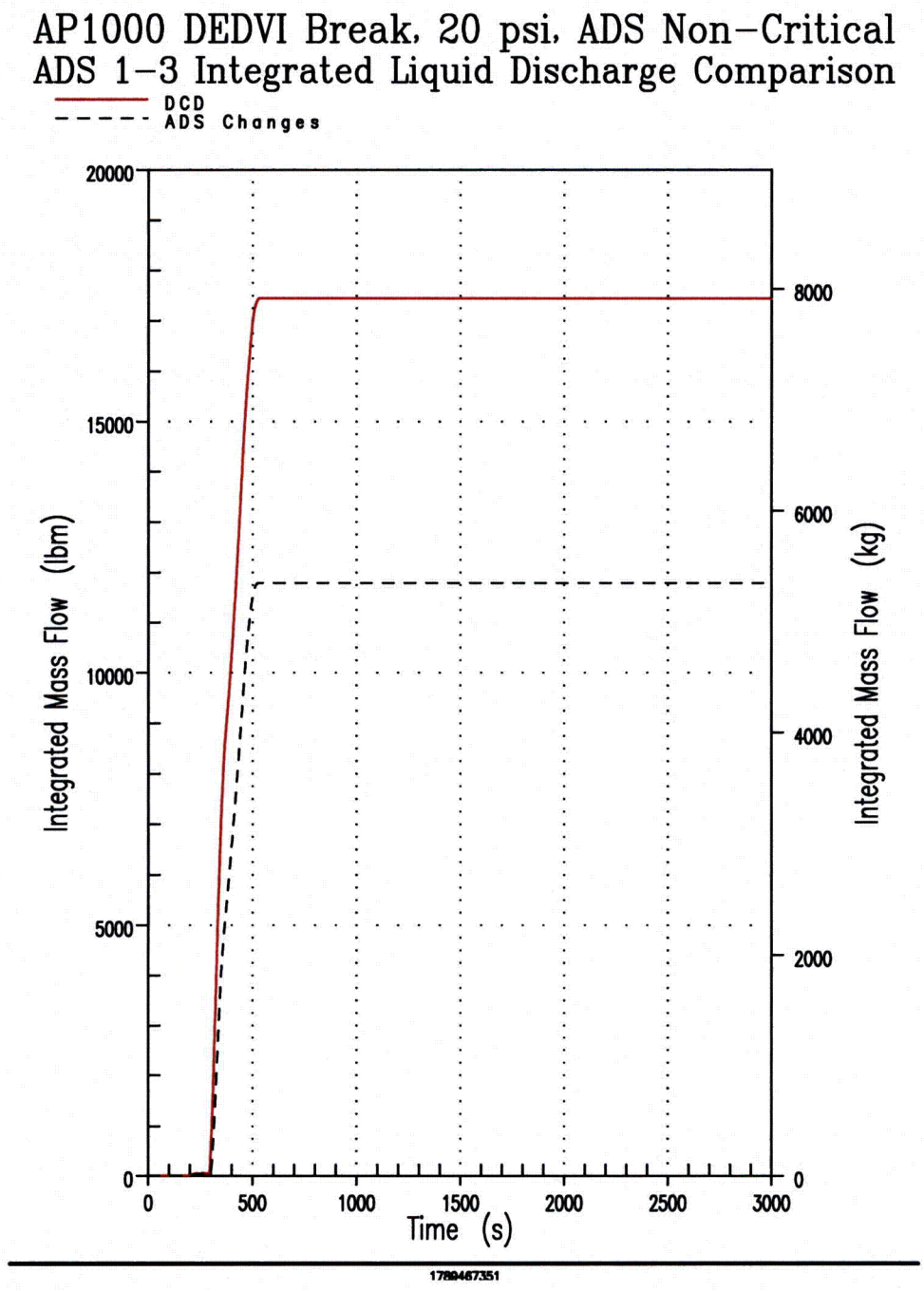

Figure 12: Integrated Liquid Discharge Comparison

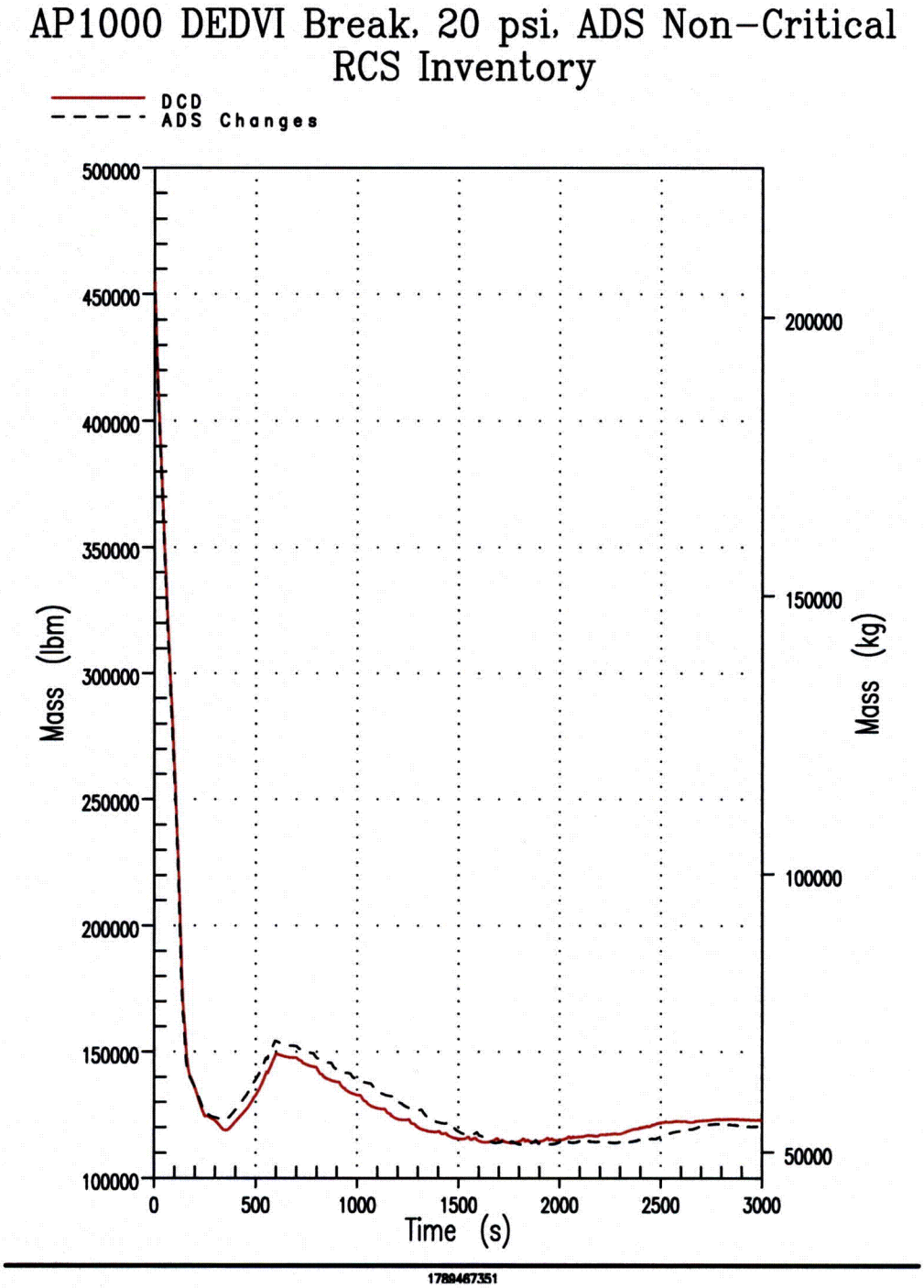

Figure 13: RCS Inventory

Inadvertent Actuation of the ADS

The third case analyzed for sensitivity to ADS valve stroke time increase is an Inadvertent Actuation of the ADS. Table 3 displays the major sequence of events and compares with the results of the case with increased ADS valve stroke times to the reference transient presented in the Design Control Document (DCD), Rev. 17. Figures 15-21 show the comparison between the two cases. Once again there doesn't appear to be any discernible difference between the two cases. Pressurizer pressure, core mixture level, and RCS inventory remain unchanged throughout the 5000 second transient. The conclusion that there is no core uncovery for this case remains valid.

Table 3: Inadvertent ADS Sequence of Events

Event	DCD Time (seconds)	ADS Change Time (seconds)
Inadvertent opening of the ADS valves	0.0	0.0
Reactor Trip Signal	37.8	42.8
ADS Stage 2	70.0	48.0
"S" signal	44.1	48.9
ADS Stage 3	190.0	168.0
Accumulator injection starts	268.0	262.4
Accumulator empties	693.0	687.6
ADS Stage 4	1746.	1713.
Core makeup tank (CMT) empty	2120.	2109.
IRWST injection starts	2662.	2654.

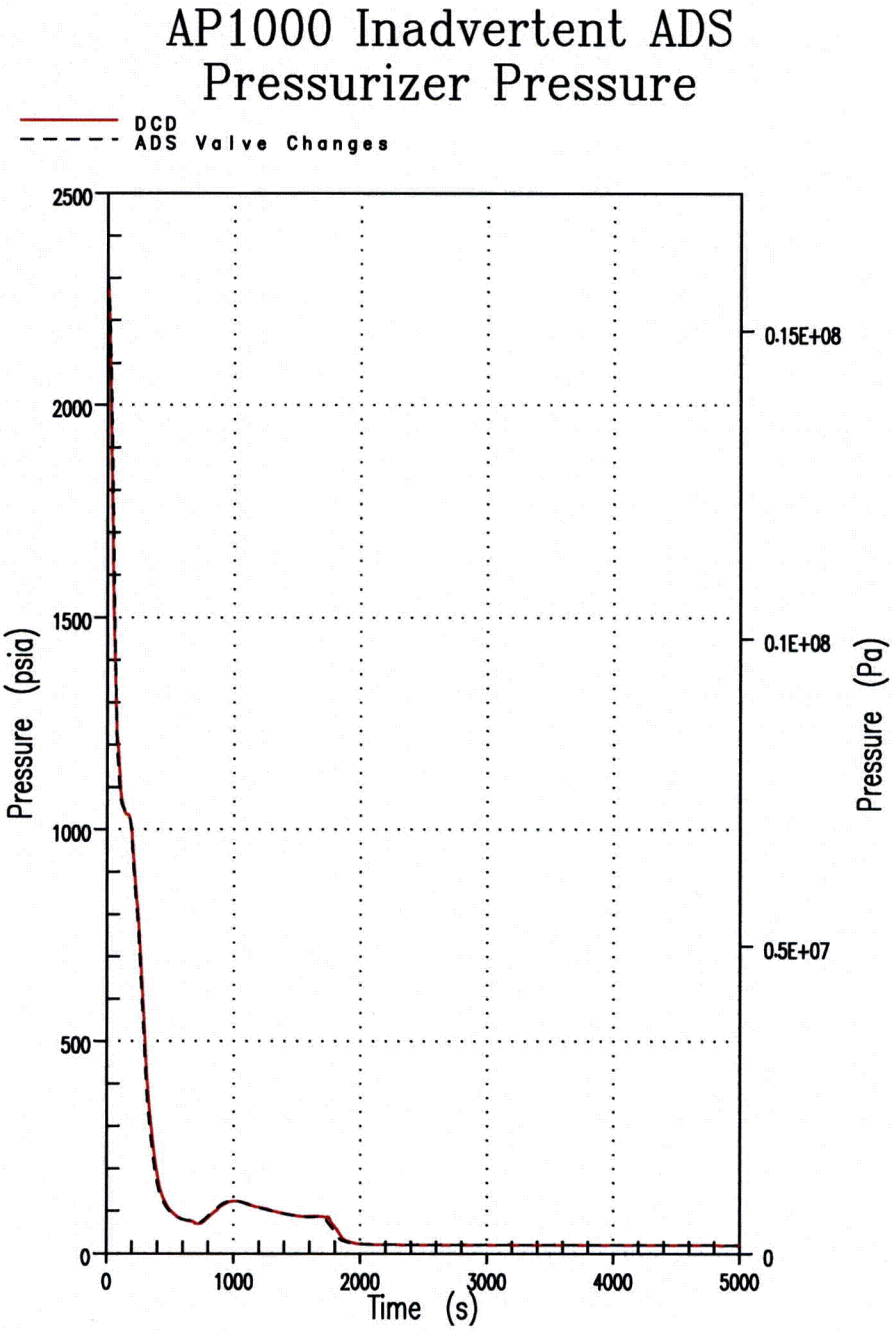

Figure 14: Pressurizer Pressure

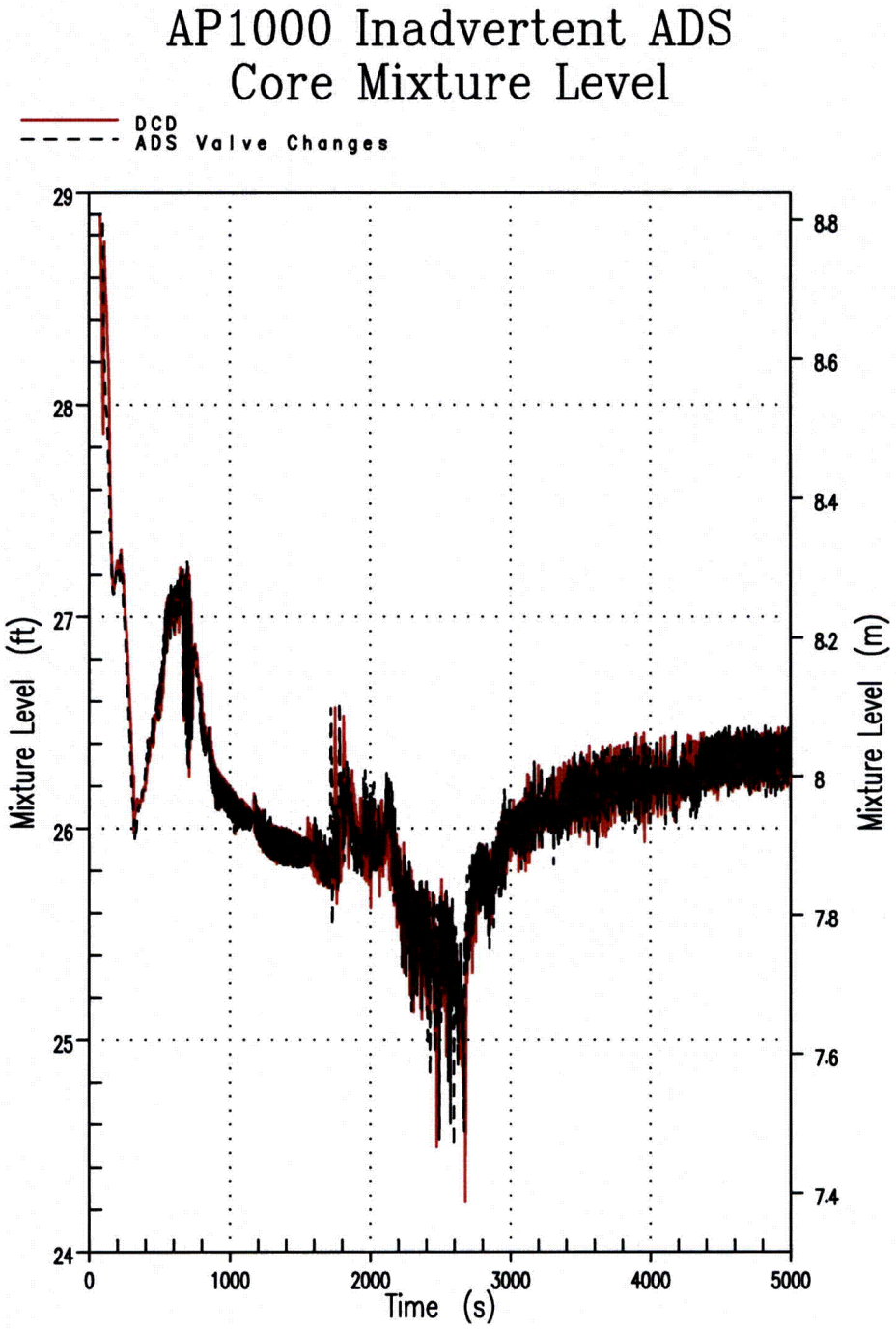

Figure 15: Core Mixture Level

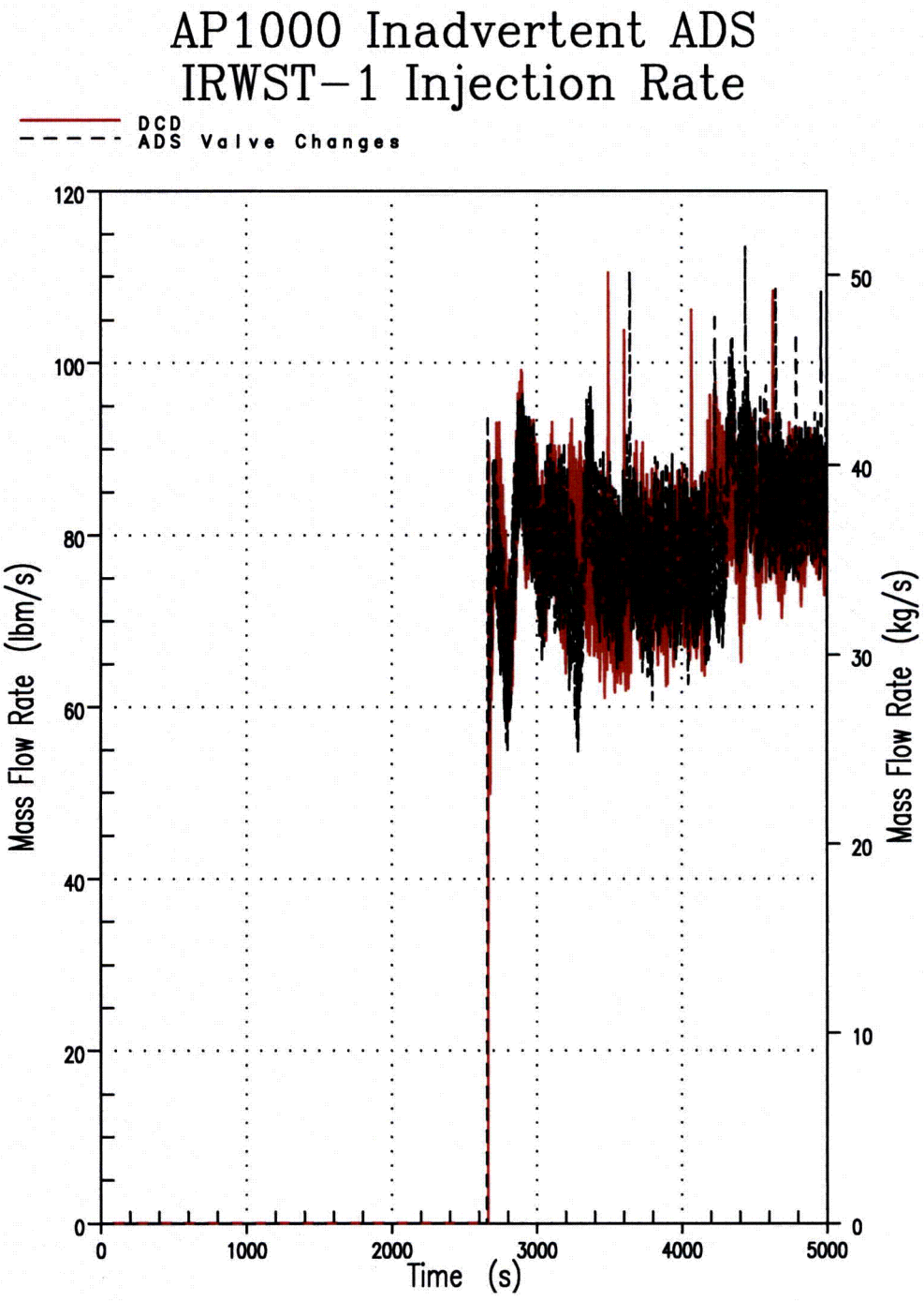

Figure 16: IRWST -1 Injection Rate

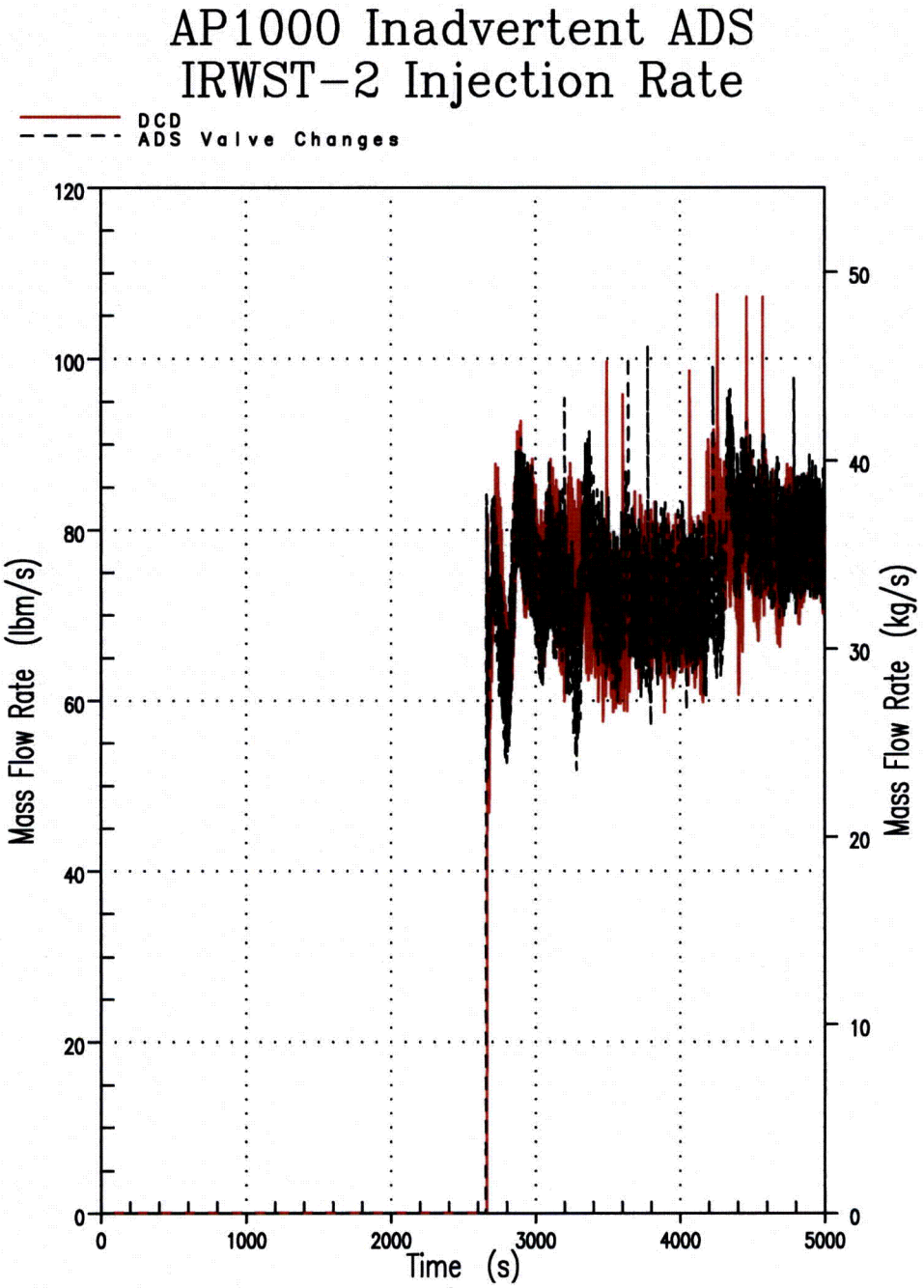

Figure 17: IRWST - 2 Injection Rate

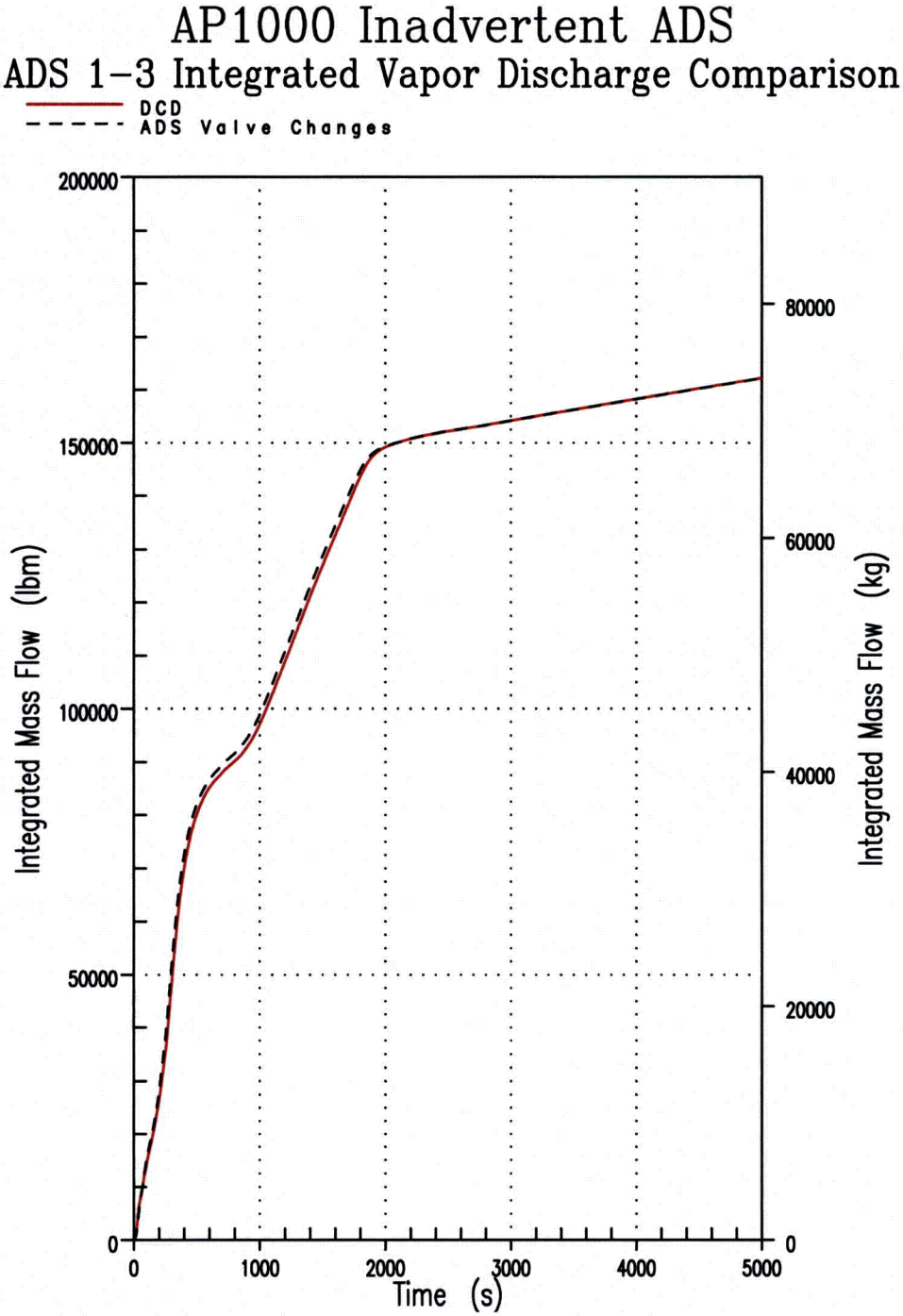

Figure 18: Integrated Vapor Discharge Comparison

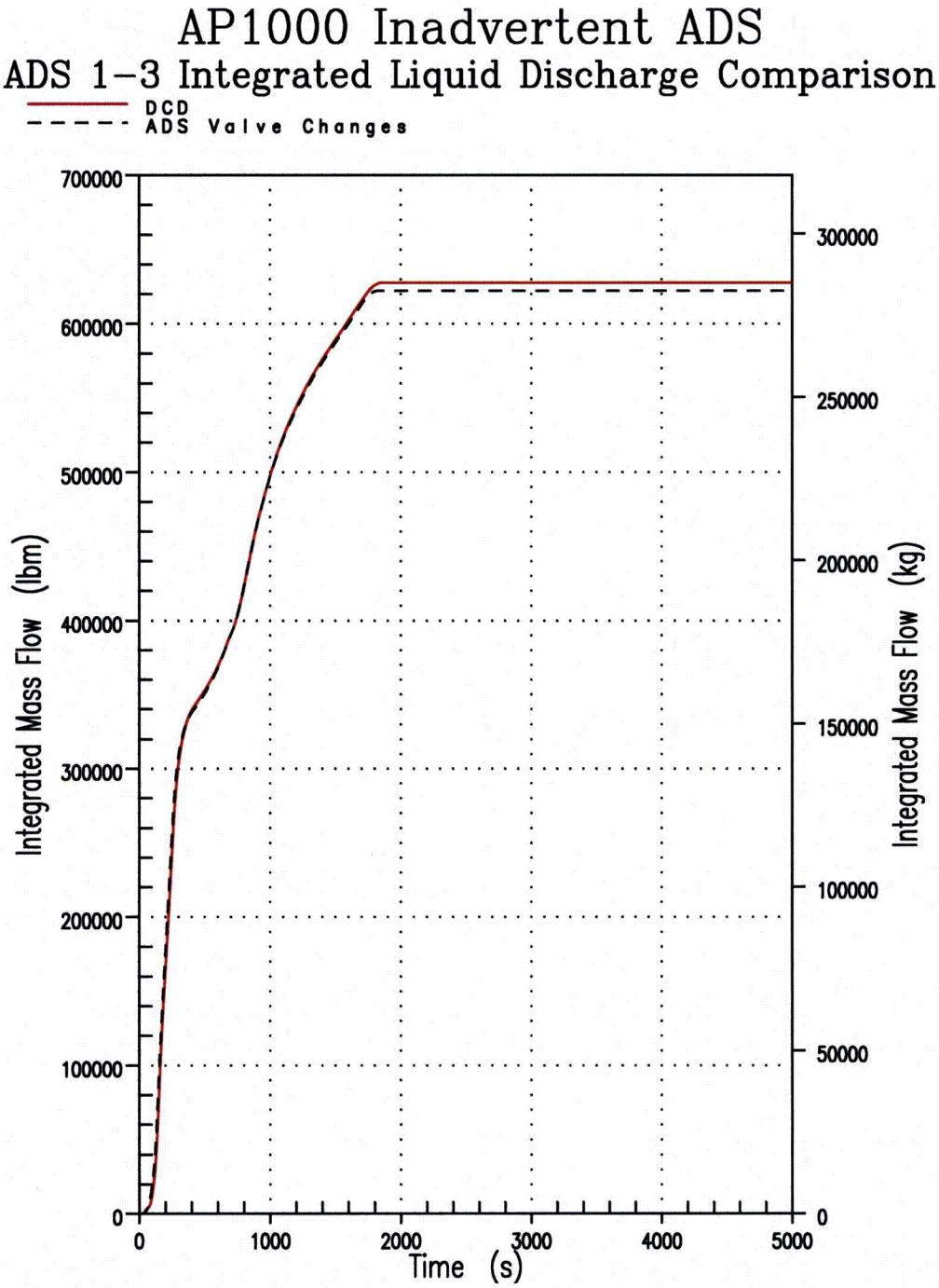

Figure 19: Integrated Liquid Discharge Comparison

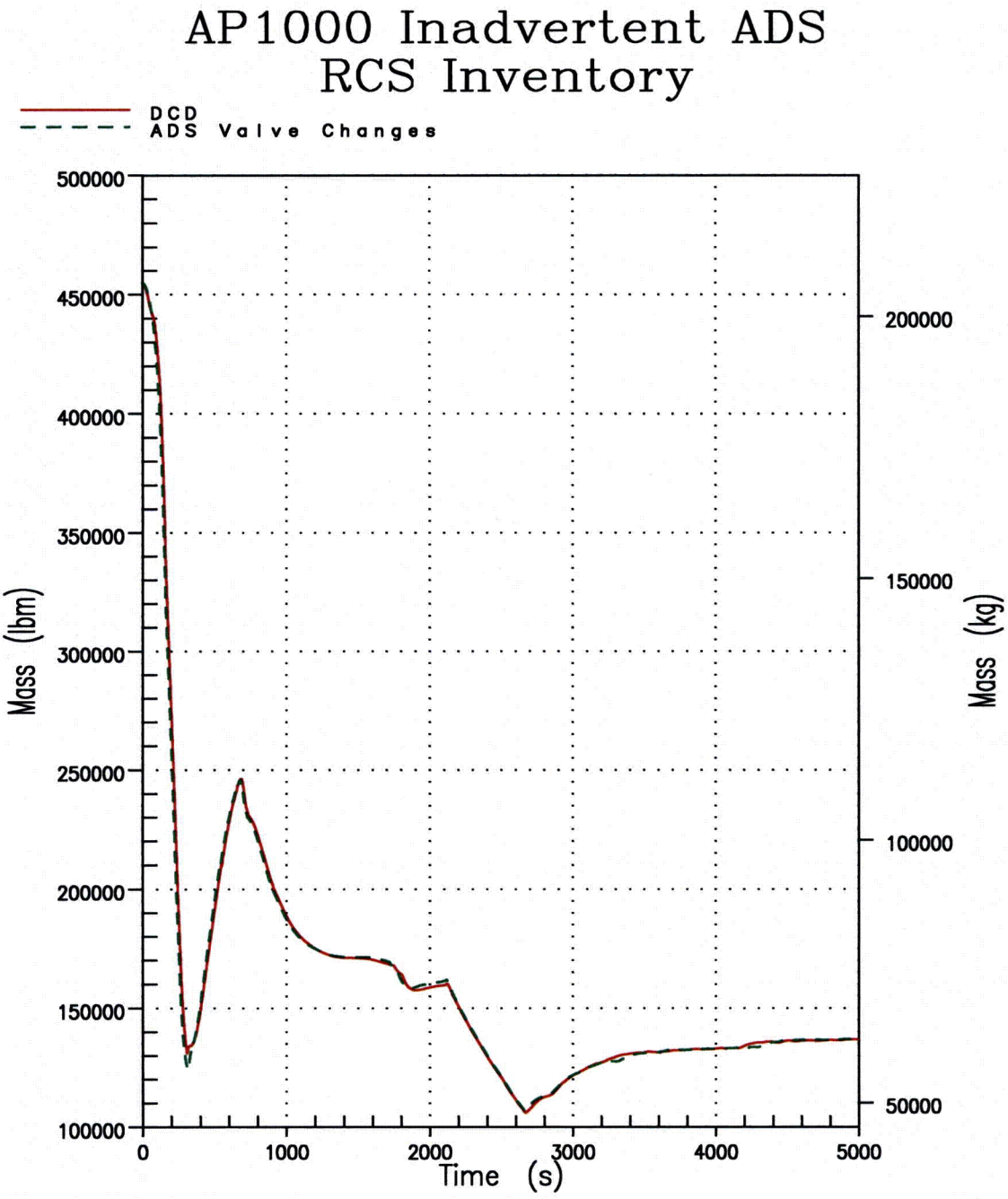

Figure 20: RCS Inventory

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None